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WILLIAM J. AILA, JR
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STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

March 23, 2022

Ms. Mary Alice Evans, Director
Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

Dear Ms. Evans:

Subject: Publication of the Draft Environmental Assessment and Anticipated Finding of No Significant Impact
Mā'ili Residential Development (Former Voice of America Site)
TMK (1) 8-7-010: 30 & 31, Mā'ili, Wai'anae, O'ahu, Hawai'i

With this letter, the Department of Hawaiian Home Lands (DHHL) hereby submits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the proposed Mā'ili Residential Development (Former Voice of America Site) project situated at TMK (1) 8-7-010: 30 & 31, on the island of Oahu for publication in the next available edition of the Environmental Notice.

In addition to this letter, we have also submitted the electronic version of the Environmental Review Program Publication Form and a searchable PDF-formatted copy of the DEA-AFONSI through the online submission platform.

If you have any questions, please call Darrell Ing of the Land Development Division at 620-9276, or via e-mail at darrell.h.ing@hawaii.gov.

Aloha,

William J. Aila Jr., Chairman
Hawaiian Homes Commission

c: Sheryl Nojima – Gray Hong Nojima & Associates (w/o enclosures)

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Friday, April 1, 2022 3:28:31 PM

Action Name

Māʻili Residential Development (Former Voice of America Site)

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

Waiʻanae, Oʻahu

Tax Map Key(s) (TMK(s))

(1) 8-7-010: 030 & 031

Action type

Agency

Other required permits and approvals

Required and Potential Permits: Department of the Army (DA) Permit; Clean Water Act, Section 401 Certification; National Pollutant Discharge Elimination System (NPDES) Permits; Disability and Communication Access Board review for compliance; Community Noise Permit; Stream Channel Alteration Permit (SCAP); Federal Consistency for Coastal Zone Management; Building Permit; Grading Permit; Trenching Permit; Sewer Connection; Subdivision Application; Surface Runoff from Construction Activities entering into City's Storm Sewer System; Street Usage Permit; Plan Approvals

Proposing/determining agency

State of Hawaiʻi, Department of Hawaiian Home Lands

Agency contact name

Darrell Ing

Agency contact email (for info about the action)

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Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Gray, Hong, Nojima & Associates, Inc.

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Consultant contact phone

(808) 521-0306

Consultant address

201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813
United States
Map It

Action summary

The State of Hawai‘i Department of Hawaiian Home Lands (DHHL) is proposing to develop approximately 40 acres of state-owned land as a homestead community in Mā‘ili, Wai‘anae, O‘ahu. This community is envisioned to accommodate approximately 280 single family and multifamily residences which will be offered to beneficiaries of the Hawaiian Homes Commission Act. The long waiting list of over 23,000 residential applicants underscores the extreme urgency to provide needed housing for the native Hawaiian beneficiaries.

Reasons supporting determination

Refer to Section 6.2 (Significance Criteria) of the DEA.

Attached documents (signed agency letter & EA/EIS)

- DraftEA_April-2022.pdf
- Maili-Residential-Development-Letter-220323.PDF

Action location map

- Maili-Residential-Development-Shape-File.zip

Authorized individual

Toby Hanzawa

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

MĀʻILI RESIDENTIAL DEVELOPMENT (FORMER VOICE OF AMERICA SITE)

DRAFT ENVIRONMENTAL ASSESSMENT

TMK (1) 8-7-010: 30 & 31
Māʻili, Waiʻanae, Oʻahu, Hawaiʻi

April 2022

Prepared for:

State of Hawaiʻi
Department of Hawaiian Home Lands
Land Development Division

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900 / Honolulu, HI 96813 / Phone: (808) 521-0306 / Fax: (808) 531-8018

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Appendix J: Geophysical Survey Anomaly Verification Letter Report, August 31, 2021

Appendix K: Beneficiary Consultation: Mā‘ili Homestead Community Residential Development Plans, Virtual Beneficiary Consultation Meeting, June 22, 2021

LIST OF ACRONYMS

AIS	Archaeological Inventory Survey
ALISH	Agricultural Lands of Importance to the State of Hawai‘i
BMP	Best Management Practices
BWS	Honolulu Board of Water Supply
CDP	Census Designated Place
Charter	Charter Communications
City	City and County of Honolulu
CZM	Hawai‘i Coastal Zone Management Program
CZMA	1972 Coastal Zone Management Act
DA	U.S. Department of the Army
dBA	Decibels A
DBEDT	State Department of Business, Economic Development and Tourism
DDC	City Department of Design and Construction
DEA	Draft Environmental Assessment
DHHL	State Department of Hawaiian Home Lands
DLNR	State Department of Land and Natural Resources
DOH	State Department of Health
DOTH	State Department of Transportation Highways Division
DPP	City Department of Planning and Permitting
DTS	City Department of Transportation Services
EA	Environmental Assessment
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
ENV	City Department of Environmental Services
EPA	U.S. Environmental Protection Agency
FEA	Final Environmental Assessment
FEMA	U.S. Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
ft	Foot or Feet
gpd	Gallons per day
gpm	Gallons per minute
GIS	Geographic Information System
H-POWER	Honolulu Program of Waste Energy Recovery
HAR	Hawai‘i Administrative Rules
HCM 6	Highway Capacity Manual 6th Edition
HECO	Hawaiian Electric Company
HEER	Hawai‘i Department of Health Hazard Evaluation and Emergency Response
HFD	Honolulu Fire Department
HHCA	Hawaiian Homes Commission Act
HPD	Honolulu Police Department
HRS	Hawai‘i Revised Statutes
HTCO	Hawaiian Telcom

IARII	International Archeological Research Institute, Inc.
LID	Low Impact Development
LOS	Level of Service
LSB	Land Study Bureau
LUC	Land Use Commission
LUO	Land Use Ordinance
MAR	Mobility Analysis Report
mph	Miles per hour
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NOAA	U.S. National Oceanic and Atmospheric Administration
NOI C	Notice of Intent Form C
NOI F	Notice of Intent Form F
NOI G	Notice of Intent Form G
NPDES	National Pollutant Discharge Elimination System
NRCS	U.S. National Resource Conservation Service
OEQC	Office of Environmental Quality Control
RCP	Reinforced concrete pipe
RLS	Reconnaissance Level Survey
ROH	Revised Ordinances of Honolulu
ROW	Right-of-Way
ROM	Rough Order of Magnitude
SCAP	Stream Channel Alteration Permit
sec/veh	Seconds per vehicle
SHPD	State Historic Preservation Division
SIC	Sandwich Isles Communication
SMA	Special Management Area
SSSC	Side-Street Stop Controlled
State	State of Hawaiʻi
TIAR	Transportation Impact Analysis Report
TMK	Tax Map Key
U.S.	United States of America
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOA	Voice of America
WSCP	Waiʻanae Sustainable Community Plan

1.0 INTRODUCTION

This Draft Environmental Assessment (DEA) is prepared pursuant to Chapter 343, Hawaiʻi Revised Statutes (HRS) and Title 11, Chapter 200.1, Hawaiʻi Administrative Rules (HAR), and is intended to address current and future instances involving the use of State and/or County lands and State and/or County funds relating to the proposed Māʻili Residential Development (Former Voice of America Site) project.

1.1 PROJECT SUMMARY

Name of Project:	Māʻili Residential Development (Former Voice of America Site)
Applicable Law:	Hawaiʻi Revised Statutes – Chapter 343 Hawaiʻi Administrative Rules – Title 11, Chapter 200.1 (Use of State lands and funds)
Type of Document:	Draft Environmental Assessment/Anticipated Finding of No Significant Impact
Island:	Oʻahu
District:	Waiʻanae
Location:	Māʻili
Tax Map Key (TMK):	(1) 8-7-010: 30 & 31
Landowner:	State of Hawaiʻi, Department of Hawaiian Home Lands
Existing Use:	Vacant Land
Project Area:	40 acres
Flood Zone:	X Beyond 500-Year Flood Plain XS 500-Year Flood Plain
State Land Use:	Agriculture
Land Use Ordinance:	AG-2 General Agriculture
Special Management Area:	Not located within the Special Management Area (SMA)
Potential Permits:	<u>Federal Government</u> • U.S. Army Corps of Engineers ○ Department of the Army (DA) Permit for Section 404 Activities of the Clean Water Act

State of Hawai‘i

- Department of Health
  - Clean Water Act, Section 401 Certification
  - National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) Form C for discharges of storm water associated with construction activities
  - NPDES NOI Form F for discharges of hydrotesting waters
  - NPDES NOI Form G for discharges of construction activity dewatering
  - Disability and Communication Access Board review for compliance with Hawai‘i Revised Statutes §103-50
  - Community Noise Permit
- Department of Land and Natural Resources
  - Stream Channel Alteration Permit (SCAP)
- Office of Planning and Sustainable Management
  - Federal Consistency for Coastal Zone Management

City and County of Honolulu

- Department of Planning and Permitting
  - Building Permit
  - Grading Permit
  - Trenching Permit
  - Sewer Connection
  - Subdivision Application
  - Surface Runoff from Construction Activities entering into City's Storm Sewer System
- Department of Transportation Services
  - Street Usage Permit

Proposing Agency:	State of Hawai‘i, Department of Hawaiian Home Lands
Address	91-5420 Kapolei Parkway
City, State, Zip	Kapolei, Hawai‘i 96707
Accepting Authority:	State of Hawai‘i, Department of Hawaiian Home Lands
Consultant:	Gray, Hong, Nojima & Associates, Inc.
Address	201 Merchant Street, Suite 1900
City, State, Zip	Honolulu, Hawai‘i 96813

Project Summary:

The State of Hawai‘i Department of Hawaiian Home Lands (DHHL) is proposing to develop approximately 40 acres of vacant land in Mā‘ili, Wai‘anae, O‘ahu into a homestead community for DHHL beneficiaries. The development will take place in two separate phases. DHHL will initially construct the backbone road and utility infrastructure that will support the proposed homestead community. In the second phase, DHHL will solicit proposals to develop the residential units, which will be constructed after the backbone infrastructure has been completed.

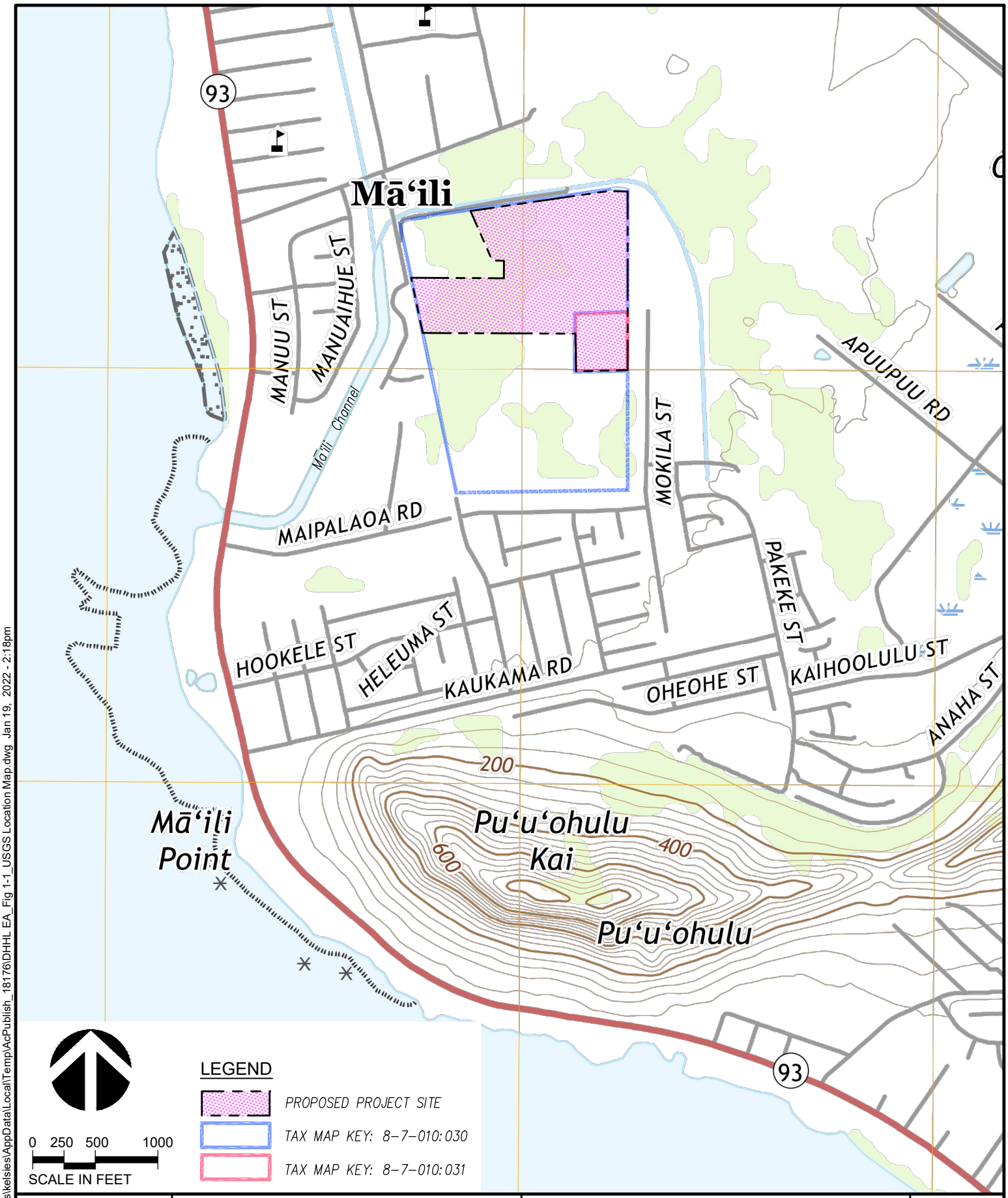
Direct short-term impacts resulting from construction activities include noise, dust and increased traffic congestion and utility interruptions related to possible offsite improvements. The proposed project will also include long-term adverse impacts related to a typical residential development, as well as an increase in population and traffic in the immediate area. Mitigation efforts will be implemented to minimize both potential short- and long-term adverse impacts to the natural and human environment which will be discussed in the upcoming sections of this assessment. No adverse cumulative effects are expected.

Because the past, present, and reasonably foreseeable future actions are expected to be consistent with the surrounding residential use of the area, the project would make no contribution to secondary impacts.

The long-term beneficial impact of the proposed development will include residences to native Hawaiian beneficiaries of the Hawaiian Homes Commission Act. The Hawaiian Homes Commission Act was enacted by the United States Congress on July 9, 1921. The Act allocated 200,000 acres of land to the Hawaiian Home Lands Trust intended to support and improve the lives of native Hawaiians. Development of the currently vacant, unoccupied land will directly benefit the native Hawaiian population. The growing waitlist of over 23,000 residential applicants (total throughout all Hawaiian Islands) highlights the importance of this project which will provide a lease and/or rental agreements for a number of native Hawaiian beneficiaries eligible under the program. Ultimately the awarded beneficiaries will have a chance to establish a permanent homestead community allowing for preservation of the values, traditions, and culture of Native Hawaiians.

1.2 LOCATION

The proposed 40-acre project site is located in Mā‘ili, Wai‘anae on the leeward coast of the island of O‘ahu (refer to Figures 1-1 and 1-2). Other residential developments, the Kamehameha Schools Community Learning Center, and a portion of Mā‘ili Channel surround the project property. The project site is located approximately 1,600 feet inland from the shoreline and mouth of Mā‘ili Channel.



CAD DRAWING: DHHL EA_Fig 1-1_USGS Location Map	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: DECEMBER 2021	CONSULTING ENGINEERS	USGS LOCATION MAP	1-1
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

Drawing name: C:\Users\kelsies\AppData\Local\Temp\AcPublish_18176\DHHL EA_Fig 1-1_USGS Location Map.dwg Jan 19, 2022 - 2:18pm

CAD DRAWING: DHHL EA_Fig 1-2_Aerial Map	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: DECEMBER 2021	CONSULTING ENGINEERS	AERIAL MAP	1-2
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

Drawing name: P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures\DHHL EA_Fig 1-2_Aerial Map.dwg Jan 19, 2022 - 2:18pm

1.3 LAND OWNERSHIP AND MAJOR APPROVALS REQUIRED

The project site is currently situated within two parcels designated as tax map key (TMK) (1) 8-7-010: 30 & 31 which are both owned by DHHL. The TMK map for both parcels is shown on Figure 1-3.

Both project parcels were transferred to DHHL from the United States of America through the Administrator of General Services (U.S. Government) via separate quitclaim deeds. The larger parcel (84.417 acres) was transferred in December 2010, while the smaller parcel (4.857 acres) was withheld due to the presence of hazardous materials from previous land activities. The smaller parcel was recently conveyed to DHHL in July 2021 after remediation work was completed by the U.S. Government. Future consolidation and subdivision of the project parcels will be included as part of the project.

1.3.1 Identification of Applicant

The State of Hawaiʻi Department of Hawaiian Home Lands is the project applicant.

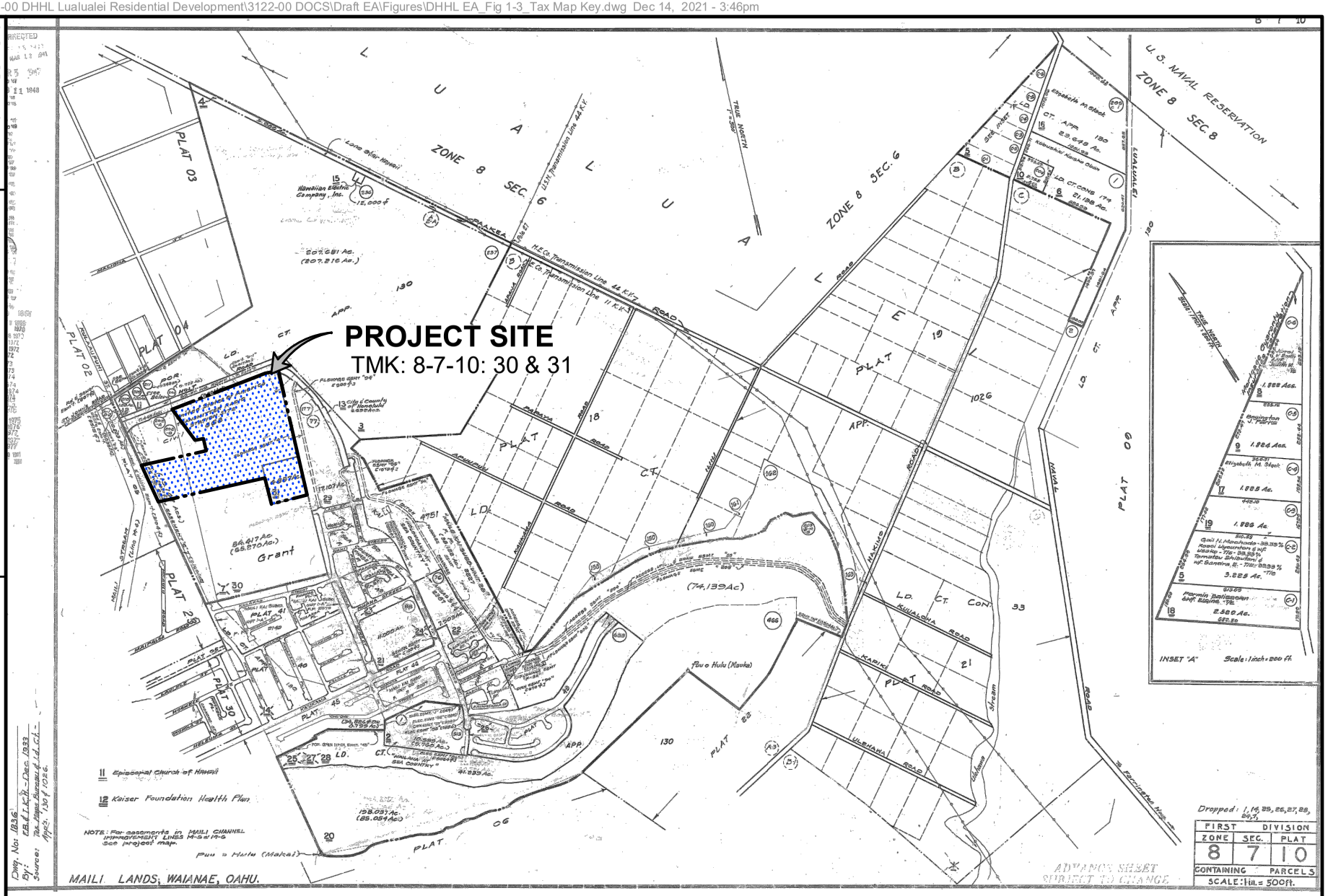
Contact: Mr. Darrell Ing
State of Hawaiʻi
Department of Hawaiian Home Lands
Land Development Division
91-5420 Kapolei Parkway
Kapolei, Hawaiʻi 96707
Phone: (808) 620-9276
Fax: (808) 620-9299
Email: Darrell.H.Ing@Hawaii.gov

1.3.2 Identification of Environmental Consultant

The environmental consultant is Gray, Hong, Nojima & Associates, Inc.

Contact: Mr. Toby T. Hanzawa, PE, LEED AP
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaiʻi 96813
Phone: (808) 521-0306
Fax: (808) 531-8018
Email: thanzawa@grayhongnojima.com

Drawing name: P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures\DHHL EA_Fig 1-3_Tax Map Key.dwg Dec 14, 2021 - 3:46pm



CAD DRAWING: DHHL EA_Fig 1-3_Tax Map Key

DATE: DECEMBER 2021

SCALE: AS NOTED

PROJECT #: 3122-00

Gray• Hong• Nojima & Associates, Inc.

CONSULTING ENGINEERS

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RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

TAX MAP KEY

FIGURE 1-3

1.3.3 Environmental Requirements

This document assesses the potential environmental impacts that may result from the proposed development through the environmental review process in accordance with Chapter 343, Hawai‘i Revised Statutes (HRS) and Title 11, Chapter 200.1, Hawai‘i Administrative Rules (HAR). Section 343-5, Chapter 343 lists “triggers” requiring an environmental review. The triggers applicable to this project includes (1) the use of state or county lands and (2) the use of state or county funds.

1.3.4 List of Anticipated Permits and Approvals

The project will require permits and approvals from various government agencies. Applicable permits and approvals will be obtained from the respective agencies prior to the start of construction activities. A list of potential permits and approvals for the project is provided in Table 1-1 below. Additional permits and approvals may be identified during the design phase of the project.

Table 1-1: Anticipated Permits and Approvals

AGENCY	ANTICIPATED PERMIT/APPROVAL
FEDERAL GOVERNMENT	
U.S. Army Corps of Engineers	• Department of the Army (DA) Permit for Section 404 Activities of the Clean Water Act
STATE OF HAWAI‘I	
Department of Health	• Hawai‘i Revised Statutes Chapter 343 Environmental Review Process for non-exempt activities involving the use of state or county lands or the use of state or county funds • Clean Water Act, Section 401 Certification • National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) Form C for discharges of storm water associated with construction activities • NPDES NOI Form F for discharges of hydrotesting waters • NPDES NOI Form G for discharges of construction activity dewatering • Disability and Communication Access Board review for compliance with Hawai‘i Revised Statutes §103-50 • Community Noise Permit

Table 1-1: Anticipated Permits and Approvals (continued)

AGENCY	ANTICIPATED PERMIT/APPROVAL
STATE OF HAWAI'I (continued)	
Department of Land and Natural Resources	• Stream Channel Alteration Permit (SCAP)
Office of Planning and Sustainable Development	• Federal Consistency for Coastal Zone Management
CITY AND COUNTY OF HONOLULU	
Department of Planning and Permitting	• Building Permit • Grading Permit • Trenching Permit • Sewer Connection • Site Development Division Approval • Subdivision Application • Surface Runoff from Construction Activities entering into City's Storm Sewer System
Department of Transportation Services	• Street Usage Permit • Construction Plan Review Approval
Department of Design and Construction, Mechanical/Electrical Division	• Construction Plan Review Approval
Board of Water Supply	• Water Availability • Construction Plan Review Approval
Various Utilities	• Construction Plan Review Approval

1.3.5 Identification of Accepting Authority

The State of Hawai'i Department of Hawaiian Home Lands is the accepting authority.

Contact: Mr. Darrell Ing
State of Hawai'i
Department of Hawaiian Home Lands
Land Development Division
91-5420 Kapolei Parkway
Kapolei, Hawai'i 96707
Phone: (808) 620-9276
Fax: (808) 620-9299
Email: Darrell.H.Ing@Hawaii.gov

1.4 SURROUNDING LAND USES

The project parcel is bordered by Māʻili Channel to the north, Sea Country residential development to the east, and additional residential developments to the south and west. North and northeast of the project parcel is a quarry site operated by Pacific Aggregate. Adjacent to the northwestern edge of the site are Ulu Ke Kukui (transitional housing facility) and Hoʻomalu O Nā Kamaliʻi (receiving home), both of which will remain. Kamehameha Schools recently constructed the Kamehameha Schools Community Learning Center located at the southwestern corner of the parcel. As previously mentioned, the site is currently situated within two parcels, which will be consolidated and subdivided as part of the project. The future subdivision of the two consolidated parcels will also create separate parcels for Ulu Ke Kukui, Hoʻomalu O Nā Kamaliʻi, and the Kamehameha Schools Community Learning Center.

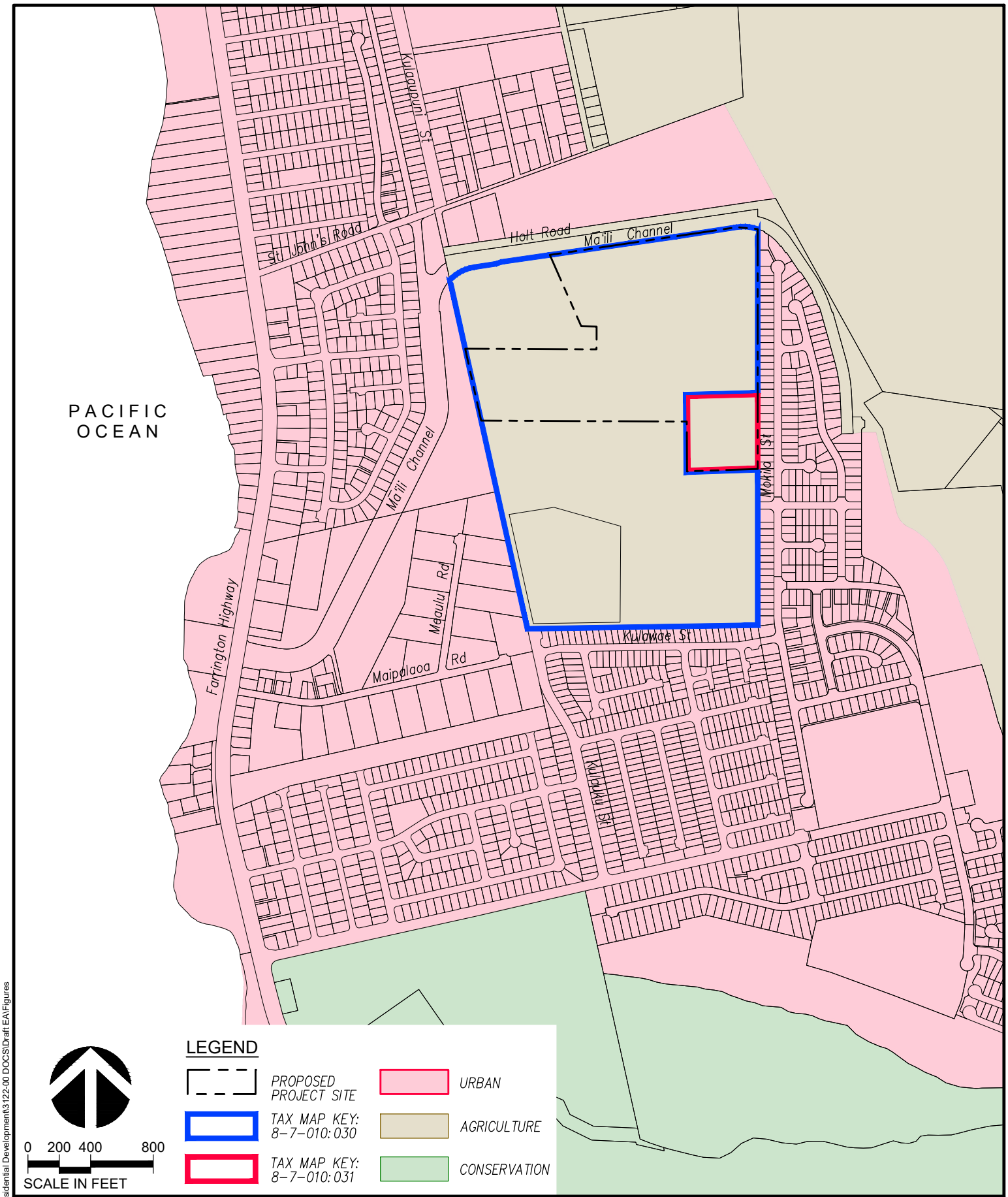
1.5 GENERAL BACKROUND

The project will include the development of former U.S. Government land into a proposed homestead community for native Hawaiian beneficiaries. The site was once occupied by a radio transmitter station (Voice of America) operated by the U.S. Government. The facility was built near the end of World War II and broadcasted American news to the Western Pacific region. Currently, all that remains from the Voice of America station are remnants of the transmitter building and foundations for the antenna system.

The proposed development will include a portion of the 84.4-acre lot designated as TMK: 8-7-010: 30 as well as the smaller parcel more recently conveyed to DHHL designated as TMK: 8-7-010: 31. Ownership of both parcels has been transferred to DHHL from the U.S. Government.

The property is within the Agriculture State Land Use District (refer to Figure 1-4) and is zoned AG-2 (General Agriculture) under the City and County of Honolulu Land Use Ordinance (refer to Figure 1-5). Re-zoning will not be required, since Hawaiian home lands are not subject to county land use regulations. The property, which is situated inland of the shoreline, is located outside of the Special Management Area (SMA) (refer to Figure 1-6).

The first phase of the project will allow DHHL to construct the backbone road and utility infrastructure that will support the proposed development. The second phase will include soliciting proposals to develop the residential units subsequent to the construction of the backbone infrastructure. Upon completion of the project, DHHL will be allowed to provide homestead leases and/or rental agreements to native Hawaiian beneficiaries who are currently on the waitlist.



CAD DRAWING: DHHL EA_Fig 1-4_State Land Use Districts

DATE: DECEMBER 2021

SCALE: AS NOTED

PROJECT #: 3122-00

Gray• Hong• Nojima & Associates, Inc.
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RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

STATE LAND USE DISTRICTS

FIGURE 1-4

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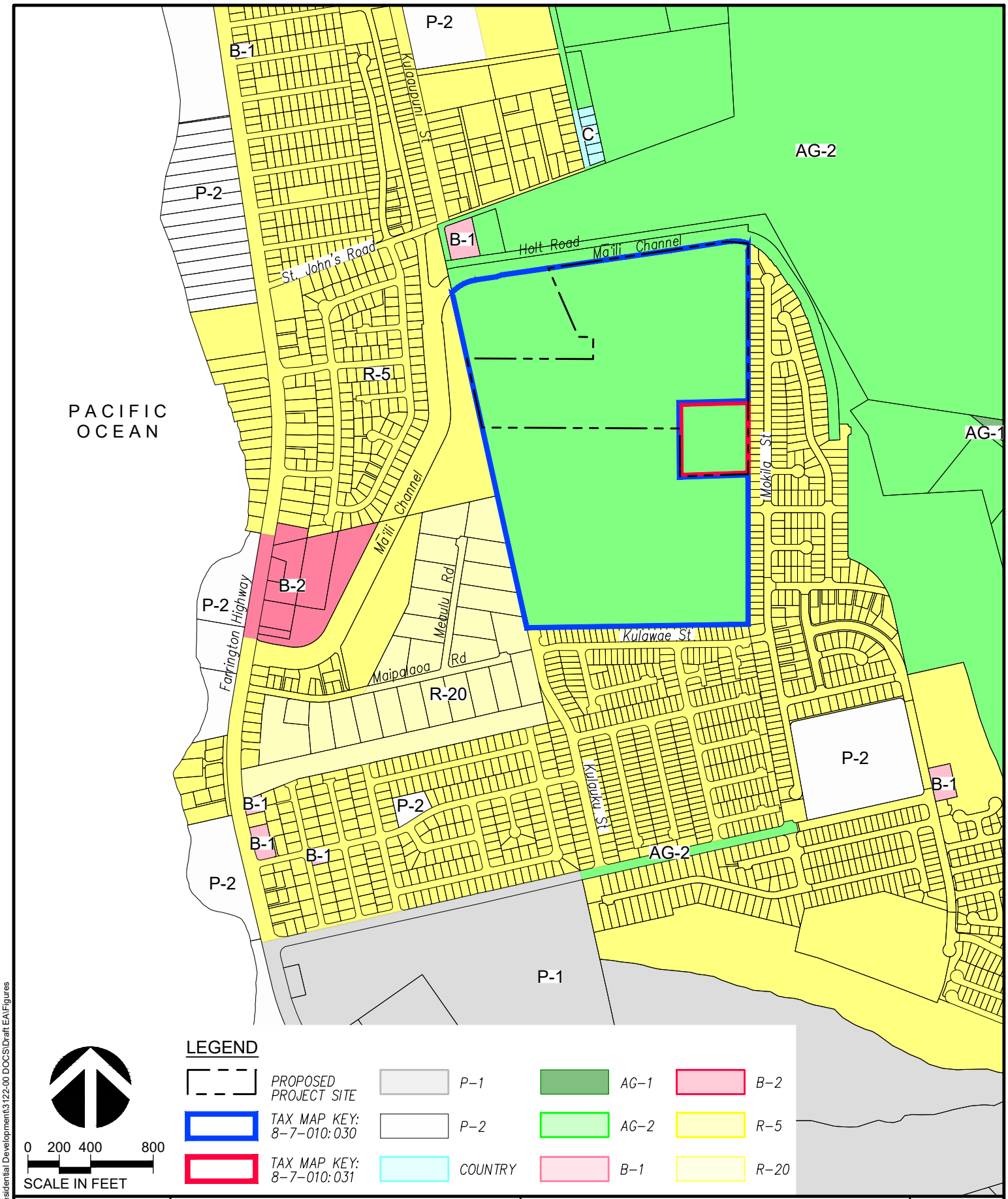

CAD DRAWING: DHHL EA_Fig 1-5_City and County Zoning	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: DECEMBER 2021	CONSULTING ENGINEERS	CITY AND COUNTY OF HONOLULU ZONING	1-5
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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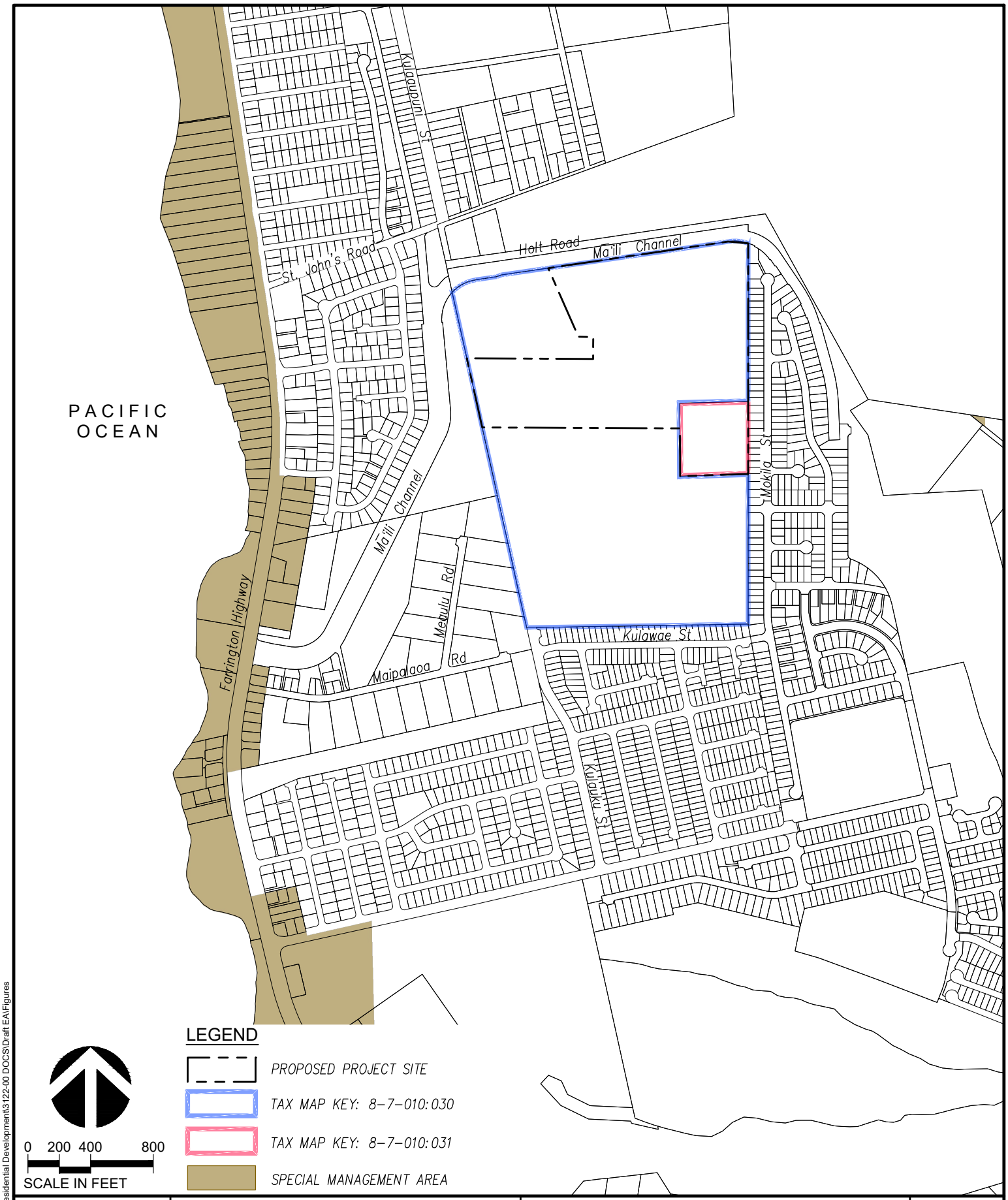

CAD DRAWING: DHHL EA_Fig 1-6_Special Management Area

DATE: DECEMBER 2021

SCALE: AS NOTED

PROJECT #: 3122-00

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RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

SPECIAL MANAGEMENT AREA

FIGURE 1-6

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2.0 PROJECT DESCRIPTION

2.1 LOCATION

The proposed project will involve the development of approximately 40 acres of vacant land currently owned by DHHL. The proposed homestead community will be located in Mā‘ili, Wai‘anae adjacent to Ulu Ke Kukui (transitional housing facility), Ho‘omalu O Nā Kamali‘i (receiving home), Kamehameha Schools Community Learning Center, and neighboring residential developments.

2.2 NEED FOR THE PROJECT

DHHL is governed by the Hawaiian Homes Commission Act enacted by the United States Congress on July 9, 1921. The Act as previously mentioned allocated 200,000 acres of land to the Hawaiian Home Lands Trust intending to benefit the native Hawaiian population throughout the Hawaiian Islands. Per the Department's General Plan: "Our mission is to manage the Hawaiian Home Lands trust effectively and to develop and deliver lands to native Hawaiians. We will partner with others towards developing self-sufficient and healthy communities."

Eligibility for a homestead lease requires that applicants meet the definition of "native Hawaiian" meaning "any descendant of not less than one-half of the blood of the races inhabiting the Hawaiian Islands previous to 1778." DHHL beneficiaries are required to have at least 50% Hawaiian blood. Applicants are allowed to designate eligible relatives as successors. DHHL defines eligible relatives as either *(1) a spouse, children, grandchildren, brother or sister provided the person or persons designated have at least 25 percent Hawaiian blood or (2) father and mother, the widows or widowers of your children, widows or widowers of your brothers and sisters, or your nieces and nephews, provided that person or persons designated have at least 50 percent Hawaiian blood.* The current beneficiary waitlist includes more than 23,000 native Hawaiians applying for residential applications, and is continuously growing. The long waitlist underscores the urgency to provide needed housing for native Hawaiian beneficiaries.

The proposed project will help to address the housing shortage for DHHL's beneficiaries. The currently vacant, unoccupied land is planned for a residential development directly benefitting the native Hawaiian population. The delivery of residences to beneficiaries will result in establishing a permanent homestead community allowing for cultural preservation and the cultivation of the values and traditions of Native Hawaiians.

2.3 KEY ELEMENTS OF THE PROPOSED PROJECT

2.3.1 Value Statement

The Department of Hawaiian Home Lands value statement reads as follows:

> *To ensure the Hawaiian Home Lands Trust is on a solid foundation with sound policies and procedures, a long-term sustainable financial plan, a commitment to serving beneficiaries, and an organizational culture that honors the spirit of its founder, Prince Jonah Kūhiō Kalaniana'ole. With the foundation firmly rooted, administrations going forward will be prepared to work side-by-side with beneficiaries and other partners to create and maintain vibrant homestead communities.*

2.3.2 Key Concepts

Development of the proposed homestead community aligns with DHHL's value statement cited in the previous paragraph. DHHL's primary responsibility lies with administration of the Hawaiian Home Lands Trust, thereby directly serving the needs of its beneficiaries. The vacant land, which was previously the site of a radio transmitter station run by the U.S. Government, has since been uninhabited for decades. The development will transform an unoccupied site into a thriving homestead community benefiting hundreds of native Hawaiian families for generations to come.

2.3.3 Site Development

A beneficiary consultation process is incorporated during the planning stages of DHHL projects. This process includes notification of beneficiaries and appropriate parties. Adhering to DHHL's value statement, the beneficiary consultation process helps to engage and involve beneficiaries early in the planning stages of a project. The consultation also allows DHHL to provide background information, as well as obtain input and concerns from beneficiaries.

A virtual beneficiary consultation meeting was held for this project on June 22, 2021. The specific purpose of this consultation meeting was to discuss possible site plans and housing options for the Mā'ili Residential Development (Former Voice of America Site). The consultation meeting included the following agenda:

- Project Background and Schedule
- Alternative Site Plans and Housing Options
- Next Steps
- Question and Answer Session
- Beneficiary Survey Questions (online poll)

The question and answer session along with the online beneficiary survey provided the opportunity to offer direct input in the process. Input related to beneficiary concerns as well as preferences related to the type(s) of homestead leases and awards were gathered and documented for future consideration by DHHL.

2.3.4 Conceptual Plan

The project proposes to development vacant land into a residential community for native Hawaiian beneficiaries. Two conceptual site plan options were proposed for consideration. One alternative is comprised entirely of single family residences, while the second alternative is a blend of single family and multifamily residences. The site plan was intentionally laid out in a modular format to provide the greatest flexibility by virtue of allowing the substitution of single family or multifamily units in the interior portions (large blocks) of the site.

As a result of DHHL deliberation and beneficiary input during the consultation meeting, the conceptual site plan option with both single family and multifamily units was chosen as the preferred alternative moving forward. This alternative includes a combination single family and multifamily development totaling approximately 280 dwelling units (refer to Figure 2-1).

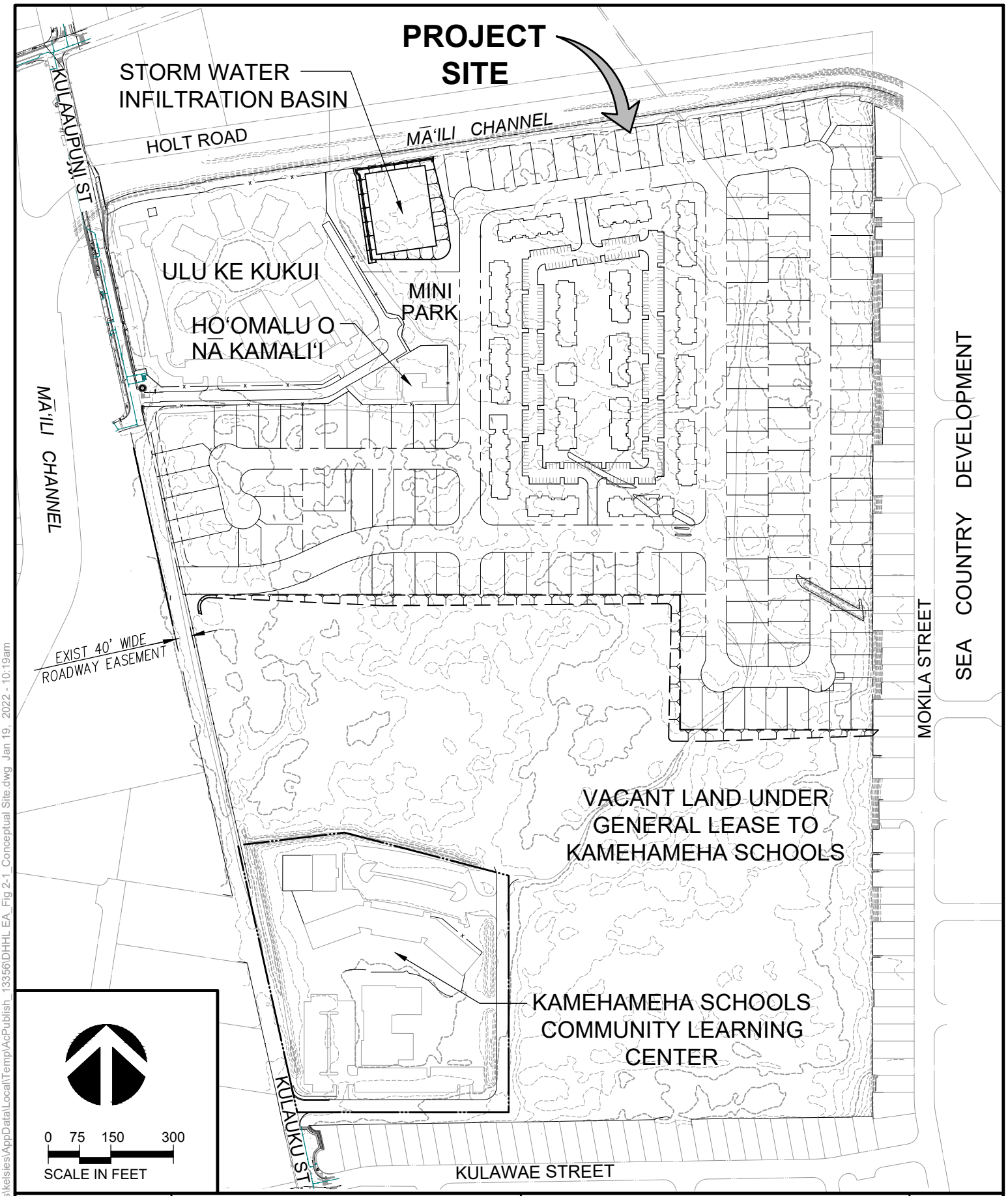
Access to the site will be serviced via St. John's Road and Kulaaupuni Street from Farrington Highway. The primary access will be located on the western border of the parcel, approximately 380 feet from the current end of Kulaaupuni Street. Roadway construction will be completed in conjunction with site grading. Since there are no utilities servicing the existing site, water, sewer, drainage and electrical improvements will be required in order to service the proposed development. An infiltration basin and small park will be situated towards the northwestern portion of the site.

2.4 PROJECT IMPLEMENTATION

2.4.1 Timing of Action

A tentative timetable for project milestones is as follows:

- Planning Phase (Environmental Review Process): 2022 to 2023
- Infrastructure Design: 2023 to 2024
- Infrastructure Construction (backbone roads and utilities): 2025 to 2026
- Residential Unit Design and Construction: 2026 to 2027
- Occupancy of Residential Units: 2028



CAD DRAWING: DHHL EA_Fig 2-1_Conceptual Site	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: DECEMBER 2021	CONSULTING ENGINEERS	CONCEPTUAL SITE PLAN	2-1
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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The project schedule will be ultimately driven by other key factors:

- Time required to obtain permits and approvals from various government agencies.
- The time required to procure construction funds for project design and construction will also affect the project schedule.
- Assuming funding will be made available for all project phases and barring any unforeseen delays, residential units could be made available to beneficiaries as early as 2028.

2.4.2 Estimated Infrastructure Costs

The estimated rough order of magnitude (ROM) infrastructure costs for the proposed project is $55,300,000. It should be noted that this estimate is based on rough schematic designs which will require further refinement during the design phase of the project. Sources of funds have not been determined, but potentially include DHHL Trust Funds, legislative appropriations, and/or Federal funds.

3.0 RELATION TO PLANS AND POLICIES

Project relevant State of Hawai‘i and City and County of Honolulu land use plans, policies, permits and approvals are described below.

3.1 STATE OF HAWAI‘I

3.1.1 State Land Use Law, Chapter 205, Hawai‘i Revised Statues

The State Land Use Commission (LUC) was established by the State Land Use Law (Chapter 205, HRS). The LUC designates all lands in the State into one of four land use districts: Urban, Rural, Agricultural, and Conservation. The LUC determines the boundaries of each district.

Discussion:
The project site is located within the Agricultural District. While the proposed residential development does not fulfill an agricultural use, because trust lands are exclusively under the authority of the Hawaiian Homes Commission, Hawaiian Home Lands are not subject to State and/or County land use controls.

3.1.2 Coastal Zone Management Act, Chapter 205A, Hawai‘i Revised Statutes

The 1972 Coastal Zone Management Act (CZMA), administered by the National Oceanic and Atmospheric Administration (NOAA), was established to provide the basis for protecting, restoring, and responsibly developing the nation’s diverse coastal communities and resources. A provision of the CZMA was to provide funding for states to develop their own Coastal Zone Management (CZM) programs. Hawai‘i’s CZM program was approved by NOAA in 1977 (HRS §205A). The lead agency to manage the state’s coastal zone is the Department of Business, Economic Development and Tourism (DBEDT) State Office of Planning. The Hawai‘i CZM area encompasses the entire State (including its land area), as problems that occur on land will eventually impact/influence the quality of the coastal waters and marine resources.

One of the key components of the CZMA is known as the federal consistency provision. Federal consistency requires that federal actions be consistent with State’s CZM. This federal consistency provision gives the State input into federal decision making for activities that affect the State’s coastal use or resources.

The proposed project is not located along the coast or within the Special Management Area (SMA) and should have little to no negative impact on the State’s ten management objectives.

3.1.3 Hawai‘i State Planning Act, Chapter 226, Hawai‘i Revised Statutes

The Hawai‘i State Planning Act was signed into law in 1978 to “improve the planning process in this State, to increase the effectiveness of government and private actions, to improve coordination among different agencies and levels of government, to provide for wise use of Hawai‘i’s resources and to guide the future development of the State” (HRS 226-1). The Act is

codified under HRS Chapter 226 and sets forth the Hawai‘i State Plan. The State Plan is a long-range comprehensive plan including an overall theme, goals, objectives, policies, priority guidelines, and implementation mechanisms. The State Plan consists of three major parts:

- Part I, describes the overall theme including Hawai‘i desired future and quality of life as expressed in goals, objectives, and policies.
- Part II, Planning Coordination and Implementation, describing a statewide planning system designed to coordinate and guide all major State and County activities and to implement the goals, objectives, policies, and priority guidelines of the Hawai‘i State Plan.
- Part III, Priority Guidelines, which express the pursuit of desirable course of action in major areas of statewide concern.

The following table outlines the proposed project's conformance with each theme, goal, objective, policy, and guideline of the Hawai‘i State Plan.

Table 3-1: Hawai‘i State Plan, Chapter 226, Part I

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-4: State Goals.			
In order to ensure, for present and future generations, those elements of choice and mobility that ensure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: 1. *A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawai‘i's present and future generations.* 2. *A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.* 3. *Physical, social and economic well-being, for individuals and families in Hawai‘i, that nourishes a sense of community responsibility, of caring and of participation in community life.*			
Discussion: The proposed homestead residential development addresses DHHL beneficiaries' interest for more homestead housing opportunities. It will support the needs of current and future generations of native Hawaiian beneficiaries by providing opportunities for home ownership and/or rental agreements. The project will also be beneficial to the state-wide housing shortage as beneficiaries vacate residences and move onto homestead lots. Short-term jobs will be generated through construction of this project and will help to support the economy.			
HRS § 226-5: Objectives and policies for population.			
Objective: *It shall be the objective in planning for the State's population to guide population growth to be consistent with the achievement of physical, economic and social objectives contained in this chapter.*			
Policies:			
1. Manage population growth statewide in a manner that provides increased opportunities for Hawai‘i's people to pursue their physical, social and economic aspirations while recognizing the unique needs of each county.	X		

Table 3-1: Hawaiʻi State Plan, Chapter 226, Part I (continued)

HAWAIʻI STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
2. Encourage an increase in economic activities and employment opportunities on the neighbor islands consistent with community needs and desires.			X
3. Promote increased opportunities for Hawaiʻi's people to pursue their socio-economic aspirations throughout the islands.	X		
4. Encourage research activities and public awareness programs to foster an understanding of Hawaiʻi's limited capacity to accommodate population needs and to address concerns resulting from an increase in Hawaiʻi's population.			X
5. Encourage federal actions and coordination among major governmental agencies to promote a more balanced distribution of immigrants among the states, provided that such actions do not prevent the reunion of immediate family members.			X
6. Pursue an increase in federal assistance for states with a greater proportion of foreign immigrants relative to their State's population.			X
7. Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.	X		
Discussion: While population growth management is not a specific goal of DHHL, implementation of the proposed project will increase economic activities and provide housing opportunities on Oʻahu, the island with the longest beneficiary waitlist.			
HRS § 226-6: Objectives and policies for the economy in general.			
Objectives: *Planning for the State's economy in general shall be directed toward achievement of the following objectives:* 1. *Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaiʻi's people, while at the same time stimulating the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited* 2. *A steadily growing and diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands.*			
Policies:			
1. Promote and encourage entrepreneurship within Hawaiʻi by residents and nonresidents of the State.			X
2. Expand Hawaiʻi's national and international marketing, communication, and organizational ties, to increase the State's capacity to adjust to and capitalize upon economic changes and opportunities occurring outside the State.			X
3. Promote Hawaiʻi as an attractive market for environmentally and socially sound investment activities that benefit Hawaiʻi's people.			X
4. Transform and maintain Hawaiʻi as a place that welcomes and facilitates innovative activity that may lead to commercial opportunities.			X
5. Promote innovative activity that may pose initial risks, but ultimately contribute to the economy of Hawaiʻi.			X
6. Seek broader outlets for new or expanded Hawaiʻi business investments.			X

Table 3-1: Hawai‘i State Plan, Chapter 226, Part I (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
7. Expand existing markets and penetrate new markets for Hawai‘i’s products and services.			X
8. Assure that the basic economic needs of Hawai‘i’s people are maintained in the event of disruptions in overseas transportation.			X
9. Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.			X
10. Encourage the formation of cooperatives and other favorable marketing arrangements at the local or regional level to assist Hawai‘i’s small scale producers, manufacturers, and distributors.			X
11. Encourage labor-intensive activities that are economically satisfying and which offer opportunities for upward mobility.			X
12. Encourage innovative activities that may not be labor-intensive, but may otherwise contribute to the economy of Hawai‘i.			X
13. Foster greater cooperation and coordination between the government and private sectors in developing Hawai‘i’s employment and economic growth opportunities.			X
14. Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.			X
15. Maintain acceptable working conditions and standards for Hawai‘i’s workers.			X
16. Provide equal employment opportunities for all segments of Hawai‘i’s population through affirmative action and nondiscrimination measures.			X
17. Stimulate the development and expansion of economic activities capitalizing on defense, dual-use, and science and technology assets, particularly on the neighbor islands where employment opportunities may be limited.			X
18. Encourage businesses that have favorable financial multiplier effects within Hawai‘i’s economy, particularly with respect to emerging industries in science and technology.			X
19. Promote and protect intangible resources in Hawai‘i, such as scenic beauty and the aloha spirit, which are vital to a healthy economy.			X
20. Increase effective communication between the educational community and the private sector to develop relevant curricula and training programs to meet future employment needs in general, and requirements of new, potential growth industries in particular.			X
21. Foster a business climate in Hawai‘i - including attitudes, tax and regulatory policies, and financial and technical assistance programs--that is conducive to the expansion of existing enterprises and the creation and attraction of new business and industry.			X
Discussion: The proposed project will generate short-term construction employment; however, it will not have a significant impact on the overall state economy.			

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-7: Objectives and policies for the economy - agriculture.			
Objectives: *Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:* *1. Viability of Hawai'i's sugar and pineapple industries.* *2. Growth and development of diversified agriculture throughout the State.* *3. An agriculture industry that continues to constitute a dynamic and essential component of Hawai'i's strategic, economic, and social well-being.*			
Policies:			
1. Establish a clear direction for Hawai'i's agriculture through stakeholder commitment and advocacy.			X
2. Encourage agriculture by making best use of natural resources.			X
3. Provide the governor and the legislature with information and options needed for prudent decision making for the development of agriculture.			X
4. Establish strong relationships between the agricultural and visitor industries for mutual marketing benefits.			X
5. Foster increased public awareness and understanding of the contributions and benefits of agriculture as a major sector of Hawai'i's economy.			X
6. Seek the enactment and retention of federal and state legislation that benefits Hawai'i's agricultural industries			X
7. Strengthen diversified agriculture by developing an effective promotion, marketing, and distribution system between Hawai'i's food producers and consumers in the State, nation, and world.			X
8. Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural by-products.			X
9. Enhance agricultural growth by providing public incentives and encouraging private initiatives.			X
10. Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.			X
11. Increase the attractiveness and opportunities for an agricultural education and livelihood.			X
12. In addition to the State's priority on food, expand Hawai'i's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.			X
13. Promote economically competitive activities that increase Hawai'i's agricultural self-sufficiency, including the increased purchase and use of Hawai'i-grown food and food products by residents, businesses, and governmental bodies as defined under section 103D-104.			X
14. Promote and assist in the establishment of sound financial programs for diversified agriculture.			X
15. Institute and support programs and activities to assist the entry of displaced agricultural workers into alternative agricultural or other employment.			X

Table 3-1: Hawaiʻi State Plan, Chapter 226, Part I (continued)

HAWAIʻI STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
16. Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.			X
17. Perpetuate, promote, and increase use of traditional Hawaiian farming systems, such as the use of loko iʻa, māla, and irrigated loʻi, and growth of traditional Hawaiian crops, such as kalo, ʻuala, and ʻulu.			X
18. Increase and develop small-scale farms.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's economy with regards to agriculture.			
HRS § 226-8: Objectives and policies for the economy - visitor industry.			
Objectives: *Planning for the State's economy with regard to the visitor industry shall be directed towards the achievement of the objective of a visitor industry that constitutes a major component of steady growth for Hawaiʻi's economy.*			
Policies:			
1. Support and assist in the promotion of Hawaiʻi's visitor attractions and facilities			X
2. Ensure that visitor industry activities are in keeping with the social, economic, and physical needs and aspirations of Hawaiʻi's people.			X
3. Improve the quality of existing visitor destination areas by utilizing Hawaiʻi's strengths in science and technology.			X
4. Encourage cooperation and coordination between the government and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring communities and activities.			X
5. Develop the industry in a manner that will continue to provide new job opportunities and steady employment for Hawaiʻi's people.			X
6. Provide opportunities for Hawaiʻi's people to obtain job training and education that will allow for upward mobility within the visitor industry.			X
7. Foster a recognition of the contribution of the visitor industry to Hawaiʻi's economy and the need to perpetuate the aloha spirit.			X
8. Foster an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawaiʻi's cultures and values.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's economy with regards to the visitor industry.			
HRS § 226-9: Objective and policies for the economy – federal expenditures.			
Objective: *Planning for the State's economy with regard to federal expenditures shall be directed towards achievement of the objective of a stable federal investment base as an integral component of Hawaiʻi's economy*			
Policies:			
1. Encourage the sustained flow of federal expenditures in Hawaiʻi that generates long-term government civilian employment.			X

Table 3-1: Hawai‘i State Plan, Chapter 226, Part I (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
2. Promote Hawai‘i’s supportive role in national defense, in a manner consistent with Hawai‘i’s social, environmental, and cultural goals by building upon dual-use and defense applications to develop thriving ocean engineering, aerospace research and development, and related dual-use technology sectors in Hawai‘i’s economy.			X
3. Promote the development of federally supported activities in Hawai‘i that respect state-wide economic concerns, are sensitive to community needs, and minimize adverse impacts on Hawai‘i’s environment.			X
4. Increase opportunities for entry and advancement of Hawai‘i’s people into federal government service.			X
5. Promote federal use of local commodities, services, and facilities available in Hawai‘i.			X
6. Strengthen federal-state-county communication and coordination in all federal activities that affect Hawai‘i.			X
7. Pursue the return of federally controlled lands in Hawai‘i that are not required for either the defense of the nation or for other purposes of national importance, and promote the mutually beneficial exchanges of land between federal agencies, the State, and the counties.	X		
Discussion: The proposed project will not directly affect the objectives and policies for the State’s economy with regards to federal expenditures.			
HRS § 226-10: Objective and policies for the economy – potential growth and innovative activities.			
Objective: *Planning for the State’s economy with regard to potential growth and innovative activities shall be directed towards achievement of the objective of development and expansion of potential growth and innovative activities that serve to increase and diversify Hawai‘i’s economic base.*			
Policies:			
1. Facilitate investment and employment in economic activities that have the potential to expand and diversify Hawai‘i’s economy, including but not limited to diversified agriculture, aquaculture, renewable energy development, creative media, health care, and science and technology-based sectors.			X
2. Facilitate investment in innovative activity that may pose risks or be less labor-intensive than other traditional business activity, but if successful, will generate revenue in Hawai‘i through the export of services or products or substitution of imported services or products.			X
3. Encourage entrepreneurship in innovative activity by academic researchers and instructors who may not have the background, skill, or initial inclination to commercially exploit their discoveries or achievements.			X
4. Recognize that innovative activity is not exclusively dependent upon individuals with advanced formal education, but that many self-taught, motivated individuals are able, willing, sufficiently knowledgeable, and equipped with the attitude necessary to undertake innovative activity.			X
5. Increase the opportunities for investors in innovative activity and talent engaged in innovative activity to personally meet and interact at cultural, art, entertainment, culinary, athletic, or visitor-oriented events without a business focus.			X

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
6. Expand Hawai'i's capacity to attract and service international programs and activities that generate employment for Hawai'i's people.			X
7. Enhance and promote Hawai'i's role as a center for international relations, trade, finance, services, technology, education, culture, and the arts.			X
8. Accelerate research and development of new energy- related industries based on wind, solar, ocean, and underground resources and solid waste.			X
9. Promote Hawai'i's geographic, environmental, social, and technological advantages to attract new economic activities into the State.			X
10. Provide public incentives and encourage private initiative to attract new industries that best support Hawai'i's social, economic, physical, and environmental objectives.			X
11. Increase research and the development of ocean-related economic activities such as mining, food production, and scientific research.			X
12. Develop, promote, and support research and educational and training programs that will enhance Hawai'i's ability to attract and develop economic activities of benefit to Hawai'i.			X
13. Foster a broader public recognition and understanding of the potential benefits of new, or innovative growth-oriented industry in Hawai'i.			X
14. Encourage the development and implementation of joint federal and state initiatives to attract federal programs and projects that will support Hawai'i's social, economic, physical, and environmental objectives.			X
15. Increase research and development of businesses and services in the telecommunications and information industries.			X
16. Foster the research and development of nonfossil fuel and energy efficient modes of transportation.			X
17. Recognize and promote health care and health care information technology as growth industries.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's economy with regards to potential growth and innovative activities.			
HRS § 226-10.5: Objective and policies for the economy – information industry.			
***Objective*:** *Planning for the State's economy with regard to telecommunications and information technology shall be directed toward recognizing that broadband and wireless communication capability and infrastructure are foundations for an innovative economy and positioning Hawai'i as a leader in broadband and wireless communications and applications in the Pacific Region.*			
Policies:			
1. Promote efforts to attain the highest speeds of electronic and wireless communication within Hawai'i and between Hawai'i and the world, and make high speed communication available to all residents and businesses in Hawai'i.			X
2. Encourage the continued development and expansion of the telecommunications infrastructure serving Hawai'i to accommodate future growth and innovation in Hawai'i's economy.			X
3. Facilitate the development of new or innovative business and service ventures in the information industry which will provide employment opportunities for the people of Hawai'i.			X

Table 3-1: Hawai‘i State Plan, Chapter 226, Part I (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
4. Encourage mainland- and foreign-based companies of all sizes, whether information technology-focused or not, to allow their principals, employees, or contractors to live in and work from Hawai‘i, using technology to communicate with their headquarters, offices, or customers located out-of-state.			X
5. Encourage greater cooperation between the public and private sectors in developing and maintaining a well-designed information industry.			X
6. Ensure that the development of new businesses and services in the industry are in keeping with the social, economic, and physical needs and aspirations of Hawai‘i’s people.			X
7. Provide opportunities for Hawai‘i’s people to obtain job training and education that will allow for upward mobility within the information industry.			X
8. Foster a recognition of the contribution of the information industry to Hawai‘i’s economy.			X
9. Assist in the promotion of Hawai‘i as a broker, creator, and processor of information in the Pacific.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State’s economy with regards to the information industry.			
HRS § 226-11: Objective and policies for the physical environment – land based, shoreline, and marine resources.			
Objectives: *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.*			
Policies:			
1. Exercise an overall conservation ethic in the use of Hawai‘i’s natural resources.			X
2. Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.	X		
3. Take into account the physical attributes of areas when planning and designing activities and facilities.	X		
4. Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.	X		
5. Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.			X
6. Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai‘i.	X		
7. Provide public incentives that encourage private actions to protect significant natural resources from degradation or unnecessary depletion.			X
8. Pursue compatible relationships among activities, facilities, and natural resources.			X
9. Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.			X

Table 3-1: Hawaiʻi State Plan, Chapter 226, Part I (continued)

HAWAIʻI STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Discussion: The project site includes vacant land zoned for agriculture. Based on the natural resources assessment report prepared by AECOS, Inc. entitled *A natural resources assessment of the former Voice of America Site* dated May 27, 2021, the site is not rare or unique and does not contain federally listed rare or endangered plants and animal species (refer to Appendix A). Taking no action would not represent prudent use of DHHL and Hawaiʻi's land-based resources. Best management practices will be implemented during construction to mitigate erosion and pollution caused by discharge of storm water runoff in accordance with "Rules Relating to Water Quality" (City Administrative Rules §20-3) and other applicable statues.			
HRS § 226-12: Objective and policies for the physical environment – scenic, natural beauty, and historic resources.			
Objective: *Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaiʻi's scenic assets, natural beauty, and multi-cultural/historical resources.*			
Policies:			
1. Promote the preservation and restoration of significant natural and historic resources.	X		
2. Provide incentives to maintain and enhance historic, cultural, and scenic amenities.			X
3. Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.	X		
4. Protect those special areas, structures, and elements that are an integral and functional part of Hawaiʻi's ethnic and cultural heritage.			X
5. Encourage the design of developments and activities that complement the natural beauty of the islands.			X
Discussion: The proposed project is not anticipated to have a significant adverse impact on scenic view planes or scenic resources. The proposed multifamily buildings and single family homes are anticipated to be "low rise", which will help to mitigate visual obstructions from the site. The Waiʻanae Sustainable Community Plan describes the importance of mauka to makai views but does not specify any view plane covering any portion of the project site. Therefore, public views are not anticipated to be significantly impacted by the proposed project. Previous Archaeological Inventory Surveys (AISs) and a Reconnaissance Level Survey (RLS) were prepared to evaluate the historical and cultural resources within the project site (see Section 4.6). Furthermore, the purpose of the proposed project is not to specifically enhance scenic, natural beauty, and historic resources objectives.			
HRS § 226-13: Objective and policies for the physical environment – land, air, and water quality.			
Objectives: *Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:*			
1. Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources.	X		
2. Greater public awareness and appreciation of Hawaiʻi's environmental resources.			X
Policies:			
1. Foster educational activities that promote a better understanding of Hawaiʻi's limited environmental resources.			X
2. Promote the proper management of Hawaiʻi's land and water resources.	X		
3. Promote effective measures to achieve desired quality in Hawaiʻi's surface, ground, and coastal waters.	X		

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
4. Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawai'i's people.	X		
5. Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.	X		
6. Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.	X		
7. Encourage urban developments in close proximity to existing services and facilities.	X		
8. Foster recognition of the importance and value of the land, air, and water resources to Hawai'i's people, their cultures and visitors.			X
Discussion: Best management practices (BMPs) will be implemented during construction to mitigate the potential impacts of runoff by minimizing opportunities for soil erosion. Site planning for the proposed project has taken existing streams and areas of potential flooding into account to avoid development in these areas. The proposed project will comply with current aural and air quality standards. According to the Federal Emergency Management Agency's (FEMA) *Flood Insurance Rate Map (FIRM) 15003C0192J*, dated November 5, 2014, the project site is situated in either Flood Zone X or Flood Zone XS and does not fall within a special flood hazard area (refer to Figure 4-6).			
HRS § 226-14: Objective and policies for facility system – in general.			
Objective: *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.*			
Policies:			
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.			X
2. Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.			X
3. Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.			X
4. Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.			X
Discussion: The proposed facility system impacts and utility connections will be coordinated with the appropriate State, City, and private entities.			
HRS § 226-15: Objective and policies for facility system – solid and liquid waste.			
Objectives: *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.	X		
2. Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility, and other areas.	X		

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Policies:			
1. Encourage the adequate development of sewerage facilities that complement planned growth.	X		
2. Promote reuse and recycling to reduce solid and liquid wastes and employ a conservation ethic.			X
3. Promote research to develop more efficient and economical treatment and disposal of solid and liquid wastes.			X
Discussion: The project will be connected to, and serviced by the City and County of Honolulu wastewater treatment and disposal system. Coordination with the Department of Environmental Services, Refuse Division will be required to arrange trash pickup service to the new residential development. Waste generation reduction practices, such as recycling, will also be encouraged.			
HRS § 226-16: Objective and policies for facility system – water.			
Objective: *Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.*			
Policies:			
1. Coordinate development of land use activities with existing and potential water supply.			X
2. Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.			X
3. Reclaim and encourage the productive use of runoff water and wastewater discharges.			X
4. Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.			X
5. Support water supply services to areas experiencing critical water problems.			X
6. Promote water conservation programs and practices in government, private industry, and the general public to help ensure adequate water to meet long-term needs.			X
Discussion: DHHL's main objective is to serve its native Hawaiian beneficiaries through administration of the Hawaiian Home Lands Trust by means of development and maintenance of land into thriving homestead communities and will support this community with adequate infrastructure, including potable water. Various water conservation measures will be considered for the proposed development.			
HRS § 226-17: Objective and policies for facility system – transportation.			
Objective: *Planning for the State's facility systems with regard to transportation shall be directed toward the achievement of the following objectives:*			
1. An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe, and convenient movement of people and goods.	X		
2. A statewide transportation system that is consistent with and will accommodate planned growth objectives throughout the State.			X

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Policies:			
1. Design, program, and develop a multi-modal system in conformance with desired growth and physical development as stated in this chapter;			X
2. Coordinate state, county, federal, and private transportation activities and programs toward the achievement of statewide objectives;			X
3. Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties;			X
4. Provide for improved accessibility to shipping, docking, and storage facilities;			X
5. Promote a reasonable level and variety of mass transportation services that adequately meet statewide and community needs;			X
6. Encourage transportation systems that serve to accommodate present and future development needs of communities;			X
7. Encourage a variety of carriers to offer increased opportunities and advantages to interisland movement of people and goods;			X
8. Increase the capacities of airport and harbor systems and support facilities to effectively accommodate transshipment and storage needs;			X
9. Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification;			X
10. Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawai'i's natural environment;			X
11. Encourage safe and convenient use of low-cost, energy-efficient, non-polluting means of transportation;			X
12. Coordinate intergovernmental land use and transportation planning activities to ensure the timely delivery of supporting transportation infrastructure in order to accommodate planned growth objectives; and			X
13. Encourage diversification of transportation modes and infrastructure to promote alternate fuels and energy efficiency.			X
Discussion: An evaluation of the impacts of the proposed development to mobility and access surrounding the project site was completed by Fehr & Peers, entitled *Mobility Analysis Report (MAR) for the Voice of America Site in Mā'ili*, dated October 29, 2021 which includes a discussion on existing public transportation within the project vicinity and a multi-modal assessment (refer to Appendix B).			
HRS § 226-18: Objective and policies for facility system – energy.			
Objectives: *Planning for the State's facility systems with regard to energy shall be directed toward the achievement of the following objectives, giving due consideration to all:*			
Policies:			
1. Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people;	X		
2. Increased energy security and self-sufficiency through the reduction and ultimate elimination of Hawai'i's dependence on imported fuels for electrical generation and ground transportation;	X		
3. Greater diversification of energy generation in the face of threats to Hawai'i's energy supplies and systems;	X		
4. Reduction, avoidance, or sequestration of greenhouse gas emissions from energy supply and use; and	X		

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
5. Utility models that make the social and financial interests of Hawai'i's utility customers a priority.	X		
a) To achieve the energy objectives, it shall be the policy of this State to ensure the short- and long-term provision of adequate, reasonably priced, and dependable energy services to accommodate demand.	X		
Other Policies:			
1. Support research and development as well as promote the use of renewable energy sources;	X		
2. Ensure that the combination of energy supplies and energy-saving systems is sufficient to support the demands of growth;	X		
3. Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;	X		
4. Promote all cost-effective conservation of power and fuel supplies through measures including:	X		
A. Development of cost-effective demand-side management programs;	X		
B. Education;	X		
C. Adoption of energy-efficient practices and technologies; and	X		
D. Increasing energy efficiency and decreasing energy use in public infrastructure;	X		
5. Ensure, to the extent that new supply-side resources are needed, that the development or expansion of energy systems uses the least-cost energy supply option and maximizes efficient technologies;	X		
6. Support research, development, demonstration, and use of energy efficiency, load management, and other demand-side management programs, practices, and technologies;	X		
7. Promote alternate fuels and transportation energy efficiency;	X		
8. Support actions that reduce, avoid, or sequester greenhouse gases in utility, transportation, and industrial sector applications;	X		
9. Support actions that reduce, avoid, or sequester Hawai'i's greenhouse gas emissions through agriculture and forestry initiatives.			X
10. Provide priority handling and processing for all state and county permits required for renewable energy projects;			X
11. Ensure that liquefied natural gas is used only as a cost-effective transitional, limited-term replacement of petroleum for electricity generation and does not impede the development and use of other cost-effective renewable energy sources; and			X
12. Promote the development of indigenous geothermal energy resources that are located on public trust land as an affordable and reliable source of firm power for Hawai'i.			X
Discussion: DHHL has developed and is implementing its own renewable energy policy (https://dhhl.hawaii.gov/wp-content/uploads/2011/05/DHHL-Energy-Policy.pdf) that is consistent with HRS § 226-18.			

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-18.5: Objective and policies for facility system – telecommunications.			
Objective: *Planning for the State's telecommunications facility systems shall be directed towards the achievement of dependable, efficient, and economical statewide telecommunications systems capable of supporting the needs of the people.*			
To achieve the telecommunications objective, it shall be the policy of this State to ensure the provision of adequate, reasonably priced, and dependable telecommunications services to accommodate demand.			
Other Policies:			
1. Facilitate research and development of telecommunications systems and resources;			X
2. Encourage public and private sector efforts to develop means for adequate, ongoing telecommunications planning;	X		
3. Promote efficient management and use of existing telecommunications systems and services; and	X		
4. Facilitate the development of education and training of telecommunications personnel.			X
Discussion: Based on a field investigation, Ronald NS Ho & Associates Inc. concluded that the existing underground Hawaiian Telcom and Charter infrastructure on Kulaaupuni Street is capable of accommodating the new infrastructure but a new fiber hub and power supply will be needed onsite to distribute the communication services. Another potential source of communication infrastructure is to extend communication service feeding the Kamehameha Schools Community Learning Center.			
HRS § 226-19: Objective and policies for socio-cultural advancement – housing.			
Objectives: *Planning for the State's socio-cultural advancement with regard to housing shall be directed toward the achievement of the following objectives:*			
1. Greater opportunities for Hawai'i's people to secure reasonably priced, safe, sanitary, and livable homes, located in suitable environments that satisfactorily accommodate the needs and desires of families and individuals, through collaboration and cooperation between government and nonprofit and for-profit developers to ensure that more affordable housing is made available to very low-, low- and moderate-income segments of Hawai'i's population.	X		
2. The orderly development of residential areas sensitive to community needs and other land uses.	X		
3. The development and provision of affordable rental housing by the State to meet the housing needs of Hawai'i's people.	X		
Policies:			
1. Effectively accommodate the housing needs of Hawai'i's people.	X		
2. Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income, and gap-group households.	X		
3. Increase homeownership and rental opportunities and choices in terms of quality, location, cost, densities, style, and size of housing.	X		
4. Promote appropriate improvement, rehabilitation, and maintenance of existing housing units and residential areas.			X
5. Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services, and other concerns of existing communities and surrounding areas.			X
6. Facilitate the use of available vacant, developable, and underutilized urban lands for housing.			X

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
7. Foster a variety of lifestyles traditional to Hawai'i through the design and maintenance of neighborhoods that reflect the culture and values of the community.			X
8. Promote research and development of methods to reduce the cost of housing construction in Hawai'i.			X
Discussion: DHHL's main objective is to serve its native Hawaiian beneficiaries through administration of the Hawaiian Home Lands Trust by means of development and maintenance of land into thriving homestead communities. Although the proposed project will not be open to all residents of the state, the proposed development will provide a lease and/or rental opportunity for DHHL beneficiaries who may currently not be living on homestead lands. Re-location of those beneficiaries to the proposed project would open units available to the general public.			
HRS § 226-20: Objective and policies for socio-cultural advancement – health.			
Objectives: *Planning for the State's socio-cultural advancement with regard to health shall be directed towards achievement of the following objectives:*			
1. Fulfillment of basic individual health needs of the general public.			X
2. Maintenance of sanitary and environmentally healthful conditions in Hawai'i's communities.	X		
3. Elimination of health disparities by identifying and addressing social determinants of health.			X
Policies:			
1. Provide adequate and accessible services and facilities for prevention and treatment of physical and mental health problems, including substance abuse.			X
2. Encourage improved cooperation among public and private sectors in the provision of health care to accommodate the total health needs of individuals throughout the State.			X
3. Encourage public and private efforts to develop and promote statewide and local strategies to reduce health care and related insurance costs.			X
4. Foster an awareness of the need for personal health maintenance and preventive health care through education and other measures.			X
5. Provide programs, services, and activities that ensure environmentally healthful and sanitary conditions.			X
6. Improve the State's capabilities in preventing contamination by pesticides and other potentially hazardous substances through increased coordination, education, monitoring, and enforcement.			X
7. Prioritize programs, services, interventions, and activities that address identified social determinants of health to improve native Hawaiian health and well-being consistent with the United States Congress' declaration of policy as codified in title 42 United States Code section 11702, and to reduce health disparities of disproportionately affected demographics, including native Hawaiians, other Pacific Islanders, and Filipinos. The prioritization of affected demographic groups other than native Hawaiians may be reviewed every ten years and revised based on the best available epidemiological and public health data.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement of health.			

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-21: Objective and policies for socio-cultural advancement – education.			
***Objectives**: Planning for the State's socio-cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations.*			
Policies:			
1. Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.			X
2. Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.			X
3. Provide appropriate educational opportunities for groups with special needs.			X
4. Promote educational programs which enhance understanding of Hawai'i's cultural heritage.			X
5. Provide higher educational opportunities that enable Hawai'i's people to adapt to changing employment demands.			X
6. Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.			X
7. Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.			X
8. Emphasize quality educational programs in Hawai'i's institutions to promote academic excellence.			X
9. Support research programs and activities that enhance the education programs of the State.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement of education.			
HRS § 226-22: Objective and policies for socio-cultural advancement – social services.			
***Objective:** Planning for the State's socio-cultural advancement with regard to social services shall be directed towards the achievement of the objective of improved public and private social services and activities that enable individuals, families, and groups to become more self-reliant and confident to improve their well-being.*			
Policies:			
1. Assist individuals, especially those in need of attaining a minimally adequate standard of living and those confronted by social and economic hardship conditions, through social services and activities within the State's fiscal capacities.			X
2. Promote coordination and integrative approaches among public and private agencies and programs to jointly address social problems that will enable individuals, families, and groups to deal effectively with social problems and to enhance their participation in society.			X
3. Facilitate the adjustment of new residents, especially recently arrived immigrants, into Hawai'i's communities.			X
4. Promote alternatives to institutional care in the provision of long-term care for elder and disabled populations.			X
5. Support public and private efforts to prevent domestic abuse and child molestation, and assist victims of abuse and neglect.			X

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
6. Promote programs which assist people in need of family planning services to enable them to meet their needs.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement of social services.			
HRS § 226-23: Objective and policies for socio-cultural advancement – leisure.			
Objective: *Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.*			
Policies:			
1. Foster and preserve Hawai'i's multi-cultural heritage through supportive cultural, artistic, recreational, and humanities-oriented programs and activities.			X
2. Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.			X
3. Enhance the enjoyment of recreational experiences through safety and security measures, educational opportunities, and improved facility design and maintenance.			X
4. Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.			X
5. Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.			X
6. Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.			X
7. Provide adequate and accessible physical fitness programs to promote the physical and mental well-being of Hawai'i's people.			X
8. Increase opportunities for appreciation and participation in the creative arts, including the literary, theatrical, visual, musical, folk, and traditional art forms.			X
9. Encourage the development of creative expression in the artistic disciplines to enable all segments of Hawai'i's population to participate in the creative arts.			X
10. Assure adequate access to significant natural and cultural resources in public ownership.			X
Discussion: The preferred conceptual site plan includes space for a park available for community use.			
HRS § 226-24: Objective and policies for socio-cultural advancement – individual rights and personal well-being.			
Objective: *Planning for the State's socio-cultural advancement with regard to individual rights and personal well-being shall be directed towards achievement of the objective of increased opportunities and protection of individual rights to enable individuals to fulfill their socio-economic needs and aspirations.*			
Policies:			
1. Provide effective services and activities that protect individuals from criminal acts and unfair practices and that alleviate the consequences of criminal acts in order to foster a safe and secure environment.			X

Table 3-1: Hawai‘i State Plan, Chapter 226, Part I (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
2. Uphold and protect the national and state constitutional rights of every individual.			X
3. Assure access to, and availability of, legal assistance, consumer protection, and other public services which strive to attain social justice.			X
4. Ensure equal opportunities for individual participation in society.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement with regards to individual rights and personal well-being.			
HRS § 226-25: Objective and policies for socio-cultural advancement – culture.			
Objective: *Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai‘i's people.*			
Policies:			
1. Foster increased knowledge and understanding of Hawai‘i's ethnic and cultural heritages and the history of Hawai‘i.			X
2. Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai‘i's people and which are sensitive and responsive to family and community needs.			X
3. Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai‘i.			X
4. Encourage the essence of the aloha spirit in people's daily activities to promote harmonious relationships among Hawai‘i's people and visitors.			X
Discussion: Although the proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement of culture, it will create a community for DHHL beneficiaries and promote cultural dissemination among residents.			
HRS § 226-26: Objective and policies for socio-cultural advancement – public safety.			
Objective: *Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:*			
1. Assurance of public safety and adequate protection of life and property for all people.			X
2. Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic well-being of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.			X
3. Promotion of a sense of community responsibility for the welfare and safety of Hawai‘i's people.			X
Policies related to public safety:			
1. Ensure that public safety programs are effective and responsive to community needs.			X
2. Encourage increased community awareness and participation in public safety programs.			X
Policies related to criminal justice:			
1. Support criminal justice programs aimed at preventing and curtailing criminal activities.			X
2. Develop a coordinated, systematic approach to criminal justice administration among all criminal justice agencies.			X

Table 3-1: Hawai'i State Plan, Chapter 226, Part I (continued)

HAWAI'I STATE PLAN, CHAPTER 226, HRS - PART I. OVERALL THEME, GOALS, OBJECTIVES AND POLICIES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
3. Provide a range of correctional resources which may include facilities and alternatives to traditional incarceration in order to address the varied security needs of the community and successfully reintegrate offenders into the community.			X
Policies related to emergency management:			
1. Ensure that responsible organizations are in a proper state of readiness to respond to major war-related, natural, or technological disasters and civil disturbances at all times.			X
2. Enhance the coordination between emergency management programs throughout the State.			X
Discussion: The proposed project will not directly affect the objectives and policies for the State's socio-cultural advancement with regards to public safety.			
HRS § 226-27: Objective and policies for socio-cultural advancement – government.			
Objective: *Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:* *1. Efficient, effective, and responsive government services at all levels in the State.* *2. Fiscal integrity, responsibility, and efficiency in the state government and county governments.*			
Policies:			
1. Provide for necessary public goods and services not assumed by the private sector.			X
2. Pursue an openness and responsiveness in government that permits the flow of public information, interaction, and response.	X		
3. Minimize the size of government to that necessary to be effective.			X
4. Stimulate the responsibility in citizens to productively participate in government for a better Hawai'i.			X
5. Assure that government attitudes, actions, and services are sensitive to community needs and concerns.	X		
6. Provide for a balanced fiscal budget.			X
7. Improve the fiscal budgeting and management system of the State.			X
8. Promote the consolidation of state and county governmental functions to increase the effective and efficient delivery of government programs and services and to eliminate duplicative services wherever feasible.			X
Discussion: Through this assessment and a beneficiary consultation, DHHL has sought input on the proposed project from government agencies, its beneficiaries, and key stake holders.			

Part II of the State Plan establishes a statewide planning system that primarily pertains to the administrative structure and implementation process of the Plan. It outlines the implementation of the State Plan through the development of functional plans and county general plans. State functional plans are developed by the state agency primarily responsible for a given area which includes agriculture, conservation lands, education, energy, higher education, health, historic preservation, housing, recreation, tourism, and transportation. County general plans and development plans are taken into consideration in the formulation and revision of state functional plans.

Part III of the State Plan establishes an overall priority guideline to address areas of statewide concern. The Hawai‘i State Plan states that “The State shall strive to improve the quality of life for Hawai‘i’s present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education” (HRS § 226-102). The priority guidelines applicable to the proposed project are discussed below.

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
HRS § 226-101: Purpose *The purpose of this part is to establish overall priority guidelines to address areas of statewide concern.*			
HRS § 226-102: Overall Direction *The State shall strive to improve the quality of life for Hawai‘i’s present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.*			
HRS § 226-103: Economic priority guidelines			
Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawai‘i’s people and achieve a stable and diversified economy:			
1. Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.			X
A. Encourage investments which:			X
i. Reflect long term commitments to the State;			X
ii. Rely on economic linkages within the local economy;			X
iii. Diversify the economy;			X
iv. Reinvest in the local economy;			X
v. Are sensitive to community needs and priorities; and			X
vi. Demonstrate a commitment to provide management opportunities to Hawai‘i residents.			X
B. Encourage investments in innovative activities that have a nexus to the State, such as:			X
i. Present or former residents acting as entrepreneurs or principals;			X
ii. Academic support from an institution of higher education in Hawai‘i;			X
iii. Investment interest from Hawai‘i residents;			X
iv. Resources unique to Hawai‘i that are required for innovative activity; and			X
v. Complementary or supportive industries or government programs or projects.			X
2. Encourage the expansion of technological research to assist industry development and support the development and commercialization of technological advancements.			X
3. Improve the quality, accessibility, and range of services provided by government to business, including data and reference services and assistance in complying with governmental regulations.			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
4. Seek to ensure that state business tax and labor laws and administrative policies are equitable, rational, and predictable.			X
5. Streamline the processes for building and development permit and review and telecommunication infrastructure installation approval and eliminate or consolidate other burdensome or duplicative governmental requirements imposed on business, where scientific evidence indicates that public health, safety, and welfare would not be adversely affected.			X
6. Encourage the formation of cooperatives and other favorable marketing or distribution arrangements at the regional or local level to assist Hawai‘i’s small-scale producers, manufacturers, and distributors.			X
7. Continue to seek legislation to protect Hawai‘i from transportation interruptions between Hawai‘i and the continental United States.			X
8. Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:			X
A. An industry that can take advantage of Hawai‘i’s unique location and available physical and human resources.			X
B. A clean industry that would have minimal adverse effects on Hawai‘i's environment.			X
C. An industry that is willing to hire and train Hawai‘i’s people to meet the industry's labor needs at all levels of employment.			X
D. An industry that would provide reasonable income and steady employment.			X
9. Support and encourage, through educational and technical assistance programs and other means, expanded opportunities for employee ownership and participation in Hawai‘i business.			X
10. Enhance the quality of Hawai‘i’s labor force and develop and maintain career opportunities for Hawai‘i's people through the following actions:			X
A. Expand vocational training in diversified agriculture, aquaculture, information industry, and other areas where growth is desired and feasible.			X
B. Encourage more effective career counseling and guidance in high schools and postsecondary institutions to inform students of present and future career opportunities.			X
C. Allocate educational resources to career areas where high employment is expected and where growth of new industries is desired.			X
D. Promote career opportunities in all industries for Hawai‘i’s people by encouraging firms doing business in the State to hire residents.			X
E. Promote greater public and private sector cooperation in determining industrial training needs and in developing relevant curricula and on-the-job training opportunities.			X
F. Provide retraining programs and other support services to assist entry of displaced workers into alternative employment.			X
Priority guidelines to promote the economic health and quality of the visitor industry:			
1. Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawai‘i's residents and visitors.			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
2. Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provide for adequate shoreline setbacks and beach access.			X
3. Support appropriate capital improvements to enhance the quality of existing resort destination areas and provide incentives to encourage investment in upgrading, repair, and maintenance of visitor facilities.			X
4. Encourage visitor industry practices and activities which respect, preserve, and enhance Hawai‘i's significant natural, scenic, historic, and cultural resources.			X
5. Develop and maintain career opportunities in the visitor industry for Hawai‘i's people, with emphasis on managerial positions.			X
6. Support and coordinate tourism promotion abroad to enhance Hawai‘i's share of existing and potential visitor markets.			X
7. Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.			X
8. Support law enforcement activities that provide a safer environment for both visitors and residents alike.			X
9. Coordinate visitor industry activities and promotions to business visitors through the state network of advanced data communication techniques.			X
Priority guidelines to promote the continued viability of the sugar and pineapple industries:			
1. Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.			X
2. Continue efforts to maintain federal support to provide stable sugar prices high enough to allow profitable operations in Hawai‘i.			X
3. Support research and development, as appropriate, to improve the quality and production of sugar and pineapple crops.			X
Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:			
4. Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.			X
5. Assist in providing adequate, reasonably priced water for agricultural activities.			X
6. Encourage public and private investment to increase water supply and to improve transmission, storage, and irrigation facilities in support of diversified agriculture and aquaculture.			X
7. Assist in the formation and operation of production and marketing associations and cooperatives to reduce production and marketing costs.			X
8. Encourage and assist with the development of a waterborne and airborne freight and cargo system capable of meeting the needs of Hawai‘i's agricultural community.			X
9. Continue the development of agricultural parks and other programs to assist small independent farmers in securing agricultural lands and loans.			X
10. Require agricultural uses in agricultural subdivisions and closely monitor the uses in these subdivisions.			X
11. Support the continuation of land currently in use for diversified agriculture.			X
12. Encourage residents and visitors to support Hawai‘i's farmers by purchasing locally grown food and food products.			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Priority guidelines for water use and development:			
1. Maintain and improve water conservation programs to reduce the overall water consumption rate.	X		
2. Encourage the improvement of irrigation technology and promote the use of nonpotable water for agricultural and landscaping purposes.	X		
3. Increase the support for research and development of economically feasible alternative water sources.			X
4. Explore alternative funding sources and approaches to support future water development programs and water system improvements.			X
Priority guidelines for energy use and development:			
1. Encourage the development, demonstration, and commercialization of renewable energy sources.	X		
2. Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.	X		
3. Provide incentives to encourage the use of energy conserving technology in residential, industrial, and other buildings.	X		
4. Encourage the development and use of energy conserving and cost-efficient transportation systems.	X		
Priority guidelines to promote the development of the information industry:			
1. Establish an information network, with an emphasis on broadband and wireless infrastructure and capability, that will serve as the foundation of and catalyst for overall economic growth and diversification in Hawai‘i.	X		
2. Encourage the development of services such as financial data processing, a products and services exchange, foreign language translations, telemarketing, teleconferencing, a twenty-four-hour international stock exchange, international banking, and a Pacific Rim management center.			X
3. Encourage the development of small businesses in the information field such as software development, the development of new information systems and peripherals, data conversion and data entry services, and home or cottage services such as computer programming, secretarial, and accounting services.			X
4. Encourage the development or expansion of educational and training opportunities for residents in the information and telecommunications fields.			X
5. Encourage research activities, including legal research in the information and telecommunications fields.			X
6. Support promotional activities to market Hawai‘i's information industry services.			X
7. Encourage the location or co-location of telecommunication or wireless information relay facilities in the community, including public areas, where scientific evidence indicates that the public health, safety, and welfare would not be adversely affected.			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Discussion: The proposed project will generate short-term construction employment; however, it will not have a significant impact on the overall state economy and will have no direct relationship to the priority guidelines to promote the economy. DHHL's main objective is to serve its native Hawaiian beneficiaries through administration of the Hawaiian Home Lands Trust by means of development and maintenance of land into thriving homestead communities and will support this community with adequate infrastructure, including potable water. Various water conservation measures will be considered for the proposed development. Based on a field investigation, Ronald NS Ho & Associates Inc. concluded that the existing underground Hawaiian Telcom and Charter infrastructure on Kulaaupuni Street is capable of accommodating the new infrastructure but a new fiber hub and power supply will be needed onsite to distribute the communication services.			
HRS § 226-104: Population growth and land resources priority guidelines			
Priority guidelines to effect desired statewide growth and distribution:			
1. Encourage planning and resource management to insure that population growth rates throughout the State are consistent with available and planned resource capacities and reflect the needs and desires of Hawai‘i's people.			X
2. Manage a growth rate for Hawai‘i's economy that will parallel future employment needs for Hawai‘i's people.			X
3. Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.			X
4. Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.			X
5. Explore the possibility of making available urban land, low-interest loans, and housing subsidies to encourage the provision of housing to support selective economic and population growth on the neighbor islands.			X
6. Seek federal funds and other funding sources outside the State for research, program development, and training to provide future employment opportunities on the neighbor islands.			X
7. Support the development of high technology parks on the neighbor islands.			X
Priority guidelines for regional growth distribution and land resource utilization:			
1. Encourage urban growth primarily to existing urban areas where adequate public facilities are already available or can be provided with reasonable public expenditures, and away from areas where other important benefits are present, such as protection of important agricultural land or preservation of lifestyles.	X		
2. Make available marginal or nonessential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.	X		
3. Restrict development when drafting of water would result in exceeding the sustainable yield or in significantly diminishing the recharge capacity of any groundwater area.			X
4. Encourage restriction of new urban development in areas where water is insufficient from any source for both agricultural and domestic use.			X
5. In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a noncontiguous new urban core.			X

Table 3-2: Hawaiʻi State Plan, Chapter 226, Part III (continued)

HAWAIʻI STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
6. Seek participation from the private sector for the cost of building infrastructure and utilities, and maintaining open spaces.			X
7. Pursue rehabilitation of appropriate urban areas.			X
8. Support the redevelopment of Kakaako into a viable residential, industrial, and commercial community.			X
9. Direct future urban development away from critical environmental areas or impose mitigating measures so that negative impacts on the environment would be minimized.	X		
10. Identify critical environmental areas in Hawaiʻi to include but not be limited to the following: watershed and recharge areas; wildlife habitats (on land and in the ocean); areas with endangered species of plants and wildlife; natural streams and water bodies; scenic and recreational shoreline resources; open space and natural areas; historic and cultural sites; areas particularly sensitive to reduction in water and air quality; and scenic resources.			X
11. Identify all areas where priority should be given to preserving rural character and lifestyle.			X
12. Utilize Hawaiʻi's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.	X		
13. Protect and enhance Hawaiʻi's shoreline, open spaces, and scenic resources.			X
Discussion: While population growth management is not a specific goal of DHHL, implementation of the proposed project will increase economic activities and provide housing opportunities on Oʻahu, the island with the longest beneficiary waitlist. While the project site includes vacant land zoned for agriculture, it is not designated Important Agricultural Land, a critical environmental area, shoreline, conservation lands or other limited resources area.			
HRS § 226-105: Crime and criminal justice			
Priority guidelines in the area of crime and criminal justice:			
1. Support law enforcement activities and other criminal justice efforts that are directed to provide a safer environment.			X
2. Target state and local resources on efforts to reduce the incidence of violent crime and on programs relating to the apprehension and prosecution of repeat offenders.			X
3. Support community and neighborhood program initiatives that enable residents to assist law enforcement agencies in preventing criminal activities.			X
4. Reduce overcrowding or substandard conditions in correctional facilities through a comprehensive approach among all criminal justice agencies which may include sentencing law revisions and use of alternative sanctions other than incarceration for persons who pose no danger to their community.			X
5. Provide a range of appropriate sanctions for juvenile offenders, including community-based programs and other alternative sanctions.			X
6. Increase public and private efforts to assist witnesses and victims of crimes and to minimize the costs of victimization.			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
Discussion: The proposed project has no direct relationship to priority guidelines in the area of crime and criminal justice.			
HRS § 226-106: Affordable housing			
Priority guidelines for the provision of affordable housing:			
1. Seek to use marginal or nonessential agricultural land, urban land, and public land to meet housing needs of extremely low-, very low-, lower-, moderate-, and above moderate income households.	X		
2. Encourage the use of alternative construction and development methods as a means of reducing production costs.			X
3. Improve information and analysis relative to land availability and suitability for housing.			X
4. Create incentives for development which would increase home ownership and rental opportunities for Hawai‘i's extremely low-, very low-, lower-, and moderate-income households and residents with special needs.			X
5. Encourage continued support for government or private housing programs that provide low interest mortgages to Hawai‘i's people for the purchase of initial owner- occupied housing.			X
6. Encourage public and private sector cooperation in the development of rental housing alternatives.	X		
7. Encourage improved coordination between various agencies and levels of government to deal with housing policies and regulations.			X
8. Give higher priority to the provision of quality housing that is affordable for Hawai‘i's residents and less priority to development of housing intended primarily for individuals outside of Hawai‘i.	X		
Discussion: The soils within the project site area are inadequate for agricultural cultivation or production. Development may be by a non-government entity, solicited and selected through the Request for Proposals process. Sale prices of turnkey houses on Hawaiian Home Lands are lower than the general market because the land is leased to beneficiaries at $1.00 per year and the cost of infrastructure improvements are not passed on to the homebuyers.			
HRS § 226-107: Quality education			
Priority guidelines to promote quality education:			
1. Pursue effective programs which reflect the varied district, school, and student needs to strengthen basic skills achievement;			X
2. Continue emphasis on general education "core" requirements to provide common background to students and essential support to other university programs;			X
3. Initiate efforts to improve the quality of education by improving the capabilities of the education work force;			X
4. Promote increased opportunities for greater autonomy and flexibility of educational institutions in their decision-making responsibilities;			X
5. Increase and improve the use of information technology in education by the availability of telecommunications equipment for:			X
A. The electronic exchange of information;			X
B. Statewide electronic mail; and			X
C. Access to the Internet.			X
Encourage programs that increase the public's awareness and understanding of the impact of information technologies on our lives;			X

Table 3-2: Hawai‘i State Plan, Chapter 226, Part III (continued)

HAWAI‘I STATE PLAN, CHAPTER 226, HRS - PART III. PRIORITY GUIDELINES Key: S = Supportive, N/S = Not Supportive, N/A = Not Applicable)	**S**	**N/S**	**N/A**
6. Pursue the establishment of Hawai‘i's public and private universities and colleges as research and training centers of the Pacific;			X
7. Develop resources and programs for early childhood education;			X
8. Explore alternatives for funding and delivery of educational services to improve the overall quality of education; and			X
9. Strengthen and expand educational programs and services for students with special needs.			X
Discussion: The proposed project has no direct relationship to priority guidelines to promote quality education.			
HRS § 226-108: Sustainability			
Priority guidelines and principles to promote sustainability shall include:			
1. Encouraging balanced economic, social, community, and environmental priorities;	X		
2. Encouraging planning that respects and promotes living within the natural resources and limits of the State;			X
3. Promoting a diversified and dynamic economy;			X
4. Encouraging respect for the host culture;	X		
5. Promoting decisions based on meeting the needs of the present without compromising the needs of future generations;	X		
6. Considering the principles of the ahupua‘a system; and			X
7. Emphasizing that everyone, including individuals, families, communities, businesses, and government, has the responsibility for achieving a sustainable Hawai‘i.			X
Discussion: DHHL has developed and is implementing its own renewable energy policy (https://dhhl.Hawai‘i.gov/wp-content/uploads/2011/09/DHHL-Energy-Policy.pdf) that is consistent with HRS § 226-108.			

3.1.4 Department of Hawaiian Home Lands, Land Use Designations

Pursuant to the Hawaiian Homes Commission Act (HHCA) and the State Constitution, trust lands are exclusively under the authority of the Hawaiian Homes Commission. Therefore, Hawaiian Home Lands are not subject to State and/or County land use controls. DHHL’s planning system functions in three tiers:

- Tier 1: The General Plan
- Tier 2: The Strategic Programs Plans and Island Plans
- Tier 3: The Regional Plans and Area Development Plans

It is the responsibility of DHHL to ensure that the land use designations are appropriately based on the needs of the Department, DHHL beneficiaries, and to protect environmental and cultural resources.

3.2 CITY AND COUNTY OF HONOLULU PLANS

3.2.1 Oʻahu General Plan

The Oʻahu General Plan provides long-range development objectives and policies for the island of Oʻahu. The Oʻahu General Plan, as amended in 2002, is the focal point of a comprehensive planning process that addresses physical, social, economic and environmental concerns affecting the City and County of Honolulu.

Although land owned by DHHL are not subject to the City and County of Honolulu land use plans and policies, including the Oʻahu General Plan, specific General Plan goals and policies relevant to the proposed project are discussed below.

Housing

Objective A – To provide decent housing for all the people of Oʻahu at prices they can afford.

> *Policy 1) Develop programs and controls which will provide decent homes at the least possible cost.*
>
> *Policy 10) Promote the construction of affordable dwellings which take advantage of Oʻahu's year-round moderate climate.*

Discussion: The proposed project promotes the development and construction of affordable residential dwellings through DHHL's Hawaiian Home Lands program. The project will support the need for affordable housing opportunities benefiting DHHL beneficiaries currently on the waitlist.

Physical Development and Urban Design

Objective A – To coordinate changes in the physical environment of Oʻahu to ensure that all new developments are timely, well-designed, and appropriate for the area in which they will be located.

> *Policy 2) Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation, and public safety facilities.*
>
> *Policy 4) Require new developments to provide or pay the cost of all essential community services, including roads, utilities, schools, parks, and emergency facilities that are intended to directly serve the development.*

Discussion: The proposed project promotes the physical development and urban design objectives of the General Plan. The site will be developed from a vacant lot into a residential homestead community and will include new infrastructure (water, sewer, drainage, electrical, roads, sidewalks, etc.) to serve the development. Infrastructure construction plans shall be submitted to the appropriate City agencies for review and approval.

3.2.2 Wai‘anae Sustainable Community Plan

The City and County of Honolulu has prepared and adopted eight regional plans which provide vision and implementation policies and guidelines for each area. The Wai‘anae Sustainable Community Plan (WSCP) is one of the eight community-oriented plans developed by the Department of Planning and Permitting and its consulting team in partnership with the community. The current version of the WSCP was adopted on March 2, 2012, and contains policies specific to the Wai‘anae Coast which were subsequently adopted through City ordinances.

Discussion:
Pursuant to the Hawaiian Homes Commission Act (HHCA) and the State Constitution, trust lands are exclusively under the authority of the Hawaiian Homes Commission. Therefore, Hawaiian Home Lands are not subject to State and/or County land use controls.

The residential homestead development is consistent with the WSCP's Vision Statement and Community Values. The project site is located within the "Rural Community Area" which follows the limits of the Community Growth Boundary. The WSCP Land Use Map designates the project site as "Rural Residential". Areas designated as "Rural Residential" are intended to include single family homes, town homes, small 2-story apartment buildings, and various relatively low-density community support facilities.

3.2.3 Land Use Ordinance

The Land Use Ordinance (LUO) implements the goals and objectives of the O‘ahu General Plan and the *Wai‘anae Sustainable Community Plan.* All lands within the City and County of Honolulu are zoned into specific uses. The property is zoned "AG-2 General Agricultural" which serves to conserve and protect agricultural activities on smaller parcels of land. The following guidelines were developed in the LUO to identify lands for consideration for AG-2 zoning:

1. Lands which are designated in the State Agricultural or Urban district and designated Agricultural by adopted City land use policies;
2. Lands which are predominantly classified as other under the Agricultural Lands of Importance to the State of Hawai‘i system; and
3. Lands which are used or are suitable for agricultural purposes and where a substantial number of parcels are less than five acres in size.

Discussion: Pursuant to the Hawaiian Homes Commission Act (HHCA) and the State Constitution, trust lands are exclusively under the authority of the Hawaiian Homes Commission. Therefore, Hawaiian Home Lands are not subject to State and/or County land use controls. Although the site is zoned AG-2, it is under DHHL's discretion to utilize the land for residential development as part of their program.

3.2.4 Special Management Area Guidelines

The purpose of the establishment of the Special Management Area (SMA) is to preserve, protect, and where possible, restore the natural resources of the coastal zone of Hawai‘i. Special controls on development within these areas are necessary to avoid permanent loss of valuable resources and foreclosure of management options and to ensure adequate public access is provided to public owned or used beaches, recreation areas, and natural reserves. Chapter 25 of the Revised Ordinances of Honolulu (ROH) outlines the guidelines used for the review of developments planned in the SMA. The SMA permitting system is part of the Coastal Zone Management (CZM) Program under HRS Chapter 205A, the CZM law.

Discussion:

The proposed project is located well inland and is not within the SMA.

4.0 DESCRIPTION OF THE NATURAL AND HUMAN ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATIVE MEASURES

4.1 CLIMATE

4.1.1 Description

The climate of Mā‘ili, located on the northwest coastline of O‘ahu, is generally characterized as warm and dry along the coastal and lower valley areas. According to the National Oceanic and Atmospheric Administration (NOAA) (September 2021), the average yearly rainfall is approximately 20 inches along the coast with an average daily temperature ranging from 70 to 90 degrees Fahrenheit. Northeasterly trade winds prevail throughout the year, although their average frequency varies from more than 90% during the summer to only 50% in January. Impacts from the trade winds are less predominant in Mā‘ili as wind flow is disrupted by the adjacent Wai‘anae Mountain range.

4.1.2 Potential Impacts and Mitigation

The proposed project is not anticipated to have a significant impact on regional climatic conditions. The site is currently vacant; therefore, due to increased paved surfaces and roof tops, some localized temperature increases are to be expected. Approximately 20 acres of the 40-acre site will be covered by either pavement or residential homes and buildings (assumed 50% for a residential development). Open spaces, a proposed mini park and infiltration basin will provide areas free of structures and should aid in minimizing significant temperature increases from roadways and buildings. No additional mitigation measures are planned.

4.2 GEOLOGY AND TOPOGRAPHY

4.2.1 Geology

As part of this initial phase of the current project, Geolabs, Inc. conducted a *Preliminary Geotechnical Engineering Exploration* (June 15, 2020, refer to Appendix C). The geology of the project site is described as follows:

> *“The Island of O‘ahu was built by the extrusion of basalt and basaltic lava from the Waianae and Koolau shield volcanoes. The older Waianae Volcano is estimated to be middle to late Pliocene in age, and Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. As the volcanic activity in Waianae Volcano ceased, lava flows from Koolau Volcano banked against its eroded eastern slope forming a broad plateau, now known as the Schofield Plateau. The project site is located on the southwestern flank of the Waianae Volcano.*
>
> *Physical and chemical weathering followed by erosion of Schofield Plateau generated sediments, which were transported to the coast. In the project vicinity*

and to the south, these sediments have accumulated and are interbedded with marine sediments and coral/algal reef formations, forming a sedimentary wedge. The thickness of the sedimentary wedge ranges from zero in the area of the Interstate Route H-1 Highway to over 1,000 feet at Ewa Beach. This wedge forms the Ewa Plain and serves as the confining formation, or "caprock," over the artesian basal aquifers of Southern O‘ahu. Deposition of sediments has continued from earlier geologic time through the present."

4.2.2 Topography

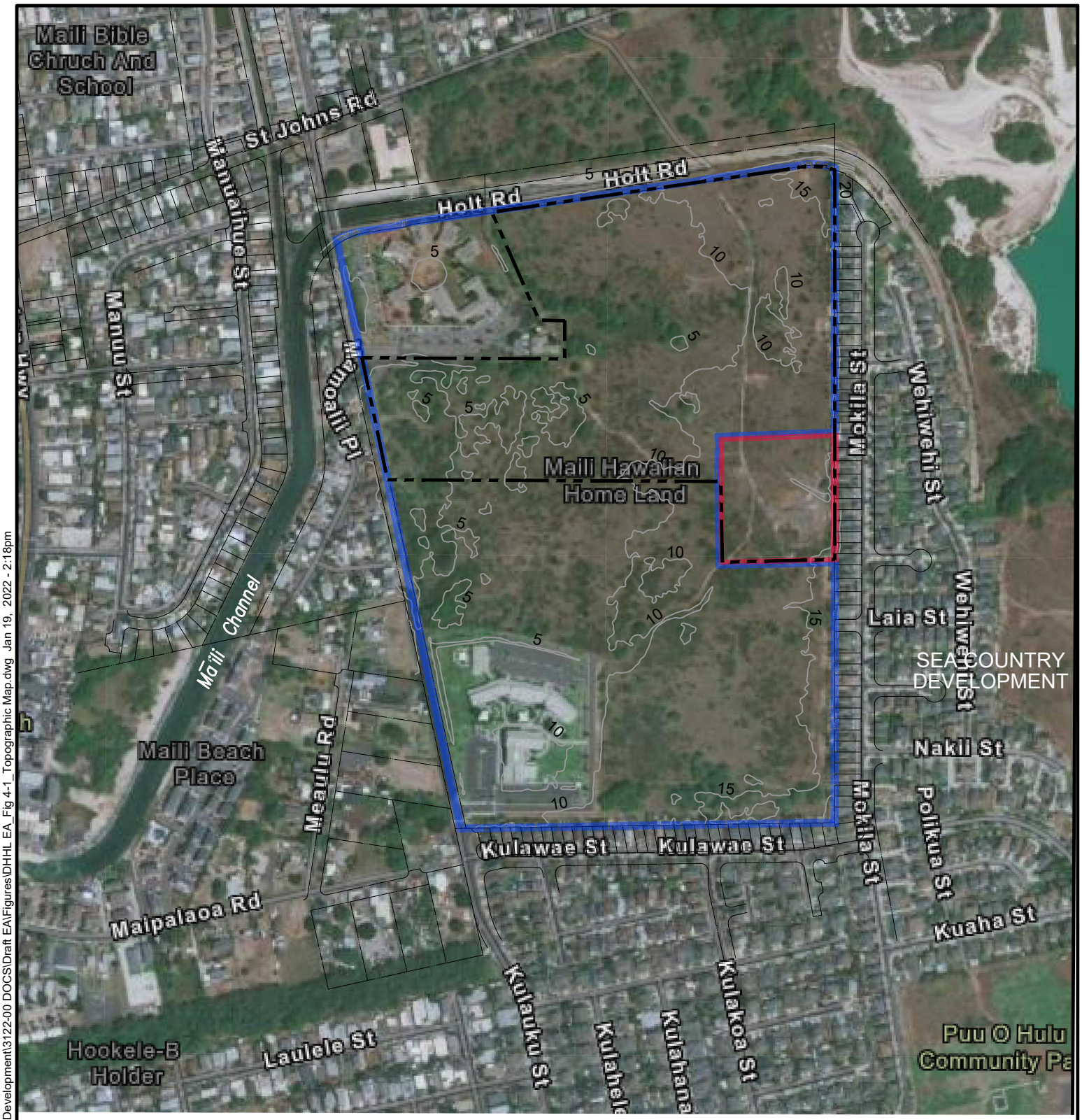
The project site is located at the foothills of the Wai‘anae Mountain range within Mā‘ili's coastal plain. The site is located approximately 1,600 feet inland and is bordered by Mā‘ili Channel to the north, Sea Country residential development to the east, Kamehameha Schools Community Learning Center to the south and additional residential developments to the west. It is situated in an agricultural district with existing ground elevations ranging from approximately 3 feet to 20 feet mean sea level (MSL). The higher elevations located on the eastern boundary of the site gradually slope in the southwesterly direction toward the coast (refer to Figure 4-1). The majority of the site is relatively flat with slopes ranging between 0% to 5%. The undeveloped site contains existing vegetation consisting of native brush and sporadic barren areas.

Photograph 4-1: Project site (looking southeast)

Photograph 4-2: Project site (looking southwest)

4.2.3 Ground Water Resources/Hydrology

Mā‘ili Channel borders the northern boundary of the project site and flows west towards the Pacific Ocean. According to the U.S. Fish and Wildlife Service (USFWS), Mā‘ili Channel is classified as an E1UBLx estuary and a R4SBCx wetland (see Figure 4-2). An E1UBLx estuary is an excavated, subtidal estuarine channel with an unconsolidated bottom. A R4SBCx wetland is an excavated, seasonally flooded, intermittent stream.



LEGEND

PROPOSED PROJECT SITE

TAX MAP KEY: 8-7-010:030

TAX MAP KEY: 8-7-010:031

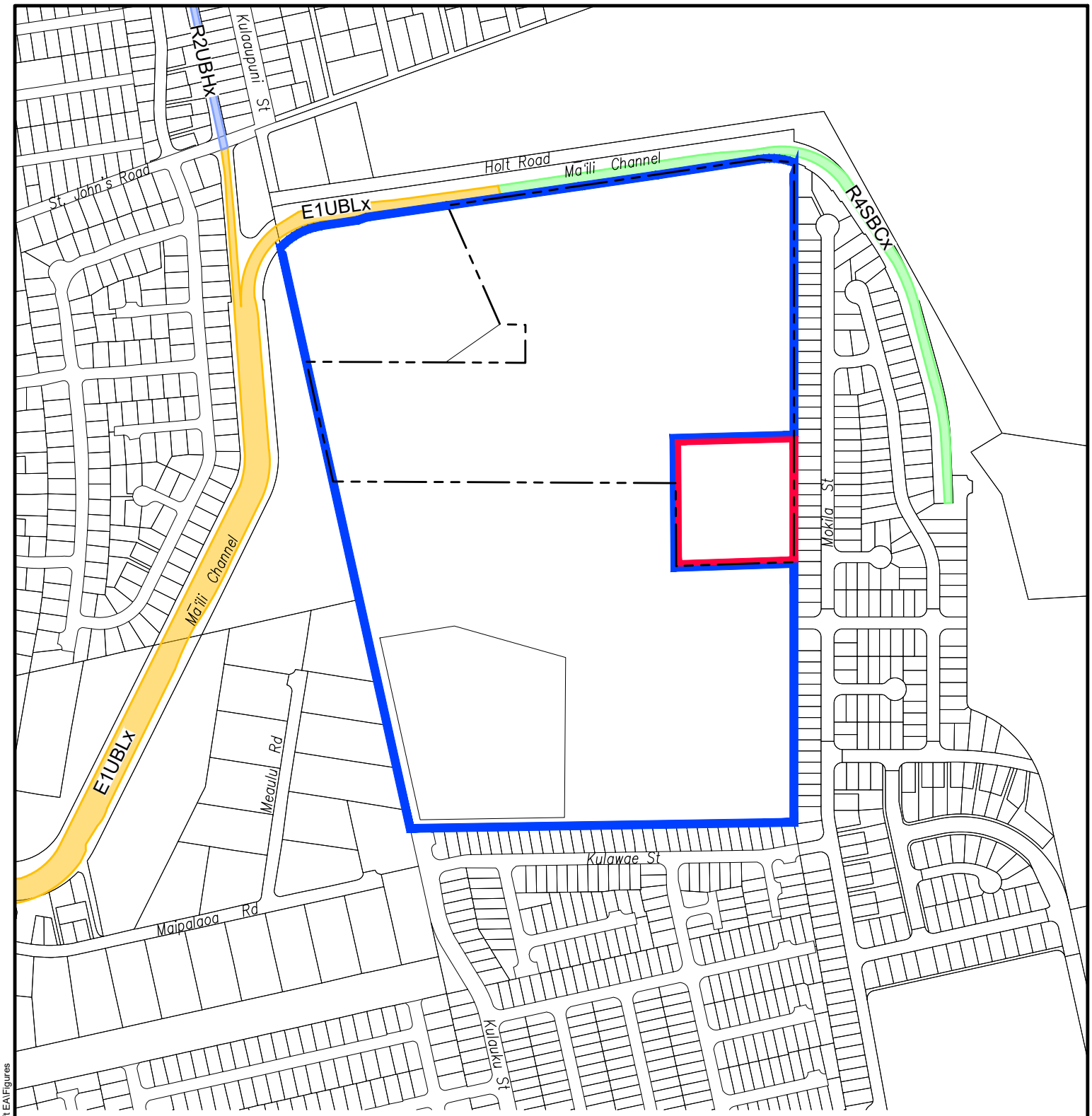
15 EXISTING CONTOUR

0 125 250 500

SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-1_Topographic Map	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: DECEMBER 2021	CONSULTING ENGINEERS	TOPOGRAPHIC MAP	4-1
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

Drawing name: P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures\DHHL EA_Fig 4-1_Topographic Map.dwg Jan 19, 2022 - 2:18pm



LEGEND

- PROPOSED PROJECT SITE
- TAX MAP KEY: 8-7-010:030
- TAX MAP KEY: 8-7-010:031
- E1UBLx
- R4SBCx
- R2UBHx

0 125 250 500
SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-2_Wetland Classification Map
DATE: DECEMBER 2021
SCALE: AS NOTED
PROJECT #: 3122-00

Gray• Hong• Nojima & Associates, Inc.
CONSULTING ENGINEERS

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Honolulu, Hawaii 96813
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Fax: (808) 531-8018

RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

USFWS NATIONAL WETLANDS INVENTORY MAP

FIGURE 4-2

P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures

The field exploration and borings completed for the *Preliminary Geotechnical Engineering Exploration* dated June 15, 2020, Geolabs, Inc. (refer to Appendix C) provided the following groundwater observations from borings taken in December 2019 between 10 AM and 2 PM:

> *"Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 and -3.3 feet MSL at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors."*

This EA recognizes stormwater as a potential source of irrigation, a source for ground water recharge, and an asset that sustains and protects natural ecosystems.

4.2.4 Potential Impacts and Proposed Mitigation

Grading activities of the proposed development will alter the existing ground slope and topography. Import of fill material will be required to fill the site to accommodate the proposed infiltration basin and various utilities. It is anticipated that the existing grades will be raised approximately 5 to 10 feet along the eastern boundary and roughly 10 to 15 feet along the southwestern boundary of the site. The impact of grading operations will be mitigated through compliance with dust and erosion control requirements of the City and County of Honolulu Grading, Soil Erosion and Sediment Control Ordinance and the provision of Chapter 11-60.1, Hawai'i Administrative Rules, Section 11-60.1-33 Fugitive Dust. Temporary Best Management Practices (BMPs) will be implemented to mitigate erosion and pollution caused by discharge of storm water runoff from site grading operations.

An overall reduction of water infiltration may result due to the proposed increase in impervious area. Reduction in infiltration will result in an increase of stormwater runoff generated. The use of post-construction storm water best management practices (BMPs), such as an infiltration basin, biofiltration systems, and landscaping will help to mitigate generated runoff as a result of reduced infiltration. Post-construction BMPs used will comply with the City and County of Honolulu, Department of Planning and Permitting's Rules Relating to Storm Drainage Standards, August 2017 and the Department of Planning and Permitting's Rules Relating to Water Quality, effective December 2018 to the extent feasible.

4.3 SOILS AND AGRICULTURE IMPACT

The following soil suitability studies were reviewed for the project site:

- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey
- University of Hawai'i Land Study Bureau (LSB) Detailed Land Classification

- State Department of Agriculture's Agricultural Lands of Importance to the State of Hawai'i (ALISH)

4.3.1 Natural Resources Conservation Service

According to the USDA NRCS soil survey and the *USDA Soil Survey of Islands of Kauai, Oahu, Maui, and Lanai, State of Hawai'i* by Foote et al. (1972), the site is comprised of three soil types which include Keaau stony clay, 2-6% slopes (KmaB), Mamala cobbly silty clay loam, 0-12% slopes (MnC), and Mokuleia clay (Mtb) (refer to Figure 4-3).

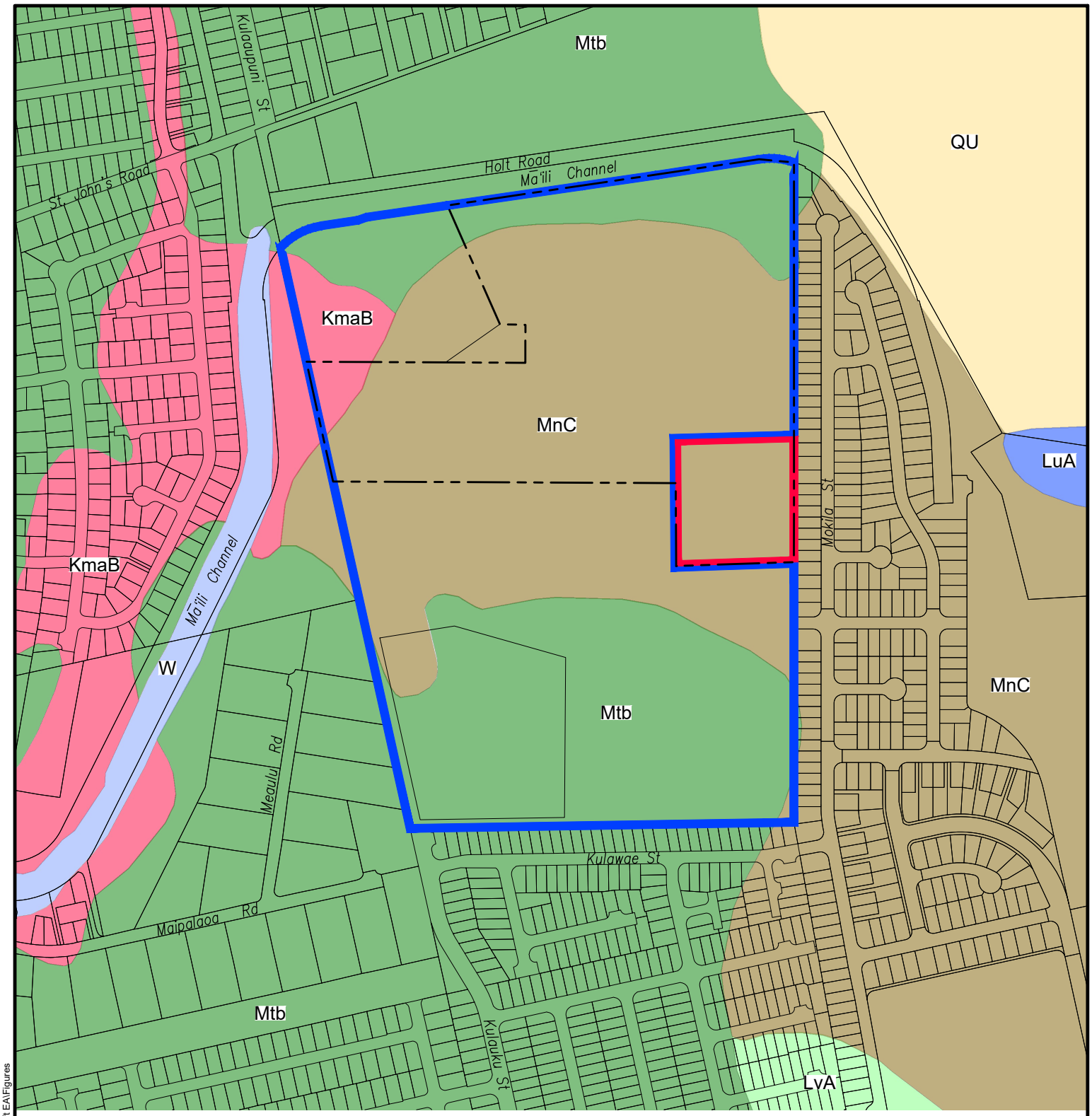
Keaau stony clay is found in a small portion of the northwest corner of the project site directly adjacent to the existing Ulu Ke Kukui transitional housing facility and is described as follows:

> *"This soil occurs on lowlands on the coastal plains. Included in mapping were small areas of coral sand and dark colored, sticky and plastic clay on fans above the Keaau soils. In a representative profile, the surface layer is dark grayish-brown soil, about 15 inches thick. The subsoil, about 19 inches thick, is very dark grayish-brown and dark-brown, mottled clay that has subangular and angular block structure. The substratum is white to very pale brown reef limestone or consolidated coral sand … Permeability is slow. Runoff is slow, and the erosion hazard is no more than slight … Workability is difficult because the soil is very sticky and very plastic. The shrink swell potential is high … This soil is used for sugarcane and pasture."* [Foote et al. 1972:65]

Mamala cobbly silty clay loam is found over the majority of the project site and is described as follows:

> *"The slope range of this soil is 0 to 12 percent, but in most places the slope does not exceed 6 percent. Stones, mostly coral fragments are common in the surface layer and in the profile … In a representative profile, the surface layer is dark reddish-brown stony silty clay loam about eight inches thick. The subsoil is dark reddish-brown silty clay loam about 11 inches thick. The soil is underlain by coral limestone and consolidated calcareous sand at depths of 8 to 20 inches. … Permeability is moderate, runoff is very slow to medium, and the erosion hazard is slight to moderate … This soil is used for sugarcane, truck crops and pasture."* [Foote et al. 1972:93]

Mokuleia clay is found along the northern portion of the project site bordering Mā'ili Channel and is described as follows:



LEGEND

- PROPOSED PROJECT SITE
- TAX MAP KEY: 8-7-010:030
- TAX MAP KEY: 8-7-010:031
- KmaB
- MnC
- Mtb
- LvA
- QU
- LuA
- W

0 125 250 500
SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-3_NRCS Soil Survey Map	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: OCTOBER 2021	CONSULTING ENGINEERS	NRCS SOIL SURVEY MAP	4-3
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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> *"This series consists of well-drained soils along the coastal plains on the islands of O‘ahu and Kaua‘i … It is nearly level … In a representative profile, the surface layer is very dark grayish-brown clay about 16 inches thick. The next layer, 34 to more than 48 inches thick, is dark-brown and light-gray, single-grain sand and loamy sand … Permeability is slow in the surface layer. Workability is difficult because of the sticky, plastic clay. This soil is used for sugarcane and pasture."* [Foote et al. 1972:9]

4.3.2 Land Study Bureau Detailed Land Classification

In the 1960's and 1970's, the Land Study Bureau (LSB) of the University of Hawai‘i prepared an inventory and evaluation of all lands in the State. The Bureau grouped and rated all non-urban land based on its agricultural productivity. The rating system was developed into a five-class productivity system with "A" representing the class of highest productivity and "E" the lowest. The rating system was based on soil texture, structure, depth, drainage, parent material, stoniness, topography, climate, and rainfall. The LSB classified the project site as very poor, "E" (refer to Figure 4-4).

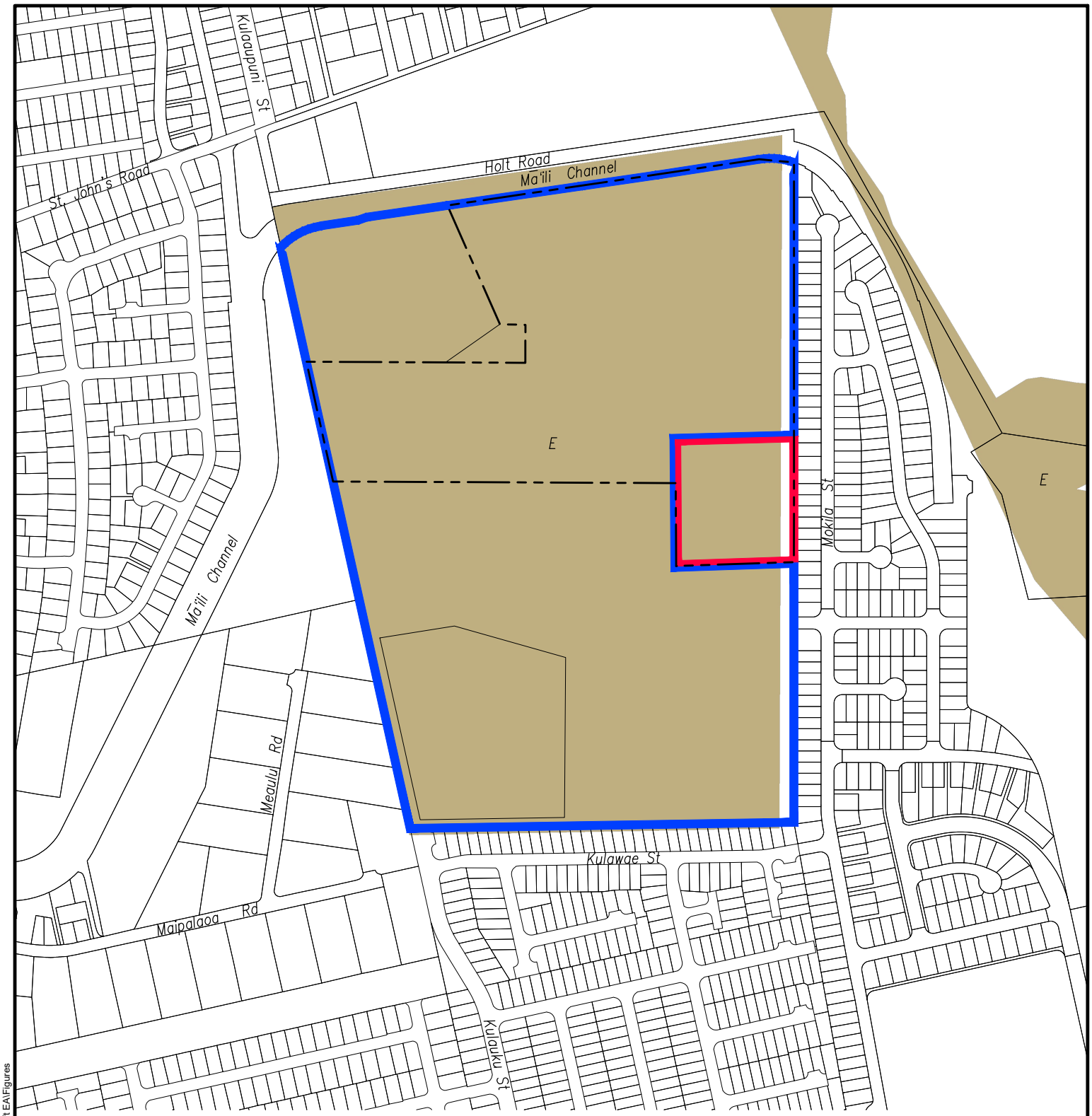
4.3.3 Agricultural Lands of Importance to the State of Hawai‘i

The Agricultural Lands of Importance to the State of Hawai‘i (ALISH) Classification System was developed and compiled in 1977. The system classifies agriculturally important lands for the State of Hawai‘i into three classes: "Prime," Unique" or "Other", with all remaining lands termed "Unclassified". The majority of the project site is rated as "Other" important agricultural land with a small western portion of the project site as "unclassified" (refer to Figure 4-5). Land classified as "Other" possess characteristics such as seasonal wetness, erodibility, and would require further management for commercial production.

4.3.4 Regional Agriculture History

The history of the Wai‘anae region was influenced by agriculture and goes back many generations. Recognized as a Major Agricultural Area by the State of Hawai‘i, the region was once known for its traditional subsistence lifestyle methods, which included maximizing food production while minimizing water use. Many agricultural remains, such as irrigation channels, traces of intricate terracing, and other past agricultural practices can be found throughout the region.

The sandalwood trade thrived in the region between 1811 to 1829 while livestock operations rose in importance in the mid-1800's. Sugar then became the predominant crop later in the century with the establishment of the Wai‘anae Sugar Mill as the first sugar mill on O‘ahu. The mill was built in 1880 and operated for over 70 years until its closure in 1946 due to economic and environmental pressures.



LEGEND

- PROPOSED PROJECT SITE
- TAX MAP KEY: 8-7-010:030
- TAX MAP KEY: 8-7-010:031
- A – VERY GOOD
- B – GOOD
- C – FAIR
- D – POOR
- E – VERY POOR

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SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-4_LSB	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: OCTOBER 2021	CONSULTING ENGINEERS	LAND STUDY BUREAU'S DETAILED AGRICULTURAL LAND PRODUCTIVITY RATINGS MAP	4-4
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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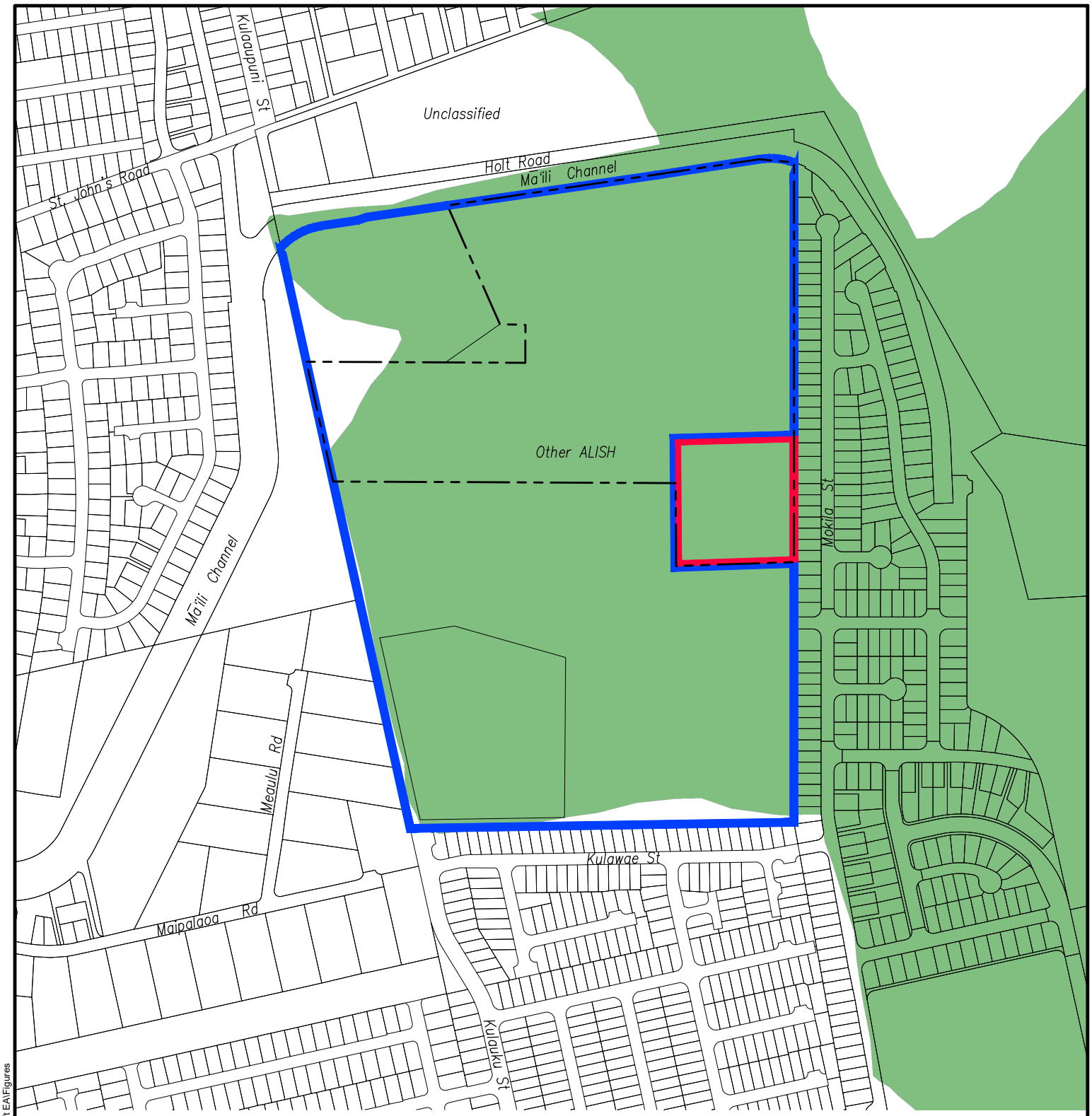

LEGEND

- PROPOSED PROJECT SITE
- TAX MAP KEY: 8-7-010:030
- TAX MAP KEY: 8-7-010:031
- PRIME ALISH
- UNIQUE ALISH
- OTHER ALISH
- UNCLASSIFIED

0 125 250 500
SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-5_ALISH	Gray• Hong• Nojima & Associates, Inc.	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	FIGURE
DATE: OCTOBER 2021	CONSULTING ENGINEERS	AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAI'I	4-5
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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4.3.5 Potential Impacts and Proposed Mitigation

Construction of the proposed project will disturb the entire site due to clearing, grubbing, and grading. Construction activities will typically impact the soil by exposure to wind and storm water runoff. Due to the size of the area to be disturbed, a National Pollutant Discharge Elimination System (NPDES) General Permit for Discharge of Storm Water Associated with Construction Activity will be required. To comply with the NPDES permit as well as the City and County of Honolulu Department of Planning and Permitting (DPP) erosion control and sediment control requirements and the Rules Relating to Water Quality, BMPs will be implemented during and after construction to mitigate erosion and discharge of pollutants. Temporary BMPs may include the use of construction ingress and egress, sediment rolls, dust screens, sediment traps, diversion swales and temporary grassing or hydromulching. Permanent BMPs may include an infiltration basin, biofiltration systems, grassed swales, and landscaping.

The soils within the project site area are inadequate for agricultural cultivation or production. Therefore, the proposed development is not expected to adversely affect the availability of agricultural land.

4.4 FLORA AND FAUNA

4.4.1 Botanical Survey

A flora and fauna assessment report was prepared by AECOS, Inc. entitled *A natural resources assessment of the former Voice of America Site* dated May 27, 2021 (refer to Appendix A). The report included a discussion on flora and fauna found within the project site and the surrounding area. The following is a summary of some of the key findings associated with the vegetation and planting at the site:

- Vegetation varies from open grassland (dominated by buffelgrass, *Cenchrus ciliaris*) to shrubland, dominated by Indian fleabane (*Pluchea indica*) and *koa haole* (*Leucaena leucocephala*). Trees (*kiawe* or *Prosopis pallida*) are scattered around the area, but form more or less open forested areas along the western and southeastern sides of the property.

- The vast majority (86%) of flowering plants are naturalized or ornamental, non-native species. Ten indigenous natives are present: *naupaka kahakai* (*Scaevola taccada*), *kou* (*Cordia subcordata*), *kīpūkai* (*Heliotropum curassavicum*), *koaliʻawa* (*Ipomoea indica*), *pāʻūohiʻiaka* (*Jacquemontia ovalifolia*), *koʻoloa keokeo* (*Abutilon incanum*), *ʻilima* (*Sida fallax*), *ʻuhaloa* (*Waltheria indica*), a small sedge (*Cyperus polystachyos*), and *pili* grass (*Heteropogon contortus*). *Koʻoloa keokeo, ʻuhaloa, ʻilima*, and *pili* are common across the site.

- No plants of conservation interest were found during the survey of the project area.

4.4.2 Wetland Survey

According to the U.S. Fish and Wildlife Service, Mā‘ili Channel is classified as an E1UBLx estuary and a R4SBCx wetland (refer to Figure 4-2). An E1UBLx estuary is an excavated, subtidal estuarine channel with an unconsolidated bottom. A R4SBCx wetland is an excavated, seasonally flooded, intermittent stream.

The AECOS report included a discussion on jurisdictional waters and wetlands within the project site and the surrounding area. The following is a brief summary of some of the key findings associated with the jurisdictional water and wetland assessment:

- The jurisdictional limits of Mā‘ili Stream may be delineated at the top of bank. The preliminary delineation is likely to require a site visit by the U.S. Army Corps of Engineers (USACE) to confirm the jurisdictional boundary.

- Mā‘ili Stream's concrete channel is not a wetland; however, prior to the start of construction, a wetland survey should be conducted along the west end of the project site. Along the west end of the project site, pickleweed is locally abundant and water forms ephemeral pools after heavy rains. The mapped soil type of or near the area is a hydric soil, so further assessment of wetlands and federal jurisdiction should be made.

4.4.3 Wildlife Survey

The AECOS report included a discussion on wildlife within the project site and the surrounding area. As part of the project an Essential Fish Habitat Assessment (EFHA) was also conducted in the project vicinity. The following is a brief summary of some of the key findings related to the project site wildlife and the EFHA:

- The project site is absent of federally designated Critical Habitat for any species. However, the project site does contain a bufflegrass grassland, which is a typical habitat for the Short-eared Owl. The O‘ahu population of this owl is a state-listed endangered species. Thus, in order to avoid disturbing nesting owls, a nesting survey should be conducted by a qualified biologist immediately prior to the start of construction.

- The project's impact to any Essential Fish Habitat (EFH) would be limited to the transport of sediment and/or pollutants in runoff to Mā‘ili Stream. With effective implementation of best management practices (BMPs) the project will have a minimal adverse impact on the EFH.

4.4.4 Potential Impacts and Proposed Mitigation

No plants of conservation interest were found during the survey of the project area. The site was also absent of federally designated Critical Habitat for any species. No significant adverse impacts to the botanical or wildlife resources should occur within the project site as a result of the proposed project.

4.5 NATURAL HAZARDS

The State of Hawai‘i is susceptible to potential natural hazards, such as flooding, tsunami inundation, hurricanes, earthquakes, volcanic eruptions, and wildfires.

4.5.1 Flooding

According to the Federal Emergency Management Agency's (FEMA) *Flood Insurance Rate Map (FIRM) 15003C0192J*, dated November 5, 2014, the project site is situated in either Flood Zone X or Flood Zone XS (refer to Figure 4-6) and does not fall within a special flood hazard area. FEMA describes these flood zones as follows:

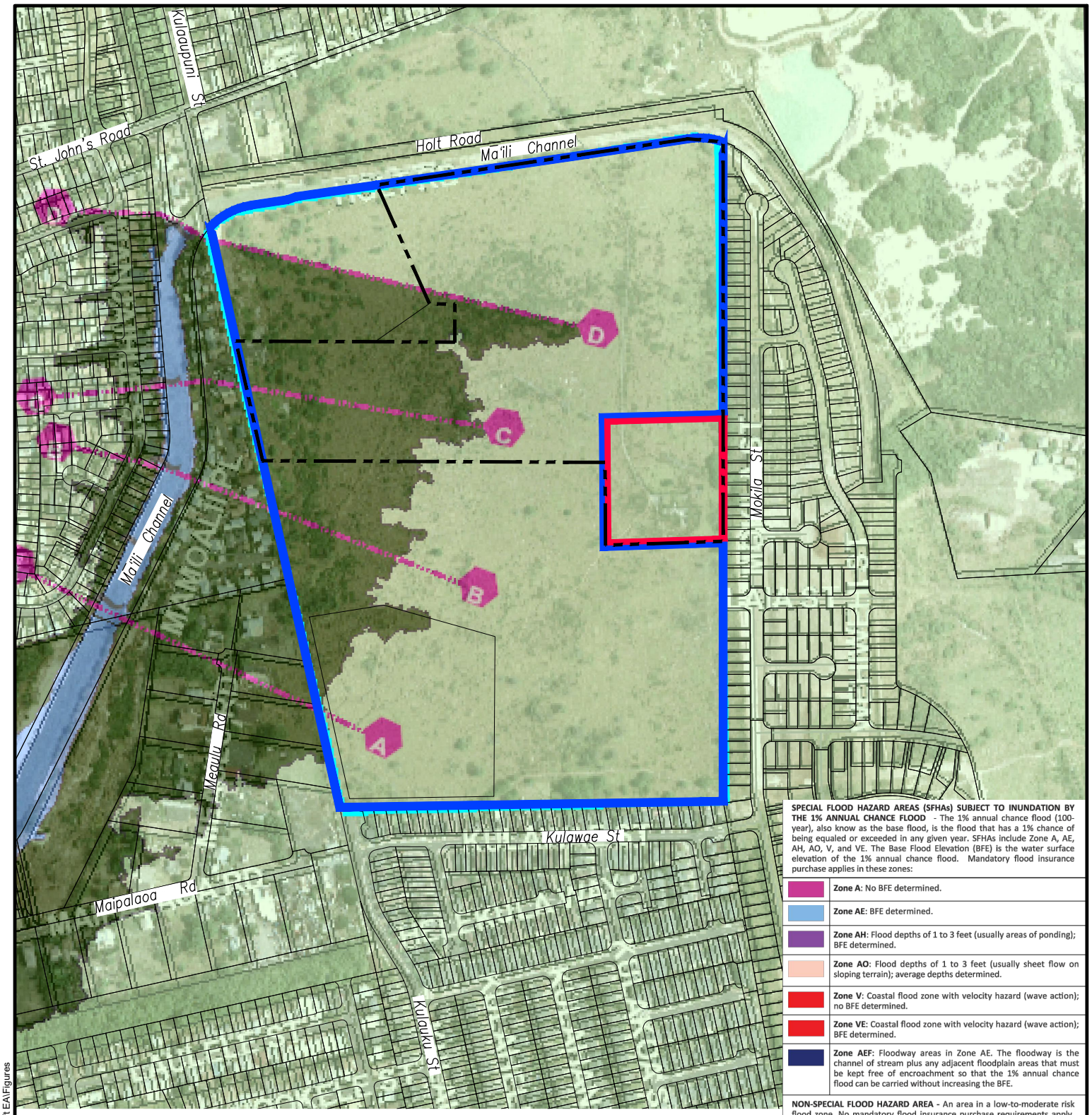
- Flood Zone X are areas outside the special flood hazard area and higher than the elevation of the 0.2% annual chance (or 500-year) flood.

- Flood Zone XS are areas of 0.2% annual (or 500-year) 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.

The floodwater elevations for the Flood Zone XS areas at sections B, C, and D (refer to Figure 4-6) are 4.54 feet, 4.64 feet, and 4.55 feet, respectively. It is anticipated that the finish elevations of the proposed development will exceed the floodwater elevations.

4.5.2 Tsunami

The project site is located in both the Tsunami Evacuation Zone and Extreme Tsunami Evacuation Zone designated by the Hawai‘i State Civil Defense (refer to Figure 4-7). The western portion of the site is within the Tsunami Evacuation Zone and the eastern portion of the site is within the Extreme Tsunami Evacuation Zone. Those presiding in the Tsunami Evacuation Zone are advised to evacuate when there is a Tsunami Warning. Those presiding in the Extreme Tsunami Evacuation Zone may be advised to evacuate if an earthquake happens in the Eastern Aleutian Islands with a magnitude 9.0 or greater.



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.

0 125 250 500

SCALE IN FEET

LEGEND

PROPOSED PROJECT SITE

TAX MAP KEY: 8-7-010:030

TAX MAP KEY: 8-7-010:031

CAD DRAWING: DHHL EA_Fig 4-6_FIRM

DATE: DECEMBER 2021

SCALE: AS NOTED

PROJECT #: 3122-00

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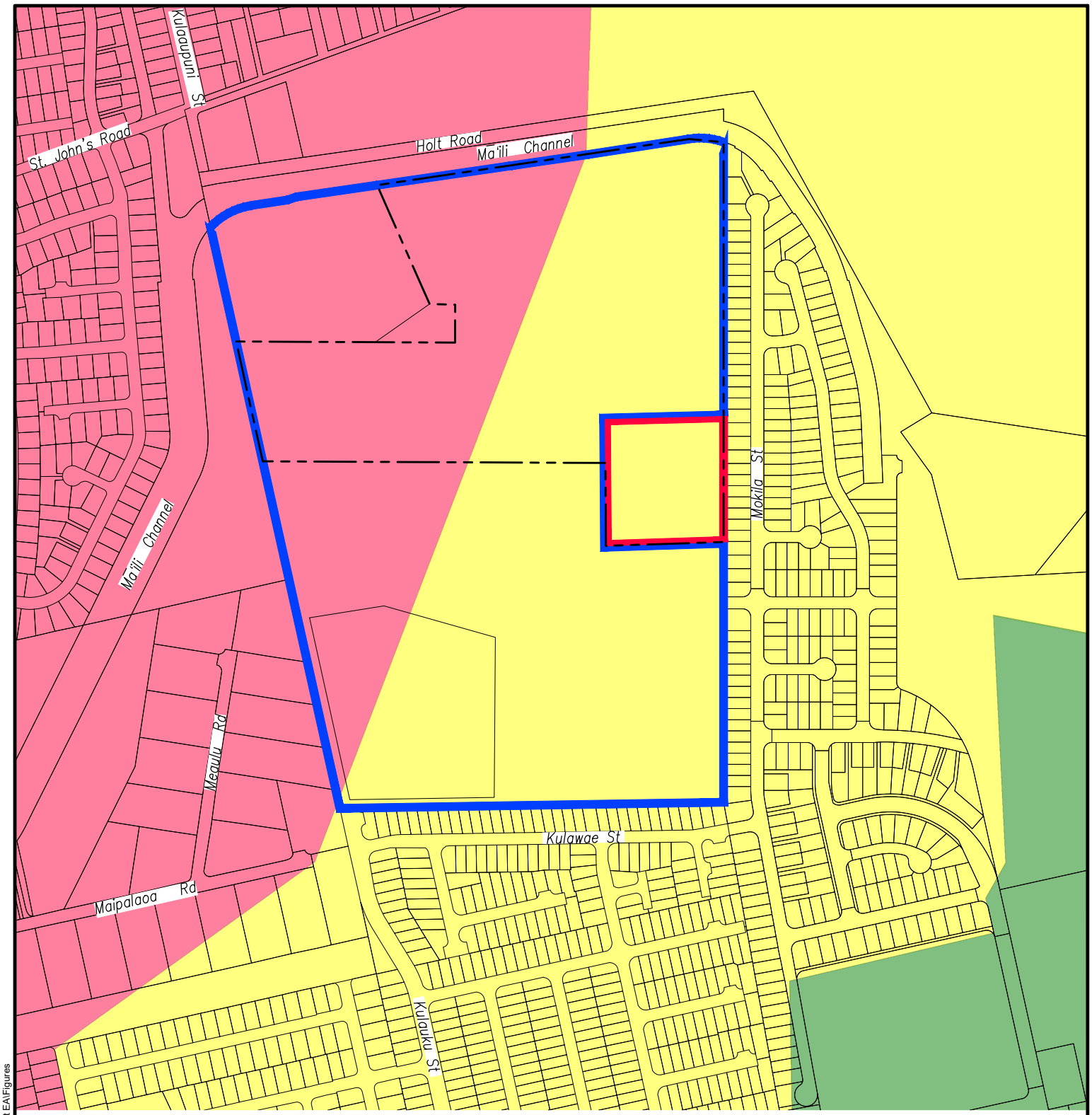
Honolulu, Hawaii 96813
Telephone: (808) 521-0306
Fax: (808) 531-8018

RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

FLOOD INSURANCE RATE MAP

FIGURE 4-6

P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures



LEGEND

- PROPOSED PROJECT SITE
- TAX MAP KEY: 8-7-010:030
- TAX MAP KEY: 8-7-010:031
- TSUNAMI EVACUATION ZONE
- EXTREME TSUNAMI EVACUATION ZONE
- SAFE ZONE

0 125 250 500
SCALE IN FEET

CAD DRAWING: DHHL EA_Fig 4-7_Tsunami Evacuation Zone
DATE: DECEMBER 2021
SCALE: AS NOTED
PROJECT #: 3122-00

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201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813
Telephone: (808) 521-0306
Fax: (808) 531-8018

RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE

TSUNAMI EVACUATION ZONE

FIGURE 4-7

P:\3122-00 DHHL Lualualei Residential Development\3122-00 DOCS\Draft EA\Figures

4.5.3 Hurricane

A hurricane forms when a tropical cyclone's maximum sustained winds reach or exceed 74 miles per hour (mph). Hurricanes are classified into a "Category" using the Saffir-Simpson Hurricane Wind Scale. The scale defines Category 1 hurricanes with wind speeds between 74 to 95 mph, Category 2 hurricanes with winds speeds between 96 to 110 mph, Category 3 hurricanes with wind speeds between 111 to 129 mph, Category 4 hurricanes with wind speeds between 130 to 156 mph, and Category 5 hurricanes with wind speeds exceeding 157 mph. Destructive winds and heavy rains associated with hurricanes cause potential for wide spread property damage and loss of life.

In the past three decades, the State of Hawaiʻi has been affected twice by devastating hurricanes: Hurricane ʻIwa (1982) and Hurricane ʻIniki (1992). It is difficult to predict these natural occurrences and the degree of potential destruction they may bring. However, it is reasonable to assume that a hurricane will occur again. The closest emergency evacuation centers located near the project site are Leihōkū Elementary School and Waiʻanae Elementary School which are approximately 2.6 and 2.7 miles away, respectively. Other nearby centers include Nānākuli Elementary School and Nānākuli High and Intermediate School.

4.5.4 Earthquake & Volcanic Hazards

Every year, thousands of earthquakes occur in Hawaiʻi with most around the Island of Hawaiʻi. According to the U.S. Geological Survey (USGS), many of these earthquakes are directly related to volcanic activity as the Hawaiʻi Island is home to the most active volcanos in the State (Kilauea, Mauna Loa, and Lōʻihi).

Historically, most earthquakes that occurred were not large enough to cause widespread damage. The last major earthquake occurred at Kīholo Bay along the Kona Cost of Hawaiʻi Island in 2006. The earthquake caused damage to roads and buildings and impacted utilities in the Kohala, Kona, and Hāmākua Districts of Hawaiʻi County as well as the eastern side of Maui. On Oʻahu, the earthquake caused a major widespread power outage. Although it is difficult to predict these natural occurrences and the degree of potential destruction they may bring, it is reasonable to assume that similar future incidences are likely to occur again.

4.5.5 Rockfall Hazards

The anticipated risk of potential rockfalls would be low, since the project site is not immediately adjacent to steep sloping areas.

4.5.6 Wildfire

The Hawaiian Islands are vulnerable to wildland fires, especially during the summer months from prolonged drought and/or high winds. However, roughly 90% of wildfire that occur throughout the State are caused by humans whether it was intentionally set or caused by

negligence. However, wild fires can also occur naturally. The Wai'anae Coast is known to have frequent fires, particularly along the mountains and hillsides, as well as unoccupied properties.

4.5.7 Potential Impacts and Proposed Mitigation

The project site is located in an area outside of the special flood hazard areas and is designated as Zone XS and Zone X according to the FIRM. Although the site is within the Tsunami Evacuation Zone and Extreme Tsunami Evacuation Zone, public locations within the Safe Zone are located nearby.

Construction of the proposed project is not expected to be adversely affected by seismic activity as the proposed residential buildings would be constructed in accordance with the Uniform and International Building Codes and other County, State, and Federal standards.

Fire hazards are a constant possibility during the summer months, and with drought conditions and/or high winds, especially in areas adjacent to large undeveloped land. The likelihood of wildfires occurring on the project site would be reduced with the development of the proposed project as the site would be occupied and maintained.

4.6 HISTORIC, ARCHAEOLOGICAL AND CULTURAL RESOURCES

Previous archaeological inventory surveys (AISs) were completed for the project area. The previous AISs were completed by International Archaeological Research Institute, Inc. (2009) and Scientific Consultant Services, Inc. (2013).

4.6.1 Historic and Archaeological Resources

Based on research that was conducted for the previous AISs, the project site was home to the Voice of America radio transmitter station during the latter years of World War II. The transmitter was built in 1944 and remained operational until at least 1964. In 1971 the property was transferred to the U.S. Coast Guard and used as a transmitting station until the antenna and transmission buildings were demolished in the 1980s. Efforts to remediate hazardous material throughout the site have been ongoing since 2018. The 84.4-acre parcel (TMK 8-7-010:030) was acquired from the U.S. Government in December 2010. The 4.9-acre parcel (TMK 8-7-010:031) was then conveyed to DHHL by the U.S. Government in July 2021.

The AIS conducted in 2009 by International Archaeological Research Institute, Inc. identified three archaeological sites within the project area. State Site 50-80-07-7081 consisted of 16 concrete pedestal foundations for the former VOA antenna configured in three nearly linear parallel arrangements oriented northeast-southwest and extending across the length of the parcel. State Site 50-80-07-7082 consisted of three remnant transmitter buildings located along the center point of the eastern boundary of the parcel and one concrete posthole. The posthole was part of a series for fence lines that traversed the property. State Site 50-80-07-7083 consisted of a remnant raised railroad bed from the Wai'anae Sugar Company.

The AIS conducted in 2013 by Scientific Consultant Services, Inc. verified the existing archaeological sites identified in the 2009 AIS and also identified three additional features. Two concrete pedestal foundations and a historic trash dump were added to State Site 50-80-07-7081. According to the AIS, the raised railroad bed identified in State Site 50-80-07-7083 was re-interpreted as a cart path associated with the Plantation Era due to the lack of evidences supporting the previous functional interpretation.

According to the 2013 AIS, the previously identified and three newly identified features within State Sites 50-80-07-7081, 50-80-07-7082, and 50-80-07-7083 were assessed for their significance as outlined in Hawai'i Administrative Rules §13-275-6. To be assessed as significant, a historic site must meet one or more of the following criteria:

A. Be associated with events that have made an important contribution to the broad patterns of our history;

B. Be associated with the lives of persons important in our past;

C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master or possess high artistic value;

D. Have yielded, or is likely to yield, information important for research on prehistory or history; or

E. Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts – these associations being important to the group's history and cultural identity.

The previously identified State Site 50-80-07-7081 and State Site 50-80-07-7082, Feature 7, were re-evaluated for significance and found to be significant under Criteria A, associated with historic events, and Criteria D, for information important to research on prehistory or history. The three additional features incorporated into State Site 50-80-07-7081 were also evaluated and found to be significant under Criteria A and Criteria D but were not recommended for preservation since they were not structurally unique. State site 50-80-07-7083 was also re-evaluated and found to be significant under Criteria A, C, and D, and was recommended for preservation.

4.6.2 Cultural Resources

The AIS conducted in 2009 by International Archaeological Research Institute, Inc. provided insight to the traditional, pre-Contact Hawaiian history and post-Contact history of Lualualei. These were based on oral traditions, archaeological research, and written documents. The AIS provides the following description:

> *The former VOA project area is located in Lualualei Ahupuaʻa within the traditional moku (traditional Hawaiian district) of Waiʻanae within along the western coast of Oʻahu. The survey parcel is towards the center, near-shore area of the ahupuaʻa. Although currently recognized as an ahupuaʻa, Lualualei was not designated as such a land division during the mid-19th century Māhele, which created a system of private land ownership in the archipelago. Traditionally, Lualualei appears to have been an ʻili ʻaina (a sub-ahupuaʻa land division) of Waiʻanae Ahupuaʻa (see Nakamura and Pantaleo 1994:5-8). Additional ʻili ʻaina within Lualualei valley and consequently now considered subdivisions of Lualualei Ahupuaʻa include Hālona, Pūhāwai, Mikilua, and Pāhoa (Kelly 1991: 313-314; Soehren 2002-2004). Māʻili, the current name for the residential area and beach park surrounding the project parcel, may have originally been an ʻili ʻaina as well (Soehren 2002-2004).*
>
> *The traditional history of the Waiʻanae District is rooted in stories of Hawaiian akua. One tradition identifies ʻUlehawa in southern Lualualei as the birthplace of the heroic demigod Māui (Sterling and Summers 1978:65). Māui pulled the Hawaiian Islands from the waters off the Waiʻanae coast with his magic fishhook and learned the secret of fire making in this area. His mother, the moon goddess Hina, made kapa in Kāneana Cave along the coast (Sterling and Summers 1978:64). The goddess Hiʻiaka, sister of the volcano goddess Pele, also visited this district when she climbed Pōhākea Pass. The normally subservient younger sister viewed Pele's destruction of her beloved forests on Hawaiʻi Island from this vantage point, thus providing her courage to resist Pele (Kelly 1991:316). Kamapuaʻa is also referenced to this area (Pukui et al. 1974:174).*
>
> *The Mahele of the mid-19th century marked a profound change in land tenure, creating a system of private land ownership as a replacement for the traditional structure … In the Māhele Kamehameha III claimed the ahupuaʻa of Lualualei along with Waiʻanae and Nānākuli. Only six Land Commission Awards (LCA) were given in Lualualei valley, all in the ʻili ʻaina of Pūhāwai. These six awards, and the rejected land claims by two other adults in the valley, indicate eight families resided in Lualualei during the mid-19th century.*

> *The Waianae Company sugar plantation began planting sugarcane in upper Waiʻanae valley in 1878 … The amount of land in Lualualei under cultivation varied during the next half century depending on leases and irrigation … A private narrow-gauge railroad transported the sugarcane from the fields to the mill, while the Oahu Railway and Land Company moved the sugar to Honolulu. After the Oahu Railway discontinued service to Waiʻanae in 1946 the Waianae Sugar Company closed.*
>
> *The presence of the U.S. Military in Lualualei and adjacent areas of leeward Oʻahu began incrementally in 1917 but greatly expanded to become the major landholder in 1929 … Between 1929 and 1933 the U.S. Navy obtained approximately 3,238 ha (8,000 acres) at the head of the Lualualei valley to establish the Naval Ammunition Depot and Naval radio transmission station … In the latter years of WWII, the Voice of America radio transmitter station was constructed in Māʻili within the current project area … Significantly for the present project area, the VOA antenna and transmission buildings were razed in the 1970s.*

More recently, International Archaeological Research Institute, Inc. (IARII) submitted a *Request for a Historic Preservation Review per Hawaiʻi Revised Statutes 6E-8 for the Department of Hawaiian Homelands Voice of America Property* (January 12, 2017) to State Historic Preservation Division (SHPD). The letter included a history of the site, background information on the property and a summary of previous archaeological inventory surveys (AISs) completed for the project area.

The letter specifically requested SHPD's concurrence of the following:

- Information provided regarding the land transfer of ownership from the U.S. Government to DHHL is sufficient (4.9-acre parcel)
- Preservation of the eastern section of the railroad bed is acceptable provided an approved preservation plan
- Data recovery of the western and central sections of the railroad bed is acceptable provided an approved data recovery plan

SHPD's response (September 19, 2017) indicated that details of the proposed development would be required as well as the status of the proposed land transfer. SHPD also requested a meeting with DHHL, the U.S. Government, and any additional appropriate parties.

In a follow up conversation with SHPD in November 2019, additional tasks were required by SHPD in order to move the project forward. Those tasks involved the land transfer and

authorization to conduct consultations, as well as additional site assessments of the archaeological sites by a historical architect or architectural historian.

MASON Architects prepared a Reconnaissance Level Survey (RLS) in March 2021 (refer to Appendix D) for SHPD documenting the current status of four historical features identified in the 2009 AIS. The RLS evaluated remnant features of the former Voice of America radio transmitting station previously assigned State Site number 50-80-07-7082 (Features 7, 14, 19, and 20). As part of the survey, MASON Architects conducted a site visit in November 2020, and observed that the four features were no longer extant. It was reported that the site was grubbed to a depth of one to two feet, removing all traces of the features except for the exposed top edges of a disconnected series of below-grade foundation walls. Although the site was previously considered significant for its association with the Office of War Information and the Voice of America radio network, the facility is no longer eligible because it has already been demolished. Furthermore, the remaining foundations are also not considered likely to yield information of historical importance or to have the potential to answer important research questions.

4.6.3 Potential Impacts and Proposed Mitigation

The key remaining archaeological resource at the proposed project site is the historic railroad bed identified as State Site 50-80-07-7083. It is proposed to be preserved in place (burial), and utilities within the area will be installed in a manner that will attempt to minimize disturbance of the railroad bed.

If significant sites, including human burials, are uncovered during construction, the contractor will be required to stop work and contact SHPD of the Department of Land and Natural Resources (DLNR) at 808-692-8015. A qualified archaeologist and a Hawaiian cultural expert recognized within the Hawaiian community for his/her cultural expertise shall be retained by the contractor to determine if any historic sites are present. If historic sites are found, the archaeologist and the Hawaiian cultural expert shall gather significant information to evaluate their significance and submit the findings to SHPD. If burial remains are found, the O‘ahu Island Burial Council at DLNR will be contacted. A mitigation plan will be developed, if required, and approved by SHPD prior to continuing with construction activities.

4.7 HAZARDOUS MATERIALS

The site is under the purview of the State of Hawai‘i Department of Health Hazard Evaluation and Emergency Response (HEER) Office. The site remains under investigation associated with former use as an antenna facility. The 4.9-acre portion of the site (TMK: 8-7-010:031) is managed under an Environmental Hazard Management Plan for management of residual levels of PCB-contaminated soil remaining in place beneath the southeastern end of the historic railroad rock berm. Considering that the current development plan includes placing a significant

amount of clean, structural backfill site-wide, residual soil contamination is unlikely to negatively impact future residential use of the site.

4.8 ROADWAYS AND TRAFFIC

The project site is located approximately one-quarter mile northeast of Farrington Highway. It is anticipated that the project's primary access will be provided through an extension of Kulaaupuni Street which is owned by the City and County of Honolulu. Kulaaupuni Street is accessed from Farrington Highway via St. John's Road. The intersection of Farrington Highway and St. John's Road is signalized.

An evaluation of the impacts of the proposed development to mobility and access surrounding the project site was completed by Fehr & Peers, entitled *Mobility Analysis Report (MAR) for the Voice of America Site in Mā‘ili*, dated October 29, 2021 (refer to Appendix B). The key roadways providing acces to or in the vicinity of the project site are described below.

> *"Farrington Highway (Route 93) is a principal arterial that largely is under the jurisdiction of HDOT. It extends as a four-lane facility from H-1/Queen Lili‘oukalani Freeway to Makaha Valley Road, where it becomes a two-lane facility to its northern terminus at Kaena Point State Park. From 0.22 miles north of the Na Ohi Kilolo Stream bridge, Farrington Highway is under the jurisdiction of the City & County of Honolulu. Adjacent to the project, the posted speed limit is 35 miles per hour (mph). A continuous sidewalk is provided on the mauka side of the roadway, and a painted shoulder is provided on the makai side of the roadway. Farrington Highway is also a designated bike route, and on-street parking is prohibited primarily in the four-lane section of roadway.*
>
> *St John's Road is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Kaukamana Road and includes approximately 22 feet of pavement width makai of Kulaaupuni Street with unpaved shoulders. The posted speed limit is 15 mph makai of Kulaaupuni Street and 25 mph mauka of Kulaaupuni Street. A narrow asphalt path is only provided on the north side of the street between Kulaaupuni Street and Manuaihue Street. On-street parking was observed on the unpaved shoulder areas.*
>
> *Kaukama Road (Route 8750) is a two-lane minor collector that is under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Pakeke Street. The posted speed limit is 25 mph. Sidewalks are provided on both sides of the roadway, and on-street parking is permitted on both sides as well.*

Kulaaupuni Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Mamoalii Place (adjacent to the project site) to a terminus at the Mā‘ili’ilii Stream. The posted speed limit is 25 mph. A sidewalk is provided on the makai side of the road between Mamoalii Place and the Mā‘ili Channel, and a raised curb designates a street-level walking path on the mauka side of the road for the same segment, with sidewalk provided on the Mā‘ili Channel bridge. A sidewalk is also provided on the makai side of the road between St John’s Road and approximately 200 feet south of Maliona Street. No sidewalk or formal path is provided on the other segments of Kulaaupuni Street, including the segment between the Mā‘ili Channel and St John’s Road. On-street parking is provided adjacent to the sidewalk, and parking was observed in the unpaved shoulder immediately adjacent to the roadway. No parking is permitted on the mauka side of the roadway between Mamoalii Place and the Mā‘ili Channel as designated by red curb.

Kulauku Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Kaukama Road to Kulawae Street. Kulauku Street has the potential to be extended to the north along the makai edge of the project site and the Kamehameha Schools Community Learning Center to connect with Kulaaupuni Street, but there are no plans to make that connection at this time. The posted speed limit is 25 mph. A sidewalk is provided on both sides of the roadway, and on-street parking is permitted on both sides as well.”

Photograph 4-3: Existing 40-foot wide easement at Kulaaupuni Street (looking south)

Photograph 4-4: Intersection of Holt Road and Kulaaupuni Street

A traffic study was conducted by Fehr & Peers entitled *Kamehameha Schools Community Learning Center in Mā‘ili, Hawai‘i – Transportation Impact Analysis Report (TIAR)*, dated May 23, 2013. The report was conducted in conjunction with the Kamehameha Schools Community Learning Center project. The project included a three-phase buildout of the learning center and assumed a three-phase buildout of the current DHHL project site. However, it is now anticipated that Kamehameha Schools will not develop beyond the current learning center footprint.

The MAR prepared for the current project provided an update to the recommendations of the 2013 TIAR study which included both the Kamehameha Schools Community Learning Center and the proposed project. The MAR is summarized below and attached in Appendix B.

Traffic counts were conducted in December 2020 at four existing intersections. The intersections that were studied included the following:

1. Farrington Highway/St. John's Road
2. Kulaaupuni Street/St. John's Road
3. Farrington Highway/Kaukama Road
4. Kulauku Street/Kaukama Road

The typical weekday AM and PM peak hour for each intersection were identified to be between 6:00 AM and 9:00 AM and 3:00 PM and 6:00 PM, respectively. The COVID-19 pandemic caused changes in temporal and behavioral travel patterns making it infeasible to conduct traffic counts that reflect typical peak hour volume levels. Subsequently, the traffic counts from December 2020 were adjusted by a 10% increase to account for demands prior to the COVID-19 pandemic. Additional adjustments were made for turning movement volumes determined to be significant deviations from normal resulting from pandemic conditions. Adjusted 2020 volumes were compared to counts taken for the Ka Pua Community Learning Center traffic study in November 2012, which were grown by 1% per year for 8 years to represent 2020 volumes. The higher of the two volumes was used as the final existing conditions volume to provide a more conservative analysis. This was done to ensure that volumes used in the Existing Conditions analysis accurately captured expected travel patterns resulting from unique land-uses in the area adversely affected by the pandemic, notably the nearby schools and educational facilities.

The traffic analysis performed in this MAR was based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6) with operations of roadway facilities described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on speed, travel time, delay, and freedom to maneuver. LOS is defined by six levels, LOS "A" through LOS "F". LOS "A" has the least congested operating conditions and LOS "F" has the most congested operation conditions.

As indicated in Table 4-1, all intersections that were studied currently operate at either LOS A or B for both peak hours, with the exception of the intersection of St. John's Road and Kulaaupuni Street which operates at LOS C during the existing AM peak hour.

Table 4-1: Existing Intersections Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for Side Street Stop)
			Delay (sec/veh)[1]	LOS	
1. Farrington Highway/St. John's Road	Signalized	AM	17.7	B	
		PM	13.9	B	
2. Kulaaupuni Street/St. John's Road	Side Street Stop	AM	21.2	C	NBL/T/R
		PM	11.8	B	NBL/T/R
3. Farrington Highway/Kaukama Road	Signalized	AM	9.5	A	
		PM	8	A	
4. Kulauku Street/Kaukama Road	Side Street Stop	AM	11.8	B	SBL
		PM	13.4	B	SBL

Source: Fehr & Peers, 2020

Notes: [1]Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.

4.8.1 Public Transportation

TheBus is the main public transportation service on the Island of O'ahu, where it served over 60 million riders in the fiscal year of 2019 on its fixed-route service. Within the project study area, Routes 40, 93, C, and PH1 provide service along Farrington Highway (Fehr & Peers, 2021).

Routes 93, C, and PH1 are express routes, while Route 40 is a regular service bus route. The existing transit schedules are summarized in Table 4-2.

Table 4-2: Existing Transit Services

Route	From	To	Weekdays			Weekends	
			Operating Hours	Headway (minutes)		Operating Hours	Headway (minutes)
				Peak	Midday		
40	Honolulu	Makaha	12:00 am – 12:00 am	30 min	30 min	12:00 am – 12:00 am	30 min
93	Downtown Honolulu	Makaha	Eastbound: 3:45 am – 8:16 am; Westbound: 3:23 am – 7:34 pm	27 min	-	-	-
C	Honolulu	Makaha	3:03 am – 11:02 pm	30 min	30 min	3:04 am – 11:09 pm	30 min
PH1	Pearl Harbor	Makaha	Eastbound: one departure from Makaha at 4:25 am; Westbound: one departure from Pearl Harbor at 3:10 pm	-	-	-	-

Source: Fehr & Peers, 2021; TheBus.org.

All routes serve the bus stops located approximately ½ mile from the project site at Farrington Highway/St John's Road. Both bus stops also have a painted shoulder to allow for bus pull-outs, so buses stopping to pick up or drop off passengers will not block vehicles traveling on Farrington Highway (Fehr & Peers, 2021).

4.8.2 Potential Impacts and Proposed Mitigation

As discussed previously, there are various roadways within the vicinity of the project site. Kulaaupuni Street and Mamoalii Place are both located just west of the project site and are maintained by the City and County of Honolulu. St. John's Road connects to both Kulaaupuni Street and Farrington Highway northwest of the project site. The project's proposed primary access will be serviced by a new entry off Kulaaupuni Street.

4.8.2.1 Intersection Level of Service

Based on the conceptual site plan, Fehr & Peers estimated the traffic generated due to the proposed project. Trip generations for both the AM and PM peak hours were used to measure the impact resulting from the proposed traffic.

A baseline scenario was identified assuming no development of the project site, followed by the addition of traffic from the development. The baseline scenario was taken at the time the project is expected to be fully built and occupied (estimated to be 2028). A growth factor of 0.90% per year was estimated based on forecasts developed for the Farrington Highway Corridor Study. To provide a worst-case forecast, a 1.0% annual growth factor was assumed over the eight-year timeframe. All intersections studied operate at LOS C or better for both peak hours except the intersection of Kulaaupuni Street and St. John's Road, which operates at LOS D during the AM peak hour (refer to Table 4-3).

The traffic generated from the proposed project was distributed using model data and existing turning movement counts to determine the likely geographical distribution of project trips. The overall trip distribution pattern estimates for the peak hour project-generated traffic are as follows:

- 25% to/from North along Farrington Highway
- 70% to/from South along Farrington Highway
- 4% local to/from Hookele Street and Kaukama Road
- 1% local to/from St. John's Road, Kulaaupuni Street and the surrounding neighborhood

The trip generation and distribution was used to analyze the operations of the four intersections with the proposed development. All intersections operate at a LOS C or better for both peak hours except the intersection of Kulaaupuni Street and St. John's Road, which operates at LOS F during the AM peak hour (refer to Table 4-3).

Table 4-3: Baseline (2028) Without and With Project Intersection Levels of Service

Intersection	Traffic Control	Peak hour	Future No Project Conditions			Future Plus Project Conditions			Change in Delay (sec/veh)[1]
			Overall Intersection or Worst Movement		Worst Movement (for SSSC)	Overall Intersection or Worst Movement		Worst Movement (for SSSC)	
			Delay (sec/veh)[1]	LOS		Delay (sec/veh)[1]	LOS		
1. Farrington Highway/ St. John's Road	Signalized	AM	20.4	C		29.6	C		9.2
		PM	18.5	B		24	C		5.5
2. Farrington Highway/ St. John's Road	SSSC	AM	29.5	D	NBL/T/R	>120	F	NBL/T/R	>60
		PM	13.5	B	NBL/T/R	19.8	C	NBL/T/R	6.3
3. Farrington Highway/ St. John's Road	Signalized	AM	9.9	A		9.7	A		-0.2
		PM	9.3	A		9.7	A		0.4
4. Farrington Highway/ St. John's Road	SSSC	AM	15.7	C	SBL	15.8	C	SBL	0.1
		PM	21.2	C	SBL	21.4	C	SBL	0.2

Source: Fehr & Peers, 2020.
Notes: SSSC = Side-Street Stop Controlled
[1]Whole intersection weighted average stopped delay expressed in seconds per vehicle for the signalized intersection. The vehicular delay for the worst movement is reported for the side-street stop-controlled intersection.

To improve operations at the Kulaaupuni Street/St. John's Road intersection, particularly during the morning peak hours, the MAR suggested the implementation of a multi-way stop which would result in average vehicle delays of 14.7 seconds in the AM peak hour. The all-way stop control is not expected to substantially affect operations at adjacent intersections and would enhance safety for pedestrians. Additionally, in the future, signal timing modifications at the Farrington Highway/St. John's Road intersection will need to be coordinated with the State's Department of Transportation, Highways Division (DOTH), prior to occupancy of the residential units. Although the overall intersection is projected to operate at a desirable level, a signal timing study will need to be completed and coordinated with DOTH to help reduce delays by improving westbound and southbound left-turn queuing. This study should be conducted closer to the start of occupancy so as to obtain more reliable data for the timing modification.

4.8.2.2 Site Access, Circulation, and Parking

Vehicle access to the site will be provided via Kulaaupuni Street, which would be extended by approximately 400 feet south of its current terminus with Mamoalii Place. A stop sign and associated pavement stripping is recommended for the westbound approach of the primary onsite roadway at Kulaaupuni Street. Overall, onsite access is considered to be adequate with the proposed and recommended improvements.

Proposed residential streets will provide continuous onsite vehicular circulation along with one cul-de-sac street on the makai side of the property. Stop signs and stripping on the single approach roadways are recommended at all onsite T-intersections.

The 145 single family lots will have dedicated parking within each parcel. It is anticipated that on-street parking will be permitted on internal streets where feasible. A parking lot with approximately 300 parking spaces will be provided for the 136 multifamily units. The proposed supply will exceed the minimum requirement for the multifamily housing per the Revised Ordinance of Honolulu Section 21-6.30 (two parking spaces per unit). No substantial circulation or parking issues are anticipated with construction of the proposed project.

4.8.2.3 Multi-modal Assessment

Transit service provided by TheBus along Farrington Highway is anticipated to increase in demand which can be accommodated based on existing service and frequency. No significant impacts to transit are anticipated to occur with buildout of the proposed project.

Minimal amounts of existing bicycle activity were observed in the study area. Bicycle access to the site will remain via the existing roadway network although the existing roadways do not provide separate bicycle facilities. It is anticipated that the existing facilities can accommodate the additional bicycle trip demand that is expected to be generated from the project and no significant impacts to bicyclist are expected to occur.

Existing sidewalks along Kulaaupuni Street and new sidewalks proposed as part of frontage improvements and within the project site will provide pedestrian access. However, several gaps exist in pedestrian facilities between the site and nearby key intersections and destinations. The MAR included optional considerations including two pedestrian paths adjacent to the proposed project site. The first path would be located on the mauka side of Kulaaupuni Street between the Mā‘ili Channel bridge and St. John’s Road. The path would help to provide project-related pedestrian access to key destinations (Mā‘ili Elementary School and Community Park, Leeward Community College Wai‘anae Moku campus, and bus stops on Farrington Highway). The second path would be located to the east just south of the project site that would provide a connection to the proposed project and the makai terminus of Laia Street within the Sea Country residential development.

4.9 NOISE

4.9.1 Description

Current sources of noise in the vicinity of the project site include vehicular traffic, typical residential noise, occasional aircraft, and natural sounds associated with weather and birds.

4.9.2 Potential Impacts and Proposed Mitigation

The proposed project is expected to produce an increase in noise levels both during and after construction is completed. The residential development could be a concern to the current residents in the surrounding neighborhoods.

In general, construction activities cannot exceed the permissible noise levels pursuant to HAR, Chapter 11-46. The Department of Health (DOH) Community Noise Control specifies that Class A (land zoned residential) may not exceed the maximum permissible noise level of 55 decibels A (dBA) during the day and 45 dBA at night. A noise permit will be obtained from DOH by the contractor if noise levels are expected to exceed the maximum permissible level to operate vehicles, construction equipment, and power tools.

The general contractor shall be responsible for obtaining necessary permits and complying with all permit conditions as well as ensuring proper maintenance of equipment with motors and the use of mufflers, if necessary. Work shall be scheduled Monday through Friday, primarily for daytime hours, as described in HAR Title 11, Chapter 46 (7:00 AM to 6:00 PM). Other mitigation measures to minimize temporary noise may be used by the contractor.

Upon completion of the proposed project, the noise levels at the project site are expected to mimic those typical of a residential neighborhood. It is anticipated that noise may be generated from both the increased number of people living in the community and vehicles traveling in the area. The ambient noise level at the site is expected to increase as the site will be developed from a vacant lot to a residential neighborhood.

4.10 AIR QUALITY

4.10.1 Description

Air quality throughout the State is generally good due to the effects of the predominant tradewinds blowing from the northeast direction. Anthropogenic and volcanic pollutants are blown toward the ocean due to the tradewind pattern. Occasionally Kona winds can carry “vog” towards O‘ahu and surrounding islands causing a decrease in visibility and an increase in volcanic air pollutants.

4.10.2 Potential Impacts and Proposed Mitigation

Exhaust transmission during construction would be generated from vehicles and construction equipment. Fugitive dust will be generated during construction activities and by vehicular traffic. Impacts due to exhaust emissions will be minimized by keeping all equipment properly tuned and maintained, as well as by minimizing unnecessary idle time. The contractor will be required to comply with Hawai‘i Administrative Rules (HAR) Title 11 Department of Health (DOH) Chapter 60.1 Air Pollution Control which contains restrictions on visible emissions from motor vehicles and fugitive dust generations. Perimeter dust fences will be installed, and graded areas

and exposed surfaces will be kept well-watered whenever feasible to reduce fugitive dust emissions.

No long-term impacts to air quality are anticipated.

4.11 VISUAL RESOURCES

4.11.1 Description

According to the Wai‘anae Sustainable Community Plan, visual resources in the Wai‘anae district include costal lands, forest lands including steep ridges and pu‘u near the coast, and peaks of the Wai‘anae Mountain range. Panoramic views of Pu‘u Mā‘ili‘ili to the north and Pu‘u o Hulu to the south can be seen from the property due to its centralized location. Ocean views are limited due to the site's low elevation.

4.11.2 Potential Impacts and Proposed Mitigation

The visual appearance of the project site is expected to change from overgrown vacant land to a residential community. Since the proposed site will be filled to accommodate the proposed utilities, ocean views from the residences of Sea Country located mauka of the project site may be obstructed. Consultation and coordination with the Sea Country Homeowner's Association will be included as part of the proposed project.

The proposed multifamily buildings and single family homes are anticipated to be "low rise", which will help to mitigate visual obstructions from the site. Landscaping and the proposed park and open areas should further mitigate visual impacts of rooflines. The Wai‘anae Sustainable Community Plan describes the importance of mauka to makai views but does not specify any view plane covering any portion of the project site. Therefore, public views are not anticipated to be significantly impacted by the proposed project.

4.12 SOCIAL & ECONOMIC CHARACTERISTICS

4.12.1 Population and Demographics

General characteristics of the population in the vicinity of the project site was provided by the U.S. Census Bureau. Demographic data for the Mā‘ili Census Designated Place (CDP) are from the 2010-2019 American Community Survey 5-Year Estimate while data for Honolulu County and the State of Hawai‘i are from the 2019 American Community Survey 1-Year Estimate. The American Community Survey Estimates represent the average characteristics of population and housing for a time range, rather than for a single point in time. The Mā‘ili CDP covers approximately 1.7 square miles and is bounded by Mā‘ili‘ili Road to the north, Pa‘akea Road and the Sea Country community to the east, Pu‘u o Hulu Kai to the south, and the coastline to the west.

According to the 2020 census, the Māʻili CDP has a total population of 11,535 persons (refer to Table 4-4). The median age of the population is 32.6 years compared to 39.6 for the State of Hawaiʻi. In the Māʻili CDP, 8.1% of the population is under 5 years of age, 69.2% of the population is 18 years and over, and 11.0% of the population is 65 years and over. The largest ethnic population in the Māʻili CDP was "Native Hawaiian/Pacific Islander" at 24.7% of the population compared to "Asian" at 43.0% for the State of Hawaiʻi. The second largest ethnic population in the Māʻili CDP was "Asian" at 18.5% of the population and the third largest was "Two or more Races" at 41.5%.

Table 4-4: Population and Ethnicity

2020 Census	Māʻili CDP	Honolulu County	State of Hawaiʻi
Population	11,535	1,016,508	1,455,271
Age			
Under 5 Years	8.1%	6.4%	6.0%
18 Years and Over	69.2%	78.8%	78.8%
65 Years and Over	11.0%	17.3%	19.0%
Median Age (Years)	32.6	38.4	39.6
Ethnicity			
White	11.8%	18.5%	22.9%
African American	1.6%	2.0%	1.6%
American Indian/Alaska Native	0.3%	0.2%	0.3%
Asian	18.5%	43.0%	37.2%
Native Hawaiian/Pacific Islander	24.7%	10.0%	10.8%
Other	1.5%	1.7%	1.8%
Two or more Races	41.5%	24.5%	15.9%

Source: 2020 Census

With regard to educational attainment within the Māʻili CDP, of the population 25 years of age and older, 40.2% are high school graduates or equivalent compared to 27.4% in the State of Hawaiʻi (refer to Table 4-5). A lower percent of the population in the Māʻili CDP obtained any type of post-secondary education degree (Associates, Bachelors, or Graduate) compared to the State.

Table 4-5: Educational Attainment

2020 Census	Mā‘ili CDP	Honolulu County	State of Hawai‘i
Educational Attainment			
High School or Equivalent degree	40.2%	25.9%	27.4%
Some college, no degree	22.7%	20.3%	20.7%
Associate's degree	9.9%	10.7%	10.6%
Bachelor’s degree	11.5%	22.9%	22.1%
Graduate or professional degree	6.3%	12.1%	11.6%

Source: 2020 Census

The median household income in the Mā‘ili CDP was higher compared to the State at $88,395 vs. $83,102 (refer to Table 4-6). However, the approximate percentage of the population in poverty was nearly double that of the State at 18.1% vs. 9.3%.

Table 4-6: Income and Poverty

2020 Census	Mā‘ili CDP	Honolulu County	State of Hawai‘i
Income and Earnings			
Median Household Income	$88,395	$87,470	$83,102
Poverty	18.1%	8.1%	9.3%
Under 18 years	32.9%	10.1%	12.4%
18 to 64 years	13.0%	7.8%	8.5%
65 years and over	7.3%	7.8%	8.7%

4.12.2 Housing

As indicated in Table 4-7 below, the median gross rent in Mā‘ili was $2,119 which is higher than in Honolulu County and in the State ($1,774 and $1,651, respectively). The median mortgage in Mā‘ili was $2,396 which is lower than both Honolulu County and the State of Hawai‘i ($2,670 and $2,472, respectively). Of the 3,096 housing units in the Mā‘ili CDP, 64.0% of the units are owner-occupied. This is higher than the county-wide and state-wide owner-occupied rates which are approximately 57.4% and 60.2%, respectively.

Many of the single family homes in the area were built in the 1950s to 1970s. The Mā‘ili Holiday development, located east of the project site along Mamoalii Place, was developed in the 1970s and the Mā‘ili Kai community, located south of the site, was developed in the 1990s. The Sea Country development, located along the eastern border of the site, was developed by D.R. Horton Hawai‘i, LLC and completed in 2015.

Table 4-7: Housing

2020 Census	Mā‘ili CDP	Honolulu County	State of Hawai‘i
Median Gross Rent	$2,119	$1,774	$1,651
Median Mortgage	$2,396	$2,670	$2,472
Housing Units			
Total Housing Units	3,096	370,665	561,066
Occupied Housing Units	2,850	336,412	490,267
Vacant Housing Units	246	34,253	70,799
Owner/Renter Characteristics			
Owner-occupied housing units	64.0%	57.4%	60.2%
Renter-occupied housing units	36.0%	42.6%	39.8%

4.12.3 Schools

Public schools serving the property include Mā‘ili Elementary School, Wai‘anae Intermediate School, and Wai‘anae High School (refer to Table 4-8). Charter schools along the Wai‘anae Coast include the Ka Waihona o ka Na‘auao School in Nānākuli and the Kamaile Academy School in Wai‘anae.

The Strive HI Performance System was designed as Hawai‘i’s school accountability and improvement system to meet the needs of students, educators, and schools and amended the existing No Child Left Behind (NCLB) program. In 2013, the State’s waiver from certain requirements of the federal NCLB was approved by the U.S. Department of Education. The Strive HI Performance System was updated in 2017 to align with the State’s Strategic Plan and reauthorization of the federal Every Student Succeeds Act.

The new system focuses on readiness for community, college, and careers and measures schools’ performance and progress based on student achievement; readiness (chronic absenteeism, high school graduation rates, college enrollment), and achievement gap (reducing the gap between “high needs students” and “non-high needs students”). Table 4-8 summarizes some of the key performance metrics for the 11 Department of Education public and charter schools in the Nānākuli-Wai‘anae Complex Area for the 2018-2019 school year.

4.12.4 Potential Impacts and Proposed Mitigation

According to the 2020 census, Honolulu County had the largest Native Hawaiian or Other Pacific Islander population in the nation. The proposed DHHL development is anticipated to have a positive impact on this population by providing a residential homestead community for DHHL’s native Hawaiian beneficiaries under the Hawai‘i Homes Commission Act.

The current housing crisis throughout the State has impacted the local community as housing costs continue to rise and many residents and families struggle to find affordable housing. With a growing waitlist of over 23,000 residential applicants, the proposed development will provide a lease and/or rental opportunity for a number of DHHL beneficiaries.

Short-term employment is expected to be generated from the proposed project with the construction of onsite and offsite infrastructure improvements, as well as building and landscaping improvements.

Table 4-8: Strive HI School Performance Report Summary

School	School Year*	Students meeting the standard (%)			Achievement Gap (points)		3rd Graders reading near, at, or above grade level	8th Graders reading near, at, or above grade level	Students Graduated on Time	Students Enrolled in Post-secondary Institutions	Student's missed 15 or more days of school	Student reported positive school climate
		Language Arts	Math	Science	Language Arts	Math						
Elementary School (State)	2018 – 2019	54%	49%	58%	-	-	-	-	-	-	13%	-
Leihoku Elementary		41%	36%	70%	20	15	55%	-	-	-	22%	76%
Mā‘ili Elementary		33%	33%	34%	29	34	64%	-	-	-	28%	66%
Mākaha Elementary		20%	16%	38%	11	4	51%	-	-	-	28%	70%
Nānāikapono Elementary		20%	19%	30%	29	22	52%	-	-	-	37%	63%
Nānākuli Elementary		24%	42%	48%	15	24	71%	-	-	-	31%	51%
Wai‘anae Elementary		17%	12%	20%	19	14	36%	-	-	-	31%	56%
Intermediate School (State)		52%	38%	41%	-	-	-	-	-	-	14%	-
Nānākuli High & Intermediate		31%	10%	9%	16	2	-	51%	71%	37%	34%	74%
Wai‘anae Intermediate		32%	18%	25%	24	17	-	48%	-	-	36%	70%
State (High School)		59%	31%	35%	-	-	-	-	-	-	19%	-
Wai‘anae High		9%	2%	24%	4	0	-	-	75%	40%	40%	71%
Public Charter School (State)					-	-	-	-	-	-	-	-
Ka Waihona o Ka Na‘auao PCS		29%	19%	28%	16	13	74%	65%	-	-	21%	73%
Kamaile Academy PCS		21%	9%	15%	4	-2	46%	40%	76%	-	33%	63%

*The U.S. Department of Education waived Hawai‘i public schools from statewide testing in the 2019-2020 school year due to COVID-19. Results from the 2018-2019 school year are shown.

4.13 INFRASTRUCTURE AND UTILITIES

This section summarizes the existing infrastructure and utilities within the vicinity of the project site as they relate to the proposed development. A more detailed description and analysis may be found in the Preliminary Engineering Report (refer to Appendix E).

4.13.1 Existing Water System

The Board of Water Supply (BWS) provides most of the water servicing the Waiʻanae District. Approximately half of the water comes from wells within Waiʻanae while the other half is conveyed to Waiʻanae from the Pearl Harbor aquifer. Due to the water system running near maximum capacity, the BWS is currently constructing the *Lualualei Line Booster Upgrade* project, increasing the water supply servicing Waiʻanae.

While water infrastructure can be found in adjacent roadways and developments, there is no water system currently serving the vacant project site. An 8-inch water line runs within Kulaaupuni Street, which services both the Ulu Ke Kukui (transitional housing facility) and Hoʻomalu O Nā Kamaliʻi (receiving home). The 8-inch line then continues parallel with the Māʻili Channel along Mamoalii Place servicing the Māʻili Holiday residential development, just west of the project site.

4.13.1.1 Potential Impacts and Mitigation

The estimated water and fire flow demand for the proposed development was calculated using the BWS *Water System Standards*. A summary of the estimated domestic water demand and fire flow requirements are as follows:

- Domestic Consumption
  - Average Daily Demand = 126,900 gallons per day (gpd)
  - Maximum Daily Demand = 190,350 gpd
  - Peak Hour Flow = 380,700 gpd
- Fire Flow Requirements (Table 100-19, *BWS Water System Standards)*
  - Single Family
    - Fire Flow = 1,000 gallons per minute (gpm)
    - Fire Flow Duration = 1 hour
    - Fire Hydrant Spacing = 350 feet
  - Multifamily
    - Fire Flow = 1,500 gallons per minute (gpm)
    - Fire Flow Duration = 1 hour
    - Fire Hydrant Spacing = 250 feet

An Early Consultation Letter was submitted to the BWS in September of 2021, providing BWS an opportunity to comment on the proposed project. BWS responded (October 6, 2021) that the

existing water system is adequate to accommodate the proposed homestead development (refer to Appendix F).

BWS also indicated that the *Lualualei Line Booster Upgrade* project is currently in construction and is projected to be completed in the upcoming months. The project will increase both pumping capacity and overall water supply to the leeward side of O‘ahu. This would help to provide adequate water supply for increasing demands required by the proposed project and other future developments. It was suggested that the project status be confirmed in the beginning of 2022. BWS also identified a current project in the neighboring roadways. The project entitled, *Farrington Highway Water System Improvements, Hookele Street Vicinity Project*, is currently in the design phase and is likely to impact waterlines in the vicinity of the project site.

The onsite water system for the development will be designed in accordance with the BWS *Water System Standards*. A proposed connection off the 242’ Service Zone via an existing 8-inch water line within Kulaaupuni Street is anticipated. The onsite water system will consist of an underground piped system sized to accommodate the domestic demand and fire flow, and will also include the installation of pressure reducing valves, as needed. Fire hydrants will be installed along the roadways to provide adequate fire protection within the development.

Water conservation measures to be considered for the proposed project include:

- Drought tolerant plants
- Xeriscape landscaping
- Efficient irrigation systems (low drip and moisture sensors)
- Use of Water Sense labeled ultra-low water fixtures and toilets

4.13.2 Existing Wastewater System

There is no wastewater system currently serving the project site. Similar to the water system, existing sewer infrastructure can be found in adjacent roadways and developments. There is a private sewer line in Mamoalii Place within the Mā‘ili Holiday residential development. A 6-inch sewer line leads to an 8-inch sewer line servicing the residential units. The 8-inch sewer line eventually connects to the 36-inch sewer interceptor along the edge of Mā‘ili Channel. The 36-inch sewer interceptor travels north along the Mā‘ili Channel and Kulaaupuni Street and is redirected west after crossing the Mā‘ili‘ilii Stream toward Farrington Highway. Once in Farrington Highway the 36-inch sewer interceptor continues north until it reaches the Wai‘anae Wastewater Treatment Plant.

There are also wastewater systems servicing existing developments within the project’s 84.4-acre parcel. The Kamehameha Schools Community Learning Center is served by an onsite wastewater system containing 4-, 6-, 8- and 12-inch sewer lines connecting to an 18-inch sewer line in Kulauku Street.

The wastewater system servicing the Ulu Ke Kukui (transitional housing facility) and Ho‘omalu O Nā Kamali‘i (receiving home) consists of 4-, 6- and 10-inch sewer lines. The onsite private sewer system crosses under the Mā‘ili Channel utilizing a 10-inch sewer line to a sewer manhole just south of the channel property line. The sewer transitions to a municipal system under the jurisdiction of the City and County of Honolulu north of the channel property line. The 10-inch sewer continues west along Holt Road until reaching Kulaaupuni Street. In Kulaaupuni Street, the sewer is redirected north and connects to a 10-inch sewer in St. John's Road. In St. John's Road, the sewer travels west and connects to the 36-inch sewer interceptor.

4.13.2.1 Potential Impacts and Mitigation

The estimated design wastewater flow for the proposed development was calculated based on the City and County of Honolulu's, Department of Environmental Services (ENV) *Wastewater System Design Standards*. The design wastewater flow is 333,768 gallons per day (gpd) based on 281 dwelling units.

A sewer connection was approved by the City and County of Honolulu for the development of up to 450 units at the project site (refer to Appendix G). The approval indicated that sewer connections are allowable on Holt Road and Kulawae Street. The Holt Road connection, located a few hundred feet north of the project site, is preferred as it is not expected to require pumping.

The project's wastewater collection system will be designed in accordance with the City and County of Honolulu's, Department of Environmental Services (ENV) *Wastewater System Design Standards* and *Wastewater System Standard Details*. Approximately 300 feet of offsite sewer line will be required to convey the project's wastewater to the closest available existing sewer manhole. This manhole is located along the northern border of the Ulu Ke Kukui site. The sewer crosses below Mā‘ili Channel, and the subsequent downstream sewer lines will convey the project's onsite flows to the City's 36-inch sewer interceptor. The onsite sewer system will consist of underground gravity sewers sized to accommodate the onsite peak wet weather wastewater flows.

4.13.3 Existing Drainage System

Mā‘ili Channel begins east of the project site bordering the Sea Country residential development. The channel runs north parallel with the project site and then turns west along the project's north border. After crossing the Kulaaupuni Street Bridge, the channel runs south, then southwest towards the coast. The channel discharges into the Pacific Ocean downstream of the crossing at Farrington Highway.

There is no internal drainage system within the project site. Storm runoff generated at the site presently sheet flows towards the west in the direction of an existing drain intake connected to a 48-inch drain line. The 48-inch drain line traverses through the neighboring Mā‘ili Holiday residential development within a 10-foot-wide drainage easement in favor of the City and County of Honolulu. The drain line discharges into the Mā‘ili Channel approximately 250 feet west of the project site.

The existing drainage concept within the project site is generally consistent with the *Hydrologic Report for Mā‘ili Holiday* prepared by William Hee & Associates, Inc. (1973). The drain intake and 48-inch drain line were constructed under the Mā‘ili Holiday Project in order to intercept runoff flowing from the project site in the westerly direction of the Mā‘ili Holiday residential development. The Kamehameha Schools Community Learning Center, south of the site, also contributes runoff to the existing drain intake. The *Hydrologic Report for Mā‘ili Holiday* did not account for the flow from this portion of the project parcel. The Hydrologic Report accounted for intercepting runoff from only the north portion of the project parcel. Therefore, the future (post-construction) drainage pattern will not follow the existing drainage pattern due to limited capacity of the drainage system at the western border.

Photograph 4-5: Existing drain intake

Photograph 4-6: Mā‘ili Channel

4.13.3.1 Potential Impacts and Mitigation

The estimated peak storm water runoff from the proposed development was calculated in accordance with the City and County of Honolulu's *Storm Drainage Standards*. Due to the proposed elevation of the site, the existing flow pattern will be altered. Instead of sheet flowing west towards the existing drain intake, the onsite drainage system will consist of swales and catch basins (and/or drain inlets) which will intercept a majority of the runoff produced onsite. The site runoff will be conveyed through an underground piped system which will lead to a box culvert. The box culvert will then discharge to an infiltration basin where runoff will infiltrate through the basin invert and into the soil matrix, thereby treating the runoff. The basin will be

designed with an overflow to convey the peak flow rate, which will discharge into the Mā‘ili Channel.

Additional offsite drainage improvements will be required in order to address changes in the drainage flow pattern resulting from the development.

- The existing drain intake structure at the southwestern corner of the project site will be replaced with a new structure which will be located further east. This new intake structure will no longer be situated within the existing 40-foot-wide roadway easement.
- The existing 48-inch reinforced concrete pipe (RCP) drain that currently connects to the existing drain intake structure mentioned above will be lengthened so that it connects to the new drain intake structure. The existing RCP drain will also be replaced entirely by a 4’ x 6’ box culvert and manholes to accommodate the proposed onsite and additional offsite flows. As mentioned previously, this drain line is maintained by the City and County of Honolulu and is located in a 10-foot-wide easement.
- Drain inlets will be constructed along the south border of Ulu Ke Kukui to intercept runoff flowing toward the proposed DHHL site along with the construction of drainage structures along the proposed Kulaaupuni Street extension fronting the proposed site entrance.

Sustainable design practices, such as Low Impact Development (LID) site design strategies and source control and treatment control best management practices, shall be implemented in order to comply with the City and County of Honolulu’s *Rules Relating to Water Quality* requirements and to help mitigate storm water pollution discharges. An infiltration basin, swales, and manufactured biofiltration systems may be utilized to treat storm water runoff.

4.13.4 Energy and Communications Systems

The proposed project site is not currently served by electrical, telephone, and cable services. Hawaiian Electric Company (HECO) has a mix of existing overhead and underground distribution systems servicing the adjacent developments. The existing Mā‘ili Holiday development, west of the site, is serviced through a single-phase underground system along Kulaaupuni Street and Mamoalii Place. The existing Ulu Ke Kukui development and Ho‘omalu O Nā Kamali‘i facility, north of the site, is serviced by an overhead three-phase system from St. Johns Road to pole 4/9Y on Kulaaupuni Street. A riser at pole 4/9Y and underground system is provided to service the site. The existing overhead lines along Kulaaupuni Street extend beyond Ulu Ke Kukui to service the Kamehameha Schools Community Learning Center, located south of the site.

Photograph 4-7 – HTCO, Charter and HECO pullboxes along Kulaaupuni Street

Photograph 4-8 – Existing overhead lines and Street Light along Kulaaupuni Street

The existing Sandwich Isles Communication (SIC), Hawaiian Telcom (HTCO) and Charter Communications (Charter) distribution is through underground infrastructure along Kulaaupuni Street and via the overhead lines along St Johns Road. The existing utility boxes (refer to Photograph 4-7) on Kulaaupuni Street service Mā‘ili Holiday development, Ulu Ke Kukui, and Ho‘omalu O Nā Kamali‘i.

The existing street lighting system along the makai side of Kulaaupuni Street consists of unmetered City and County of Honolulu street lights (refer to Photograph 4-8).

4.13.4.1 Potential Impacts and Mitigation

Based on a recent field investigation, it was observed that existing electrical infrastructure is available to serve the site via the existing overhead lines along Kulaaupuni Street. It is anticipated that a riser will be installed at an existing utility pole to provide underground Hawaiian Electric Company (HECO) service to the site. The site service will include underground electrical ductlines, handholes and concrete pads for HECO transformers and switchgears.

The existing Hawaiian Telcom and Charter underground infrastructure (4-inch conduit) on Kulaaupuni Street is capable of accommodating the new infrastructure but a new fiber hub and power supply will be needed onsite to distribute the communication services. Another potential

source of communication is to extend communication service feeding the Kamehameha Schools Community Learning Center. With either option, underground service will be provided to the site which includes communication ductlines, handholes and concrete pads for power supplies.

New street light bases, poles, luminaires and concrete bases will be installed with underground electrical feeds along the Kulaaupuni Street extension and onsite. City light standards will be installed, since the roadways are expected to be licensed for maintenance purposes to the City and County of Honolulu in the future.

4.13.5 Existing Solid Waste Collection

Most residential and commercial solid waste collected on O‘ahu is taken to the Campbell Industrial Park H-POWER (Honolulu Program of Waste Energy Recovery) Plant. Over 700,000 tons of waste are processed at the plant which produces up to 10% of O‘ahu’s electricity. Noncombustible construction and demolition debris, industry waste, and residual ash from H-POWER are disposed of in a landfill. There are two landfills on O‘ahu; The Waimanalo Gulch Sanitary Landfill and the PVT Landfill located in Nānākuli (for construction and demolition waste only). The City and County of Honolulu Department of Environmental Services, Refuse Division is responsible for the collection and disposal of solid waste island wide. The project site is currently vacant and does not generate waste.

4.13.5.1 Potential Impacts and Mitigation

Solid waste will be generated during and post-construction due to the proposed project. Anticipated short-term impacts are construction waste which will include vegetation, rocks and debris from the grading and grubbing of the project site as well as building construction debris. Long-term impacts will see an increase in residential source solid waste. Solid waste that is generated will be disposed of in accordance with HRS, Chapters 342H and 3421, and HAR, Chapter 11-58.1, Solid Waste Management Controls. Waste generation reduction practices, such as recycling, will be encouraged. Coordination with the Department of Environmental Services, Refuse Division will be required to arrange trash pickup service for the new residential development.

4.14 PUBLIC SERVICES AND FACILITIES

4.14.1 Police Protection

The site is located within Honolulu Police Department (HPD) District 8. The Wai‘anae Police Substation is located approximately two miles away at the intersection of Farrington Highway and Wai‘anae Valley Road at 85-939 Farrington Highway.

4.14.1.1 Potential Impacts and Mitigation

It is anticipated that occasional and unavoidable demand for police service will occur due to the increase in the onsite population. The Wai‘anae Police Substation is within minutes of the site providing access to emergency services.

4.14.2 Fire Protection

The Honolulu Fire Department (HFD) provides fire prevention, suppression, and protection services for O‘ahu. The Wai‘anae Fire Station is approximately three miles away and is located at 85-645 Farrington Highway.

4.14.2.1 Potential Impacts and Mitigation

It is anticipated that occasional and unavoidable demand for fire protection will occur. Access for fire apparatus as well as water service for the proposed project capable of supplying the required fire flow for fire protection will be provided. The fire station is also located within minutes of the proposed site.

4.14.3 Health Care Services

The Wai‘anae Coast Comprehensive Health Center is approximately two miles away and is located at 86-260 Farrington Highway. The Health Center also provides emergency services. Additionally, several privately-operated medical/dental clinics and offices are located in the vicinity of the project area.

4.14.3.1 Potential Impacts and Mitigation

It is anticipated that occasional and unavoidable demand for emergency health care services will occur due to the increase in onsite population. The nearest emergency health service center in proximity to the site is the Wai‘anae Coast Comprehensive Health Center.

4.14.4 Recreation and Cultural Facilities

Recreational facilities within the vicinity of the proposed project include Mā‘ili Kai Community Park, Mā‘ili Community Park, Pu‘u o Hulu Community Park, Mā‘ili Beach Park, and the Mā‘ili Pillbox hiking trail. Facilities further south of the project site include Ulehawa Beach Park and Nānākuli Beach Park. Facilities further north of the project site include Lualualei Beach Park, Pokai Bay Beach Park, Piilaau Park, and Wai‘anae District Park.

4.14.4.1 Potential Impacts and Mitigation

The project is not anticipated to hinder or obstruct access to nearby recreational facilities. A mini park is included in the conceptual plan of the proposed project and will provide residents with an area for outdoor recreation.

4.14.5 Educational Facilities

There are several educational facilities and programs located near the property. Facilities within a one-mile radius include Mā‘ili Elementary School, Kamehameha Schools Mā‘ili Preschool, Kamehameha Schools Nānākuli Preschool, Kamehameha Schools Community Learning Center, Kamehameha Schools Hoaliku Drake Preschool, INPEACE Keiki Steps (Mā‘ili Elementary School), Head Start Mā‘ili Elementary School, Head Start Ulu Ke Kukui, Head Start Keiki Country, Head Start Nānākuli, and Mā‘ili Bible School.

Public schools serving the property include Mā‘ili Elementary School, Wai‘anae Intermediate School, and Wai‘anae High School. Charter schools along the Wai‘anae Coast include the Ka Waihona o ka Na‘auao K-8 School in Nānākuli and the Kamaile Academy K-9 School in Wai‘anae.

4.14.5.1 Potential Impacts and Mitigation

The proposed project is anticipated to increase enrollment at public schools serving the property due to the increase in population. With the addition of multifamily and single family units, an increase in families with children who will likely attend public schools in the vicinity is expected.

5.0 ALTERNATIVES

In compliance with the provisions of Section 11-200.1-24(h) the project alternatives are discussed in the following section.

5.1 NO ACTION

The No Action alternative will result in no change to the project site. The proposed residential development would not be built and the property would remain undeveloped.

Under this No Action alternative the short- and long-term adverse and beneficial impacts would not occur. Short-term construction jobs would not be generated, thus, impacting those who would have otherwise benefitted financially during this period. In the long-term, residences for beneficiaries would not be constructed. The project site would remain unchanged and vacant, costing DHHL funds and personnel to maintain the vacant land until future plans for the site are established. The current vacant state of the land would also bring the potential for unwanted activities such as homeless encampments, fires, illegal dumping, etc. However, the potential for adverse environmental impacts associated with construction activities would be adverted. Also, in the long-term the vacant site would benefit from the lack of residential infrastructure and permanent residents that would otherwise impact the environment, similar to surrounding developments.

As discussed in Section 2.2, the Department of Hawaiian Home Lands (DHHL) waitlist of over 23,000 residential applicants throughout the state and approximately 11,000 on Oahu alone highlights the extreme importance of this project, as well as other proposed homestead developments. The No Action alternative would further hinder DHHL's efforts to provide homestead leases and awards to native Hawaiian beneficiaries. The waitlist would continue to lengthen, thereby exacerbating the State's housing shortage.

5.2 ALTERNATIVE SITE PLANS

As discussed in Section 2.3.4, two conceptual site plan options were proposed for consideration. One alternative is comprised entirely of single family residences, while the second alternative is a blend of single family and multifamily residences. Both alternatives would also include an infiltration basin and small park situated towards the northwestern portion of the site.

The single family alternative would provide approximately 200 lots each consisting a minimum of 5,000 square-feet. The mixed alternative would currently provide 145 single family lots and 136 multifamily units totaling 281 units; however, the actual unit count would be finalized during the design phase. The site plan was intentionally laid out in a modular format to provide the greatest flexibility by virtue of allowing the substitution of either single or multifamily units in the interior portions (large blocks) of the site.

Either site plan alternative would have a positive impact by providing needed housing opportunities for native Hawaiian beneficiaries and establishing a permanent homestead community. Water demand, solid waste and wastewater generation, and increased traffic would be greater with the blended alternative. However, compared with the single family option the blended alternative would provide a higher density thereby serving more beneficiaries and provide a mix of housing options to better serve a variety of needs.

After DHHL deliberation and beneficiary input, the conceptual site plan option with both single family and multifamily units was chosen as the preferred alternative moving forward.

Both alternative site plans propose the development of a residential neighborhood and either alternative would require road construction, grading and utility improvements. Selecting either alternative would not result in a substantially different impact on the surrounding environment.

6.0 FINDINGS, SUPPORTING REASONS, AND ANTICIPATED DETERMINATION

6.1 PROBABLE IMPACT, INCLUDING CUMULATIVE IMPACTS

Cumulative impacts include the impact on the environment as a result of the incremental impact of the action when incorporated with other past, present, and reasonably foreseeable future actions. This assessment discusses the project and the cumulative impacts that may result from construction of the proposed residential development.

The long-term cumulative impact of the proposed project will help to address the housing shortage for DHHL's beneficiaries. Development of the currently vacant, unoccupied land will directly benefit the native Hawaiian population. Upon completion of the project, DHHL will be allowed to provide homestead leases and/or rental agreements to native Hawaiian beneficiaries who are currently on the waitlist. Ultimately the awarded beneficiaries will have a chance to establish a permanent homestead community allowing for preservation of the values, traditions, and culture of Native Hawaiians.

6.2 SIGNIFICANCE CRITERIA

Based upon the information discussed in previous sections, the proposed project is not expected to have a significant impact on the environment. To further the discussion the significance criteria found in Section 11-200.1-13, HAR, is outlined in relation to the proposed project below.

1. *Irrevocably commit a natural, cultural, or historic resource*

Discussion: It is anticipated that the proposed project will not irrevocably commit to the loss of natural, cultural or historic resources. According to the AECOS report entitled *A natural resources assessment of the former Voice of America Site* dated May 27, 2021, the Mā'ili Stream's concrete channel is not considered a wetland. However, prior to the start of construction it is anticipated that a wetland survey will be conducted along the west end of the project site. Pickleweed is locally abundant and water forms ephemeral pools after heavy rains. The mapped soil type of or near the area is a hydric soil, so further assessment of wetlands and federal jurisdiction should be made. Following the survey, coordination with appropriate agencies will be conducted.

The historic railroad bed located in the east and central portion of the site is expected to be preserved in place (burial), and utilities within the area will be installed in a manner that will attempt to minimize disturbance of the railroad bed. The remaining foundations of the Voice of America radio transmitting station site was previously considered significant for its association with the Office of War Information and the Voice of America radio network. However, the facility is no longer eligible because it has since been demolished.

2. *Curtail the range of beneficial uses of the environment*

Discussion: The proposed project extends urbanization of the surrounding area which will diminish the range of beneficial uses of the environment (e.g., agricultural use, open space, industrial/commercial development).

Although the project site is situated in the State Agricultural district and the City Agricultural-2 zone, the Land Study Bureau (LSB) classified the soil on the site as very poor, "E" and the Agricultural Lands of Importance to the State of Hawai'i (ALISH) classified the land as "Other" and not "Prime" or "Unique". Therefore, agricultural use of the site would not be beneficial.

With the growing DHHL waitlist and need for housing, the proposed project would provide a greater benefit to beneficiaries compared to open space or industrial/commercial development use. Although other possible uses of the property will be dismissed, construction of the project's residential units will mimic and complement neighboring residential developments while providing needed housing.

3. *Conflict with the State's environmental policies or long-term environmental goals established by law*

Discussion: The proposed project is consistent with the State's environmental policies, goals, and guidelines. Environmental issues including land, water, visual, air, flora and fauna, parks, and other natural resources have been discussed earlier in this assessment. Potential adverse impacts associated with short-term construction-related activities can be mitigated through standard construction mitigation practices, such as implementation of Best Management Practices (BMPs).

4. *Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State*

Discussion: The proposed development will benefit the economic and social welfare of the community by providing housing for native Hawaiian beneficiaries. Establishing a permanent homestead community will allow for cultural preservation and the cultivation of the values and traditions of Native Hawaiians.

5. *Have a substantial adverse effect on public health*

Discussion: The proposed project will be constructed in accordance with applicable City, State and Federal rules and regulations governing public health and safety. The anticipated primary health short- and long-term concerns are related to noise, air and water quality impacts that are discussed in other parts of this assessment.

6. *Involve adverse secondary impacts, such as population changes or effects on public facilities*

Discussion: It is anticipated that the proposed project will not involve adverse secondary impacts in the surrounding area. The slight increase in population in the Mā‘ili area will be due to the development of approximately 280 new residential units, which will alleviate the current housing crisis that has impacted the local community as housing costs continue to rise. Construction plan approvals involving utilities (sewer, water, drainage, electrical, etc.) will be coordinated accordingly with the appropriate utility companies and government agencies prior to the start of construction.

7. *Involve a substantial degradation of environmental quality*

Discussion: The project is surrounded by established residential neighborhoods similar to the proposed development. While emulating adjacent developments the proposed project will not involve the substantial degradation of the environment. The anticipated impacts to the environment are not substantial and have been discussed in previous sections of this assessment along with proposed mitigation measures such as the use of temporary BMPs during construction (construction ingress and egress, sediment rolls, dust screens, sediment traps, diversion swales, temporary grassing or hydromulching, watering open-graded surfaces to minimize dust emissions, etc.) and the implementation of post-construction BMPs (infiltration basin, biofiltration systems, landscaping, etc.).

8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions*

Discussion: The proposed project is not related to any additional actions or activity in the region that will have a cumulative adverse effect on the environment or involve a commitment for larger actions. The project is confined to the development of the 40-acre site, and there are no plans in the immediate future to expand beyond the specified footprint. Potential off-site impacts associated with infrastructure improvements have been discussed in previous sections of this assessment.

9. *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat*

Discussion: There were no federally designated Critical Habitat for any species nor plants of conservation interest observed at the site during the field investigation by the project biologist. However, a bufflegrass grassland was noted. This grassland is a typical habitat for the Short-eared Owl. The O‘ahu population of this owl is a state-listed endangered species. Thus, in

order to avoid disturbing nesting owls, a nesting survey should be conducted by a qualified biologist immediately prior to the start of construction.

10. *Have a substantial adverse effect on air or water quality or ambient noise levels*

Discussion: Temporary noise, air and water quality impacts due to construction will be generated in the short-term. Construction operations will comply with regulatory requirements, and mitigation measures will be implemented as necessary. This includes adherence to the Department of Health (DOH) Community Noise Control rules which outlines permissible noise levels during the day and night as well as allowable work days and hours discussed previously in Section 4.9.2. Temporary best management practices (BMPs) to mitigate erosion and pollution caused by discharge of storm water runoff associated with site grading operations will also be implemented.

Upon completion of the proposed project, long-term impacts to the noise levels at the project site are expected to mimic those typical of the neighboring residential areas. Also, the residential units are expected to have a minimal effect on the long-term ambient air quality. Long-term impacts to water quality are not anticipated due to the implementation of permanent post-construction BMPs in accordance with the City Rules Relating to Water Quality requirements to mitigate the potential for storm water pollution.

11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters*

Discussion: The proposed project site is not located in an environmentally sensitive area such as a flood plain, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. While the site is located in the Tsunami Evacuation Zone, as previously mentioned it is in close proximity to public locations situated within the Safe Zone.

A portion of the site is also located within the sea level rise exposure area – passive flooding. A significant portion of the site is currently located outside the notated area. Additionally, the proposed site will be raised to construct an infiltration basin and utility systems, thereby elevating finished grades above areas makai of the project.

12. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in County or State plans or studies*

Discussion: The proposed project is not anticipated to have a significant adverse impact on scenic view planes or scenic resources. The project will transform an overgrown vacant land

into a residential homestead community. The proposed multifamily buildings and single family homes are anticipated to be "low rise", which will mitigate visual obstructions at the site. The Wai'anae Sustainable Community Plan describes the importance of mauka to makai views but does not specify any view plane covering any portion of the project site. Therefore, it is not anticipated that scenic vistas or view plans will be significantly impacted by the proposed project.

13. *Require substantial energy consumption or emit substantial greenhouse gases*

Discussion: It is anticipated that there will be no long-term requirement for substantial energy consumption or emittance of substantial greenhouse gases. Initial project construction will require additional energy consumption and emittance of greenhouse gasses. Once construction is completed the residential development is expected to increase electrical demand in the area, although the loads are expected to be comparable to a similar residential development in size and density. Green design features (e.g., energy efficient fixtures and appliances, solar or photovoltaic panels, building orientation, etc.) could be implemented and integrated in the subsequent building design phase to reduce energy requirements.

6.3 DETERMINATION

Based on the cumulative impacts and mitigation efforts discussed in this assessment along with the significance criteria analyzed in this section, it is anticipated that the proposed project will not have a significant impact on the natural and human environment. Therefore, pursuant to Chapter 343, HRS, it is anticipated that DHHL will issue a Finding of No Significant Impact (FONSI).

7.0 CONSULTED PARTIES AND PARTICIPANTS IN THE EA PROCESS

Various agencies (or agency documents) were consulted in preparation of this EA.

7.1 EARLY CONSULTATION

An early consultation letter was sent to various agencies, organizations, and individuals listed in the following table. Those that submitted comments are highlighted. Comment and response letters have been reproduced and are provided (refer to Appendix F).

Table 7-1: Early Consultation Comment Letters

AGENCY	LETTER SENT	COMMENT RECEIVED
STATE OF HAWAIʻI		
Department of Agriculture	09/17/2021	No Comments
Department of Business, Economic Development, & Tourism Hawaiʻi State Land Commission	09/17/2021	No Comments
Department of Education	09/17/2021	09/30/2021
Department of Health Environmental Health Administration	09/17/2021	No Comments
Department of Health Office of Hazard Evaluation & Emergency Response	09/17/2021	No Comments
Department of Human Services	09/17/2021	10/14/2021
Department of Land & Natural Resources Historic Preservation Division	09/17/2021	No Comments
Department of Land & Natural Resources Land Division	09/17/2021	10/18/2021
Department of Transportation	09/17/2021	10/21/2021
Environmental Review Program	09/17/2021	No Comments
Office of Hawaiian Affairs	09/17/2021	No Comments
Office of Planning Hawaiʻi Coastal Zone Management Program	09/17/2021	10/17/2021
State Historic Preservation Division - Oʻahu Burial Council	09/17/2021	No Comments
CITY AND COUNTY OF HONOLULU		
Board of Water Supply	09/17/2021	10/06/2021
Department of Community Services	09/17/2021	09/30/2021
Department of Design & Construction	09/17/2021	10/01/2021

Table 7-1: Early Consultation Comment Letters (continued)

AGENCY	LETTER SENT	COMMENT RECEIVED
CITY AND COUNTY OF HONOLULU (continued)		
Department of Environmental Service	09/17/2021	No Comments
Department of Parks and Recreation	09/17/2021	11/24/2021
Department of Planning and Permitting	09/17/2021	10/29/2021
Department of Transportation Services	09/17/2021	No Comments
Honolulu Fire Department	09/17/2021	09/28/2021
Honolulu Police Department	09/17/2021	10/01/2021
FEDERAL		
Department of Housing and Urban Development	09/17/2021	No Comments
Department of Transportation Federal Aviation Administration	09/17/2021	No Comments
U.S. Army Corps of Engineers Pacific Ocean Division	09/17/2021	No Comments
U.S. Fish & Wildlife Service	09/17/2021	10/01/2021
U.S. Geological Survey Pacific Islands Water Science Center	09/17/2021	No Comments
U.S. Pacific Fleet	09/17/2021	No Comments
PRIVATE ORGANZATIONS & INDIVIDUALS		
Nanakuli Hawaiian Homestead Community Association	09/17/2021	No Comments
Nanakuli-Mā‘ili Neighborhood Board No. 36, Neighborhood Commission Office	09/17/2021	No Comments
Princess Kahanu Estates Hawaiian Homes Association	09/17/2021	No Comments
Princess Kahanu Estates Hawaiian Homes Association	09/17/2021	No Comments
Sea Country Community Association	09/17/2021	No Comments
Wai‘anae Kai Hawaiian Homestead Association	09/17/2021	No Comments
Wai‘anae Valley Homestead Association	09/17/2021	No Comments
Councilmember Andria Tupola, District 1, City & County of Honolulu Council	09/17/2021	No Comments

Table 7-1: Early Consultation Comment Letters (continued)

AGENCY	LETTER SENT	COMMENT RECEIVED
PRIVATE ORGANZATIONS & INDIVIDUALS (continued)		
Mayor Rick Blangiardi, City & County of Honolulu	09/17/2021	No Comments
Representative Cedric Asuega Gates, District 44, State of Hawai‘i Legislature	09/17/2021	No Comments
Representative Ed Case, U.S. House of Representatives	09/17/2021	No Comments
Representative Kaiali‘i Kahele, U.S. House of Representatives	09/17/2021	No Comments
Representative Stacelynn K.M. Eli, District 43, State of Hawai‘i Legislature	09/17/2021	No Comments
Senator Brian Schatz, U.S. Senate	09/17/2021	No Comments
Senator Maile Shimabukuro, District 21, State of Hawai‘i Legislature	09/17/2021	No Comments
Senator Mazie Hirono, U.S. Senate	09/17/2021	No Comments
UTILITIES		
AT&T	09/17/2021	
Hawaiian Electric Company, Environmental Department	09/17/2021	09/23/2021
Hawaiian Telcom, Environmental and Safety Office	09/17/2021	No Comments
Charter Communications	09/17/2021	10/14/2021
The Gas Company	09/17/2021	No Comments

8.0 REFERENCES

AECOS Inc., A natural resources assessment of the former Voice of America Site (TMK: 8-7-010:030 & 031) Lualualei, Leeward Oʻahu, May 27, 2021.

City and County of Honolulu, Board of Water Supply, *Water System Standards*, 2002.

City and County of Honolulu, Board of Water Supply, *Your Letter Dated September 16, 2021 Requesting Comments on the Environmental Assessment Pre-Consultation for a Residential Development at the Former Voice of America Site off Kulaaupuni Street – Tax Map Key: 8-7-010: 030 & 031,* October 6, 2021.

City and County of Honolulu, Department of Environmental Services, *Wastewater System Design Standards*, July 2017.

City and County of Honolulu, Department of Planning and Permitting, *General Plan*, 1992 & amended 2002.

City and County of Honolulu, Department of Planning and Permitting, *Land Use Ordinance*, October 22, 1986 & amended 2015.

City and County of Honolulu, Department of Planning and Permitting, *Rules Relating to Water Quality*, December 24, 2018.

City and County of Honolulu, Department of Planning and Permitting, *Sewer Connection Application*, September 14, 2021

City and County of Honolulu, Department of Planning and Permitting, *Storm Drainage Standards*, August 2017.

Dudek, *Report on UAV-Based Magnetic survey for the purpose of UXO and other ferrous material detection in the Maʻili site,* August 5, 2020.

Element Environmental, LLC, *Letter Report Geophysical Survey Anomaly Verification*, August 31, 2021.

Element Environmental, LLC, *Limited Phase II Environmental Site Assessment 80-Acre Former Voice of America Site*, July 2017.

Fehr & Peers, *Kamehameha Schools Community Learning Center in Māʻili, Hawaiʻi – Transportation Impact Analysis Report (TIAR)*, May 23, 2013.

Fehr & Peers, *Mobility Analysis Report (MAR) for the Voice of America Site in Māʻili,* October 29, 2021.

Foote et. al. (1972). *Soil Survey of the Islands of Kauai, Oʻahu, Maui, Molokai, and Lanai, State of Hawaiʻi.* August 1972.

International Archaeological Research Institute, Inc., *An Archaeological Inventory Survey of the Former Voice of America Site, Māʻili, Lualualei Ahupuaʻa, Waiʻanae District, Oʻahu*, August 2009.

International Archaeological Research Institute, Inc., *Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā‘ili, Lualualei Ahupua‘a, Wai‘anae Moku, Island of O‘ahu*, February 2021.

International Archaeological Research Institute, Inc., *Request for a Historic Preservation Review per Hawai‘i Revised Statutes 6E-8 for the Department of Hawaiian Homelands Voice of America Property*, January 12, 2017.

MASON Architects, *State Historic Preservation Division Reconnaissance Level Survey*, March 2021.

PBR Hawai‘i & Associates, Inc., *Kamehameha Schools Community Learning Center at Mā‘ili Final Environmental Assessment*, May 2013.

Scientific Consultant Services, Inc., *Kamehameha Schools Community Learning Center Archaeological Inventory Survey, 2013*

State of Hawai‘i, Department of Hawaiian Home Lands, *General Plan*, February 26, 2002.

State of Hawai‘i, Department of Hawaiian Home Lands, *Hawaiian Homes Commission Water Policy Plan*, July 22, 2014.

State of Hawai‘i, Department of Hawaiian Home Lands, *Wai‘anae-Lualualei Regional Plan*, December 2018.

State of Hawai‘i, Department of Health Clean Water Branch, *2020 State of Hawai‘i Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress Pursuant to Sections §303(d) and §305(b) Clean Water Act (P.L. 97-117),* July 30, 2020.

State of Hawai‘i, Department of Health, *State of Hawai‘i Annual Summary 2019 Air Quality Data*, July 2021.

State of Hawai‘i, Hawai‘i State Plan Council, Department of Planning and Economic Development, *Hawai‘i State Plan: Revised*, 1986

U.S. Geological Survey, Wai‘anae 7.5 Minute Quadrangle Map, 2017.

Web Sites Used in Preparation of this Report:

City and County of Honolulu: Board of Water Supply
http://www.hbws.org/cssweb/

City and County of Honolulu: Department of Environmental Services
Wastewater - http://www.honolulu.gov/envwwm.html

City and County of Honolulu: Department of Emergency Management
https://www.honolulu.gov/dem/default.html

City and County of Honolulu: Department of Planning and Permitting
Interactive GIS Maps and Data - http://gis.hicentral.com
Planning Division - http://www.honoluludpp.org/Planning.aspx
Transit Oriented Development - http://www.honolulu.gov/Tod

City and County of Honolulu: Department of Transportation Services
http://www.honolulu.gov/dts.html

City and County of Honolulu: Honolulu Rail Transit
http://www.honolulutransit.org/

City and County of Honolulu: Revised Ordinances of Honolulu
http://www1.honolulu.gov/council/ocs/roh/

City and County of Honolulu: TheBus
http://www.thebus.org/

State of Hawaiʻi: Department of Education
https://www.hawaiipublicschools.org

State of Hawaiʻi: Department of Hawaiian Home Lands
http://dhhl.hawaii.gov/

State of Hawaiʻi: Department of Health
Clean Air Branch - http://health.hawaii.gov/cab/
Clean Water Branch - http://health.hawaii.gov/cwb/
e-Permitting Portal - https://eha-cloud.doh.hawaii.gov/epermit/
Environmental Planning Office, Land Use Planning Review -
http://health.hawaii.gov/epo/home/landuse-planning-review-program/
Hazard Evaluation and Emergency Response Office
http://eha-web.doh.hawaii.gov/eha-cma/Org/HEER/
Safe Drinking Water Branch - http://health.hawaii.gov/sdwb/
Office of Environmental Quality Control - http://health.hawaii.gov/oeqc/

APPENDICES

Appendix A: A natural resources assessment of the former Voice of America Site, May 27, 2021

Appendix B: Mobility Analysis Report (MAR) for the Voice of America Site in Mā‘ili, October 29, 2021

Appendix C: Preliminary Geotechnical Engineering Exploration, June 15, 2020

Appendix D: State Historic Preservation Division Reconnaissance Level Survey, March 2021

Appendix E: Mā‘ili Residential Development (Former Voice of America Site) Preliminary Engineering Report, November 2021

Appendix F: Early Consultation Public Comments

Appendix G: Approved Sewer Connection Application

Appendix H: Draft Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, February 2021

Appendix I: Report on UAV-Based Magnetic Survey, August 2020

Appendix J: Geophysical Survey Anomaly Verification Letter Report, August 31, 2021

Appendix K: Beneficiary Consultation: Mā‘ili Homestead Community Residential Development Plans, Virtual Beneficiary Consultation Meeting, June 22, 2021

APPENDIX A

A natural resources assessment of the former
Voice of America Site, May 27, 2021

AECOS No. 1628

A natural resources assessment of the former Voice of America Site (TMK: 8-7-010: 030 & 031) Lualualei, leeward Oʻahu

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May 27, 2021

A natural resources assessment of the former Voice of America Site (TMK: 8-7-010: 030 & 031) Lualualei, leeward Oʻahu

May 27, 2021 *AECOS* No. 1628

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Introduction

AECOS Inc. was contracted by Gray Hong Nojima & Associates, Inc. to conduct a natural resources survey of the State of Hawaiʻi, Department of Hawaiian Home Lands (DHHL) former Voice of America Site in Lualualei, leeward Oʻahu and to assess whether the adjacent Māʻili Stream is considered jurisdictional under the Clean Water Act (CWA) and Rivers and Harbors Act (RHA), and/or a wetland protected under Executive Order 11990[1]. This 89.27-ac (36.13-ha) site (TMK: 8-7-010: 030 & 031) is accessed off Kulaʻaupuni Street in Māʻili. Proposed is development of approximately 300 single-family residential lots and multi-family units for native Hawaiian beneficiaries on 40 ac (16 ha) of the land, a majority of which is vacant. Scant evidence by way of concrete support bases and some old paved roadway remains of the Voice of America radio station. However, occupying leased portions (total area of 5.6 ac or 2.27 ha) of TMK: 8-7-010: 030 are the Ulu Ke Kukui transitional housing and Hoʻomalu O Nā Kamaliʻi, projects serviced by Holt Road off Kulaʻaupuni Street. These two developments are fenced off and not included in our survey. Some 40 ac (16 ha) of TMK: 8-7-010: 030 is designated for Kamehameha Schools Community Learning Center at Māʻili (CLC-M). The margins of this fully landscaped complex were included in the survey, as was Kulauku Street up to the CLC-M entrance. In addition, the survey included a brief look at the entrance roads (St. Johns Road and Kulaʻaupuni Street) and vicinity aquatic environments, specifically Māʻili Stream bordering the north property boundary of TMK: 8-7-010: 030, the

[1] This report is intended to become part of the public record and incorporated into an EA for the subject project.

estuary of Mā'ili Stream out to the ocean mouth, and the nearshore of the Pacific Ocean in the vicinity of the Mā'ili Stream discharge point.

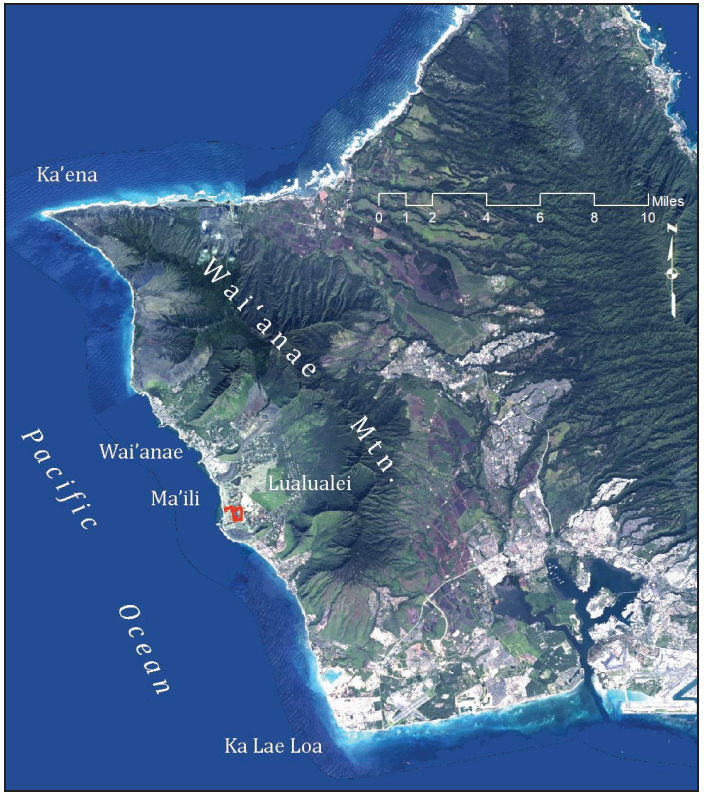

Figure 1. Project location (red) on leeward O'ahu.

Figure 2. Survey area (terrestrial) outlined in red.

Site Description

The site is mostly level ground at around the 6-ft (2-m) elevation and surrounded on the west, south, and east by housing of suburban Mā'ili. Mā'ili Stream borders the north side and vacant land to the north of this concrete-lined drainage canal extends to St. John Road. All of the area is an ancient raised reef platform. Although appearing mostly flat, the ground does slope gradually to the west where, at times, runoff pools along an unimproved track (extension of Kula'aupuni Street). In this area, surface runoff is stopped by the adjacent built-up area of houses along Mamoali'i Place and the water infiltrates into the ground.

Mā'ili Stream

Mā'ili (or Maipalaoa Stream) and its watershed is sometimes considered a sub-watershed of the larger Mā'ili'ili Stream (State Watershed Code No. 35004), which originates in the Waianae Mountains (Parham et. al., 2008). Mā'ili Stream is an excavated, fully concrete-lined, trapezoidal channel that drains the coastal plain of Mā'ili and discharges into the Pacific Ocean at Ulehawa Beach Park (Figure 3). The total length of Mā'ili Stream is short, reaching less than one mile (1.6 km) inland.

Mā'ili Stream channel receives runoff from residential neighborhoods in Mā'ili, a portion of Lualualei Naval Reservation, and agricultural lots *mauka* (inland) of the residential area; this contribution is rain-dependent and largely seasonal. From approximately 200 m (656 ft) upstream of Kula'aupuni Street (just *mauka* of Ulu Ke Kukui, adjacent to the Project site), downstream to the stream mouth, the excavated channel intersects the brackish groundwater and is an estuary: the water in this segment of the channel is brackish, tidally influenced, and relatively permanent (Figure 4).

The estuary *makai* of Farrington Highway bridge is lined with limestone boulder berms and has a limestone solution bench across the outlet in the intertidal zone. During high tide or during large swells, seawater enters the estuary over the solution bench, providing some flushing of the channel waters. In fact, deposits of seaweed are present in the channel, up to 1,145 m (0.7 mi) inland from Farrington Highway (Figure 5). During low tide the stream does have visible outflow to the ocean (*AECOS*, 2019).

The subject watershed is relatively dry throughout the year. The nearest rain gage to the Project site, Lualualei, records an average annual rainfall of 31.9 in (810 mm), with rainfall typically highest in January and lowest in June (Giambelluca et. al, 2013; Figure 6).

Figure 3. Estuary of Mā'ili Stream showing water quality stations.

Figure 4. Shallow water of the estuary of Ma'ili Stream adjacent to the Project site, which is above left bank (on the left in this photograph).

Figure 5. High tides deposited seaweed in Ma'ili Stream far inland, here adjacent to the Project site (left bank on right in this photograph).

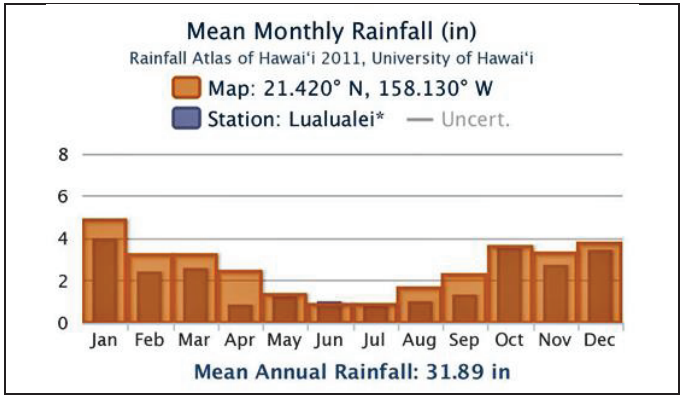

Figure 6. Mean monthly rainfall at Lualualei rain gage.

The entire Project area falls within the non-special flood hazard area, and consists of both zone "X" and "XS". Zone X are areas outside of the 0.2% annual chance flood. Zone XS are 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 (HDLNR, 2011).

USDA-NRCS mapped soils in the survey area are predominantly Mokuleia clay (Mtb) and Mamala cobbly silty clay loam, 0-12% slopes (MnC), with a small portion of Keaau stony clay, 2-6% slopes (KmaB) on the northwest of the Project site (USDA-NRCS, 2020a). KmaB is on the Hydric Soils List for O'ahu (USDA-NRCS, 2020b).

Jurisdictional Waters

Waters of the U.S. (also called "jurisdictional waters") are surface waters that come under federal jurisdiction as authorized by the CWA and the RHA. Authority over these waters is granted to various federal agencies, including the U.S. Environmental Protection Agency (USEPA), with the U.S. Army Corps of Engineers (USACE) having permit authority for actions that impact

jurisdictional waters. Jurisdictional waters include all tidal waters and a subset of streams (both perennial and intermittent), lakes, reservoirs, and wetlands.

On June 22, 2020, the Navigable Waters Protection Rule (NWPR) came into effect (USACE and USEPA, 2020), which redefined the scope of waters regulated under the CWA. As applicable to Mā'ili Stream channel and the Project site, the NWPR specifically identifies tidal waters and intermittent and perennial stream tributaries as jurisdictional waters but excludes ephemeral tributaries and wetlands without a direct hydrologic surface connection to an otherwise jurisdictional water body.

In the NWPR, a *tributary* is defined as an intermittent or perennial surface water channel (e.g., stream) that contributes surface flow to other waters of the U.S. (e.g., ocean) in a typical year. An *intermittent* stream is one that has surface water flowing continuously during certain times of the year and more than in direct response to precipitation and a *perennial* stream has surface water flowing continuously year-round. An *ephemeral* stream has surface water flowing or pooling only in direct response to precipitation. A tributary does not lose its jurisdictional status if it flows through a channelized non-jurisdictional surface water (such as a culvert) and a perennial or intermittent ditch is jurisdictional if it is a relocated tributary or is constructed in an adjacent wetland. The jurisdictional boundary of tidal waters is the mean high water (MHW, in RHA) and high tide line (HTL, in CWA), in non-tidal streams it is the ordinary high water mark (OHWM), and the jurisdictional boundary of adjacent wetlands is the wetland/upland boundary. *Wetlands* are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

If a wetland is present and adjacent to a jurisdictional water, CWA and RHA jurisdiction extends to the wetland/upland boundary. Adjacent wetlands means wetlands that (i) abut a jurisdictional waterbody, (ii) are inundated by flooding from a jurisdictional waterbody, (iii) are separated from a jurisdictional waterbody only by a natural berm, bank, dune, or similar natural feature; or (iv) are physically separated from a jurisdictional waterbody by an artificial dike, barrier, or similar artificial structure so long as that structure allows for a direct hydrologic connection in a typical year, such as via a culvert, flood or tide gate, pump, or similar artificial feature (USACE and USEPA, 2020).

Executive Order 11990 (The President, 1977) requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and

enhance the values of wetlands. Wetlands protected by this Executive Order are defined similarly as they are in the NWPR (see above).

Methods

Aquatic Environments Surveys

Surveys were undertaken to cover aquatic environments in the Project vicinity, specifically of the concrete-lined channel of lower Mā'ili Stream estuary and the ocean nearshore near the mouth of the estuary. Our survey of the subject property included looking for any areas that might need further consideration as wetlands based upon dominant plant species present or primary indicators of wetland hydrology.

Water Quality Survey

The team collected water samples and measured *in situ* water quality at five stations in the vicinity of the Project (see Figure 3): "Station 1" located at the upper end of the Mā'ili Stream estuary off the northwest corner of the Project property; "Station 2" in Mā'ili Stream estuary 2360 feet (720 m) from the mouth; "Station 3" at the mouth of the Mā'ili Stream channel; "Station 4" off the beach at Ulehawa Beach Park just north of the stream mouth; and "Station 5" off the shore some 720 ft (220 m) south of the stream mouth.

Samples were collected on September 30, 2020 from just below the water surface, chilled in a cooler with ice, and returned to *AECOS* laboratory for water quality analyses (*AECOS* Log No. 40912). Water quality measurements made in the field included: temperature, salinity, conductivity, pH, and dissolved oxygen (DO); analyses conducted in the laboratory included: turbidity, total suspended solids (TSS), ammonia (NH_3) nitrate+nitrite (NO_3+NO_2), total nitrogen (TN), total phosphorus (TP), and chlorophyll α. Analytical methods are listed in Table 1.

Estuarine Biological Survey

Bryson Luke and Susan Burr undertook a survey for aquatic animals in the Mā'ili Stream estuary on September 30, 2020. The survey consisted of making visual observations while wading in the estuary channel and walking along the banks. The biologists noted relative abundances (e.g., rare, common, abundant) of each species encountered as the survey progressed. Nomenclature and identifications follow *Hawai'i's Native and Exotic Freshwater Animals*

(Yamamoto and Tagawa, 2000), *Hawai'i's Sea Creatures* (Hoover, 1999), *Shore Fishes of Hawai'i* (Randall, 2010), and *Hawaiian Reef Plants* (Huisman et al, 2007).

Table 1. Analytical methods used for water samples collected on September 30, 2020 from Mā'ili Stream and nearshore waters.

Analysis	Method	Reference	Instrument
Temperature	SM 2550B	SM (2017)	YSI Pro Plus DO meter thermistor
Salinity	SM 2550B	SM (2017)	YSI Pro Plus
pH	SM 4500H+	SM (2017)	pH pHep HANNA meter
Dissolved Oxygen	SM 4500-O G	SM (2017)	YSI Pro Plus
Turbidity	EPA 180.1 rev. 2.0	USEPA (1993b)	Hach 2100Q Turbidimeter
Ammonium	EPA 349	USEPA (1997a)	Lachat Quickchem 8500
Nitrate + Nitrite	EPA 353.2	USEPA (1993a)	Lachat Quickchem 8500
Total Nitrogen	ASTM D5176-08	ASTM (2015)	Shimadzu TNM-1
Ortho-Phosphate	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Total Phosphorus	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Chlorophyll α	SM10200H(M)	SM (1998)	Turner Fluorometer

Marine Biological Survey

Susan Burr conducted a reconnaissance survey of marine resources on the solution bench and in the nearshore waters in the vicinity of the Mā'ili Stream mouth. The snorkel survey extended approximately 120 m (400 ft) offshore, beginning at 09:55, 34 minutes after a predicted 0.33 ft low tide relative to mean lower low water (MLLW: Waianae ID 1612482: NOAA-NOS, 2020). Depths surveyed ranged from 1 to 3 m (3 to 10 ft); underwater visibility was poor—on the order of 2 m (6 ft). Marine algae, fishes, and macroinvertebrates were identified in the field and verified with various texts: *Hawai'i's Sea Creatures* (Hoover, 1999), *Shore Fishes of Hawai'i* (Randall, 2010), and *Hawaiian Reef Plants* (Huisman et al, 2007).

Preliminary Jurisdictional Waters Determination

In the field, we confirmed that Mā'ili Stream has a surface connection to the Pacific Ocean, and, therefore, considering flow regime, may considered to be a tidal waterbody or a jurisdictional tributary. We reviewed literature, maps, and GIS datasets prior to our field study; sources included: U.S. Fish and Wildlife Service, National Wetlands Inventory (NWI; USFWS, 2020); U.S. Dept. of Agriculture, Natural Resource Conservation Service (USDA-NRCS) web soil survey (USDA-NRCS; 2020a); U.S. Geological Survey (USGS) StreamStats (USGS, 2017); National Oceanic and Atmospheric Administration (NOAA) Climate Data Online (NOAA-NCEI, 2020); and State of Hawaii Dept. of Land and Natural Resources (HDLNR) Flood Hazard Assessment Tool (FHAT; HDLNR, 2011).

No open water bodies or streams of any kind are present within the Project site. However, we did assess the site for any areas with wetland hydrology indictors (i.e., areas with surface water, surface saturation) or dominated by wetland vegetation (plant hydrophytes) indicating presence of wetlands where further delineation might be required.

Terrestrial Botanical Survey

The natural resources survey of flora in the Project area was undertaken by Eric Guinther on September 30, 2020. The wandering pedestrian transect was recorded on a Trimble 6000 Series GNSS unit (Trimble GeoXH), providing guidance in real time on location and adequacy of coverage and position locations of any plants encountered of particular interest or concern.

Plant species were identified as they were encountered. Plant species names follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2019).

Terrestrial Vertebrates Survey

Avian Survey

Reginald David conducted the terrestrial vertebrates survey on September 30, 2020. Seven avian count-stations were sited roughly equidistant from each other within the Project site. A single eight-minute avian point count was made at each of the count stations. The avian counts were conducted in the early morning hours with the aid of Leica 8 X 42 binoculars and by listening for

vocalizations. Additionally, two 30-minute time-dependent waterbird counts were completed, one from the bridge on Kulaʻaupuni Street over Māʻili Stream and the other from the Farrington Highway bridge over the estuary. Time not spent counting birds at point-count stations was used to search the Project area for species and habitats not detected during the point-counts. Weather conditions were ideal, with unlimited visibility, no precipitation, and winds between 1 and 15 kph.

The avian phylogenetic order and nomenclature used in this report follow the AOU *Check-List of North and Middle American Birds* 2019, and the Sixtieth Supplement to the American Ornithological Society's *Check-List of North American Birds* (Chesser et al., 2019, 2020).

Mammalian Survey

The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial mammalian species detected within the survey area. Mammal scientific names follow Wilson and Reeder (2005).

Results

Water Quality

Water quality results are presented in Table 2. Considering that the stations cover the estuarine portion of Maʻili Stream from near the upper end to the mouth and include two nearby shore stations, the wide range in values for every measured parameter is as expected. Salinity shows the very different waters present: 11 psu (about 1/3 the salinity of ocean water) at the upper end of the estuary and 26 psu midway towards the mouth. At the ocean away from the estuary mouth, salinity was a typical oceanic value of 36 psu. Temperature varied from 26.8 °C to a somewhat surprising 29.7°C at one of the ocean shore stations (Sta, 5).

pH increased as expected from a low of 6.98 at Sta. 1 to typical oceanic values of 8.3 at Stations 4 and 5. DO saturation values were high at all stations (range: 87 to 104%), except at Station 2. Turbidity and TSS values were high: in the range of 0.64-1.40 ntu and 4.1-6.9 mg/l at stations 2 through 5, but excessive at Station 1 (60.4 ntu and 139 mg/L). The high Chl. α value at Sta. 1 establishes that a phytoplankton bloom was occurring in the stagnant water at the upper end of the estuary. Much of the turbidity at this station is a result of this

Table 2. Water quality measurements for Maʻili Stream estuary and nearshore waters at mouth for September 30, 2020.

Station	Temp. (°C)	Salinity (PSU)	pH	DO (mg/L)	DO Sat. (%)	Turbidity† (NTU)
Sta. 1	26.8	11.0	6.98	7.17	97	60.4
Sta. 2	28.3	25.9	7.24	3.53	52	1.34
Sta. 3	28.6	31.1	7.70	5.67	87	1.40
Sta. 4	28.4	35.9	8.28	6.64	104	0.64
Sta. 5	29.7	35.8	8.28	6.07	97	1.20
Station	**TSS (mg/L)**	**NH_4 (µgN/L)**	**NO_3+NO_2 (µgN/L)**	**Total N (µgN/L)**	**Total P (µgP/L)**	**Chl. α (µg/L)**
Sta. 1	139	17	8840	10,400	17	26.6
Sta. 2	4.1	93	3010	4080	32	1.44
Sta. 3	4.6	52	1290	1870	<3	0.73
Sta. 4	4.4	86	21	288	6	1.71
Sta. 5	6.9	22	<1	76	10	0.77

productivity and photosynthesis there was contributing to both the high DO and low ammonium values. Chlorophyll α was typical at all other stations.

All nitrogen moieties (NH_4, NO_3+NO_2, TN) were high in the estuary and at the mouth, being much lower at the two ocean shore stations. Most of the nitrogen measured in the TN values at the estuary stations is inorganic (NH_4 and NO_3+NO_2). TP values were on the low side at all but Sta. 2.

Preliminary Jurisdictional Waters Determination

Māʻili Stream is identified (as Maipalaoa Stream) on the USFWS National Wetlands Inventory (NWI) (USFWS, 2020). Despite the name, the NWI identifies both surface waters and wetlands. The lower segment of Māʻili Stream is characterized in the NWI as an excavated, subtidal estuarine channel with an unconsolidated bottom (E1UBLx)—an excavated estuary. The upper segment is characterized as an excavated, seasonally flooded, intermittent stream (R4SBCx)—an excavated intermittent stream. Our field observations on September 30, 2020 generally support these characterizations and also confirm the concrete-lined channel is not a wetland. The channel has neither wetland

vegetation nor hydric soil (see Figs. 4 and 5), so it does not meet two of the three required criteria. We did not prepare wetland data determination sheets for this concrete-lined channel.

Water quality parameters (described above) measured in the channel near and downstream of Ulu Ke Kukui confirm the water is tidally-influenced, and, as described below, marine and estuarine fishes inhabit the channel. Inland of this point, the channel was dry and flow in the channel is either ephemeral or intermittent. Because the channel is a single, connected basin, for jurisdictional purposes, it should be considered as a single waterbody. Thus, under the NWPR, the line of federal jurisdiction in Māʻili Stream channel can be drawn on the channel walls, at a minimum of the MHW[2]. The assertion that jurisdictional limits are at the top-of-bank of the channel wall is a conservative assumption, but appropriate for this Project. All potential jurisdictional limits are contained within the channel: HTL, MHW, MHHW, and OHWM.

No other streams were found to be present within the Project vicinity. No land adjacent to Māʻili Stream displayed wetland hydrology or was found to have vegetation dominated by wetland plants. Our survey revealed only one area on the Project site that might require further assessment of federal jurisdiction where water forms ephemeral pools after heavy rains along the west margin of the site and pickleweed (*Batis maritima*) is locally abundant.

Vegetation

Vegetation across the site varies from open grassland (dominated by buffelgrass, *Cenchrus ciliaris*) to shrubland, dominated by Indian fleabane (*Pluchea indica*) and *koa haole* (*Leucaena leucocephala*; Figures 8a and 8b). Trees (*kiawe* or *Prosopis pallida*) are scattered around the area, but form more or less open forested areas along the western and southeastern sides of the property.

Flora

Table A1 (see Attachment A) is a listing of flowering plants (angiosperms) observed during the survey with 72 taxa identified from the survey area. The vast majority (86%) are naturalized or ornamental, non-native species. Ten indigenous natives are present: *naupaka kahakai* (*Scaevola taccada*), *kou* (*Cordia subcordata*), *kīpūkai* (*Heliotropum curassavicum*), *koaliʻawa* (*Ipomoea*

[2] Tidal datum from the nearest NOAA tidal gage (1612366, Fort Kamehameha, Bishop Point, Pearl Hbr, HI) indicates Mean Higher Water (MHW) is +0.19 m (+0.62 ft) above the Mean Sea Level (MSL), and Mean Higher High Water (MHHW) is+0.33 m (+1.08 ft) above MSL (NOAA, 2021).

Figure 8a (upper). A majority of the site is grassland/shrubland. Figure 8b (lower). In many areas, shrubland predominates with scattered *kiawe* trees.

indica), *pāʻūohiʻiaka* (*Jacquemontia ovalifolia*), *koʻoloa keokeo* (*Abutilon incanum*), *ʻilima* (*Sida fallax*), *ʻuhaloa* (*Waltheria indica*), a small sedge (*Cyperus polystachyos*), and *pili* grass (*Heteropogon contortus*). *Koʻoloa keokeo, ʻuhaloa, ʻilima*, and *pili* are common across the site. The others are mostly uncommon or rare here, and the percent of natives (14%) is typical for a lowland location on Oʻahu. A single Polynesian introduction (*kukui* or *Aleurites moluccana*) and 10 ornamentals were recorded. The ornamentals were found mostly along the borders of adjacent developed projects and house lots. Many of the natives are plantings made at CLC-M.

Aquatic Biota

Māʻili Stream estuary extends inland confined to a concrete channel (Figs. 4 and 5. above), the upper extent of the estuary near the northwest corner of the Project area. Farther upstream, flow in Māʻili Stream is ephemeral, but the size of the concrete channel suggests a large volume of water is anticipated during infrequent freshets. Table A2 (Attachment A) lists aquatic species observed by *AECOS* on September 30, 2020, as well as reported in Māʻili Stream near the Project area from previous biological surveys (*AECOS*, 2010; 2019). Relative abundances in the table are provided only for species observed during the September 2020 survey.

Clumps of marine algae (*Acanthophora spicifera* and *Gracilaria salicornia*) are the most conspicuous feature in the channel near the Project site. Schools of finger-sized striped mullet or *pua ʻama* (*Mugil cephalus*) inhabit this very upper end of the estuary. Blackchin tilapia (*Sarotheron melanotheron*) and liberty/Mexican molly (*Poecilia* sp. hybrid complex [*salvatoris/mexicana* group) are also conspicuous and the nearly transparent, glass shrimp or *ʻōpae huna* (*Palaemon debilis*) can be seen along the edge of the water in the channel.

Although the water is brackish downstream of Kulaʻaupuni Street bridge, the inhabitants of the estuary are decidedly more marine in character here than upstream of the bridge. Blackchin tilapia remain dominant, but large adult striped mullet or *ʻamaʻama* are common in the channel and conspicuous marine fishes, such as racoon butterflyfish (*Chaetodon lunulatus*), *puhi kāpā* or snowflake moray (*Echidna nebulosa*), *toʻau* (*Lutjanus fulvus*), and *ʻoama* (*Mulloidichthys flavolineatus*) are present.

Marine Biota[3]

The littoral limestone bench at Ulehawa Beach Park hosts Hawaiian mussel (*Brachidontes crebristriatus*). The splash pools on the limestone bench host a few juvenile fishes (*āholehole* or *Kuhlia xenura*, *Plectroglyphidodon impairipennis*, and *Bathygobius* spp.) and invertebrates, including: *pipipi* (*Nerita picea*), false limpet (*Siphonaria normalis*), helmet urchin (*Colobocentrotus atratus*), and periwinkle (*Littorina pintado*). A diverse assemblage of algae and invertebrates occur in tidal pools on the bench: *Padina* spp., *Laurencia* spp., *Sargassum echinocarpum*, *Microdictyon setchellianum*, and *Neomeris* sp. are the most commonly observed species. Less commonly seen algae include: *Tricleocarpa fragilis*, *Turbinaria ornata*, *S. obtusifolium*, *S. polyphyllum*, *Spatoglossum macrodontum*, *Cladophora* sp., *Dictyosphaeria cavernosa* and *D. verslyuii*. Urchins (*Echinometra mathaei*, *E. oblonga,* and *Heterocentrotus mammillatus*) and snakehead cowry (*Cypraea caputserpentis*) are found in crevices on the bench. Other invertebrates observed include variable worm snail (*Serpulorbis variabilis*), *ʻaʻama* (*Grapsus tenuicrustatus*), hermit crab (Family Diogenidae), ashy sea cucumber (*Holothuria cinerascens*), and teated sea cucumber (*H. whitmaei*).

A submerged (sublittoral) limestone shelf lies offshore of the estuary mouth. Urchins are ubiquitous on this shelf, their scouring activity visible in the surface. Blue soft coral (*Sarcothelia edmondsoni*) is common on the limestone, whereas hermatypic corals are sparse. Off the seaward face of the shelf (at approximately the 12-ft or 4-m depth), the bottom is low-relief limestone, with low-growing and turf-forming algae and some corals (*Porites lobata*, *Porites* spp., and *Pocillopora meandrina*). Several large outcrops with large (80-cm or 30-in) *Porites* spp. colonies occur (Figure 9). Some colonies of *Pocillopora meandrina* were bleached in 2020, but fewer than were noticed in the 2019 survey (*AECOS*, 2019).

Common fishes observed off the stream mouth are surgeonfishes, damselfish, goatfishes, triggerfish, butterflyfishes, wrasses, and Moorish idol. A few green sea turtle or *honu* (*Chelonia mydas*) were seen in both 2019 and in the current survey. Relative abundances of marine organisms encountered during the survey are listed in Table A3 (Attachment A).

[3] The marine community observed in the September 2020 marine survey is nearly identical to the community observed in July 2019 (*AECOS*, 2019), with respect to diversity and abundances; therefore, the description below is nearly identical to that in our 2019 report.

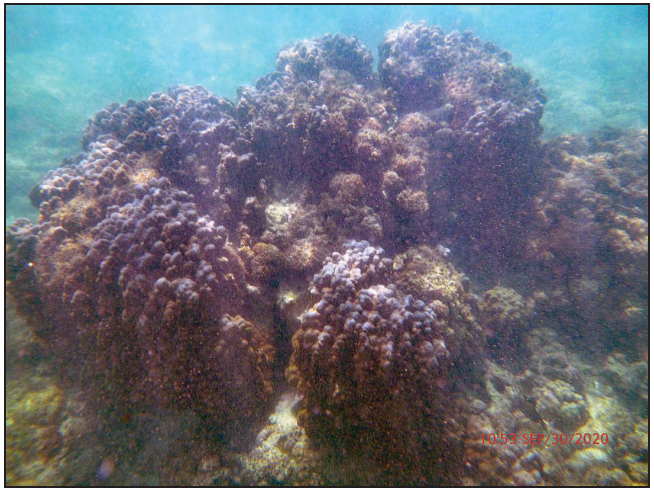

Figure 9. Large outcrop with coral colonies offshore of the mouth of Mā'ili Stream.

Avian Fauna

A total of 310 individual birds of 18 species and representing 13 separate families, was recorded during station counts (Table A4; see Attachment A). Three species recorded: Pacific Golden-Plover (*Pluvialis fulva*), Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*), and Short-eared Owl (*Asio flammeus sandwichensis*) are native species. The plover is an indigenous, migratory shorebird species, the Black-crowned Night-Heron is a resident indigenous, water obligate species and the Short-eared Owl, or *pueo* as it known locally, is an endangered endemic subspecies of the near cosmopolitan Short-eared Owl (DLNR, 1998; USFWS, 2015, n.d.). The remaining 15 species recorded during the course of this survey are alien to the Hawaiian Islands.

Avian diversity and densities are in keeping with the lowland grass and shrub environments present within the site. Four species—Rock Pigeon (*Columba livia*), Red-vented Bulbul (*Pycnonotus cafer*), Zebra Dove (*Geopelia* striata) and

Common Myna (*Acridotheres tristis*)—accounted for 52% of all birds recorded during station counts. The most frequently recorded species was Rock Pigeon, which accounted for 17% of the total number of individual birds recorded during station point-counts.

No waterbirds were recorded at either of the 30-minute time dependent waterbird count at the Mā'ili estuary locations.

Mammals

Three terrestrial mammalian species were detected on site during the course of this survey. We saw a number of small Indian mongooses (*Herpestes javanicus auropunctatus*) within the site and along roadways. Cat (*Felis catus*) tracks and scat were seen at numerous locations within the site. Numerous dogs (*Canis lupus familiaris*) were heard barking from locations outside of the survey area. Tracks and scat of dogs, cats and mongooses were encountered on the various trails and unimproved roads we walked.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, nd). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to listed species to the maximum extent practicable.

Water Quality

Estuarine waters are typically highly variable in water quality, representing a place of mixing of stream and seawater. In this case, the lack of flow in Ma'ili Stream at the time of the survey suggests somewhat stagnant conditions would be present. Salinity well below that of seawater at the upper end indicates perhaps a recent injection of fresh water or groundwater seepage into the system. The comparative low temperature at Sta. 1 (26.8 °C), some 3C° below that of the nearby nearshore ocean waters is suggestive of groundwater influence. However, the nearshore temperature of 29.7 °C at Station 5 is high; average seawater temperature off O'ahu in September is 27.2 °C (September and October are the warmest months of seawater of O'ahu; NOAA-NCEI, 2020).

As noted, the high chlorophyll α value at the upper end of the estuary is an indication of a phytoplankton bloom in that location, probably being fed by

nutrients in groundwater seepage. Values measured elsewhere in the estuary and the ocean are more typical for natural waters. Dense phytoplankton in active photosynthesis (eutrophication) will raise the DO, raise the pH, and represent a significant contribution to turbidity. Uptake of ammonium is occurring as indicated by the low value at Station 1. The fact that pH is not particularly high at Station 1 (at 6.98) is somewhat unusual although DO saturation is at 97% (and DO highest of any of the stations at 7.17 mg/L), and not supersaturation (above 100%).

An indication of poor water quality in this sampling event is the high nitrogen concentrations at all three stations within the estuary (though much diluted at the mouth). Outflow from the system is impacting on Station 4 as indicated by all the nitrogen moieties comparing Stations 4 and 5.

Preliminary Jurisdictional Waters Determination

The results of the jurisdictional waters survey of Mā'ili Stream are intended for planning and environmental permitting purposes. The jurisdictional limits of Mā'ili Stream may be conservatively drawn at the top-of-bank of the Mā'ili Stream channel. The channel does not contain a wetland and, therefore, is not subject to Executive Order 11990. Acceptance of our preliminary delineation by the USACE may require a field visit to make a jurisdictional determination and confirm the boundary. Our delineation is not official until accepted in writing by the USACE.

The area along the west margin of the site (described above on page 14) might require further assessment of federal jurisdiction. Water forms ephemeral pools after heavy rains here, pickleweed is locally abundant, and the mapped soil type of or near the area is a hydric soil.

- Prior to construction, a wetland survey should be conducted to determine if this area is within the Project area, and, if so, delineate the boundaries and obtain a jurisdictional determination from the USACE. Jurisdictional determinations are valid for a period of five years, so the survey should be timed accordingly.

Floral Resources

No plants of conservation interest or statutory concern (HDLNR, 1998; USFWS, nd-a) were encountered during our survey of the Project area.

Estuarine Biota

Flow in Mā'ili Stream upstream of the estuary is likely ephemeral, resulting in a depauperate freshwater fauna. While not observed during this survey, native gobies that reside in estuaries—for example, *'o'opu 'akupa* (*Eleotris sandwicensis*) and *'o'opu naniha* (*Stengobius hawiiensis*)—have been observed near the mouth Mā'ili Stream (*AECOS*, 2010). Native gobies are amphidromous: eggs are laid in the stream and the larvae that hatch from these eggs move down stream and out into the ocean where they develop for a time before migrating back into fresh water to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). These fishes may occur in the concrete channel adjacent to the Project area, but the habitat is not ideal for them and no habitat is available for them farther upstream. In addition to the poor physical environment, predatory blackchin tilapia make survival here difficult for these animals.

Discharge of storm water from the DHHL development will not have adverse impacts on estuarine biota, assuming the system is built in compliance with the Storm Water Management Program (SWMP) developed to comply with requirements in National Pollutant Discharge Elimination System (NPDES) permit for the O'ahu municipal separate storm sewer system (MS4).

Marine Biota

Invertebrates

Coral species are protected by Hawai'i State regulations that prohibit damage to "any stony coral by any intentional or negligent activity causing the introduction of sediment, biological contaminants, or pollution into state waters" (HDLNR, 2014). On September 20, 2018, NOAA issued a proposed rule for listing the cauliflower coral (*Pocillopora meandrina*) as an endangered or threated species under ESA (NOAA-NMFS, 2018). A global status review has been initiated by NOAA to determine whether listing it throughout its range is warranted.

Hawai'i Department of Land and Natural Resources (HDLNR) regulates shellfishes such as pearl oysters (HDLNR, 1987) and *'opihi* (HDLNR, 1989). One *'opihi* species (*C. exarata*) was observed in our survey. Fishing regulations are in place for certain fishes (HDLNR, 2014); however, because fishing activity is not expected to be influenced or impacted by the Project, these catch-regulated species are not discussed further.

Sea turtles

The distinct population segment (DPS) of green sea turtle that occurs in Hawai'i is federally-listed as a threatened species (USFWS and NOAA-NMFS, 2016; USFWS, 2018) and as a threatened subspecies (*Chelonia mydas agassizi*) under State of Hawai'i regulations (HDLNR, 2014).

Threats to the green sea turtle in Hawai'i include: disease and parasites, accidental fishing take, boat collisions, entanglement in marine debris, loss of foraging habitat to development, and ingestion of marine debris. Throughout the global range of green sea turtle, nesting and foraging habitats are being altered and destroyed by coastal development, beach armoring, beachfront lighting, vehicular/pedestrian traffic, invasive species, and pollution from discharges and runoff (NOAA & USFWS, 2007a, 2007b). Adult green sea turtles forage in shallow nearshore areas and coral reefs. Contamination from effluent discharges and runoff has degraded these environments, and invasive species may reduce native algae species preferred by green sea turtles or could exacerbate susceptibility to, or development of disease (NOAA-NMFS and USFWS, 2007a). Fibropapillomatosis, a disease characterized by the presence of internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators continues to be a major threat to green sea turtles. Extremely high incidence has been reported in Hawai'i, where affliction rates peaked at 47-69% in some foraging areas (Murakawa et al., 2000).

Hawksbill sea turtle is distributed across the Pacific, Indian, and Atlantic oceans. Hawksbill sea turtle is much less common in the Hawaiian Islands than green sea turtle and is known to nest only in the southern reaches of the state (NOAA-PIFSC, 2010). Hawksbill sea turtle is federally-listed as endangered (USFWS, nd) and is listed as an endangered subspecies (*Eretmochelys imbricata bissa*) under Hawai'i state regulations (HDLNR, 2014). Hawksbill sea turtle faces many of the same threats affecting green sea turtle (see above section; NOAA-NMFS, 2007b).

Monk Seal — The endangered Hawaiian monk seal (*Monachus schauinslandi*) is known to occur in the Project vicinity. The Hawaiian monk seal was listed as an endangered species pursuant to the ESA on November 23, 1976 (41 FR 51612) and remains listed as endangered. In that same year, the Hawaiian monk seal population was designated as "depleted" under the Marine Mammal Protection Act (MMPA). The majority of Hawaiian monk seal sighting information collected in the main Hawaiian Islands is reported by the general public and, therefore, highly biased by location and reporting effort. The only truly systematic monk seal count data available for the main Hawaiian Islands are

from aerial surveys conducted by the Pacific Islands Fisheries Science Center (PIFSC) in 2000, 2001, and 2008 (Baker and Johanos, 2004; PIFSC unpublished data). No seals were sighted in Mā'ili during these three complete surveys of O'ahu.

Reports by the general public, which are non-systematic and not representative of overall seal use of main Hawaiian Island shorelines, have been collected in the main Hawaiian Islands since the early 1980s. For the purposes of this report, a sighting is defined as a calendar day during which an individual seal is documented as present at a specific location. There have been 2732 reported sightings of monk seals in Mā'ili (between Mā'ili Point and Maili'ili Stream mouth) from 2009 to 2018 (Table 3). Sightings were divided into six areas based on reported location and include Mā'ili Beach Park, Mā'ili Point, Mā'ili Stream, Mā'ili'ili Stream, Maipaloa Beach, and Nani Kai Beach Park. The vast majority (81%) of the sightings were reported at Mā'ili Point. Of the total sightings, 2629 reports can be attributed to 36 uniquely identifiable seals (Table 4). No monk seal births have been documented in Mā'ili.

Table 3. Number of reported Hawaiian monk seal sightings in Mā'ili, between Mā'ili Point and Mā'ili'ili i Stream, on the island of Oahu (2009 to 2018).

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	**Total**
Mā'ili Beach Park	5	6	9	22	11	40	12	13	100	9	**227**
Mā'ili Point	23	43	125	216	165	143	209	296	484	514	**2218**
Mā'ili Stream	0	0	0	0	0	1	53	0	0	0	**54**
Mā'ili'ili i Stream	0	0	0	0	0	0	7	0	0	0	**7**
Maipaloa Beach	0	0	1	0	7	9	18	0	0	0	**35**
Nani Kai Beach Park	0	3	0	8	4	7	13	6	137	13	**191**
Total	**28**	**52**	**135**	**246**	**187**	**200**	**312**	**315**	**721**	**536**	**2732**

Table 4. Number of sightings of uniquely identified Hawaiian monk seals reported in Mā'ili, between Mā'ili Point and Mā'ili'ili i Stream, on the island of Oahu (2009 to 2018).

Seal ID	Sex	Sightings
R010	Female	5
R012	Male	21
R018	Male	26
R020	Female	42
R2AU	Male	3
R303	Female	9
R3CU	Male	7
R4DF	Female	4
R6FI	Male	105
R912	Female	111
RA20	Female	1
R6FI	Male	105
R912	Female	111
RA20	Female	1
RB00	Female	1
RB24	Female	47
RE74	Male	158
RG32	Male	2
RH32	Male	122
RH36	Female	12
RH48	Female	101
RH92	Female	8
RI37	Female	8
RK36	Male	77
RK72	Male	414
RL12	Female	1
RL42	Female	3
RN14	Male	178
RO28	Female	181
RN36	Female	13
RR70	Male	308
RS00	Female	2
RT12	Male	73

Table 4 (continued).

Seal ID	Sex	Sightings
RW02	Male	137
RW08	Male	198
RW22	Male	231
RV08	Male	5
T21M	Male	2
T34M	Male	13
Total		**2629**

Invertebrates

Yellow-faced bee are listed as endangered in the Hawaiian Islands (USFWS, 2016), and six of seven species of yellow-faced bee are known to occur on O'ahu island (*Hylaeus anthracinus*, *H. assimulans*, *H. facilis*, *H. kuakea, H. longiceps,* and *H. mana*) in montane and coastal habitat. Coastal habitat for yellow-faced bee is restricted to a narrow zone, 30 to 65 ft (10-20 m) wide along the coastline (USFWS-PIFWO, nd). No yellow-faced bee species was observed during our survey and the Project area is beyond 65 ft (20 m) from the ocean shore. However, the Project site could be considered adjacent to yellow-faced bee habitat, and woody *kiawe* debris favored by some yellow-faced bee species is especially abundant in some areas. Food resources for this insect are most likely to be present in the plantings of native flowers at CLC-M.

Blackburn's sphinx moth (*Manduca blackburnii*), an insect federally listed as endangered in Hawai'i (USFWS, 2000), is not presently known to occur on O'ahu. The caterpillar of this moth feeds exclusively on plants in the Family Solanaceae (USFWS 2003; HDLNR, 2005), particularly tree tobacco. No plants in this family were noted in our survey.

Avian Resources

The findings of the avian survey are consistent with the location of the property and habitats present there. As previously mentioned, three of the species detected are native species. Pacific Golden-Plover is an indigenous migratory shorebird species which nest in the high Arctic during the late spring and summer months, returning to Hawai'i and the tropical Pacific to spend the fall and winter months each year. They usually leave Hawai'i and return to the Arctic in late April or the very early part of May. Pacific Golden-Plover are

commonly countered shorebirds throughout the Hawaiian Islands during late summer through mid-spring months. Black-crowned Night-Heron is a resident indigenous, water obligate species commonly found close to just about any water feature in the Hawaiian Islands.

Short-eared owl

The Hawaiian sub-species of the Short-eared Owl is an endangered endemic subspecies of the near cosmopolitan Short-eared Owl. The Oʻahu population of this species listed as an endangered species under State of Hawaiʻi, endangered species statutes (DLNR, 1998). The species is not listed under federal endangered species statutes.

The species is known to nest within the Lualualei Naval Magazine. A buffelgrass grassland present on a good portion of the DHHL site (Figure 3) is typical of the habitat that this species nests in on the Island of Oʻahu. This owl is a ground nesting species. This species is not habitat restricted on Oʻahu, though there certainly is less suitable nesting habitat than there once was, this species faces daunting odds on an Island as heavily populated as Oʻahu – they are a ground nesting diurnal species, the sheer number and densities of mammalian predator on the Island make it very difficult for this species to successful nest except within protected areas that have a strong mammalian predator control program in place.

- To avoid disturbance of any nesting Short-eared Owls, it is recommended that a nesting survey be conducted by a qualified biologist immediately prior to clearing and grubbing activities.

Waterbirds

As previously mentioned, we did not record any waterbirds within the concrete-lined channel of Māʻili Stream. The habitat is not particularly conducive for waterbirds, being shallow and brackish. It is possible that Black-necked Stilt (*Himantopus mexicanus knudseni*) use resources in the canal or on the beach on a temporary basis. The Hawaiian endemic subspecies of the Black-necked Stilt is listed as an endangered species under both federal and state endangered species statutes (DLNR, 2015; USFWS, nd-a)

Seabirds

It is possible that Hawaiian Petrel (*Puffinus sandwichesis*), Band-rumped Storm-Petrel (*Hydrobates castro*), and Newell's Shearwater (*Puffinus newelli*) over-fly the Project area between April and the middle of December each year in very

small numbers. Newell's Shearwaters are not known to breed on Oʻahu, though recent acoustical surveys have recorded low numbers of this species calling over the higher reaches of the Island (Young, et al., 2019). These authors also recorded one Hawaiian Petrel over the Island. No suitable nesting habitat exists within or close to the Project area for any of these three seabird species.

The primary cause of mortality in Hawaiian Petrels and Newell's Shearwaters in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with man-made structures and, if not killed outright, become easy targets of opportunity for feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003).

The principal potential impact that the proposed project poses to protected seabirds is the threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main types of outdoor lighting are: 1) construction lighting for nighttime construction activities, and 2) street and/or security lighting at the completed Project. In either case, all associated lights should be shielded, and where large flood/work lights are used, these should be placed on poles that are high enough to allow the lights to be pointed directly at the ground (Reed et al., 1985; Teller et al., 1987). Deleterious impacts to transiting seabirds can be avoided if construction occurs during daylight hours and all outdoor lighting installed is fully "dark sky compliant" (HDLNR-DOFAW, 2016).

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the habitats currently present on the site. Although no rodents were recorded on either survey it is likely that some, of the established alien *muridae* found on Oʻahu—roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*)—use various resources found within *the general project area on a seasonal basis. All of these introduced rodents are deleterious to native fauna.

Hawaiian hoary bats

Hawaiian hoary bats may overfly the Project area on a seasonal basis. The principal impact that the Project may pose to bats is during the clearing and grubbing phases as vegetation is removed. The removal of vegetation within the Project site may temporarily displace individual bats using the vegetation for roosting. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of a roost tree is likely to be minimal. However, during the pupping season, females carrying their pups and very small pups may be unable to rapidly vacate a roost site as it is felled.

- Potential adverse impacts from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 ms (15 ft) between June 1 and September 15, the period in which bats may have pups.

Protected and Listed Species

No species protected by State of Hawaiʻi Administrative Rules (DLNR, 1998, 2015), nor federally endangered or threatened species (USFWS, nd-a), were observed in Māʻili Stream or vicinity. One federally protected species was observed in our survey: green sea turtle. Other state- and/or federally-listed marine species—hawksbill sea turtle and monk seal—may occur in the general vicinity of the Project considering the distribution of these species and occurrences throughout the Islands (HDLNR, 2015; USFWS, nd-a).

Critical Habitat

No federally designated Critical Habitat for any species occurs within the Project site (USFWS, nd-b). No equivalent designation exists under State of Hawaiʻi endangered species statutes.

Critical habitat for Hawaiian monk seals has been designated (NOAA-NMFS, 2015) and includes the seafloor and marine habitat to 10 m above the seafloor from the 200 m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points. These terrestrial boundary points define preferred pupping areas and significant haul-out areas (NOAA-NMFS, 2015). The ocean shoreline off Māʻili falls within assigned boundary points OA21 and OA22—Maiʻli Beach through Kalaeloa Barbers Point Harbor—and therefore is designated monk seal terrestrial critical habitat. The waters offshore of the Project area are designated monk seal marine critical habitat.

Essential Fish Habitat in the Project Vicinity

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The Magnuson-Stevens Act (MSA) provisions at 50 CFR 600.10 provide further definition for the purpose of interpreting EFH as follows:

> *"Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle*

The Project vicinity is located within the boundaries of the Hawaiʻi Archipelago Fishery Ecosystem Plan (FEP; WPRFMC, 2009a). This place-based FEP uses an ecosystem-based approach with "geographically defined ecosystem plans containing identical fishery regulations." The FEP identifies and categorizes Management Unit Species (MUS) based on the managed fisheries and incorporates all of the management provisions of the former Fishery Management Plans, with updates. MUS known to be present in waters around the Hawaiʻi Archipelago include Bottomfish and Seamount Groundfish MUS (BMUS), Crustaceans MUS (CMUS), Precious Corals MUS (PCMUS), and Coral Reef Ecosystems MUS (CREMUS). Pelagic MUS (PMUS) are managed separately through the Pacific Pelagic FEP. According to the Hawaiʻi Archipelago and Pacific Pelagic FEPs, the following MUS and life history stages are identified as likely present at, near, or dependent on the Project area:

- BMUS: all life stages for shallow complex, eggs and post-hatch pelagic for intermediate and deep complexes.
- CMUS: all life stages.
- CREMUS: all life stages
- PMUS: all life stages.

Waters and substrate in the Project vicinity are designated as EFH for managed fishery species listed in Table 5.

The Project is located close to the estuarine reach of Māʻili Stream. Nearby waters off the coast are designated as EFH (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic, and crustacean MUS. According to the EFH designations in the Hawaiʻi FEP, the area is absent of EFH for precious corals, deep-water shrimp, and seamount ground fish. No juveniles or adults for either BMUS or CMUS were recorded from our surveys in

the area.

The Hawai'i and Pelagic FEPs further identify ecologically valuable subsections of EFH for the above MUS as "habitat areas of particular concern" (HAPC). These HAPCs are based on the importance of the ecological functions provided, the sensitivity to human or development-induced environmental degradation or stress, and rarity. There are no HAPCs near the Project vicinity that might be affected by the Project.

Table 5. EFH designated in Project vicinity.

MUS	Species Complex	Designated EFH
CREMUS[+]	All currently and potentially harvested coral reef taxa	Water column and all benthic substrate to a depth of 50 fathoms (fm) from the shoreline to the Exclusive Economic Zone (EEZ).
BMUS (all stages)[++]	Bottomfish Shallow Complex	Eggs and post-hatch pelagic: Water column from the surface to 240-m depth from the shoreline to the EEZ. Post-settlement and Subadult/adult: Water column from the surface to 240-m depth from the shoreline to the EEZ.
	Bottomfish Intermediate and Deep complexes	Eggs and post-hatch pelagic: Water column from the surface to 400-m depth from the shoreline to the EEZ.
CMUS[+]	Spiny/Slipper Lobster and Kona Crab complexes (all stages)	Eggs and larvae: water column from the surface to 150-m depth, from the shoreline to the EEZ. Juveniles and adults: bottom habitat from the shoreline to 100-m depth.
PMUS[+++]	Temperate/Tropical Species, Sharks and Squid complexes	Eggs and larvae: water column from the surface to 200-m depth, from the shoreline to the EEZ. Juveniles and adults: water column from the surface to 1,000-m depth, from the shoreline to the EEZ.

[+]Western Pacific Regional Fishery Management Council, 2009a.
[++] Western Pacific Regional Fishery Management Council, 2016.
[+++] Western Pacific Regional Fishery Management Council, 2009b.

In February 2019, NMFS published a final rule to reclassify certain management

unit species in the Pacific Islands as ecosystem component species (ECS; NOAA-NMFS, 2019, 84 FR 2767). An ECS means a stock that a Council or the Secretary has determined does not require conservation and management but is identified in an FEP to achieve ecosystem management objectives. The intent is to focus management efforts on species that are in need of conservation and management and improve efficiency of fishery management in the region. The rule reduces the number of MUS from 173 species or families to 20 in the Hawai'i FEP. The rule also removes the definitions of "Currently Harvested Coral Reef Taxa (CHCRT)" and "Potentially Harvested Coral Reef Taxa (PHCRT)" and revises the definitions of "Ecosystem Component Species" and "Special Permit" throughout. In the current regulations, coral reef MUS are divided into two categories: CHCRT and PHCRT. CHCRT are those species that are harvested commercially in the EEZ, and PHCRT are those species that may be potentially harvested in the future. This final rule reclassifies all coral reef MUS as ECS, so the designations CHCRT and PHCRT are unnecessary (NOAA-NMFS, 2019).

The extent of impacts associated with the proposed Project with the potential to affect EFH is limited to the transport of sediment and/or pollutants in runoff that reaches Mā'ili estuary. Mā'ili Stream often exhibits high levels of turbidity under existing conditions and likely transports sediment loads in the drainage. Project BMPs are intended to reduce the extent to which sediment disturbed as a result of construction would be transferred to coastal waters, and with effective implementation they will contribute to minimal adverse impacts to EFH.

References Cited

AECOS, Inc. 2010. Biological reconnaissance and water quality survey of Mā'ili Stream for a bridge replacement project on the leeward coast of O'ahu. Prep. For SSFM. *AECOS* Report No. 1201: 21 pp.

_____. 2019. Biological and water quality surveys, Mā'ili Stream Flood Control Improvement Project, Mā'ili, O'ahu, Hawai'i. *AECOS* Report No. 1585B: 44 pp.

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, in: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna. Studies in Avian Biology No. 22*. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. Pp. 108-123.

ASTM. 2015. Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence Detection. ASTM D5176-08(2015).

Baker, J. D., and T. C. Johanos. 2004. Abundance of the Hawaiian monk seal in the main Hawaiian Islands. Biological Conservation 116:103-110.

Balazs, G. H., H. F. Hirth, P. Kawamoto, E. Nitta, L. Ogren, R. Wass and J. Wetherall. 1992. Recovery plan for Hawaiian sea turtles. *Nat Marine Fish. Ser., S. F. S. C.*, Honolulu, Adm. Rep. H-92-01: 76 pp.

Bonaccorso, F. J., C. M. Todd, A. C. Miles, and P. M. Gorresen. 2015. Foraging range movements of the endangered Hawaiian hoary bat, *Lasiurus cinereus semotus*. *J. of Mammology*, 96:64-71.

Brock, R. E. 1988a. Green sea turtle population monitoring during blasting work at West Beach, Oahu. Final Report. Prep. for Alfred A. Yee Division, Leo A. Daly. 15 pp.

_____. 1988b. Green turtles (*Chelonia mydas*) at Hawai'i Kai, Hawai'i: An analysis of the impacts with the development of a ferry system. Prep. for Sea Engineering, Inc. 26 pp.

Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, N. A. Mason, P. C. Rassmusen, J. V. Remsen Jr., D. F. Stotz, and K. Winker. 2020. Sixty-first Supplement to the Check-list of North American Birds. American Ornithological Society. Available online at URL: http://checklist.aou.org/taxa; last retrieved July 31, 2020.

Chaloupka, M. and C. Limpus. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. *Biological Conservation*, 102: 14 pp.

_____, T. M. Work, G. H., Balazs, S. K. K. Murakawa, and R. Morris. 2008. Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982–2003). *Mar Biol*., 154: 11 pp.

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. *Colonial Waterbirds*, 21 (1): 11-19.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. *The Auk,* 120: 669-679.

Ford, J. I. and R. A. Kinzie III. 1982. Life crawls upstream. *Nat. Hist*., 91: 61-67.

Giambelluca, T. W., Q. Chen, A. G. Frazier, J. P. Price, Y. –L. Chen, P. –S. Chu, J. K. Eischeid, and D. M. Delparte. 2013: online Rainfall Atlas of Hawai'i. *Bull. Amer. Meteor. Soc.* 94: 313-316. doi. 10.1175/BAMS-D-11-00228.1. Available online at URL: http://rainfall.geography.hawaii.edu/interactivemap.html; last retrieved December 7, 2020.

Hadley, T. H. 1961. Shearwater calamity on Kauai. *Elepaio*, 21: 60.

Hawaii Cooperative Park Service Unit (HCPSU). 1990. Hawaii stream assessment. A preliminary appraisal of Hawaii's stream resources. Prep. for State of Hawaii, Commission on Water Resource Management. National Park Service, Hawaii Cooperative Park Service Unit, Rept. No. R84: 294 pp.

Hawaii Department of Land and Natural Resources (HDLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

_____. 2005. Terrestrial Invertebrates. Blackburn's Sphinx Moth, *Manduca blackburni*. Hawaii's Comprehensive Wildlife Conservation Strategy, October 1, 2005. Available online at URL: https://dlnr.hawaii.gov/wildlife/files/2013/09/Fact-Sheet-Blackburns-Sphinx-Moth.pdf; last retrieved March 5, 2020.

_____. 2009. Hawai'i Administrative Rules. Title 13. Department of Land and Natural Resources. Chapter 4. Protected Marine Fisheries. 15 pp.

_____. 2011. Flood Hazard Assessment Tool. Available online at: http://gis.hawaiinfip.org/ FHAT/; last retrieved January 11, 2021.

Hawaii Department of Land and Natural Resources (HDLNR). 2014. Hawaiʻi Administrative Rules, Title 13, Department of Land and Natural Resources, Chapter 95, Protected Marine Fisheries Resources, Rules Regulating the Taking and Selling of Certain Marine Resources. 14 pp.

_____. 2015. Hawaiʻi Administrative Rules, Title 13, Department of Land and Natural Resources, Subtitle 5 Forestry and Wildlife, Part 2 Wildlife, Chapter 124, Indigenous Wildlife, Endangered and Threatened Wildlife, Injurious Wildlife, Introduced Wild Birds, and Introduced Wildlife. February 27, 2015. 16 pp.

Hawaiʻi Department of Land and Natural Resources-Division of Forestry and Wildlife (HDLNR-DOFAW). 2016. Wildlife Lighting. PDF available at URL: http://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf; last retrieved February 21, 2020.

Hoover, J. P. 1999. *Hawaiʻi's Sea Creatures: A Guide to Hawaiʻi's Marine Invertebrates.* Revised Edition. Mutual Publishing. 366 pp.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawaiʻi. Pp. 234-242, *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas.

Huisman J. M., I. A. Abbott, and C. M. Smith. 2007. *Hawaiian Reef Plants*. University of Hawaii Sea Grant College Program Publication. Report No. UNIHI-SEAGRANT-BA-03-02. 234 pp.

Imada, C. T. 2019. Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). *Bishop Museum Tech. Rept. 69*. 209 pp.

Johanos, T. C. 2019a. Hawaiian Monk Seal Research Program Hawaiian monk seal survey data collected in the main Hawaiian Islands, 2008-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/5676; last retrieved May 25, 2021.

Johanos, T. C. 2019b. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (annual) collected in the Hawaiian Archipelago, 1962-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/12939; last retrieved May 25, 2021.

_____. 2019c. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (seal) collected in the Hawaiian Archipelago, 1962-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/5677; last retrieved May 25, 2021.

Kinzie, R. A. III. 1988. Habitat utilization by Hawaiian stream fishes with reference to community structure in oceanic stream islands. *Environ. Biol. of Fishes*, 22: 179-192.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). 1996. MSFCMA as amended through October 11, 1996. 16 U.S.C. §1801-1883. Available online at URL: https://www.fisheries.noaa.gov/resource/document/magnuson-stevens-fishery-conservation-and-management-act; last retrieved May 25, 2021.

Murakawa, S. K. K., G. H. Balazs, D. M. Ellis, S. Hau & S. M. Eames. 2000. Trends in Fibropapillomatosis among Green Turtles Stranded in the Hawaiian Islands, 1982–98. Pp. 239-241 *in*: Kalb, H. & T. Wibbels (Compilers). Proceedings of the *(PDF) Presence of fibropapillomatosis in green turtles Chelonia mydas at Príncipe Island in the Gulf of Guinea*. Available online at: https://www.researchgate.net/publication/235746310_Presence_of_fibropapillomatosis_in_green_turtles_Chelonia_mydas_at_Principe_Island_in_the_Gulf_of_Guinea; last retrieved May 25, 2021.

National Oceanic and Atmospheric Administration – National Weather Service Forecast Office, Honolulu, HI (NOAA-NWS). 2020. Hydrology in Hawaii. Available online at URL: https://www.weather.gov/hfo/hydro_summary; last retrieved January 11, 2021.

National Oceanic and Atmospheric Administration–National Centers for Environmental Information (NOAA-NCEI). 2020. Climate Data Online. Available online at URL: https://www.ncdc.noaa.gov/cdo-web/; last retrieved on November 19, 2020.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2014. Department of Commerce. Endangered and Threatened Wildlife and Plants: Final Listing Determination on Proposal to List 66 Reef-building Coral Species and to Reclassify Elkhorn and Staghorn Corals. Available online at URL: https://www.fisheries.noaa.gov/protected-resource-regulations; last retrieved May 25, 2021.

_____. 2015a. Endangered and Threatened Species: Final Rulemaking To Revise Critical Habitat for Hawaiian Monk Seals. *Federal Register*, *80* (162; August 21, 2015): 50925-50988.

_____. 2015b. Endangered and Threatened Species: Final Rulemaking To Revise Critical Habitat for Hawaiian Monk Seals. *Federal Register*, 80 (162; August 21, 2015): 50925-50988.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2016. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Revision of Species-Wide Listing; Final Rule. *Federal. Register*, 81(174; September 8, 2016): 62260-62320.

_____. 2018. Endangered and Threatened Wildlife; Positive 90-Day Finding on a Petition to List the Cauliflower Coral, *Pocillopora meandrina*. Proposed Rule. *Federal Register*, 83 (September 8, 2018): 47592-47598.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 1998. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD. 97 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/15970; last retrieved May 25, 2021.

_____. 2019. Department of Commerce. Final Rule, Pacific Island Fisheries; Reclassifying Management Unit Species to Ecosystem Component Species. *Federal Register*, 84 (February 8, 2019): 2767-2775.

National Oceanic and Atmospheric Administration–National Ocean Service (NOAA-NOS). 2020. Tide Predictions at Sta. 1612482 Waianae, HI.

Subordinate Station. Reference Sta. Honolulu 1612340. Available online at URL: https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=1612482&units=standard&bdate=20200930&edate=20200930&timezone=LST&clock=12hour&datum=MLLW&interval=hilo&action=dailychart; last retrieved October 5, 2020.

_____. 2021. Datums for 1612366, Fort Kamehameha, Bishop Point, Pearl Hbr HI. Available online at URL: https://tidesandcurrents.noaa.gov/datums.html?datum=MSL&units=0&epoch=0&id=1612366&name=FORT+KAMEHAMEHA%2C+BISHOP+POINT%2C+PEARL+HBR&state=HI; last retrieved on January 27, 2021.

National Oceanic and Atmospheric Administration–National Centers for Environmental Information (NOAA-NCEI). 2020. Water Temperature Table of All Coastal Regions. Available online at https://www.ncei.noaa.gov/access/data/coastal-water-temperature-guide/all_meanT.html; last retrieved on December 16, 2020.

National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service (NOAA & USFWS). 2007a. Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. 105 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/17044; last retrieved May 25, 2021.

_____. 2007b. Hawksbill Sea Turtle (*Eretmochelys imbricata*). 5-Year Review. 93 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/17041; last retrieved May 25, 2021.

Pacific Islands Fishery Science Center (PIFSC). Internal report IR 19-008. Issued August 15, 2019.

Parham, J. E., G. R. Higashi, E. K. Lapp, D. G. K. Kuamoʻo, R. T. Nishimoto, S. Hau, J. M. Fitzsimmons, D. A. Polhemus and W. S. Devick. 2008. Atlas of Hawaiian Watersheds and their Aquatic Resources. Island of Oʻahu. Bishop Museum and Division of Aquatic Resources. 614 pp.

Podolsky, R., D. G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kauaʻi. *Colonial Waterbirds*, 21: 20-34.

Randall, J.E. 2010. *Shore Fishes of Hawai'i*. Revised edition. University of Honolulu Press. 234 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. *The Auk*, 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In:* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell's Shearwater. Pp. 76-78 *in*: Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Standard Methods (SM). 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. 1998. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1220 pp.

_____. 2017. Standard Methods for the Examination of Water and Wastewater, 23rd Edition. American Public Health Association, American Water Works Association, Water Environment Federation.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places.* Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. *'Elepaio,* 39: 71.

_____, J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. *Wildlife Soc. Bull*., 15: 406-413.

The President. 1977. Protection of Wetlands. Executive Order 11990. *Federal Register*, 42 (101; May 25, 1977): 26961.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency (USACE and USEPA). 2020. Department of Defense, Department of the Army, Corps of Engineers, 33 CFR Part 328, Environmental Protection Agency, 40 CFR Parts 110, 112, 116, 117, 122, 230, 232, 300, 302, and 401, The Navigable Waters Protection Rule: Definition of "Waters of the United States". *Federal Register*, 85 (77; Tuesday, April 21, 2020): 22250-22342.

U.S. Department of Agriculture–Natural Resources Conservation Service (USDA-NRCS). 2020a. Web Soil Survey, Soil Map—Island Of O'ahu Area, Hawai'i. Available online at URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx; last retrieved January 25, 2021.

_____. 2020b. National Hydric Soils List by State. Available online at URL: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/?cid=nrcs142p2_053957; last retrieved January 25, 2021.

U.S. Environmental Protection Agency (USEPA). 1993a. Methods for the determination of inorganic substances in environmental samples. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH. EPA/600/R-93/100.

_____. 1993b. Method 353.2, Revision 2.0: determination of nitrate-nitrite nitrogen by automated colorimetry. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

U.S. Environmental Protection Agency (USEPA). 1997a. Method 349.0. Determination of ammonia in estuarine and coastal waters by gas segmented continuous flow colorimetric analysis; version 1.0. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

_____. 1997b. Methods for determination of chemical substances in marine and estuarine matrices – 2nd edition. USEPA, Washington, DC. EPA /600/R-97/072.

_____. 2019. National Hydrography Dataset Plus. Available online at URL: https://www.epa.gov/waterdata/get-nhdplus-national-hydrography-dataset-plus-data; last retrieved on November 19, 2020.

U.S. Fish & Wildlife Service (USFWS). 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

U.S. Fish & Wildlife Service (USFWS). 2016. 50 CFR 17. Final Rule: Endangered and Threatened Wildlife and Plants; Endangered Status for 49 Species from the Hawaiian Islands. *Federal Register*, 81 (190; Friday, September 30, 2016): 67786-67860.

_____. 2000. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Blackburn's Sphinx Moth from the Hawaiian Islands, *Federal Register*, 65: (21; February 1, 2000): 4770-4779.

_____. 2003. Draft recovery plan for the Blackburn's Sphinx Moth (*Manduca blackburni*). USFWS, Portland, Oregon. September 2005.

_____. undated (nd-a). USFWS Endangered Species. Available online at URL: https://www.fws.gov/endangered/; Last retrieved September 4, 2019. Also: Environmental Conservation Online System (ECOS), at URL: https://ecos.fws.gov/ecp/species-reports; last retrieved September 4, 2019.

_____. undated website (nd-b). Critical Habitat Portal. Available online at URL: https://ecos.fws.gov/ecp/report/table/critical-habitat.html; last retrieved May 20, 2020.

_____. 2020. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Data layers are from 2005. Available online at URL: https://www.fws.gov/wetlands/Data/Mapper.html; last retrieved January 27, 2021.

U.S. Fish & Wildlife Service-Pacific Islands Fish and Wildlife Office (USFWS-PIFWO). No date (nd). Avoidance and Minimization Measures. Available online at URL: https://www.fws.gov/pacificislands/articles.cfm? id=149489720; last retrieved July 31, 2020.

U.S. Geological Survey (USGS). 2017. StreamStats. Available online at URL: http://streamstatus.usgs.gov; last retrieved December 11, 2020.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. *Manual of the Flowering Plants of Hawai'i: Volume I and II*. Bishop Museum Special Publication 83. University of Hawai'i Press. 1853 pp.

_____ and _____. 1999. *Supplement to the Manual of the flowering plants of Hawai'i*, pp. 1855-1918. *In:* Wagner, W. L., D. R. Herbst, and S. H. Sohmer, Manual of the flowering plants of Hawai'i. Revised edition. 2 vols. University of Hawaii Press and B.P. Bishop Museum.

Western Pacific Regional Fishery Management Council (WPRFMC). 2001. Final Coral Reef Ecosystem Fishery Management Plan. Available online at URL: https://www.wpcouncil.org/former-fishery-management-plans/coral-reef-ecosystem-fishery-management-plan/; last retrieved May 25, 2021.

_____. 2009a. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu, HI: N.P., 2009. Available online at URL: https://www.wpcouncil.org/fishery-ecosystem-plans-amendments/hawaii-fishery-ecosystem-plan/; last retrieved May 25, 2021.

_____. 2009b. Fishery Ecosystem Plan for the Pacific Pelagic Fisheries of the Pacific Region. Available online at URL: https://www.wpcouncil.org/fishery-ecosystem-plans-amendments/pelagics-fishery-ecosystem-%20plan/; last retrieved May 25, 2021.

_____. 2016. Amendment 4 to the Fishery Ecosystem Plan for the Hawaii Archipelago. Revised Descriptions and Identification of Essential Fish Habitat and Habitat Areas of Particular Concern for Bottomfish and Seamount Groundfish of the Hawaiian Archipelago. Available online at URL: https://www.wpcouncil.org/wp-content/uploads/2013/03/2016-01-28-FINAL-Hawaii-FEP-Amd-4-Bottomfish-EFH-RIN-0648-XD907-All-Pages-with-Appendices.pdf; last retrieved May 25, 2021.

Wilson, D. E. and D. M. Reeder (eds.). 2005. Wilson & Reeder's Mammal Species of the World (Third Edition). Available online at URL: http://www.departments.bucknell.edu/biology/resources/msw3/browse.asp; last retrieved December 9, 2019.

Wurth. T. 2019. NOAA-Pacific Island Fisheries Science Center-Protected Species Division. Hawaiian Monk Seal Research Program. Personal communication. Email dated July 29, 2019.

Yamamoto, M. N. and A. W. Tagawa. 2000. *Hawai'i's Native and Exotic Freshwater Animals*. Mutual Publishing, Honolulu. 200 pp.

Young, L. C., E. A. VanderWerf, M. McKown, P. Roberts, J. Schueter, and A. Vorsino. 2019. Evidence of Newell's Shearwaters and Hawaiian Petrels on Oahu, Hawaii. *The Condor, Ornithological Applications 2019,* 121: 1-7.

Attachment A

Species Lists

Table A1. Plant species listing for DHHL Lualualei VOA site.

Species listed by family	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
? *Barleria repens*		Nat	R	<2>
Ruellia prostrata Poir.	prostrate wild petunia	Nat	R	<2>
AIZOACEAE				
Trianthema tetragonioides (Pall.) Kuntze	---	Nat	O	<1>
AMARANTHACEAE				
Alternanthera pungens Kunth	khaki weed	Nat	U	<1>
Amaranthus spinosus L.	spiny amaranth	Nat	R	<1>
Amaranthus viridus L.	slender amaranth	Nat	R	<1,2>
ANACARDIACEAE				
Mangifera indica L.	mango	Nat	R	<2>
Schinus terebinthefolius Raddi	Christmas berry	Nat	C	
ASTERACEAE (COMPOSITAE)				
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat	U	
Pluchia indica (L.) Less.	Indian fleabane	Nat	A	
Pluchea x *fosbergii*	---	Nat	O	
Spagneticola trilobata (L.) Pruski	wedelia	Nat	U	<2>
Tridax procumbens L.	coat buttons	Nat	U	<2>
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	U	
BATACEAE				
Batis maritima L.	pickleweed	Nat	CL	<3>
BIGNONIACEAE				
Tecoma cf. *castaneifolia* (D. Don) Melch.	---	Orn	U	<4>
BORAGINACEAE				
Cordia subcordata Lam.	*kou*	**Ind**	R	<2>
Heliotropium curassavicum L.	*kīpūkai*	**Ind**	U	<1,3>

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
CACTACEAE				
Hylocereus undatus (Haw.) Britrton & Rose	night-blooming cereus	Orn	U	<2>
CARICACEAE				
Carica papaya L.	papaya	Nat	R	<2>
CHENOPODIACEAE				
Atriplex suberecta Verd.	---	Nat	U	
Salsola tragus L.	Russian thistle	Nat	O	
CONVOLVULACEAE				
Ipomoea indica (J. Burm.) Merr.	*koali'awa*	**Ind**	OL	
Ipomoea obscura (L.) Ker-Gawl	---	Nat	O	<1>
Ipomoea triloba L.	little bell	Nat	U	<2>
Jacquemontia ovalifolia (Choisy) H. Hallier	*pā'ūohi'iaka*	**Ind**	U	
Merremia aegyptica (L.) Urb.	hairy merremia	Nat	R	
CUCURBITACEAE				
Momordica charantia L.	wild bitter melon	Nat	U	<2>
CRASSULACEAE				
Bryophyllum daigremontianum (Raymond-Hamer & H. Perrier) A. Berger	---	Orn	R	<4>
EUPHORBIACEAE				
Aleurites moluccana (L.) Willd.	*kukui*	**Pol**	R	<2>
Euphorbia heterophylla L.	*kaliko*	Nat		
Euphorbia hypericifolia L.	graceful spurge	Nat		
Euphorbia hirta L.	garden spurge	Nat	R	<2>
Albizia saman (Jacq.) F. Muell.	monkeypod (juv.)	Nat	R	<2>
Cassia sp.	shower tree	Orn	R	<2>
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	O	
Indigofera hendicaphyla Jacq.	creeping indigo	Nat	O	<2>
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	AA	
Macroptilium atropurpureum (DC.) Urb.	---	Nat	R	
Prosopis juliflora (Sw.) DC.	long-spine *kiawe*	Nat	R	<2,3>
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat	C	
Vachellia farnesiana (L.) Willd.	*klu*	Nat	C	

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
GOODENACEAE				
Scaevola taccada (Gaertn.) Roxb.	*naupaka kahakai*	**Ind**	R	<2>
LAMIACEAE				
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat	R	
Ocimum cf. *gratissimum* L.	---	Nat	R	<4>
MALVACEAE				
Abutilon grandifolium (Wild.) Sweet	hairy abutilon	Nat	R	<2>
Abutilon incanum (Link) Sweet	*ko'oloa keokeo*	**Ind**	CL	
Gossypium cf. *barbadense* L.	sea island cotton	Nat	R	
Hibiscus rosa-sinensis L.	Chinese hibiscus cult.	Orn	R	<2>
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	R	
Sida ciliaris L.	---	Nat	A	<1>
Sida fallax Walp.	*'ilima*	**Ind**	OL	
Sida spinosa L.	prickly sida	Nat	U	<1>
Waltheria indica L.	*'uhaloa*	**Ind**	C	
MELIACEAE				
Azadirachta indica Adr. Juss.	neem	Nat	R	<2>
MORINGACEAE				
Moringa oleifera Lam.	horseradish tree	Nat	R	<1>
NYCTAGINACEAE				
Boerhavia coccinea Mill.	false *alena*	Nat	O	<1>
Bougainvillea cf. *spectabilis* Wild.	bougainvillea	Orn	R	<2>
PORTULACEAE				
Portulaca oleracea L.	pigweed	Nat	R	<1>
RUTACEAE				
Murraya paniculata (L.) W. Jack	mock orange	Nat	U	<2>
	FLOWERING PLANTS			
	MONOCOTYLEDONES			
ALOEACEAE				
Aloë vera (L.) N.L. Burman	aloe vera	Orn	R	
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki,* ti	Nat	U	<2>
Furcraea foetida (L.) Haw.	Mauritius hemp	Nat	R	
ARECACEAE				
Cocos nucifera L.	coconut palm	Nat	R	<2>

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
ARECACEAE (cont.)				
Dypsis lutescens (H. Wendl.) Beentje & J. Dransfield	areca palm	Orn	U	<2>
Wodyetia bifurcata A. K. Irvine	foxtail palm	Orn	U	<2>
CYPERACEAE				
Cyperus polystachyos Rottb.	---	**Ind**	U	<2>
POACEAE				
Cenchrus ciliaris L.	buffelgrass	Nat	AA	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	A	
Chloris virgata Sw.	feather fingergass	Nat		
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	AA	
Eleusine indica (L.) Gaertn.	wiregrass	Nat		
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	*pili*	**Ind**	CL	<2>
Megathyrsus maximus (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat	AA	
Melinus repens (Willd.) Zizka	Natal redtop	Nat		
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	U	<1>
Sporobolus pyramidatus (Lam.) Hitch.	---	Nat	C	<1><3>

Legend to Table A1

STATUS = distributional status for the Hawaiian Islands:

- **Ind** = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.
- Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
- Orn = A cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawai'i.
- **Pol** = An early Polynesian introduction. Introduced before 1778.

ABUNDANCE = occurrence ratings for plant species:

- -- - Species not present in area.
- R – Rare — seen in only one or perhaps two locations.
- U - Uncommon — seen at most in several locations
- O - Occasional — seen with some regularity
- C - Common — observed numerous times during the survey
- A - Abundant — found in large numbers; may be locally dominant.
- AA - Very abundant — abundant and dominant; defining vegetation type.

NOTES:
- <1> – Mostly limited to disturbed areas (roads).
- <2> - Plantings on adjacent projects areas (Ulu ke Kukui; Kam schools Learning center
- <3> – Indicative or found in areas of ephemeral wetlands.
- <4> - Plant lacking key diagnostic characteristics (flower, fruit) or in poor condition; identification, therefore, uncertain.

Table A2 List of aquatic species observed in Mā'ili Stream estuary. Abundance codes are only provided for species observed in the vicinity of the Project site during the September 2020 survey.

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
	ALGAE			
CYANOPHYTA	GREEN ALGAE			
OSCILLATORIACAE				
Lyngbya majuscula (Dilwyn) Harvey ex Gomont		--	**Ind**	2, 3
Lyngbya semiplena (C.Agardh) J. Agardh		--	**Ind**	2, 3
RHODOPHYTA	RED ALGAE			
GRACILARIACAE				
Gracilaria salicornia (C.Agardh) Dawson		C	**Ind**	1a, 1b, 2, 3
RHODOMELACAE				
Acanthophora spicifera (Vahl) Borgesen		A	Nat	1a, 1b, 2, 3
PHAEOPHYTA	BROWN ALGAE			
SARGASSACEAE				
Sargassum echinocarpum J.Ag		--	**Ind**	2, 3
	INVERTEBRATES			
CNIDARIA, ANTHOZOA, SCLERACTINIA				
PORITIDAE				
Porites cf. *lobata* Dana	lobe coral	--	**Ind**	2, 3
POCILLOPORIDAE				
Pocillopora meandrina Dana	cauliflower coral	--	**Ind**	2, 3
MOLLUSCA,GASTROPODA				
NEOTAENIOGLOSSA				
THIARIDAE				
Tarebia granifera Lamarck	quilted melania	--	Nat	2
MOLLUSCA,BIVALVIA OSTREOIDA				
OSTREIDAE				
unid.	indet. oyster	--	--	2
ECHINODERMATA ECHINOIDEA				
ECHONMETRIDAE				
Echinometra mathei Blainville	*'ina kea*; rock boring urchin	--	**Ind**	2, 3
Echinometra oblonga Blainville	*'ina*; oblong urchin	--	**Ind**	2, 3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
ARTHROPODA,INSECTA ODONATA				
AESHNIDAE				
Anax junius Drury	*pinao*; green darner	--	Nat	3
COENAGRIONIDAE				
Enallagma civile Hagen	familiar bluet	--	Nat	1b, 2
LIBELLULIDAE				
Crocothemis servilia (Drury, 1773)	scarlet skimmer	--	Nat	1b, 2, 3
Pantala flavescens (Fabricius, 1798)	wandering glider	U	Nat	1a, 1b, 3
Tramea lacerata Hagen	black saddlebags	--	Nat	3
ARTHROPODA, MAXILIPODA SESSILIA				
BALANIDAE				
Amphibalanus eburneus Gould	white rock barnacle	--	Nat	3
ARTHROPODA, MALACOSTRACA, DECOPODA				
GRAPSIDAE				
Grapsus tenuicrustatus	*ʻaʻama*; thin-shelled rock crab;	--	**Ind**	2, 3
Metopograpsus thukuhar Owen	*ʻalamihi, kūkūau*; purple-clawed shore crab	--	Nat	3
CAMBARIDAE				
Procambarus clarkii (Girard, 1852)	crayfish	R	Nat	1a
PALAEMONIDAE				
Palaemon debilis Dana	*ʻōpae huna* glass shrimp	C	**Ind**	1a, 3
PORTUNIDAE				
Scylla serrata Forskal	Samoan crab	R	Nat	1a, 2
Thalamita crenata (H. Milne Edwards, 1834)	blue-pincer swimming crab	--	**Ind**	1b, 2
	FISHES			
CHORDATA, ACTINOPTERYGII, ANGUILLIFORMES				
MURAENIDAE				
Echidna nebulosa (Ahl, 1789)	*puhi kāpā*; snowflake moray	--	**Ind**	1b
CHORDATA, ACTINOPTERYGII, BELONIFORMES				
BELONIDAE				
Platybelone argus (Lesuer, 1821)	keeltail needlefish	--	**Ind**	3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
CHORDATA, ACTINOPTERYGII, CLUPEIFORMES				
ENGRAULIDAE				
Encrasicholina purpurea (Fowler, 1900)	*nehu;* Hawaiian anchovy	--	**End**	2, 3
CHORDATA, ACTINOPTERYGII, CYPRINODONTIFORMES				
POECILIIDAE				
Poecilia sp.	indet. molly	C	Nat	1a, 2, 3
Poecilia sp. hybrid complex (*salvatoris/mexicana* group)	liberty/Mexican molly	C	Nat	1a, 1b, 3
CHORDATA, ACTINOPTERYGII, MUGILIFORMES				
MUGILIDAE				
Mugil cephalus Linnaeus, 1758	*pua ʻama*; striped mullet (finger size)	A	**Ind**	1a, 2, 3
Mugil cephalus Linnaeus, 1758	*ʻamaʻama*; striped mullet (adult)	--	**Ind**	1b
CHORDATA, ACTINOPTERYGII, PERCIFORMES				
ACANTHURIDAE				
Acanthurus blochii Valenciennes in Cuvier and Valenciennes, 1835	*pualu*; ringtail surgeonfish	--	**Ind**	1b
Acanthurus triostegus sandvicensis Streets	*manini*; convict tang	--	**End**	1b, 2, 3
BLENNIDAE				
Istiblennius zebra (Vailant & Sauvage, 1875)	zebra rockskipper	--	**Ind**	1b, 2, 3
CARANGIDAE				
indet.	unid. jack	--	**Ind**	3
Scomberoides lysan (Forsskål, 1775)	*lai*	--	**Ind**	2
CHAETODONTIDAE				
Chaetodon lunulatus Quoy and Gairmard, 1824	racoon butterflyfish	--	**Ind**	1b
CICHLIDAE				
Archocentrus nigrofasciatus (Günther, 1867)	convict cichlid	--	Nat	3
Sarotheron melanotheron (Rüppell, 1852)	blackchin tilapia	C	Nat	1a, 1b, 2, 3
GOBIIDAE				
Awaous stamineus (Eydoux and Souleyet, 1850)	*ʻoʻopu nākea*	--	**Ind**	3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
GOBIIDAE (cont.)				
Bathygobius cocosensis (Bleeker, 1854)	*ʻoʻopu ōhune;* Cocos frillgoby	--	**Ind**	2
Stenogobius hawaiiensis Watson, 1991	*ʻoʻopu naniha*	--	**Ind**	3
ELEOTRIDAE				
Eleotris sandwicensis (*Vaillant and Sauvage*, 1875)	*ʻoʻopu akupa*	--	**End**	3
KUHLIIDAE				
Kuhlia sandvicensis (Steindachner, 1876)	*ʻāholehole;* zebra head flagtail	--	**Ind**	2, 3
Kuhlia xenura (Jordan and Gilbert, 1882)	*ʻāholehole*; Hawaiian flagtail	--	**End**	2, 3
LABRIDAE				
Thalassoma duperrey (Quoy and Gairmard, 1824)	saddle wrasse; *hinalea lauwili*	--	**End**	2, 3
LUTJANIDAE				
Lutjanus fulvus (Forster in Bloch and Schneider, 1801)	*toʻau*; blacktail snapper	--	Nat	1b
MULLIDAE				
Mulloidichthys flavolineatus (Lacepède, 1801)	*ʻoama*; yellowstripe goatfish	--	**Ind**	1b
POMACENTRIDAE				
Abudefduf abdominalis (Quoy & Gaimard, 1825)	*mamo*; Hwn. sergeant	--	**End**	2, 3
Abudefduf sordidius (Forskål, 1775)	*kūpīpī;* blackspot sergeant	--	**End**	2, 3
SCARIIDAE				
Scarus psittacus (Forskål, 1775)	*uhu; palenose parrotfish*	--	**Ind**	2, 3
SPHYRAENIDAE				
Sphyraena barracuda (Edwards in Catesby, 1771)	*kākū*; great barracuda	--	**Ind**	2, 3
ZANCLIDAE				
Zanclus cornutus (Linnaeus, 1758)	Moorish idol	--	**Ind**	2, 3
CHORDATA, ACTINOPTERYGII, TELEOSTEI				
SYNODONTOIDEI				
unid. Synodontoidei	lizardfishes	--	**Ind**	1b

* Abundance codes given only for species observed in the vicinity of the Project site during the September 2020 survey.

Table A2 (continued)

LEGEND TO TABLE A2

Abundance categories:
- R – Rare – only one or two individuals observed.
- U – Uncommon – several to a dozen individuals observed.
- O – Occasional – seen irregularly in small numbers
- C – Common -observed everywhere, although generally not in large numbers.
- A – Abundant – observed in large numbers and widely distributed.

Status categories:
- **End** – Endemic – species found only in Hawaiʻi
- **Ind** – Indigenous – species found in Hawaiʻi and elsewhere
- Nat – Naturalized – species were introduced to Hawaiʻi intentionally, or accidentally.

Location codes:
- 1a – observed in present survey in project area
- 1b – observed in present survey downstream of project area
- 2 – observed by *AECOS* in Mā'ili Stream Channel on July 5, 2019
- 3 – observed by *AECOS* in Mā'ili Stream Channel on March 23, 2009

Table A3. List of marine biota observed on the limestone bench and marine waters offshore of Mā'ili Stream during the July 2019 and September 2020 surveys.

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
	ALGAE		
CHLOROPHYTA	GREEN ALGAE		
Caulerpa racemosa (Forkssal) J. Agardh		**Ind**	O
Codium edule Silva		**Ind**	R
Dictyosphaeria versluyii Weber-van Bosse		**Ind**	R
Halimeda discoidea Decaisne		**Ind**	O
Neomeris sp.		**Ind**	C
Ulva expansa (Setchell) Setchell & N.L.Gardner	large sea lettuce	**Ind**	U
RHODOPHYTA	RED ALGAE		
Acanthophora pacifica (Setchell) Kraft		**Ind**	C
Acanthophora spicifera(Vahl) Borgesen		Nat	R
Asparagopsis taxiformis (Delile) Trevisan	*limu kohu*	**Ind**	A
Haliptilon subulatum (Ellis&Solander) Johansen		**Ind**	O
Hydrolithon gardineri (Foslie) Verheij & Prud'homme		**Ind**	O
Hydrolithon onkodes (Heydrich) Penrose & Chamberlain		**Ind**	O
Hydrolithon reinboldii (Weber-van Bosse) Foslie		**Ind**	O
Hypnea chordacea Kutzing		**Ind**	O
Laurencia mcdermidiae Abbott		**End**	R
Laurencia nidifica J. Agardh		**Ind**	R
Sporolithon erythraeum (Rothpletz) Kylin		**Ind**	U
Tricleocarpa cylindrical (Ellis & Solander) Huisman & Townsend		**Ind**	R
Tricleocarpa fragilis (Linnaeus) Huisman & Townsend		**Ind**	R

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
PHAEOPHYTA	BROWN ALGAE		
Asteronema breviarticulatum (J. Agardh) Ouriques & Bouzon		**Ind**	O
Dictyota ceylanica Kutzing		**Ind**	C
Dictyota friabilis Setchell		**Ind**	O
Dictyota sandvicensis Sonder	Hawaiian dictyota	**End**	U
Padina spp.		**Ind**	A
Padina sanctae-crucis Borgesen		**Ind**	R
Sargassum echinocarpum J Agardh		**End**	C
Sargassum obtusifolium J Agardh		**End**	O
Turbinaria ornata (Turner) J. Agardh		**Ind**	U
	INVERTEBRATES		
CNIDARIA, ANTHOZOA, ALCYONACEA			
XENIIDAE			
Sarcothelia edmondsoni Verrill	blue soft coral	**End**	C
ZOANTHINARIA	ZOANTHIDS		
Palythoa caesia Dana	blue-gray zoanthid	**Ind**	O
CNIDARIA, ANTHOZOA, SCLERACTINIA	HARD CORALS		
POCILLOPORIDAE			
Pocillopora damicornis Linnaeus	lace coral	**Ind**	O
Pocillopora meandrina Dana	cauliflower coral	**Ind**	C
PORITIDAE			
Porites sp.		**Ind**	C
Porites compressa Dana	finger coral	**Ind**	O
Porites lobata Dana	lobe coral, *pohaku puna*	**Ind**	O
MOLLUSCA, GASTROPODA	SNAILS and SLUGS		
PATELLIDAE			
Cellana sandwicensis Pease	yellow-foot *'opihi*	**End**	O
Siphonaria normaliis Gould	false limpet	**Ind**	O
NERITIDAE			
Nerita picea Recluz	black nerite; *pipipi*	**End**	C
LITTORINIDAE			
Littorina pintado Wood	periwinkle; *pipipi kōlea*	**Ind**	C

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
THAIDIDAE			
Morula granulata Duclos	granular drupe; *maka'awa*	**Ind**	O
Morula uva Roding	grape drupe	**Ind**	O
MOLLUSCA, BIVALVIA	BIVALVES		
MYTILIDAE			
Brachidontes crebristriatus Conrad	Hawaiian mussel	**End**	O
ARTHROPODA, CRUSTACEA, DECAPODA			
GRAPSIDAE			
Grapsus tenuicrustatus Herbst	thin shelled rock crab; *'a'ama*	**Ind**	O
ECHINODERMATA, ECHNOIDEA, ECHINOMETRIDAE	SEA URCHINS		
Echinometra mathaei Blainville	rock boring urchin; *'ina kea*	**Ind**	A
Echinometra oblonga Blainville	oblong boring urchin; *'ina*	**Ind**	A
Heterocentrotus mammillatus Linnaeus	red pencil urchin; *hā'uke'uke'ula'ula*	**Ind**	O
DIADEMATIDAE			
Diadema paucispinum Agassiz	long-spined urchin; *wana hālula*	**Ind**	O
Echinothrix calamaris Pallas	banded urchin	**Ind**	O
TOXOPNEUSTIDAE			
Tripneustes gratilla Linnaeus	collector urchin; *hāwa'e maoli*	**Ind**	C
CHORDATA, ACTINOPTERYGII	BONY FISHES		
ACANTHURIDAE	SURGEONFISHES and UNICORNFISH		
Acanthurus achilles Shaw	Achilles tang; *pāku'iku'i*	**Ind**	O
Acanthurus nigrofuscus Forsskal	brown tang, *mā'i'i'i*	**Ind**	C
Acanthurus olivaceus Bloch & Schneider	orangeband surgeonfish, *na'ena'e*	**Ind**	C
Acanthurus triostegus Linnaeus	convict tang; *manini*	**Ind**	C
Naso lituratus Forestner	orangespine unicornfish; *umaumalei*	**Ind**	O
Naso unicornis Forkssal	bluespine unicornfish; *kala*	**Ind**	O
BALISTIDAE	TRIGGERFISH		
Rhinecanthus rectangulus Block & Schneider	*humuhumu nukunuku apua'a*	**Ind**	O

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
BELONIDAE	NEEDLEFISH		
Platybelone argalus Leseur	keeltail needlefish	**Ind**	O
CHAETODONTIDAE	BUTTERFLYFISH		
Chaetodon lunula Lacepede	raccoon butterflyfish; *kīkākapu*	**Ind**	U
Chaetodon miliaris Quoy & Gaimard	milletseed butterflyfish; *lauwiliwili*	**End**	O
Chaetodon multicinctus Garrett	multiband butterflyfish; *kīkākapu*	**End**	R
Chaetodon quadrimaculatus Gray	fourspot butterflyfish, *lauhau*	**Ind**	O
Forcipiger flavissimus Jordan & McGregor	common longnose butterflyfish; *lauwiliwili nukunuku 'oi'oi*	**Ind**	U
LABRIDAE	WRASSES		
Gomphosus varius Lacepede	bird wrasse; *hīnālea 'i'iwi*	**Ind**	U
Thalassoma duperrey Quoy & Gaimard	saddle wrasse; *hinalea lauwili*	**End**	C
Thalassoma trilobatum Lacepede	Christmas wrasse; *'awela*	**Ind**	O
MULLIDAE	GOATFISH		
Mulloidichthys vanicolensis Valenciennes	yellow fin goatfish, *weke 'ula*	**Ind**	O
Parupeneus multifasciatus Quoy & Gaimard	manybar goatfish, *moana*	**Ind**	O
OSTRACIIDAE			
Ostracion meleagris Shaw	spotted boxfish; *moa*	**Ind**	R
POMACENTRIDAE	DAMSELFISH		
Abudefduf abdominalis Quoy & Gaimard	Hawaiian sergeant; *mamo*	**End**	C
Abudefduf vaigiensis Quoy & Gaimard	Indo-Pacific sergeant	**Ind**	C
Abudefduf sordidus Forsskal	blackspot sergeant; *kūpīpī*	**Ind**	O
Plectroglyphidodon imparipennis Vailiant & Sauvage	bright-eye damselfish	**Ind**	O
Stegastes marginatus Jenkins	Hawaiian gregory	**End**	U
ZANCLIDAE			
Zanclus cornutus Linnaeus	moorish idol; *kihikihi*	**Ind**	U

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
	REPTILES		
CHORDATA, REPTILIA **CHELONIIDAE**			
Chelonia mydas Linnaeus	green sea turtle, *honu*	**Ind**	R

Key to Table A3

Abundance categories:
- R – Rare – only one or two individuals observed.
- O – Occasional – seen irregularly in small numbers
- C – Common –observed everywhere, although generally not in large numbers.
- A – Abundant – observed in large numbers and widely distributed.

Status categories:
- **End** – Endemic – species found only in Hawai'i.
- **Ind** – Indigenous – species found in Hawai'i and elsewhere.
- Nat – Naturalized – species introduced to Hawai'i intentionally, or accidentally.

Table A4. Avian species detected at the former Voice of America site in Lualualei, September 2020.

Common Name	Scientific Name	Status	*RA*
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	A	0.29
Domestic Chicken	*Gallus gallus*	A	1.14
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Rock Pigeon	*Columba livia*	A	7.57
Spotted Dove	*Streptopelia chinensis*	A	1.57
Zebra Dove	*Geopelia striata*	A	6.57
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
	Charadriinae - Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	**IM**	0.19
	PELECANIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Black-crowned Night-Heron	*Nycticorax nycticorax hoactli*	**I**	0.14
	STRIGIFORMES		
	STRIGIDAE - Typical Owls		
Short-eared Owl	*Asio flammeus sandwichensis*	**Es**	0.29
	PASSERIFORMES		
	PYCNONOTIDAE - Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	A	6.71
Red-whiskered Bulbul	*Pycnonotus jocosus*	A	0.57
	ZOSTEROPIDAE - White-eyes		
Warbling White-eye	*Zosterops japonicus*	A	2.14
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	3.71
	ESTRILDIDAE – Estrildid Finches		
Common Waxbill	*Estrilda astrild*	A	2.86
Java Sparrow	*Lonchura punctulata*	A	3.57

Table A4 (continued).

Common Name	Scientific Name	Status	*RA*
	PASSERIDAE – Old World Sparrows		
House Sparrow	*Passer domesticus*	A	0.86
	FRINGILLIDAE – Fringilline and Carduline Finches & Allies Carduelinae – Carduline Finches& Hawaiian Honeycreepers		
House Finch	*Haemorhous mexicanus*	A	3.43
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	2.14
	THRAUPIDAE – Tanagers		
Red-crested Cardinal	*Paroaria coronata*	A	0.43

Key to Table A4.

Status:

Es = Endemic to the Hawaiian Islands; state listed as endangered.
I = Indigenous to the Hawaiian Islands.
IM = Indigenous, migratory species.
A = Alien; naturalized, non-native species (introduced).

Relative Abundance (***RA***): Species count / number of point-count stations (n=7).

APPENDIX B

Mobility Analysis Report (MAR) for the Voice of America Site in Māʻili, October 29, 2021

Mobility Analysis Report (MAR)

for the

Voice of America Site in Maili

Prepared for:
Gray, Hong, Nojima & Associates, Inc.
on behalf of
Department of Hawaiian Homelands (DHHL)

October 29, 2021

SD20-0360

FEHR PEERS

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1. Executive Summary

This report documents the assessment of mobility and access associated with the proposed development on the Department of Hawaiian Home Lands (DHHL) site located in the community of Maili on the island of Oahu. The project site is located mauka and south of the existing Ulu Ke Kui apartment development on Kulaaupuni Street. The project involves construction of 136 multi-family dwelling units and 145 single-family dwelling units, and it is anticipated to be built and fully occupied by 2028. Access to the site for all modes is proposed via one street connecting to Kulaaupuni Street south of Holt Road.

The impacts of the proposed project to mobility and access surrounding the project site were evaluated following guidelines and standards of the affected government agencies. A multimodal evaluation of mobility effects from the project was conducted to determine potential impacts to walking, biking, transit, and traffic operations. Four study intersections in the vicinity of the project were evaluated during the weekday morning (AM) and evening (PM) peak hours for Existing (2020) conditions, Baseline (2028) conditions with and without the project, and Baseline (2028) with Kulaaupuni Street extended to Kulauku Street without and with the project.

Trip generation for the facility was determined based on standard trip rates published in the *Trip Generation Manual* (10th Edition, 2017) by the Institute of Transportation Engineers (ITE), as well as appropriate reductions to account for the mix of uses and the travel characteristics of other uses in this area. The proposed project is expected to generate 2,382 net new daily vehicle trips, including 170 net new vehicle trips during the AM peak hour (42 inbound/128 outbound) and 218 net new vehicle trips during the PM peak hour (81 inbound/218 outbound).

Key findings of the mobility analysis are summarized below:

- The project will have a significant impact at the Kulaaupuni Street/St John's Road intersection, where operations for side street traffic are expected to be LOS F during the AM peak hour. All-way stop control will need to be implemented at this intersection to reduce delays and improve operations to desirable levels (i.e., LOS D or better).
- Westbound queue lengths and westbound delays at the Farrington Highway/St John's Road intersection will be excessive under no project conditions and will worsen under with project conditions. Additional capacity on this approach is not considered feasible based on available right of way. While the overall intersection is projected to operate at a desirable level, the project sponsor will need to work with HDOT to ensure that signal timing is adjusted by the time of project occupancy in 2028 to reduce projected vehicle queues. Additional green time for the westbound phase should be provided to reduce delays and queues. It is feasible to move green time from the northbound and southbound phases to the eastbound and westbound phases to reduce westbound queues while maintaining acceptable LOS at the intersection. This would involve completion of a signal timing study to justify modification of timings subject to approval by DOT.

- The project will construct an extension of Kulaaupuni Street (including a sidewalk on along the mauka side of the street) along its entire frontage. Extending Kulaaupuni Street from south of the project site to Kulauku Street was identified as a neighborhood improvement in the traffic study for the Community Learning Center development project to the south, but is not required to serve the DHHL project or to mitigate any potential impacts. An operations analysis assuming the full extension in place shows that it will reduce the average amount of delay at most intersections by one or two seconds except at one location (Farrington Highway/Kaukama Street) where it increases delay by the same amount. The full extension would benefit the westbound St. John's Road approach at Farrington Highway by reducing the AM peak hour vehicle queue and delays and would improve overall community connectivity
- Two active transportation opportunities were identified that could enhance bicycle, pedestrian and/or transit access and safety in the vicinity of the site:
    - Installation of a formal walking path for the mauka side of Kulaaupuni Street from the Maili Channel bridge to St John's Road. This connection would improve access to Maili Elementary School and Community Park, the Leeward Community College Waianae Moku campus, and bus stops on Farrington Highway. The path should be designed as an accessible facility and ideally would physically separate pedestrians and vehicles (e.g., via installation of a raised asphalt curb).
    - A bicycle/pedestrian connection from the southeast corner of the project site to Laia Street to improve neighborhood connectivity and access to local parks and shops. The project sponsor would have to obtain an easement from or agreement with the adjacent property since this connection would traverse land outside of the current site plan.

2. Introduction

This mobility analysis report (MAR) presents the study conducted by Fehr & Peers for the proposed development on the Department of Hawaiian Home Lands (DHHL) Voice of America (VOA) site located in the community of Maili on the island of Oahu. This MAR was conducted in accordance with the guidelines and standards of the affected government agencies, and it addresses the potential impact of the project on all modes of travel.

The project site encompasses roughly 40 acres located on tax map parcels 8-7-010:030 and 031, and it is under the jurisdiction of the Department of Hawaiian Home Lands (DHHL). The project site is bounded by Kulaaupuni Street on the makai side, Kamehameha Schools Community Learning Center and vacant DHHL land to the south, the Maili Channel to the north, and the Sea Country residential development on the mauka side, as shown on **Figure 1**.

2.1 Project Description

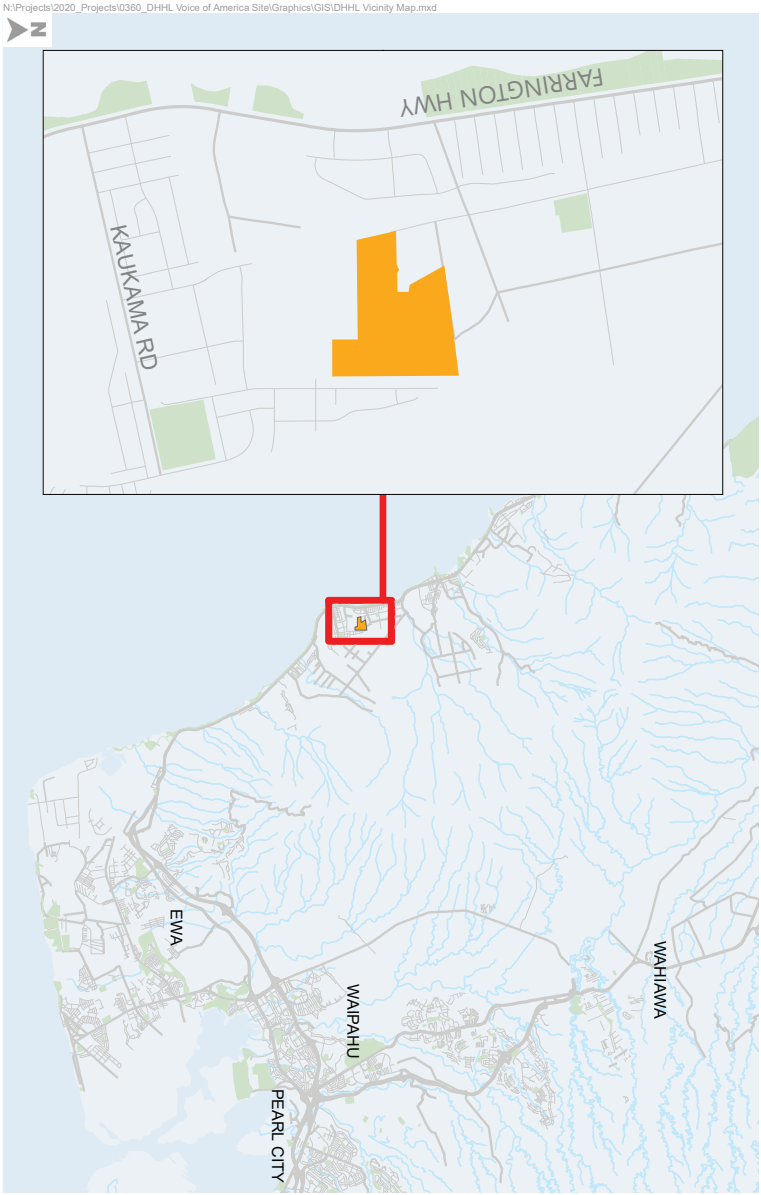
The project involves construction of 281 residential dwelling units, consisting of 145 single family units and 136 multi-family units. Vehicular access to the site is proposed via a project driveway on Kulaaupuni Street approximately 400 feet south of Holt Road. The project site plan is shown on **Figure 2**.

2.2 Study Area

The transportation analysis focused on evaluating the potential project-related transportation impacts at four existing intersections in the vicinity of the proposed project. The analyzed intersections are listed below and are shown on **Figure 3**:

1. Farrington Highway/St John's Road
2. Kulaaupuni Street/St John's Road
3. Farrington Highway/Kaukama Road
4. Kulauku Street/Kaukama Road

The intersection of Farrington Highway/Hookele Street was also included in the network analysis to account for coordinated corridor operations along Farrington Highway. This study analyzes the potential project-related traffic impacts under typical weekday AM and PM peak hour traffic conditions. The AM and PM peak hour for each intersection are identified as the highest one-hour totals of traffic at the intersection between 6:00 AM and 9:00 AM and 3:00 and 6:00 PM on a weekday.



Legend

Project Site

Figure 1

Vicinity Map and Project Site

Voice of America Site in Maili - Mobility Analysis Report

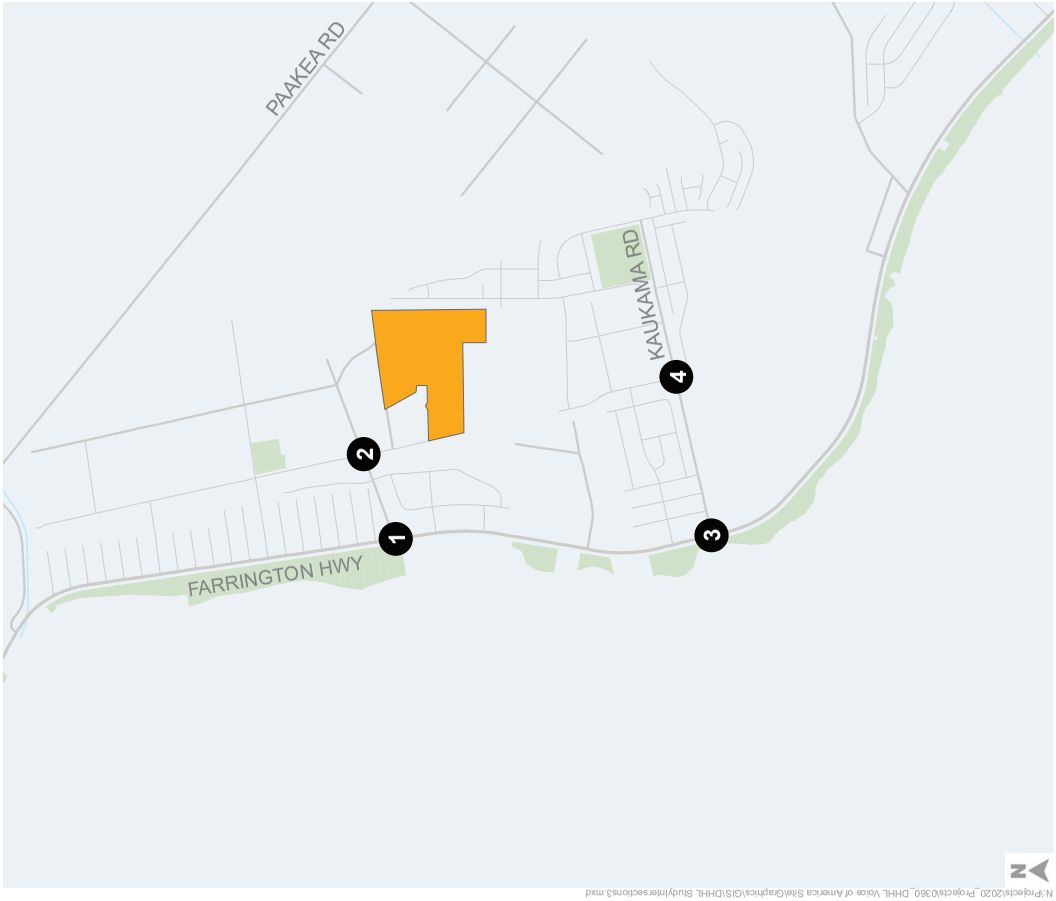


Figure 3

Project Site & Study Intersections

Voice of America Site in Maili - Mobility Analysis Report

Legend

Project Site

Study Intersections

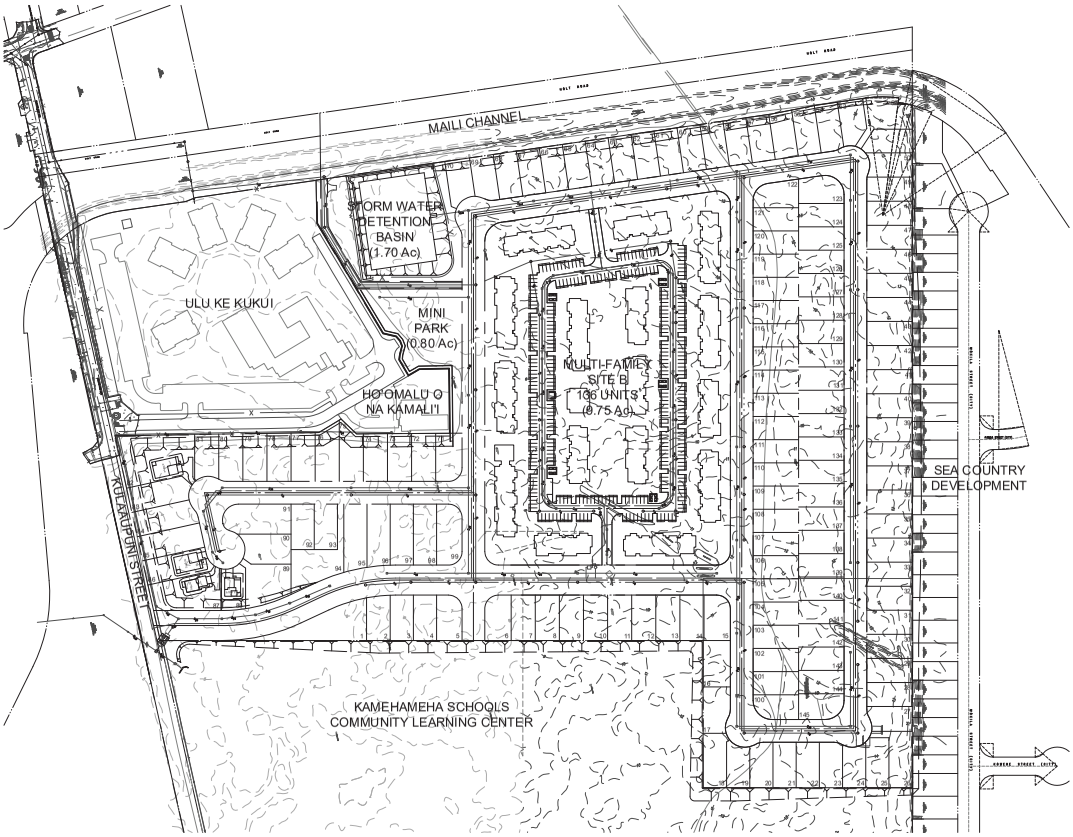


Figure 2

Site Plan

DHHL Voice of America Site

UNIT TABULATION

SINGLE FAMILY LOTS - 145 LOTS

MULTI-FAMILY UNITS - 136 UNITS

TOTAL UNITS - 281 UNITS

SITEPLAN OPTION 3

SF & MF HYBRID

FEET 1"=200'

0 100 200 400

Conceptual Design

June 22, 2021

Developed for Department of Hawaiian Home Lands

DHHL VOICE OF AMERICA SITE

Maili, Oahu, Hawaii

KY International Inc.

Architects and Planners

1100 Alakea Street, Suite 1988

Honolulu, Hawaii 96813

Telephone 808-524-1268

Facsimile 808-599-8881

A-8

2.3 Study Scenarios

The operations of the study intersections were evaluated during the weekday AM and PM peak hours for the following scenarios:

- **Existing Conditions** – Given the ongoing COVID-19 pandemic, traffic counts collected in early December 2020 do not reflect typical levels of peak hour volumes. Accordingly, the observed volumes were adjusted using the comparison of 2020 vs. 2019 volumes reported by the State of Hawaii Department of Transportation – Highways Division – Planning Branch (HDOT). Additional adjustments were made to reflect typical neighborhood traffic volumes not captured in the 2020 counts based on counts from 2012, in particular resulting from Ma'ili Elementary, Ma'ili Preschool, and Leeward Communitiy College Wai'anae Moku. This scenario represents an existing conditions scenario if the COVID-19 pandemic had not occurred. The analysis of traffic operations under this scenario was conducted for the peak hours and existing intersection lane configurations. The existing conditions analysis also includes a description of key area roadways and a review of existing transit facilities and services near the site.
- **Baseline (2028) No Project Conditions** – Existing peak-hour volumes increased to account for forecasted growth in the area at the opening year of the project in 2028. Traffic growth was estimated based on an annual growth factor to account for ambient traffic growth within the study area.
- **Baseline (2028) Plus Project Conditions** – This traffic scenario includes traffic volumes under Baseline (2028) No Project conditions plus the addition of forecasted project-generated traffic.
- **Baseline (2028) No Project Conditions with Kulaaupuni Extension** – This traffic scenario assumes the extension of Kulaaupuni Street south of the Project site to Kulauku Street and reassigns Baseline (2028) No Project traffic volumes accordingly. This scenario is provided for informational purposes only.
- **Baseline (2028) Plus Project Conditions** – This traffic scenario includes traffic volumes under Baseline (2028) No Project Conditions with Kulaaupuni Extension plus the addition of forecasted project-generated traffic. This scenario is provided for informational purposes only.

2.4 Traffic Analysis Methods

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6), published by the Transportation Research Board in 2016. The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels are defined, from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions.

2.4.1 Signalized Intersections

The method described in "Chapter 19: Signalized Intersections" of the *HCM 6* was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay alone is used to characterize LOS for the entire intersection or for an approach. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using Synchro 10.0 analysis software and is correlated to a LOS designation, as shown in **Table 1**.

Table 1: Signalized Intersection LOS Definitions

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of desirable delay. These high-delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered undesirable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

2.4.2 Unsignalized Intersections

The operations of the unsignalized intersections were evaluated using the method contained in "Chapter 20: Two-Way Stop-Controlled Intersections" of the *HCM 6*. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At this two-way- or side-street-stop-controlled (SSSC) intersection, the average control delay is calculated for the minor-street stopped movement and the major-street left turns, not for the overall intersection. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented for SSSC. As shown in **Table 2**, LOS F is assigned to the

movement if the volume-to-capacity (V/C) ratio for the movement exceed 1.0, regardless of control delay. The average control delay for unsignalized intersections is calculated using Synchro 10.0 analysis software and is correlated to a LOS designation, as shown in **Table 2**.

Table 2: Unsignalized Intersection LOS Definition

Level of Service (V/C ≤ 1.0)	Level of Service (V/C > 1.0)[1]	Description	Delay in Seconds
A	F	Little or no delay	≤ 10.0
B	F	Short traffic delay	> 10.0 to 15.0
C	F	Average traffic delays	> 15.0 to 25.0
D	F	Long traffic delays	> 25.0 to 35.0
E	F	Very long traffic delays	> 35.0 to 50.0
F	F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.
Notes:
[1] For approach-based and intersection-wide assessments, such as that used for all-way stop controlled intersections, LOS is defined solely by control delay.

2.4.3 Significant Impact Criteria

The analysis of Baseline (2028) conditions compares no-project operations with conditions when the project is fully built out to determine whether project implementation is expected to result in a significant impact on the surrounding roadways. Based on previous studies conducted for the City & County of Honolulu Department of Planning and Permitting (DPP) Traffic Review Branch (TRB), the minimum desired operating standard for a signalized intersection is typically LOS D. Additionally, HDOT strives to maintain LOS D intersection operations for state facilities, but both agencies acknowledge that some facilities may operate at worse levels during peak hours. Both agencies usually define a significant intersection impact as when the operation of a signalized intersection changes from LOS D or better to LOS E or F. Impacts are also defined to occur when the addition of project traffic exacerbates locations already operating at or projected to operate at LOS E or F. When evaluating intersection operations at any location, other factors are considered in the analysis, such as traffic volumes and potential secondary impacts to pedestrian, bicycle, and transit travel.

Significant impacts are categorized as either a project-specific or cumulative impact. An impact is considered project-specific at a signalized intersection if the addition of project traffic is expected to degrade LOS D or better operations to LOS E or F operations. An impact is considered a cumulative impact at a signalized intersection if the addition of project trips exacerbates LOS E or F operations and increases the intersection delay by more than five (5) seconds.

For unsignalized intersections, the criterion for a project-specific impact is the same as for signalized intersections, as described above (i.e., LOS D or better to E or F). However, the project is determined to have a potentially significant cumulative impact when it adds traffic to a study location that includes a controlled approach operating at an undesirable level (i.e., LOS E or F) *and* one or more volume-based signal warrants are met. The signal warrants used for this evaluation are those described in Chapter 4C of the *Manual of Uniform Control Devices* (MUTCD, 2009), published by the US Department of Transportation Federal Highways Administration (FHWA).

The City & County of Honolulu Department of Planning & Permitting (DPP) Traffic Review Branch (TRB) and HDOT have not approved detailed criteria for significant pedestrian, bicycle, and transit impacts. However, these impacts are generally evaluated based on whether a proposed project would: 1) conflict with existing or planned pedestrian, bicycle, or transit facilities and services, or 2) create substantive walking, bicycling, or transit use demand without providing adequate and appropriate facilities for non-motorized mobility. Existing facilities for pedestrians, bicycles, and transit users were inventoried to evaluate the quality and scope of facilities/services currently in place. The assessments of planned pedestrian, bicycle, and transit facilities were conducted using information in planning documents, such as the *2019 Oahu Bike Plan Update* and the *Primary Urban Center Development Plan (2004)*. For these modes, if the proposed project is expected to conflict with existing or planned improvements to pedestrian and bicycle facilities, or if the project is expected to generate a substantial demand that could warrant additional transit service, then the project would be determined to have a project-specific impact to non-motorized modes of transportation.

It should be noted that the City & County Department of Transportation Services (DTS) has developed an analysis methodology for evaluating multimodal operations for vehicular, bicycle, pedestrian and transit modes. However, this methodology is only currently required for City & County-sponsored projects and will only be completed if required to address comments provided by DTS through DPP TRB.

3. Existing Conditions

This chapter describes the existing pedestrian, bicycle, and transit facilities, as well as the roadway network located within the project study area. A discussion of the existing intersection LOS operation results is also included in this chapter.

3.1 Existing Site and Transportation Facilities

The existing Voice of America site contains the Ulu Ke Kukui transitional housing project, Hoomalu O Na Kamalii, and the Kamehameha Schools Community Learning Center at Maili. All these existing uses will remain, and the proposed project will be developed on vacant land within the overall Voice of America site. A focused data collection effort was undertaken to identify existing transportation conditions in the vicinity of the proposed site. The assessment of existing conditions relevant to this study includes existing public transit, bicycle, and pedestrian facilities, as well as an inventory of the street system, traffic volumes on these facilities, and operating conditions at key intersections.

3.1.1 Existing Transit Facilities and Services

TheBus is the main public transportation service on the Island of Oahu, where it served over 60 million riders in the fiscal year of 2019 on its fixed-route service. Within the greater project study area, Routes 40, 93, C, and PH1 provide service along Farrington Highway. Route 403 also operates in the Maili area on Paakea Road, but there is no direct pedestrian access between the site and stops on that route.

Routes 93, C, and PH1 are express routes, while Route 40 is a regular service bus route. The existing transit schedules are summarized in **Table 3**.

Table 3: Existing Transit Services

Route	From	To	Weekdays			Weekends	
			Operating Hours	Headway (minutes)		Operating Hours	Headway (minutes)
				Peak	Midday		
40	Honolulu	Makaha	12:00 am – 12:00 am	30 min	30 min	12:00 am – 12:00 am	30 min
93	Downtown Honolulu	Makaha	Eastbound: 3:45 am – 8:16 am; Westbound: 3:23 pm – 7:34 pm	27 min	-	-	-
C	Honolulu	Makaha	3:03 am – 11:02 pm	30 min	30 min	3:04 am – 11:09 pm	30 min
PH1	Pearl Harbor	Makaha	Eastbound: one departure from Makaha at 4:25 am; Westbound: one departure from Pearl Harbor at 3:10 pm	-	-	-	-

Source: Fehr & Peers, 2021; TheBus.org.

All routes serve the bus stops located at Farrington Highway/St John's Road, located approximately a 2/3-mile walk from the middle of the proposed project site. The northbound bus stop is provided with a bench, and the southbound bus stop is provided with a shelter and a bench. Both bus stops also have a painted shoulder to allow for bus pull-outs, so buses stopping to pick up or drop off passengers will not block vehicles traveling on Farrington Highway.

3.1.2 Existing Bicycle Activity

The roadways in the study area do not provide separate bicycle facilities and have a minimal amount of bicycle activity. Based on the peak period traffic counts which included bicycle counts, no more than three (3) bicyclists were observed at any of the study intersections in the AM peak hour. In the PM peak hour, 14 bicycles were observed at the Kulaaupuni Street/St John's Road intersection, and 11 were observed at Farrington Highway/St John's Road. No more than five (5) bicyclists were observed at Farrington Highway/Kaukama Road and Kulauku Street/Kaukama Road in the PM peak hour.

3.1.3 Existing Pedestrian Activity

Most of the study area intersections have a minimal amount of pedestrian activity, with counts between five (5) and 15 pedestrians passing through each intersection during the peak hours. The exception is the Kulauku Street/Kaukama Road intersection, which had 28 pedestrians observed in the AM peak hour and 63 pedestrians observed in the PM peak hour.

3.1.4 Collision History

Collision data was reviewed to identify the occurrence of collisions by mode in the study area. According to the Hawaii State Office of Planning data, 11 collisions occurred at the study intersections from 2016 through June 2018. A screenshot of the data is shown on the next page. Table 4 below details the locations, dates, and types of crashes. As shown, most incidents were vehicle collisions. Two (2) pedestrian-related collisions were recorded at Farrington Highway/St John's Road during this period, and no bicycle-related collisions were reported.

Table 4: Collision History 2016 Through June 2018

Crash Type	Crash Type	Year	Number of Crashes
Farrington Hwy/St John's Rd	Motorcycle/ Moped	2016	1
Farrington Hwy/St John's Rd	Pedestrian	2016	1
Farrington Hwy/St John's Rd	Car/Truck	2016	1
Farrington Hwy/St John's Rd	Pedestrian	2017	1
Farrington Hwy/St John's Rd	Car/Truck	2017	1
Farrington Hwy/Kaukama Rd	Car/Truck	2016	3
Farrington Hwy/Kaukama Rd	Car/Truck	2017	2
Kulauku St/Kaukama Rd	Car/Truck	2018	1

Source: Fehr & Peers, 2021; Hawaii State Office of Planning.

Source: https://histategis.maps.arcgis.com/apps/webappviewer/index.html?id=2ad9abc4cf064a9dabbf46763eddf8b5

3.1.5 Existing Roadway System

The key roadways providing access to or in the vicinity of the project site are described below. As noted in **Section 2**, the site is located east of Kulaaupuni Street and south of the Maili Channel.

Farrington Highway (Route 93) is a principal arterial that largely is under the jurisdiction of HDOT. It extends as a four-lane facility from H-1/Queen Liliuokalani Freeway to Makaha Valley Road, where it becomes a two-lane facility to its northern terminus at Kaena Point State Park. From 0.22 miles north of the Na Ohi Kilolo Stream bridge, Farrington Highway is under the jurisdiction of the City & County of Honolulu. Adjacent to the project, the posted speed limit is 35 miles per hour (mph). A continuous sidewalk is provided on the mauka side of the roadway, and a painted shoulder is provided on the makai side of the roadway. Farrington Highway is also a designated bike route, and on-street parking is prohibited primarily in the four-lane section of roadway.

St John's Road is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Kaukamana Road and includes approximately 22 feet of pavement width makai of Kulaaupuni Street with unpaved shoulders. The posted speed limit is 15 mph makai of Kulaaupuni Street and 25 mph mauka of Kulaaupuni Street. A narrow asphalt path is only provided on the north side of the street between Kulaaupuni Street and Manuaihue Street. On-street parking was observed on the unpaved shoulder areas.

Kaukama Road (Route 8750) is a two-lane minor collector that is under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Pakeke Street. The posted speed limit is 25 mph. Sidewalks are provided on both sides of the roadway, and on-street parking is permitted on both sides as well.

Kulaaupuni Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Mamoalii Place (adjacent to the project site) to a terminus at the Mailiilii Stream. The posted speed limit is 25 mph. A sidewalk is provided on the makai side of the road between Mamoalii Place and the Maili Channel, and a raised curb designates a street-level walking path on the mauka side of the road for the same segment, with sidewalk provided on the Maili Channel bridge. A sidewalk is also provided on the makai side of the road between St John's Road and approximately 200 feet south of Maliona Street. No sidewalk or formal path is provided on the other segments of Kulaaupuni Street, including the segment between the Maili Channel and St John's Road. On-street parking is provided adjacent to the sidewalk, and parking was observed in the unpaved shoulder immediately adjacent to the roadway. No parking is permitted on the mauka side of the roadway between Mamoalii Place and the Maili Channel as designated by red curb.

Kulauku Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Kaukama Road to Kulawae Street. Kulauku Street has the potential to be extended to the north along the makai edge of the project site and the Community Learning Center at Maili to connect with Kulaaupuni Street, but there are no plans to make that connection at this time. The posted speed limit is 25 mph. A sidewalk is provided on both sides of the roadway, and on-street parking is permitted on both sides as well.

3.2 Existing Traffic Volumes/Lane Configurations

Given the ongoing COVID-19 pandemic and the resulting change in temporal and behavioral travel patterns, it was not possible to conduct traffic counts that reflect typical peak hour volume levels. Accordingly, the analysis of existing traffic conditions is based on counts collected in early December 2020, which were adjusted to account for demand prior to the COVID-19 pandemic.

The adjustment factor was based on Year 2019 to 2020 traffic volume comparisons reported by HDOT for a location on H-1 at mile marker 3.43 at the Kualakai Parkway interchange. This location was the nearest reported volume comparison to the project and is the only access between the Leeward coast regions and the central and eastern Oahu regions. According to HDOT reports, traffic volumes on December 2 were 10% lower than 2019 annual average daily traffic, volumes for all of December were 7% lower, and

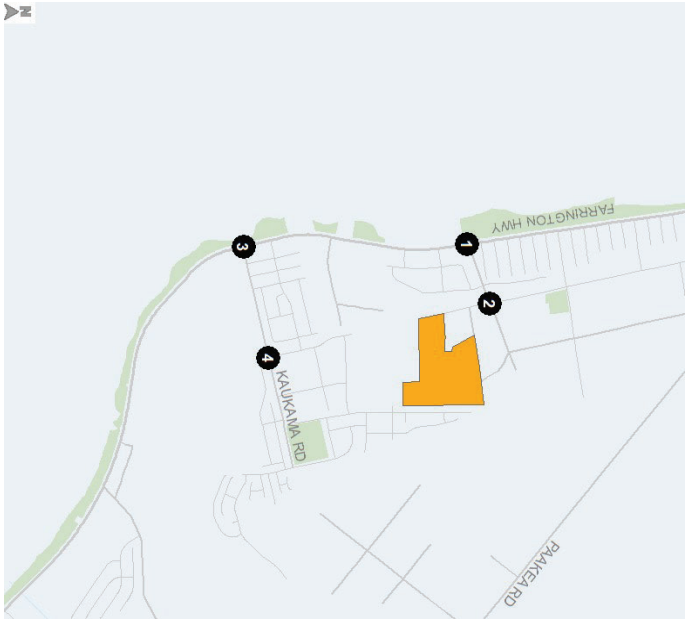
volumes for all of November were 11% lower. Based on this data, an adjustment factor of 10% was applied to increase observed traffic volumes from December 1, 2020, to volumes representative of an existing condition scenario for 2020 if the COVID-19 pandemic had not occurred.

Additional adjustments were made for turning movement volumes determined to be significant deviations from normal resulting from pandemic conditions. Existing condition volumes were compared to counts taken for the Ka Pua Community Learning Center traffic study in November 2012, which were grown by 1% per year for 8 years to represent 2020 volumes. If the grown 2012 volume from the Ka Pua Community Learning Center traffic study was higher than the adjusted 2020 count taken for this study, the grown 2012 volumes was used as the final existing conditions volume to provide a more conservative analysis. This was done to ensure that volumes used in the Existing Conditions analysis accurately captured expected travel patterns resulting from unique land-uses in the area adversely affected by the pandemic, notably the nearby schools and educational facilities.

Signal timing data for the study intersections was obtained from field observations. Traffic volumes at the intersection of Farrington Highway/Hookele Street were estimated based on study intersection count data. **Figure 4** presents the analyzed peak hour turning movement volumes, corresponding lane configurations, and traffic control devices under Existing conditions. **Appendix A** provides traffic count data sheets.

3.3 Existing Intersection Operations

Peak hour intersection capacity analysis was performed for the study intersections using the methodology described in **Section 2.4** and the Existing Conditions peak hour traffic volumes. Due to *HCM 6* limitations for analyzing signalized intersections, St John's Road has been analyzed as having a speed limit of 25 mph at the intersection with Farrington Highway. **Table 5** summarizes the results of the intersection operations analysis for Existing conditions. Detailed LOS worksheets are provided in **Appendix B**. As shown in **Table 5**, all intersections operate at LOS C or better in both peak hours. Note that the calculated LOS generally represents operations in the field. Some intersection approaches, notably the westbound approach at Farrington Highway/St John's Road, experience long delays and lengthy queues intermittently during the AM peak hour.



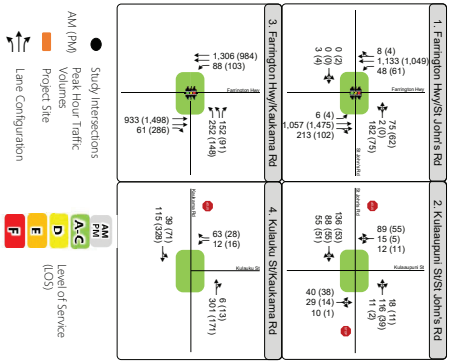


Figure 4
Traffic Volumes, Lane Configurations, and Level of Service
Existing Conditions

Table 5: Existing Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for Side Street Stop)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	17.7	B	
		PM	13.9	B	
2. Kulaaupuni St/St John's Rd	Side Street Stop	AM	21.2	C	NBL/T/R
		PM	11.8	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.5	A	
		PM	8	A	
4. Kulauku St/Kaukama Rd	Side Street Stop	AM	11.8	B	SBL
		PM	13.4	B	SBL

Source: Fehr & Peers, 2020.
Notes:
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.

4. Baseline (2028) No Project Conditions

To evaluate the potential impacts of traffic generated by the proposed project on the surrounding street system, it was necessary to first develop estimates of future traffic conditions in the area without the project. Future traffic conditions without the project reflect traffic increases due to regional growth and development near the study site at the time the project is expected to be fully built and occupied. This scenario is referred to as baseline or "no project" conditions. The forecasted future traffic volumes were then used as a baseline to identify impacts from the project on the roadway system. This chapter describes the development of this future traffic scenario.

4.1 Baseline (2028) No Project Traffic Estimates

The following section summarizes the growth assumptions used to estimate the amount of traffic that would be added to existing intersection volumes to develop volume estimates for Baseline (2028) No Project conditions.

A growth factor is typically applied to the baseline traffic volumes to account for future regional growth. For this study, the growth factor was derived from forecasts developed as part of the Farrington Highway Corridor Study. Growth within the study area was estimated to be approximately 0.90% per year. To provide a worst-case forecast, a 1.0% annual growth factor was assumed for all turning movements in the study area, compounded over the eight-year timeframe (2020 to 2028).

Figure 5 illustrates the forecasted peak hour traffic volumes and lane configurations for Baseline (2028) No Project conditions.

4.2 Baseline (2028) No Project Intersection Levels of Service

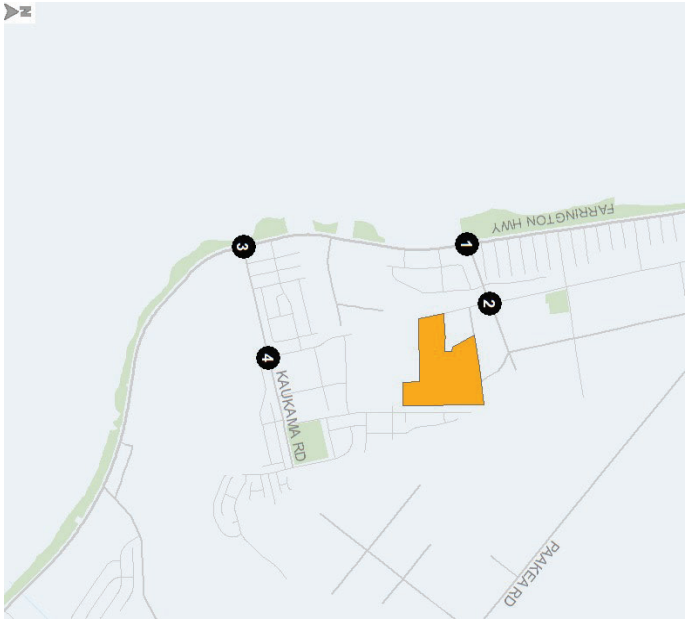
Levels of service (LOS) calculations were conducted to evaluate the operating levels of the study intersections under Baseline (2028) No Project conditions with the forecasted growth in traffic. The results of the LOS analysis for the study intersections are presented in **Table 6.** The corresponding LOS calculation sheets are included in **Appendix B**.

The changes in operations from Existing conditions are the result of the addition of ambient traffic growth. The analysis results indicate that all intersections will operate at desirable levels of service. While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS D), where the 95th percentile queue is projected to exceed 500 feet. This is caused by the limited approach capacity (i.e., a shared lane for turning and through vehicles, as well as by the lengthy amount of green time for through traffic on Farrington Highway.

Table 6: Baseline (2028) No Project Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for Side Street Stop)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	20.4	C	
		PM	18.5	B	
2. Kulaaupuni St/St John's Rd	Side Street Stop	AM	29.5	D	NBL/T/R
		PM	13.5	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.9	A	
		PM	9.3	A	
4. Kulauku St/Kaukama Rd	Side Street Stop	AM	15.7	C	SBL
		PM	21.2	C	SBL

Source: Fehr & Peers, 2020.
Notes:
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.



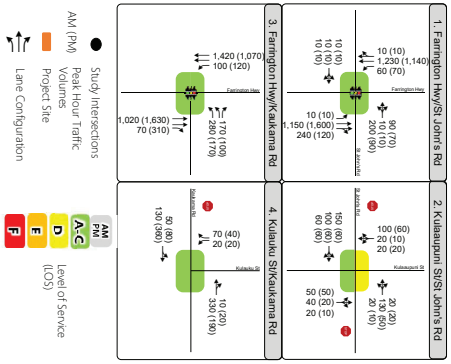


Figure 5
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Conditions

5. Project Traffic Estimates

This section describes the anticipated number of vehicle trips and the directionality of those trips that would result from implementation of the proposed project. Future traffic added to the roadway system by the project is estimated using a three-step process: (1) project trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic that would be added to the roadway network. The second step estimates the direction of travel to and from the project site. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

5.1 Project Trip Generation Estimates

The vehicle trip generation for the proposed project was estimated using standard trip rates published in the *Trip Generation Manual* (10th Edition, 2017) by the Institute of Transportation Engineers (ITE).

The project trip totals were then adjusted using the Mixed-Use (MXD) Trip Generation Model developed by Fehr & Peers and the Environmental Protection Agency (EPA), which is based on statistically superior data compared to the mixed-use methodology used by ITE alone. This model accounts for the local site context and other factors to estimate potential internalization and multimodal trip reductions using published travel survey data.

As shown in **Table 7**, the proposed project is expected to generate a total of 2,378 net new daily vehicle trips, including 151 net new vehicle trips during the AM peak hour (99 inbound/88 outbound) and 223 net new vehicle trips during the PM peak hour (104 inbound/118 outbound).

Table 7: Project Vehicle Trip Generation Estimates

Land Use	Quantity	Vehicle Trips						
		Daily[1]	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single-Family Housing	145 dwelling units	1,464	27	81	108	91	54	145
Multi-Family Housing	136 dwelling units	987	15	49	64	49	29	78
Gross New Trips		**2,451**	**42**	**130**	**172**	**140**	**83**	**223**
Internal Capture Reduction		(10)	0	0	0	0	0	0
Walk and Bike Reduction		(59)	0	(2)	(2)	(3)	(2)	(5)
Total Reductions		**(69)**	**0**	**(2)**	**(2)**	**(3)**	**(2)**	**(5)**
NET NEW VEHICLE TRIPS		**2,378**	**73**	**78**	**151**	**104**	**118**	**223**

Source: Fehr & Peers, 2020 using Institute of Transportation Engineers *Trip Generation Manual* (10th Edition, 2017) trip rates and Mixed-Use (MXD) Trip Generation Model developed by Fehr & Peers and the Environmental Protection Agency.

Project Trip Distribution and Assignment

The geographic distribution of trips generated by the proposed project is dependent on characteristics of the street system serving the project site, the level of accessibility of routes to and from the project site, and primary land uses to which project tenants would be drawn (e.g., job centers, residential areas, shopping destinations, services, and schools).

The project's trip distribution pattern was primarily developed by using model data and existing turning movement counts to determine the likely geographic distribution of project trips. The more localized distribution was based on available travel paths and Google Maps typical travel times. The resulting overall trip distribution pattern estimates for the peak hour project-generated traffic are as follows:

- 25% to/from North along Farrington Highway
- 70% to/from South along Farrington Highway
- 4% local to/from Hookele Street and Kaukama Road
- 1% local to/from St. John's Road, Kulaaupuni Street and the surrounding neighborhood

Using the estimated trip generation and the distribution patterns discussed above, the traffic generated by the proposed project was assigned to the individual turning movements at intersections within the street network. **Figure 6** details the project's trip distribution and trip assignment at each study intersection.

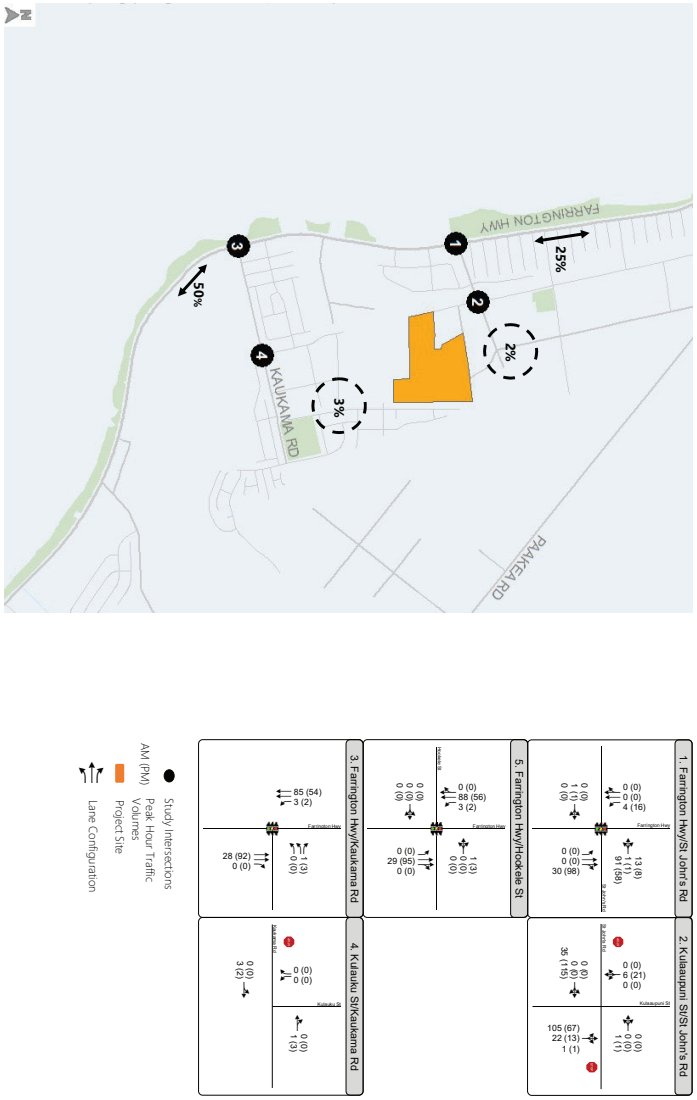


Figure 6
Traffic Volumes and Lane Configurations
Trip Distribution and Assignment

6. Baseline (2028) Plus Project Conditions

This section describes the analysis of potential impacts on the roadway system due to projected future increases in traffic, including traffic generated by the project in 2028. The Baseline (2028) Plus Project roadway network is the same network assumed under the Baseline No Project scenario. The analysis compares the project levels of service (LOS) at each study intersection with and without the addition of project-generated trips to determine potential impacts to the transportation network.

6.1 Baseline (2028) Plus Project Intersection Levels of Service

To forecast the peak hour operating conditions at each study intersection, the project trip assignment was superimposed on Baseline (2028) No Project traffic volumes to yield Baseline (2028) Plus Project volumes.

Figure 7 presents the forecasted Baseline (2028) Plus Project AM and PM peak hour volumes. The peak hour volumes were used to analyze operations using the LOS methodology described in **Section 2.4**. The comparative LOS analysis results for the study intersections under Baseline (2028) Without and With Project conditions are presented in **Table 8**. Detailed LOS results are included in **Appendix B**.

The results presented in **Table 8** indicate that under Baseline (2028) Plus Project conditions, operations at the signalized intersections are largely unchanged with the addition of project-generated traffic, with less than 10 seconds of increased delay at each location and in each peak hour. At the unsignalized intersections, LOS D conditions in the AM peak hour at Kulaaupuni Street/St John's Road would be exacerbated by project traffic with operations for the northbound approach projected to worsen to LOS F.

While the Farrington Highwayy/St John's Road intersection is projected to operate at or above the minimum desired level in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS F), where the 95th percentile queue is expected to extend back to Manuaihue Street. On Farrington Highway, the 95th percentile southbound left-turn queue length is projected to be 100 feet during the PM peak hour, which is the total available turn pocket storage.

6.2 Collision Assessment

The proposed project is not changing the transportation network in the vicinity where crashes occur as discussed in **Section 3.1.4**. While the project will add a small amount of traffic to these facilities where these crashes occurred, the project is not anticipated to change the crash rate. Given that it is not possible to perfectly predict human behavior and random fluctuations in crash locations or frequency, additional factors and influences may obfuscate the effects of the proposed project. This does not constitute, and is not meant to be, a comprehensive review of safety in the study or surrounding area, which could be much broader in scope (e.g., including a review of individual collision records, human factors considerations, and comparisons of the collision rates and frequencies with similar localities).

Table 8: Baseline (2028) Without and With Project Intersection Levels of Service

			Future No Project Conditions			Future Plus Project Conditions			
			Overall Intersection or Worst Movement			Overall Intersection or Worst Movement			
Intersection	Traffic Control	Peak Hour	Delay (sec/veh)[1]	LOS	Worst Movement (for SSSC)	Delay (sec/veh)[1]	LOS	Worst Movement (for SSSC)	Change in Delay (sec/veh)[1]
1. Farrington Hwy/St John's Rd	Signalized	AM	20.4	C		29.6	C		9.2
		PM	18.5	B		24	C		5.5
2. Kulaaupuni St/St John's Rd	SSSC	AM	29.5	D	NBL/T/R	**>120**	**F**	NBL/T/R	**>60**
		PM	13.5	B	NBL/T/R	19.8	C	NBL/T/R	6.3
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.9	A		9.7	A		-0.2
		PM	9.3	A		9.7	A		0.4
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL	15.8	C	SBL	0.1
		PM	21.2	C	SBL	21.4	C	SBL	0.2

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for the signalized intersection. The vehicular delay for the worst movement is reported for the side-street stop-controlled intersection.

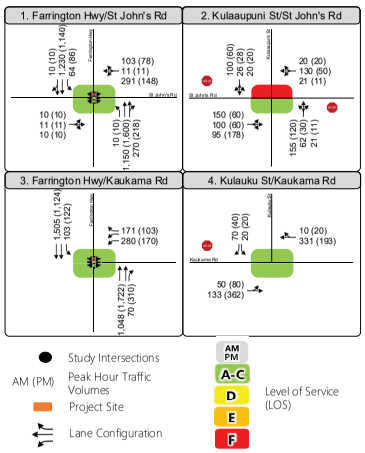


Figure 7
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Plus Project Conditions

6.3 Needed Traffic Improvements

6.3.1 Kulaaupuni St/St John's Road

A multi-way stop will improve operations at Kulaaupuni Street/St John's Road under Baseline (2028) Plus Project conditions. Implementation of this control would result in average vehicle delays of 14.7 seconds in the AM peak hour. While AWSC would add delay to the eastbound and westbound approaches, which currently are uncontrolled movements, this control is not expected to substantially affect operations at adjacent intersections. In addition, the installation of stop signs on all approaches would enhance safety for pedestrians in that all vehicles would be required to stop at this location. Pedestrians crossing St. John's Road trying to get to and from existing neighborhoods and the project site south of this roadway would benefit from all vehicles being controlled at the Kulaaupuni Street intersection.

6.3.2 Farrington Highway/St John's Road

Signal timing modifications at this intersection will improve westbound and southbound left-turn queueing at Farrington Highway/St John's Road. Because signals are likely to be retimed between current conditions and 2028, updated signal timing should consider future increases in traffic to/from St John's Road in the future such that side street queues be reduced without substantially impacting throughput on the highway. The project sponsor should work with HDOT to ensure that updated timing improves westbound operations. For example, reallocating up to 20 seconds of green time from the northbound and southbound through phase to the eastbound and westbound through phase would reduce westbound queues by 100 feet, while still maintaining LOS C overall operations at the intersection. The project sponsor would be responsible for conducting a signal timing study to justify any signal timing modifications and subject to approval by DOT. Unfortunately, adequate right of way on St. John's Road is not available to allow the addition of a second westbound left-turn lane to reduce queues and delays on this approach.

7. Baseline (2028) No Project Conditions with Kulaaupuni Extension

In the future, Kulaaupuni Street is expected to be extended south of the project site, past the Community Learning Center at Maili property, to connect with Kulauku Street. This extension was studied as part of the Community Learning Center development project and is likely to be constructed as part of future development within the overall Voice of America site. Analysis of this scenario with the extension was incorporated in this study to assess operations of study facilities with and without the project for informational purposes only and to be consistent with previous studies.

The following section summarizes the assumptions used to estimate the how traffic patterns will change with the extension and summarizes the operations under Baseline (2028) No Project with Kulaaupuni Extension conditions.

7.1.1 Redistribution of Vehicle Trips

Connecting Kulaaupuni Street to Kulauka Street would provide enhanced neighborhood connectivity by increasing the number of available travel paths and minimizing the need to use Farrington Highway for local trips between adjacent neighborhoods. While some neighborhood trips going north or south on Farrington Highway may use the extension, many of the trips expected to use the facility are to/from the educational facilities, public parks, shops, and other trip generators within the neighborhoods.

Trips were reassigned to the roadway network based on existing peak hour turning movement volumes, existing travel patterns, and available travel paths.

Figure 8 illustrates the forecasted peak hour traffic volumes and lane configurations for Baseline (2028) No Project with Kulaaupuni Extension conditions.

7.2 Baseline (2028) No Project with Kulaaupuni Extension Intersection Levels of Service

Levels of service (LOS) calculations were conducted to evaluate the operating levels of the study intersections under Baseline (2028) No Project conditions with the forecasted growth in traffic. The results of the LOS analysis for the study intersections are presented in **Table 9.** The corresponding LOS calculation sheets are included in **Appendix B**.

The changes in operations from Existing conditions are the result of the addition of ambient traffic growth and the assumed Kulaaupuni Street connection. The analysis results indicate that all intersections will operate at or above the minimum desired overall levels of service. The change in average delay is projected to decrease by approximately one or two seconds from "no extension" conditions at most study

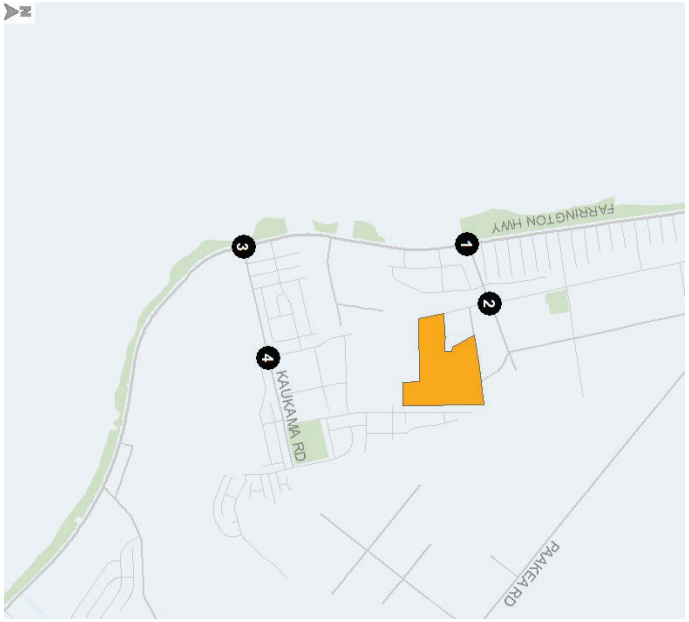
locations. A slight increase in delay is expected at the Farrington Highway/Kaukama Road intersection where some vehicles are expected to divert from the St. John's Road approach.

While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour would continue to be highest on the westbound approach. With the extension, the 95th percentile queue is expected to be reduced to 440 feet, or roughly 80 feet less than under "no extension" conditions.

Table 9: Baseline (2028) with Kulaaupuni Extension Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for SSSC)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	19.0	B	
		PM	16.6	B	
2. Kulaaupuni St/St John's Rd	SSSC	AM	27.8	D	NBL/T/R
		PM	13.1	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	10.3	B	
		PM	9.5	A	
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL
		PM	17.2	C	SBL

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.



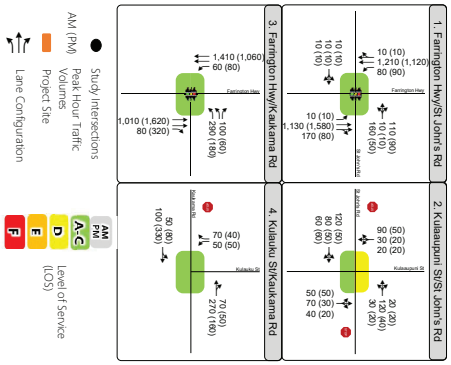


Figure 8
Traffic Volumes, Lane Configurations, and Level of Service
Baseline (2028) Conditions with Kulaaupuni Extension

8. Project Traffic Estimates with Kulaaupuni Extension

This section describes the anticipated assignment of project-generated vehicle trips that would result from extension of Kulaaupuni Street.

Project Trip Assignment with Kulaaupuni Street Extension

The extension of Kulaaupuni Street allows for an alternate route to access the project from the south. Therefore, a majority of project trips to/from the south along Farrington Highway were assigned to use the Kulaaupuni Street extension via Kaukama Road and Hookele Street to access the site.

Figure 9 details the project's trip distribution and trip assignment at each study intersection with the Kulaaupuni Street extension in place.

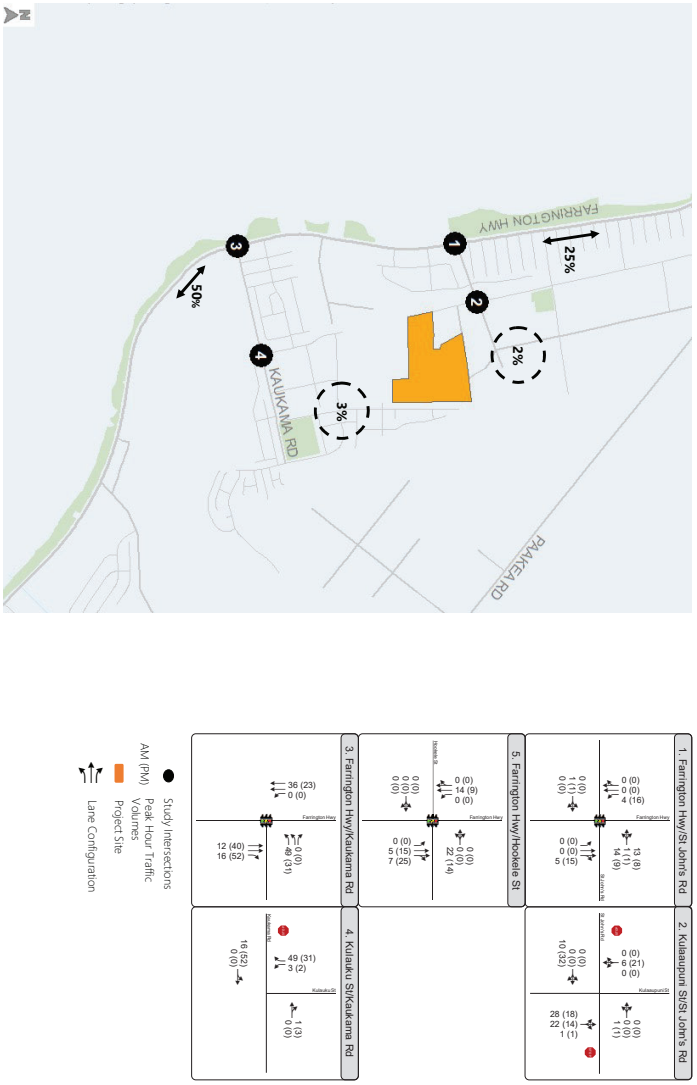


Figure 9
Traffic Volumes and Lane Configurations
Trip Distribution and Assignment with Kulaaupuni Extension

9. Baseline (2028) Plus Project Conditions with Kulaaupuni Extension

This section describes the analysis of potential impacts to the roadway system from the addition of project-generated traffic in 2028 with the proposed Kulaaupuni Road extension in place. The Baseline (2028) Plus Project with Kulaaupuni Extension roadway network is the same network assumed under the Baseline (2028) No Project with Kulaaupuni Extension scenario. The analysis compares the project levels of service (LOS) at each study intersection with and without the addition of project-generated trips to determine potential impacts to the transportation network.

9.1 Baseline (2028) Plus Project with Kulaaupuni Extension Intersection Levels of Service

To forecast the peak hour operating conditions at each study intersection, the project trip assignment was superimposed on Baseline (2028) No Project with Kulaaupuni Extension traffic volumes to yield Baseline (2028) Plus Project with Kulaaupuni Extension volumes.

Figure 10 presents the forecasted Baseline (2028) Plus Project with Kulaaupuni Extension AM and PM peak hour volumes. The peak hour volumes were used to analyze operations using the LOS methodology described in **Section 2.4**. The comparative LOS analysis results for the study intersections under Baseline (2028) No Project and With Project with Kulaaupuni Extension conditions are presented in **Table 10**. Detailed LOS results are included in **Appendix B**.

The results presented in **Table 10** indicate that under Baseline (2028) Plus Project with the Kulaaupuni Extension in place, operations at the signalized intersections are largely unchanged with the addition of project-generated traffic with less than two seconds of increased delay at each location and in each peak hour. Baseline LOS D conditions in the AM peak hour at the Kulaaupuni Street/St John's Road intersection with the extension would be exacerbated by project traffic with operations degrading to LOS E.

While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS D), where the 95th percentile queue is 490 feet.

Figure 10
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Plus Project Conditions with Kulaaupuni Extension

Table 10: Baseline (2028) Without and With Project with Kulaaupuni Extension Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Future No Project w/ Kulaaupuni: Intersection or Worst Movement Delay (sec/veh)[1]	Future No Project w/ Kulaaupuni: Intersection or Worst Movement LOS	Future No Project w/ Kulaaupuni: Worst Movement (for SSSC)	Future Plus Project w/ Kulaaupuni: Intersection or Worst Movement Delay (sec/veh)[1]	Future Plus Project w/ Kulaaupuni: Intersection or Worst Movement LOS	Future Plus Project w/ Kulaaupuni: Worst Movement (for SSSC)	Change in Delay (sec/veh)[1]
1. Farrington Hwy/St John's Rd	Signalized	AM	19	B		20	C		1
		PM	16.6	B		17.6	B		1
2. Kulaaupuni St/St John's Rd	SSSC	AM	27.8	D	NBL/T/R	48	E	NBL/T/R	20.2
		PM	13.1	B	NBL/T/R	15	C	NBL/T/R	1.9
3. Farrington Hwy/Kaukama Rd	Signalized	AM	10.3	B		11.7	B		1.4
		PM	9.5	A		10.6	B		1.1
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL	16.8	C	SBL	1.1
		PM	17.2	C	SBL	30.1	D	SBL	12.9

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for the signalized intersection. The vehicular delay for the worst movement is reported for the side-street stop-controlled intersection.

9.2 Needed Traffic Improvements

9.2.1 Kulaaupuni Street/St John's Road

A multi-way stop would improve operations at Kulaaupuni Street/St. John's Road under Baseline (2028) Plus Project conditions. Implementation of this control would result in average vehicle delays of 12 seconds in the AM peak hour. While AWSC would add delay to the eastbound and westbound approaches, which currently are uncontrolled movements, this control is not expected to substantially affect operations at adjacent intersections. In addition, the installation of stop signs on all approaches would enhance safety for pedestrians in that all vehicles would be required to stop at this location. Pedestrians crossing St. John's Road trying to get to and from existing neighborhoods and the project site south of this roadway would benefit from all vehicles being controlled at the Kulaaupuni Street intersection.

9.2.2 Farrington Highway/St John's Road

Signal timing modifications at this intersection should be made to improve westbound and southbound left-turn queueing at Farrington Highway/St John's Road. Because signals are likely to be retimed between current conditions and 2028, updated signal timing should consider increases in traffic to/from St John's Road in the future such that side street queues can be reduced without substantially impacting throughput on the highway. The project sponsor should work with HDOT to ensure that updated timing improves westbound operations. The project sponsor would be responsible for conducting a signal timing study to justify any signal timing modifications and subject to approval by DOT. Unfortunately, adequate right of way on St. John's Road is not available to allow the addition of a second westbound left-turn lane to reduce queuing and delays on this approach.

10. Site Access, Circulation, and Parking

This chapter includes a review of the site access and on-site circulation for vehicles, bicyclists, and pedestrians, which would also include most transit users. An evaluation of off-site active and transit travel modes is presented in **Section 11**.

10.1 Site Access

As shown in the site plan (**Figure 2**), vehicle access to the site will be provided via Kulaaupuni Street, which would be extended by approximately 400 feet south of its current terminus with Mamoalii Place. The primary mauka-makai on-site roadway intersecting Kulaaupuni Street would be designed as a full-access roadway to accommodate the future extension of Kulaaupuni Street. Turn volumes at this intersection are projected to be low enough such that no dedicated turn pockets are necessary. It is recommended that the westbound approach of the primary on-site roadway will include a stop sign and associated pavement striping at Kulaaupuni Street.

Overall, on-site access is considered to be adequate with the proposed and recommended improvements.

10.2 On-Site Circulation & Parking

On-site vehicular circulation will be provided via a network of residential streets that provide continuous circulation plus one cul-de-sac street on the makai side of the property. In general, the street segments are short enough and through traffic is not an issue such that speed control devices would not be needed. To clearly establish vehicular right of way and to enhance safety, all on-site T-intersections are recommended to include a stop sign and striping on the single approach roadway. Several surrounding neighborhood streets are marked with 15 mph speed limit signs, and this approach could be utilized within the project to encourage drivers to maintain slow speeds within the site.

A parking lot with approximately 300 parking spaces will be provided for the 136 multi-family units. The required parking supply per unit per the Revised Ordinances of Honolulu Section 21-6.30 is two parking spaces per unit, so the proposed supply will exceed the Code's minimum requirement for the multi-family housing buildings.

The 145 single-family lots will have dedicated parking within each parcel, and it is anticipated that on-street parking will be permitted on all internal streets where feasible. Parking should be expressly prohibited near each intersection to provide adequate sight distance of pedestrians and cyclists at these locations.

No substantial circulation or parking issues are anticipated with construction of the proposed project.

11. Multimodal Assessment

This chapter includes a review of multimodal access to the site and circulation for buses, other vehicles, pedestrians, and bicyclists surrounding the site.

11.1 Transit Facilities and Services

As noted in Section 3, transit service is currently provided along Farrington Highway by TheBus. Within the project study area, Routes 40, 93, C, and PH1 provide service along the highway, which will be able to serve project residents, commuters, and visitors of the project site. Some increase in demand to transit is anticipated with implementation of the proposed project, which can be accommodated based on existing service and frequency. Within the project study area, implementation of the proposed project is not expected to conflict with any existing or planned transit service included in the planning documents listed in **Section 2.4.3.** No significant impacts to transit are anticipated to occur with buildout of the proposed project. However, a formal walking path from the site to access transit on the highway is discontinuous.

11.2 Bicycle Facilities

Bicyclists will access the site via the existing roadway network. While these roadways in the study area do not provide separate bicycle facilities, they serve a minimal amount of existing bicycle activity. The project is expected to generate additional bicycle trip demand, but the existing facilities can accommodate these trips from a capacity perspective. Lower speed and lower volume residential streets typically do not have separate bicycle facilities, the final Bike Plan does not include any new bicycle facilities on the roadways immediately adjacent to the project site.

Implementation of the proposed project is not expected to conflict with any existing bikeways or planned bicycle facilities included in the planning documents listed in **Section 2.4.3**. Accordingly, no significant impacts to bicyclists are expected to occur with buildout of the proposed project.

11.3 Pedestrian Facilities

Pedestrians will access the site via existing sidewalks along Kulaaupuni Street, as well as via new sidewalks that the project will install as part of frontage improvements. Roadways internal to the project site are all expected to have sidewalks or formal paths on at least one side of the street.

However, several gaps exist in pedestrian facilities between the site and nearby key intersections and destinations. Specifically, project-generated pedestrians do not have a formal path between the Maili Channel bridge and the St. John's Road intersection to accommodate travel between the site and key destinations such as Maili Elementary School and Community Park, the Leeward Community College Waianae Moku campus, and bus stops on Farrington Highway. An improvement opportunity that could be considered is the development of a formal walking path on the mauka side of Kulaaupuni Street between the bridge and St John's Road. This could be accomplished through installation of a raised curb

along the pavement edge and an asphalt or decomposed granite path to provide an accessible facility (i.e., compliant with the Americans with Disabilities Act (ADA)).

Without the completion of the full Kulaaupuni Street extension, the project site will be isolated from the adjacent neighborhoods located south and mauka of the site including Mokila Street and Kaukama Road. These areas include the Maili Kai Community Park and the Sea Country General Store. To provide access to this area, an improvement opportunity that could be considered is a pedestrian and bicycle connection (i.e., a shared use path) from the southeast corner of the project site to the makai terminus of Laia Street. The path could be located between Lots 24 and 25, for example, and then extend alongside the Sea Country development. This would provide greater connectivity between neighborhoods to the north and south, facilitate bicycle and pedestrian trips, and reduce overall vehicle miles of travel.

Appendix A: Traffic Count Data

FEHR PEERS

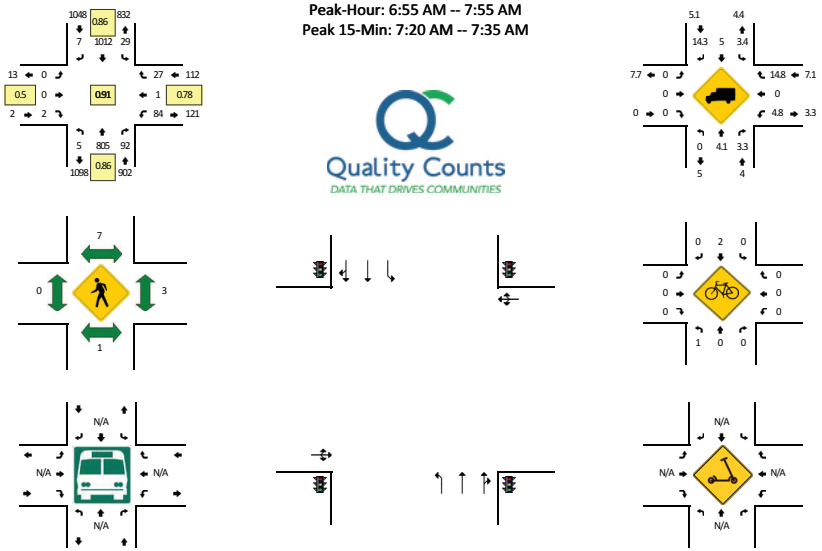
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Farrington Hwy -- Saint Johns Rd
CITY/STATE: Maili, HI

QC JOB #: 15306601
DATE: Tue, Dec 1 2020

Peak-Hour: 6:55 AM -- 7:55 AM
Peak 15-Min: 7:20 AM -- 7:35 AM



5-Min Count Period Beginning At	Farrington Hwy (Northbound)				Farrington Hwy (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	31	3	0	3	91	1	0	0	0	0	0	8	0	0	0	137	
6:05 AM	0	32	2	0	1	129	1	0	0	0	0	0	10	0	2	0	177	
6:10 AM	1	33	5	0	1	88	1	0	1	0	0	0	7	1	1	0	139	
6:15 AM	0	33	1	0	0	99	0	0	0	0	1	0	6	0	4	0	144	
6:20 AM	0	30	1	0	0	97	2	0	0	0	1	0	5	0	1	0	137	
6:25 AM	1	57	2	0	3	78	0	0	0	0	1	0	5	0	4	0	151	
6:30 AM	0	39	2	0	4	92	1	0	1	0	0	0	10	0	0	0	149	
6:35 AM	0	62	3	0	1	109	0	0	1	0	1	0	4	0	1	0	182	
6:40 AM	0	44	5	0	1	83	0	0	0	0	0	0	9	0	5	0	147	
6:45 AM	0	52	7	0	1	92	0	0	0	0	1	0	11	0	2	0	166	
6:50 AM	0	60	4	0	2	70	0	0	0	0	0	0	13	0	6	0	155	
6:55 AM	0	64	5	0	2	89	0	0	0	0	0	0	4	0	0	0	164	1848
7:00 AM	0	57	6	0	3	106	1	0	0	0	0	0	7	0	0	0	180	1891
7:05 AM	0	71	8	0	2	86	0	0	0	0	0	0	9	1	4	0	181	1895
7:10 AM	1	43	2	0	1	105	1	0	0	0	1	0	5	0	2	0	161	1917
7:15 AM	0	57	10	0	0	57	1	0	0	0	0	0	6	0	2	0	133	1906
7:20 AM	0	64	6	0	6	105	1	0	0	0	0	0	8	0	3	0	193	1962
7:25 AM	0	79	6	0	4	84	0	0	0	0	0	0	14	0	2	0	189	2000
7:30 AM	2	85	8	0	1	81	1	0	0	0	0	0	4	0	5	0	187	2038
7:35 AM	0	58	9	0	4	88	0	0	0	0	0	0	4	0	1	0	164	2020
7:40 AM	1	64	12	0	0	65	0	0	0	0	0	0	8	0	4	0	154	2027
7:45 AM	1	81	13	0	3	69	1	0	0	0	1	0	11	0	2	0	182	2043
7:50 AM	0	82	7	0	3	77	1	0	0	0	0	0	4	0	2	0	176	2064
7:55 AM	0	58	8	0	7	77	0	0	0	0	2	0	7	1	3	0	163	2063
8:00 AM	0	43	4	0	2	58	0	0	2	0	1	0	11	0	3	0	124	2007
8:05 AM	0	77	2	0	4	76	0	0	0	0	0	0	4	0	4	0	167	1993
8:10 AM	1	50	4	0	2	74	1	0	0	1	1	0	12	1	4	0	151	1983
8:15 AM	0	57	8	0	3	69	1	0	2	1	0	0	4	0	4	0	149	1999
8:20 AM	0	42	9	0	1	79	0	0	0	0	0	0	6	0	5	0	142	1948
8:25 AM	0	59	3	0	2	89	0	0	0	0	0	0	4	0	6	0	163	1922
8:30 AM	0	55	6	0	2	65	0	0	1	0	1	0	10	0	1	0	141	1876
8:35 AM	0	49	2	0	5	55	0	0	0	0	0	0	7	0	4	0	122	1834
8:40 AM	0	53	8	0	1	69	0	0	3	0	1	0	7	0	4	0	146	1826
8:45 AM	0	62	4	0	3	60	1	0	0	0	0	0	5	0	1	0	136	1780
8:50 AM	0	52	4	0	2	56	0	0	0	0	0	0	5	0	3	0	122	1726
8:55 AM	0	67	2	0	1	78	1	0	0	0	0	0	4	0	3	0	156	1719

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	912	80	0	44	1080	8	0	0	0	0	0	104	0	40	0	2276
Heavy Trucks	0	32	4		4	84	0		0	0	0		0	0	12		136
Buses																	
Pedestrians		0				0				0				8			8
Bicycles	4	0	0		0	0	0		0	0	0		0	0	0		4
Scooters																	

Comments:

Report generated on 12/7/2020 9:53 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Farrington Hwy -- Saint Johns Rd

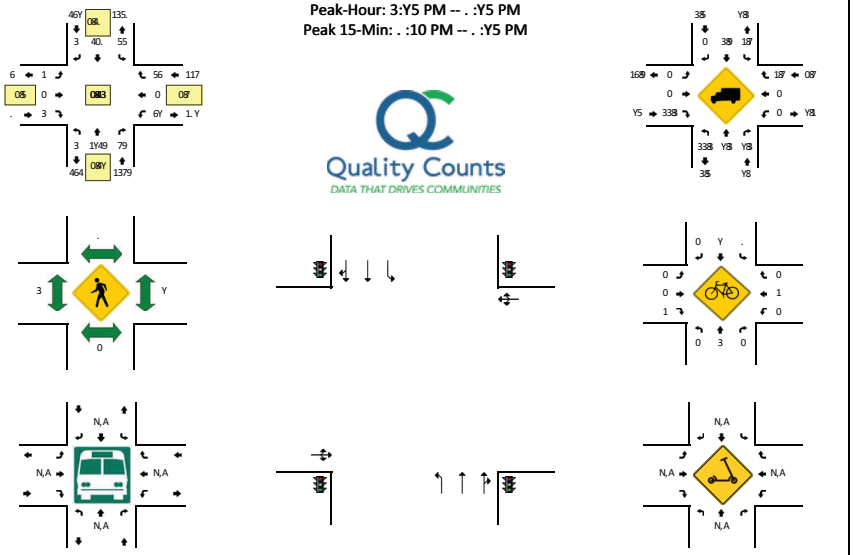
CIT/, STATE: MailiDHI

QC JOB #: 1530660Y

2ATE: TueD2ec 1 Y0Y0

Peak-Hour: 3:Y5 PM -- . :Y5 PM

Peak 15-Min: . :10 PM -- . :Y5 PM



5-Min Count Period Beginning At	Farrington Hwy (Northbound)				Farrington Hwy (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	45	16	0	.	93	0	0	0	0	0	0	5	0	Y	0	145	
3:05 PM	0	76	11	0	Y	43	1	0	1	0	0	0	10	0	9	0	Y11	
3:10 PM	0	130	5	0	.	10Y	0	0	0	0	0	0	11	0	.	0	Y56	
3:15 PM	0	4.	1Y	0	9	96	0	0	0	0	0	0	.	0	.	0	149	
3:Y0 PM	0	91	3	0	3	6.	1	0	0	0	0	0	6	0	3	0	151	
3:Y5 PM	0	113	3	0	3	7.	0	0	0	0	0	0	9	0	Y	0	Y1Y	
3:30 PM	0	103	7	0	.	97	0	0	0	0	0	0	7	0	7	0	Y04	
3:35 PM	0	1YY	5	0	.	70	0	0	1	0	1	0	5	0	9	0	YY5	
3:. 0 PM	0	107	7	0	5	99	0	0	0	0	0	0	.	0	Y	0	Y0.	
3:. 5 PM	0	104	11	0	.	90	0	0	0	0	0	0	Y	0	3	0	144	
3:50 PM	0	49	1.	0	3	67	0	0	0	0	0	0	4	0	.	0	145	
3:55 PM	0	104	5	0	.	93	1	0	0	0	0	0	.	0	5	0	Y01	Y. 55
. :00 PM	0	100	9	0	3	63	0	0	0	0	0	0	3	0	6	0	17Y	Y. . Y
. :05 PM	1	70	7	0	5	97	1	0	0	0	0	0	3	0	6	0	17Y	Y. 13
. :10 PM	1	1Y5	9	0	13	7.	1	0	0	0	Y	0	5	0	Y	0	Y. 0	Y349
. :15 PM	1	1Y7	4	0	.	64	0	0	0	0	0	0	5	0	9	0	YY3	Y. Y3
. :Y0 PM	0	103	Y	0	3	70	0	0	0	0	0	0	9	0	.	0	144	Y. 91
. :Y5 PM	0	79	6	0	5	50	0	0	0	0	0	0	3	0	1	0	15Y	Y. 11
. :30 PM	1	105	9	0	6	7Y	Y	0	0	0	0	0	3	0	Y	0	Y07	Y. 10
. :35 PM	0	11Y	6	0	5	74	1	0	0	1	0	0	.	0	1	0	Y14	Y. 0.
. :. 0 PM	0	107	10	0	3	69	1	0	1	0	0	0	10	0	.	0	Y0.	Y. 0.
. :. 5 PM	0	114	1.	0	Y	56	1	0	0	0	1	0	9	0	3	0	Y03	Y. 07
. :50 PM	1	79	1.	0	5	69	0	0	1	0	1	0	9	1	3	0	179	Y. 00
. :55 PM	0	77	9	0	1	69	0	0	0	0	0	0	7	0	9	0	197	Y399
5:00 PM	0	110	9	0	Y	56	0	0	0	0	0	0	4	1	.	0	174	Y37.
5:05 PM	Y	47	1Y	0	5	75	0	0	0	0	0	0	5	0	3	0	Y10	Y. 1Y
5:10 PM	3	44	11	0	3	67	1	0	1	0	1	0	11	1	3	0	Y0Y	Y39.
5:15 PM	0	109	.	0	Y	93	0	0	1	1	1	0	9	0	5	0	Y01	Y35Y
5:Y0 PM	0	4Y	7	0	Y	59	0	0	0	0	1	0	15	0	5	0	170	Y333
5:Y5 PM	0	1. 6	4	0	1	56	1	0	0	0	0	0	9	1	3	0	YY.	Y. 05
5:30 PM	1	77	9	0	Y	55	0	0	1	1	1	0	.	0	9	0	169	Y36.
5:35 PM	Y	44	6	0	6	6Y	1	0	0	0	0	0	7	0	9	0	141	Y336
5:. 0 PM	0	107	11	0	.	6Y	0	0	1	0	0	0	.	0	5	0	145	Y3Y9
5:. 5 PM	0	131	3	0	.	53	0	0	0	0	0	0	0	0	Y	0	143	Y319
5:50 PM	1	79	11	0	4	59	1	0	0	0	0	0	.	0	1	0	191	Y301
5:55 PM	0	100	9	0	5	. 0	0	0	0	0	0	0	5	0	3	0	160	YY73

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	7	1. Y.	9Y	0	70	43Y	.	0	0	0	7	0	67	0	5Y	0	Y6. 7
Heavy Trucks	.	Y0	0		.	. 0	0		0	0	.		0	0	0		9Y
Buses																	
Pedestrians		0				.				.				0			7
Bicycles	0	1Y	0		0	.	0		0	0	0		0	0	0		16
Scooters																	

Comments:

Report generated on 1Y, 9, Y0Y0 4:53 AM

SOURCE: Quality CountsDLLC (http:, , www8qualitycounts8net) 1-799-570-YY1Y

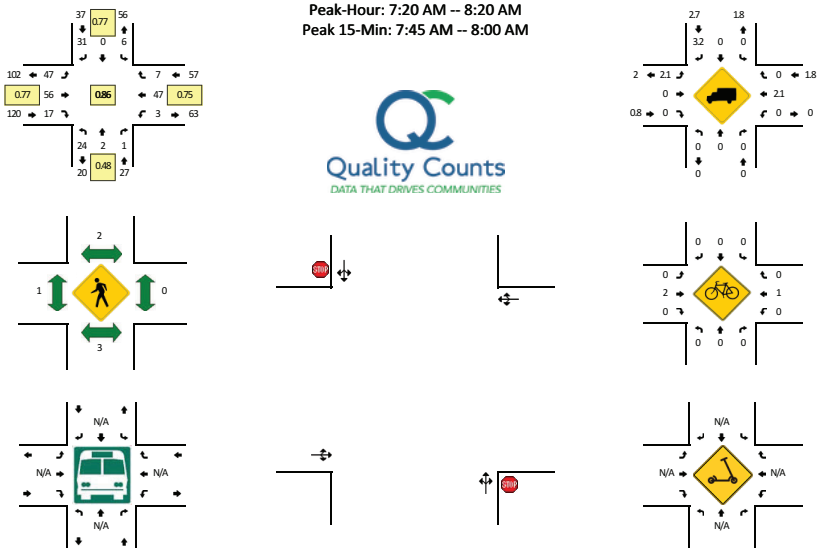
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulaaupuni St -- Saint Johns Rd
CITY/STATE: Maili, HI

QC JOB #: 15306603
DATE: Tue, Dec 1 2020

Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:45 AM -- 8:00 AM



5-Min Count Period Beginning At	Kulaaupuni St (Northbound)				Kulaaupuni St (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	1	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	5	
6:05 AM	6	0	0	0	0	0	4	0	2	3	1	0	0	3	0	0	19	
6:10 AM	2	0	0	0	0	1	1	0	2	0	0	0	0	1	0	0	7	
6:15 AM	4	0	0	0	0	0	0	0	4	1	0	0	0	2	0	0	11	
6:20 AM	1	0	0	0	0	0	4	0	1	0	0	0	0	2	0	0	8	
6:25 AM	1	0	0	0	0	0	1	0	1	1	0	0	0	3	0	0	7	
6:30 AM	0	0	0	0	0	0	3	0	1	1	3	0	0	1	0	0	9	
6:35 AM	2	1	0	0	0	0	4	0	2	0	0	0	0	3	0	0	12	
6:40 AM	5	0	0	0	0	0	0	0	4	2	1	0	0	2	0	0	14	
6:45 AM	3	0	0	0	0	1	2	0	4	2	0	0	0	4	0	0	16	
6:50 AM	3	0	0	0	1	0	5	0	4	0	2	0	0	6	0	0	21	
6:55 AM	2	1	0	0	0	0	2	0	4	2	0	0	0	2	0	0	13	142
7:00 AM	0	0	0	0	0	1	4	0	1	5	2	0	0	2	0	0	15	152
7:05 AM	3	2	0	0	1	1	1	0	6	6	0	0	0	4	0	0	24	157
7:10 AM	1	0	0	0	0	0	2	0	8	2	1	0	0	4	0	0	18	168
7:15 AM	0	0	0	0	0	0	2	0	1	2	0	0	0	0	1	0	6	163
7:20 AM	3	0	0	0	0	0	1	0	4	4	1	0	0	5	0	0	18	173
7:25 AM	8	1	0	0	1	0	3	0	2	4	1	0	0	6	0	0	26	192
7:30 AM	1	0	1	0	1	0	1	0	7	7	2	0	0	2	0	0	22	205
7:35 AM	2	0	0	0	0	0	1	0	5	5	1	0	0	2	2	0	18	211
7:40 AM	0	0	0	0	0	0	4	0	6	3	0	0	0	3	0	0	16	213
7:45 AM	1	1	0	0	1	0	4	0	6	7	3	0	2	2	1	0	28	225
7:50 AM	2	0	0	0	0	0	3	0	6	6	0	0	1	3	0	0	21	225
7:55 AM	2	0	0	0	1	0	2	0	5	4	2	0	0	5	0	0	21	233
8:00 AM	0	0	0	0	0	0	2	0	2	7	2	0	0	2	2	0	17	235
8:05 AM	0	0	0	0	1	0	6	0	0	4	1	0	0	7	1	0	20	231
8:10 AM	3	0	0	0	1	0	2	0	1	2	2	0	0	7	0	0	18	231
8:15 AM	2	0	0	0	0	0	2	0	3	3	2	0	0	3	1	0	16	241
8:20 AM	4	0	0	0	0	0	1	0	4	4	2	0	0	1	2	0	18	241
8:25 AM	3	0	0	0	0	0	0	0	3	4	2	0	0	4	0	0	16	231
8:30 AM	2	1	1	0	0	0	4	0	0	3	1	0	0	7	0	0	19	228
8:35 AM	1	0	0	0	1	0	0	0	2	4	1	0	1	5	0	0	15	225
8:40 AM	4	0	0	0	0	3	2	0	1	3	2	0	0	4	0	0	19	228
8:45 AM	3	1	0	0	0	0	1	0	4	2	1	0	0	0	1	0	13	213
8:50 AM	3	1	0	0	0	1	3	0	0	4	0	0	0	2	0	0	14	206
8:55 AM	1	0	0	0	0	0	0	0	2	4	1	0	0	1	0	0	9	194

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	4	0	0	8	0	36	0	68	68	20	0	12	40	4	0	280
Heavy Trucks	0	0	0		0	0	0		4	0	0		0	4	0		8
Buses																	
Pedestrians		0				8				4				0			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 12/7/2020 9:53 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

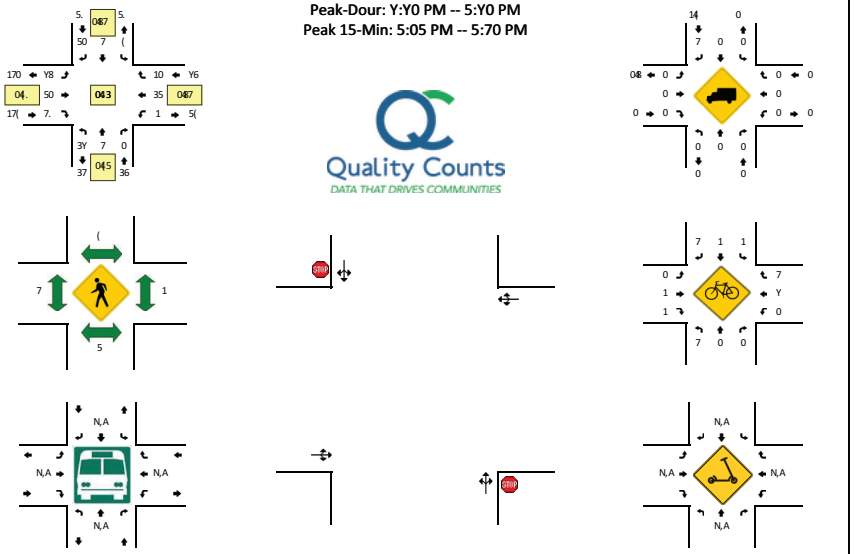
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulaaupuni St -- Saint Johns Rd
CIT/, STATE: MailiHDI

QC JOB #: 1530660Y
2ATE: TueH2 ec 1 7070

Peak-Dour: Y:Y0 PM -- 5:Y0 PM
Peak 15-Min: 5:05 PM -- 5:70 PM



5-Min Count Period Beginning At	Kulaaupuni St)NorthboundW				Kulaaupuni St)SouthboundW				Saint Johns Rd)EastboundW				Saint Johns Rd)U estboundW				Total	Dourly Totals
	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9		
3:00 PM	3	0	0	0	0	0	7	0	Y	6	7	0	0	0	0	0	1(	
3:05 PM	7	0	0	0	1	0	7	0	6	Y	7	0	0	8	1	0	76	
3:10 PM	Y	1	0	0	0	1	5	0	3	7	7	0	0	5	1	0	7Y	
3:15 PM	3	0	0	0	0	0	Y	0	3	7	7	0	0	7	1	0	1(	
3:70 PM	7	0	0	0	0	0	Y	0	8	5	Y	0	0	3	0	0	76	
3:75 PM	1	0	0	0	0	0	6	0	1	Y	1	0	1	1	1	0	16	
3:30 PM	5	0	0	0	0	0	5	0	1	1	7	0	0	Y	1	0	1.	
3:35 PM	7	7	0	0	1	1	1	0	1	3	1	0	0	7	0	0	1Y	
3:Y0 PM	7	1	0	0	0	0	7	0	1	Y	5	0	0	1	7	0	18	
3:Y5 PM	7	1	0	0	0	7	1	0	7	3	7	0	0	7	1	0	16	
3:50 PM	1	1	0	0	0	0	5	0	5	(	6	0	0	3	0	0	78	
3:55 PM	1	3	0	0	1	0	1	0	1	8	7	0	0	Y	7	0	73	7YY
Y:00 PM	7	1	0	0	0	0	7	0	3	7	7	0	0	6	1	0	1.	7Y6
Y:05 PM	1	7	0	0	0	0	5	0	1	5	7	0	0	7	0	0	18	738
Y:10 PM	0	1	0	0	1	0	3	0	3	7	7	0	0	Y	0	0	16	730
Y:15 PM	1	0	0	0	0	0	Y	0	7	(	Y	0	0	1	1	0	70	733
Y:70 PM	0	0	0	0	0	0	1	0	5	7	7	0	0	7	1	0	13	770
Y:75 PM	7	1	0	0	0	1	1	0	0	3	7	0	0	5	0	0	15	71.
Y:30 PM	0	1	0	0	0	1	7	0	3	3	3	0	0	1	0	0	1Y	71Y
Y:35 PM	0	0	0	0	0	1	7	0	Y	7	Y	0	0	7	1	0	16	716
Y:Y0 PM	5	1	0	0	1	0	8	0	1	7	7	0	0	Y	0	0	7Y	777
Y:Y5 PM	Y	0	0	0	0	0	7	0	3	5	Y	1	0	3	0	0	77	778
Y:50 PM	7	0	0	0	0	0	3	0	6	5	1	0	0	3	1	0	71	771
Y:55 PM	7	0	0	0	0	0	Y	0	5	8	1	0	0	0	1	0	71	71.
5:00 PM	1	0	0	0	0	0	3	0	Y	3	3	0	0	6	0	0	70	770
5:05 PM	3	0	0	0	1	0	(	0	7	3	7	0	0	7	7	0	77	77Y
5:10 PM	3	0	0	0	1	0	7	0	(	(	6	0	0	1	0	0	7(	735
5:15 PM	3	0	0	0	0	0	7	0	5	Y	Y	0	0	5	0	0	73	738
5:70 PM	Y	1	0	0	1	0	6	0	1	Y	1	0	0	3	1	0	77	7Y(
5:75 PM	Y	0	0	0	0	0	(	0	5	1	3	0	1	1	0	0	77	75Y
5:30 PM	1	0	0	0	1	0	3	0	Y	Y	0	0	0	1	5	0	1.	75.
5:35 PM	7	0	0	0	7	7	3	0	Y	Y	7	0	0	6	0	0	75	768
5:Y0 PM	7	0	0	0	0	0	7	0	Y	6	3	1	0	7	1	0	71	765
5:Y5 PM	1	1	0	0	1	0	7	0	7	Y	3	0	0	3	0	0	1(	760
5:50 PM	Y	0	0	0	1	0	3	0	5	0	7	0	0	1	1	0	1(	756
5:55 PM	7	0	0	0	0	0	0	0	(	6	5	0	0	7	0	0	77	75(

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	
All Vehicles	36	0	0	0	8	0	YY	0	56	56	Y8	0	0	37	8	0	788
Deavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Buses																	
Pedestrians		Y				70				8				0			37
Bicycles	0	0	0		0	0	0		0	0	Y		0	0	0		Y
Scooters																	

Comments:

Report generated on 17, (, 7070 . :53 AM

SO9 RCE: Quality CountsHLLC)http:, , www4qualitycounts4netW1-8((-580-7717

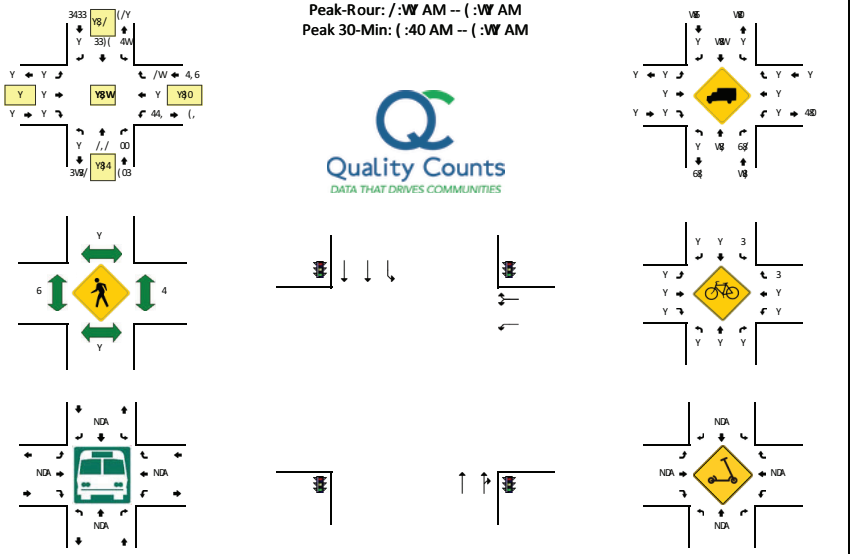
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kaukama Sd -- Jarrington RQy
CITHD2TATE: Maili7RI

BC #O1 5: 306Y//Y,
. ATE: Tue7. ec 3 4Y4Y

Peak-Rour: /:WY AM -- (:WY AM
Peak 30-Min: (:40 AM -- (:WY AM



0-Min Count Period 1eginning At	Kaukama Sd UNorthbound9				Kaukama Sd U2outhbound9				Jarrington RQy UEastbound9				Jarrington RQy UF estbound9				Total	Rourly Totals
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w		
/:YY AM	Y	66	W	Y	3	, 4	Y	Y	Y	Y	Y	Y	3(	Y	3	Y	3W	
/:Y0 AM	Y	40	4	Y	4	330	Y	Y	Y	Y	Y	Y	3/	Y	W	Y	3/ W	
/:3Y AM	Y	66	4	Y	4	36(	Y	Y	Y	Y	Y	Y	6Y	Y	Y	Y	4YW	
/:30 AM	Y	6Y	6	Y	3	33/	Y	Y	Y	Y	Y	Y	4/	Y	3	Y	3((	
/:4Y AM	Y	WY	6	Y	W	, 4	Y	Y	Y	Y	Y	Y	40	Y	6	Y	3/ (	
/:40 AM	Y	/Y	/	Y	Y	344	Y	Y	Y	Y	Y	Y	30	Y	W	Y	4Y(	
/:6Y AM	Y	6/	4	Y	Y	3Y3	Y	Y	Y	Y	Y	Y	30	Y	W	Y	30)	
/:60 AM	Y	04	0	Y	4	, ,	Y	Y	Y	Y	Y	Y	43	Y	W	Y	3) 6	
/:WY AM	Y	W	W	Y	6	34Y	Y	Y	Y	Y	Y	Y	3)	Y	4	Y	3, 6	
/:W0 AM	Y	W6	W	Y	3	, W	Y	Y	Y	Y	Y	Y	3W	Y	4	Y	30)	
/:0Y AM	Y	W8	4	Y	Y	,)	Y	Y	Y	Y	Y	Y	4W	Y	0	Y	3(Y	
/:00 AM	Y	(0	/	Y	3	, 6	Y	Y	Y	Y	Y	Y	46	Y	6	Y	4Y3	436Y
(:YY AM	Y	/,	/	Y	4	3YY	Y	Y	Y	Y	Y	Y	4)	Y	6	Y	4Y)	43, Y
(:Y0 AM	Y	06	6	Y	4	3YY	Y	Y	Y	Y	Y	Y	4Y	Y	6	Y	3) 3	44Y(
(:3Y AM	Y	64	Y	Y	4	3YW	Y	Y	Y	Y	Y	Y	33	Y	0	Y	30W	430(
(:30 AM	Y	0,	/	Y	W	3Y6	Y	Y	Y	Y	Y	Y	4Y	Y	0	Y	3, (	43((
(:4Y AM	Y	(3	/	Y	3	, W	Y	Y	Y	Y	Y	Y	30	Y	(	Y	3, W	44YW
(:40 AM	Y	/(	(	Y	4	) 0	Y	Y	Y	Y	Y	Y	4Y	Y	36	Y	3, W	43, 3
(:6Y AM	Y	(0	W	Y	6	3Y6	Y	Y	Y	Y	Y	Y	3/	Y	,	Y	43Y	44W6
(:60 AM	Y	/0	(	Y	6	, 6	Y	Y	Y	Y	Y	Y	4Y	Y	(	Y	3, 0	4400
(:WY AM	Y	/0	W	Y	Y	) 6	Y	Y	Y	Y	Y	Y	34	Y	(	Y	3(3	4466
(:W0 AM	Y	) 4	(	Y	4	W	Y	Y	Y	Y	Y	Y	44	Y	(	Y	3/ (	44W4
(:0Y AM	Y	0Y	(	Y	W	, Y	Y	Y	Y	Y	Y	Y	3/	Y	6	Y	3(Y	44W4
(:00 AM	Y	00	36	Y	4	( )	Y	Y	Y	Y	Y	Y	,	Y	W	Y	3/ 3	44Y4
) :YY AM	Y	WW	33	Y	0	/)	Y	Y	Y	Y	Y	Y	4/	Y	0	Y	30,	4306
) :Y0 AM	Y	//	(	Y	(	(/	Y	Y	Y	Y	Y	Y	3(	Y	)	Y	3) 3	4306
) :3Y AM	Y	04	33	Y	(	(6	Y	Y	Y	Y	Y	Y	4W	Y	W	Y	3(3	43(Y
) :30 AM	Y	//	(	Y	0	(6	Y	Y	Y	Y	Y	Y	3)	Y	0	Y	3(W	43W
) :4Y AM	Y	0(	/	Y	0	) (	Y	Y	Y	Y	Y	Y	44	Y	W	Y	3) 3	436W
) :40 AM	Y	W6	0	Y	0	, /	Y	Y	Y	Y	Y	Y	36	Y	6	Y	3/ 0	43Y0
) :6Y AM	Y	0W	3	Y	W	(Y	Y	Y	Y	Y	Y	Y	3(	Y	4	Y	3W	4YW6
) :60 AM	Y	0W	0	Y	0	/ 3	Y	Y	Y	Y	Y	Y	3)	Y	)	Y	303	3, , ,
) :WY AM	Y	W	W	Y	0	) 3	Y	Y	Y	Y	Y	Y	)	Y	)	Y	30W	3,) 4
) :W0 AM	Y	0)	33	Y	6	) 4	Y	Y	Y	Y	Y	Y	34	Y	W	Y	3(Y	3,) 0
) :0Y AM	Y	W	W	Y	/	06	Y	Y	Y	Y	Y	Y	)	Y	W	Y	34W	3, 6,
) :00 AM	Y	/4	(	Y	4	/)	Y	Y	Y	Y	Y	Y	3Y	Y	,	Y	30)	3, 6/

Peak 30-Min J loQrates	Northbound				2outhbound				Eastbound				F estbound				Total
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	
All Vehicles	Y	) 4)	(4	Y	64	334W	Y	Y	Y	Y	Y	Y	44W	Y	33/	Y	46, /
Reavy Trucks	Y	4W	Y		Y	/Y	Y		Y	Y	Y		Y	Y	Y		) W
1uses																	
Pedestrians		Y				Y				Y				Y			Y
1icycles	Y	Y	Y		Y	Y	Y		Y	Y	Y		Y	Y	Y		Y
2cooters																	

Comments:

Seport generated on 34D(D4Y4Y , :06 AM

2OwSCE: B uality Counts7LLC Uhttp:DDQQQ8quality counts8 het93-) ((-0) Y-4434

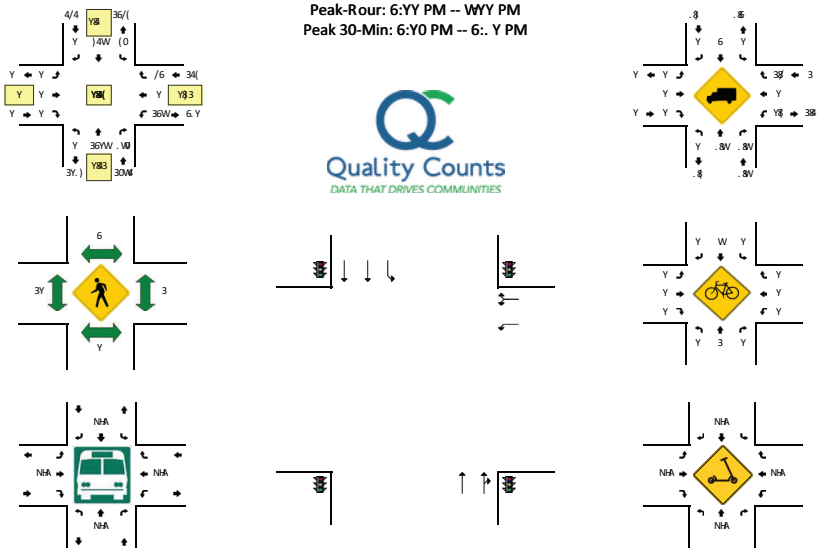
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kaukama Sd -- Jarrington RQy
CIT, HDTATE: Maili2RI

BC #O1 5: 306Y//3Y
7ATE: Tue27ec 3 . Y. Y

Peak-Rour: 6:YY PM -- WYY PM
Peak 30-Min: 6:Y0 PM -- 6:. Y PM



0-Min Count Period 1eginning At	Kaukama Sd UNorthbound9				Kaukama Sd UDouthbound9				Jarrington RQy UEastbound9				Jarrington RQy UF estbound9				Total	Rourly Totals
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w		
6:YY PM	Y	4/	3W	Y	3Y	/(	Y	Y	Y	Y	Y	Y	3.	Y	(	Y	. Y/	
6:Y0 PM	Y	33W	. W	Y	6	))	Y	Y	Y	Y	Y	Y	)	Y	0	Y	. W	
6:3Y PM	Y	3YW	33	Y	0	).	Y	Y	Y	Y	Y	Y	36	Y	(	Y	. . .	
6:30 PM	Y	33Y	. 3	Y	6	) 0	Y	Y	Y	Y	Y	Y	36	Y	W	Y	. 6/	
6:. Y PM	Y	44	. .	Y	(	)/	Y	Y	Y	Y	Y	Y	. Y	Y	W	Y	. 6)	
6:. 0 PM	Y	3YW	3)	Y	6	) Y	Y	Y	Y	Y	Y	Y	3.	Y	0	Y	. . .	
6:6Y PM	Y	3Y/	. .	Y	/	( )	Y	Y	Y	Y	Y	Y	)	Y	/	Y	. . /	
6:60 PM	Y	333	. 3	Y	4	(6	Y	Y	Y	Y	Y	Y	3.	Y	/	Y	. 6.	
6:W PM	Y	3Y)	3(	Y	4	(0	Y	Y	Y	Y	Y	Y	/	Y	W	Y	. 34	
6:W0 PM	Y	3. .	. /	Y	6	0(	Y	Y	Y	Y	Y	Y	3.	Y	W	Y	. . W	
6:0Y PM	Y	3Y)	63	Y	)	/3	Y	Y	Y	Y	Y	Y	33	Y	)	Y	. . (	
6:00 PM	Y	3. .	3)	Y	4	/.	Y	Y	Y	Y	Y	Y	(	Y	6	Y	. . 3	. (30
WYY PM	Y	40	. (	Y	0	/.	Y	Y	Y	Y	Y	Y	(	Y	/	Y	. Y.	. (33
WY0 PM	Y	(4	. 4	Y	6	06	Y	Y	Y	Y	Y	Y	3(	Y	W	Y	3) 0	. / 0W
W3Y PM	Y	3Y4	. 0	Y	/	(6	Y	Y	Y	Y	Y	Y	36	Y	6	Y	. . 4	. / / 3
W30 PM	Y	36/	34	Y	0	/Y	Y	Y	Y	Y	Y	Y	3Y	Y	0	Y	. 60	. / / Y
W. Y PM	Y	33(	. 3	Y	0	(6	Y	Y	Y	Y	Y	Y	0	Y	/	Y	. . (	. / W4
W. 0 PM	Y	3Y3	. (	Y	0	(.	Y	Y	Y	Y	Y	Y	4	Y	0	Y	. 34	. / W
W6Y PM	Y	3Y/	34	Y	(	0Y	Y	Y	Y	Y	Y	Y	/	Y	36	Y	. Y3	. / . 3
W60 PM	Y	3YW	36	Y	W	) 6	Y	Y	Y	Y	Y	Y	(	Y	(	Y	. 3)	. / Y(
WW PM	Y	33W	. .	Y	.	) (	Y	Y	Y	Y	Y	Y	36	Y	W	Y	. W	. / 6Y
WW0 PM	Y	33/	6Y	Y	W	W	Y	Y	Y	Y	Y	Y	/	Y	.	Y	. YW	. / 3Y
W0Y PM	Y	4(	. 3	Y	3	(3	Y	Y	Y	Y	Y	Y	/	Y	(	Y	. Y6	. 0) /
W00 PM	Y	33.	. (	Y	W	W	Y	Y	Y	Y	Y	Y	/	Y	W	Y	. Y3	. 0 / /
0:YY PM	Y	3Y4	. /	Y	0	(Y	Y	Y	Y	Y	Y	Y	/	Y	0	Y	. . 3	. 0) 0
0:Y0 PM	Y	33.	. 3	Y	W	04	Y	Y	Y	Y	Y	Y	/	Y	/	Y	. Y)	. / Y)
0:3Y PM	Y	3YW	3/	Y	3Y	(.	Y	Y	Y	Y	Y	Y	6	Y	4	Y	. 3W	. 046
0:30 PM	Y	3Y.	6W	Y	3.	/ /	Y	Y	Y	Y	Y	Y	3.	Y	33	Y	. 6(	. 040
0:. Y PM	Y	3Y6	63	Y	4	/6	Y	Y	Y	Y	Y	Y	3W	Y	)	Y	. .)	. 04/
0:. 0 PM	Y	3. .	. .	Y	(	0/	Y	Y	Y	Y	Y	Y	33	Y	)	Y	. . /	. / Y6
0:6Y PM	Y	3Y)	34	Y	0	/.	Y	Y	Y	Y	Y	Y	4	Y	)	Y	. 33	. / 36
0:60 PM	Y	334	34	Y	0	0/	Y	Y	Y	Y	Y	Y	/	Y	6	Y	. Y)	. / Y6
0:W PM	Y	3. 4	. .	Y	(	W4	Y	Y	Y	Y	Y	Y	)	Y	6	Y	. 3)	. 0(4
0:W0 PM	Y	36Y	66	Y	6	06	Y	Y	Y	Y	Y	Y	W	Y	(	Y	. 6Y	. / Y0
0:0Y PM	Y	4(	. 0	Y	/	0.	Y	Y	Y	Y	Y	Y	0	Y	)	Y	346	. 040
0:00 PM	Y	4/	. W	Y	0	W	Y	Y	Y	Y	Y	Y	3Y	Y	/	Y	3) 6	. 0((

Peak 30-Min J loQrates	Northbound				Douthbound				Eastbound				F estbound				Total
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	
All Vehicles	Y	363.	. . W	Y	WW	3Y. Y	Y	Y	Y	Y	Y	Y	36/	Y	/ W	Y	.) YY
Reavy Trucks	Y	6.	Y		Y	6/	Y		Y	Y	Y		Y	Y	Y		/)
1uses																	
Pedestrians		Y				W				W				W			3.
1icycles	Y	Y	Y		Y	Y	Y		Y	Y	Y		Y	Y	Y		Y
Dcooters																	

Comments:

Seport generated on 3. H(H Y. Y 4:06 AM

DOwSCE: Buality Counts2LLC Uhttp:HQ.QQ8quality counts8net93-) ((-0) Y-. . 3.

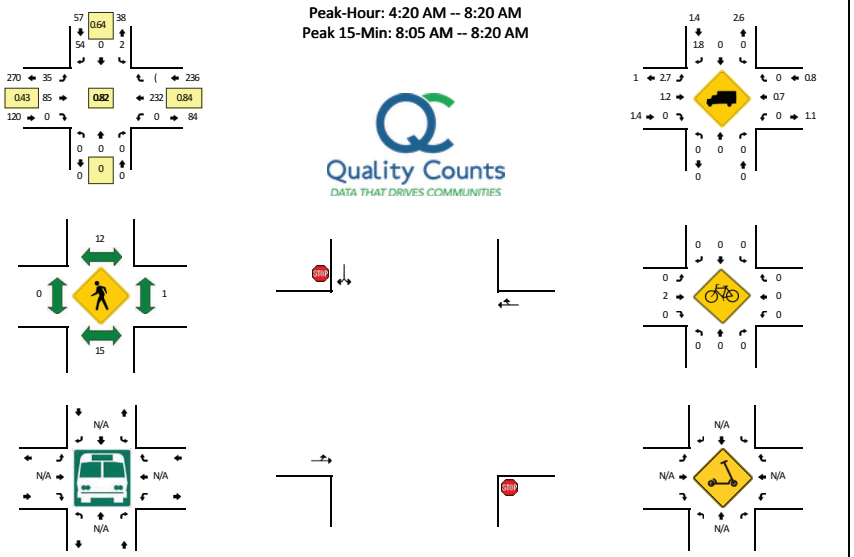
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulauku St -- Kaukama J d
CITY/STATE: Maili, HI

R C QDB #: 15306611
DATE: Tue, Dec 1 2020

Peak-Hour: 4:20 AM -- 8:20 AM
Peak 15-Min: 8:05 AM -- 8:20 AM



5-Min Count Period Beginning At	Kulauku St)NorthboundW				Kulauku St)SouthboundW				Kaukama J d)EastboundW				Kaukama J d)U estboundW				Total	Hourly Totals
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9		
6:00 AM	0	0	0	0	0	0	1	0	0	3	0	0	0	1(	0	0	18	
6:05 AM	0	0	0	0	0	0	5	0	1	3	0	0	0	18	0	0	24	
6:10 AM	0	0	0	0	1	0	(	0	0	3	0	0	0	31	1	0	(0	
6:15 AM	0	0	0	0	0	0	(	0	1	2	0	0	0	13	0	0	20	
6:20 AM	0	0	0	0	0	0	2	0	1	4	0	0	0	20	0	0	30	
6:25 AM	0	0	0	0	0	0	5	0	1	(	0	0	0	20	1	0	31	
6:30 AM	0	0	0	0	0	0	(	0	1	1	0	0	0	16	0	0	22	
6:35 AM	0	0	0	0	1	0	6	0	1	3	0	0	0	17	0	0	30	
6:(0 AM	0	0	0	0	0	0	(	0	1	8	0	0	0	1(	0	0	24	
6:(5 AM	0	0	0	0	0	0	(	0	0	3	0	0	0	14	1	0	25	
6:50 AM	0	0	0	0	0	0	(	0	0	2	0	0	0	18	0	0	2(	
6:55 AM	0	0	0	0	0	0	(	0	2	5	0	0	0	17	0	0	30	32(
4:00 AM	0	0	0	0	1	0	6	0	1	5	0	0	0	26	0	0	37	3(5
4:05 AM	0	0	0	0	0	0	2	0	0	3	0	0	0	15	0	0	20	338
4:10 AM	0	0	0	0	0	0	(	0	1	1	0	0	0	20	0	0	26	32(
4:15 AM	0	0	0	0	0	0	2	0	0	8	0	0	0	22	0	0	32	336
4:20 AM	0	0	0	0	0	0	2	0	3	5	0	0	0	20	0	0	30	336
4:25 AM	0	0	0	0	0	0	(	0	3	(	0	0	0	21	0	0	32	334
4:30 AM	0	0	0	0	0	0	5	0	0	6	0	0	0	23	0	0	3(	3(7
4:35 AM	0	0	0	0	0	0	4	0	2	10	0	0	0	2(	0	0	(3	362
4:(0 AM	0	0	0	0	0	0	(	0	1	2	0	0	0	20	0	0	24	362
4:(5 AM	0	0	0	0	0	0	8	0	(	5	0	1	0	14	1	0	36	343
4:50 AM	0	0	0	0	0	0	1	0	(	4	0	0	0	11	0	0	23	342
4:55 AM	0	0	0	0	1	0	2	0	4	5	0	0	0	16	0	0	31	343
8:00 AM	0	0	0	0	0	0	3	0	(	7	0	0	0	15	1	0	32	366
8:05 AM	0	0	0	0	0	0	7	0	2	10	0	0	0	25	2	0	(8	37(
8:10 AM	0	0	0	0	0	0	6	0	3	13	0	0	0	21	0	0	(3	(11
8:15 AM	0	0	0	0	1	0	6	0	1	7	0	0	0	17	0	0	36	(15
8:20 AM	0	0	0	0	0	0	1	0	(	7	0	0	0	16	0	0	30	(15
8:25 AM	0	0	0	0	0	0	6	0	3	8	0	0	0	11	0	0	28	(11
8:30 AM	0	0	0	0	0	0	8	0	0	(	0	0	0	13	1	0	26	(03
8:35 AM	0	0	0	0	0	0	5	0	1	7	0	0	0	13	0	0	28	388
8:(0 AM	0	0	0	0	0	0	3	0	1	3	0	0	0	16	0	0	23	38(
8:(5 AM	0	0	0	0	1	0	(	0	2	11	0	1	0	7	0	0	28	346
8:50 AM	0	0	0	0	0	0	2	0	3	7	0	0	0	12	0	0	26	347
8:55 AM	0	0	0	0	0	0	6	0	2	6	0	0	0	16	0	0	30	348

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	
All Vehicles	0	0	0	0	(	0	8(	0	2(	128	0	0	0	260	8	0	508
Heavy Trucks	0	0	0		0	0	(		0	(	0		0	(	0		12
Buses																	
Pedestrians		8				12				0				0			20
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

J eport generated on 12/4/2020 7:53 AM

SO9 J CE: R uality Counts, LLC)http://www.qualitycounts.netW1-844-580-2212

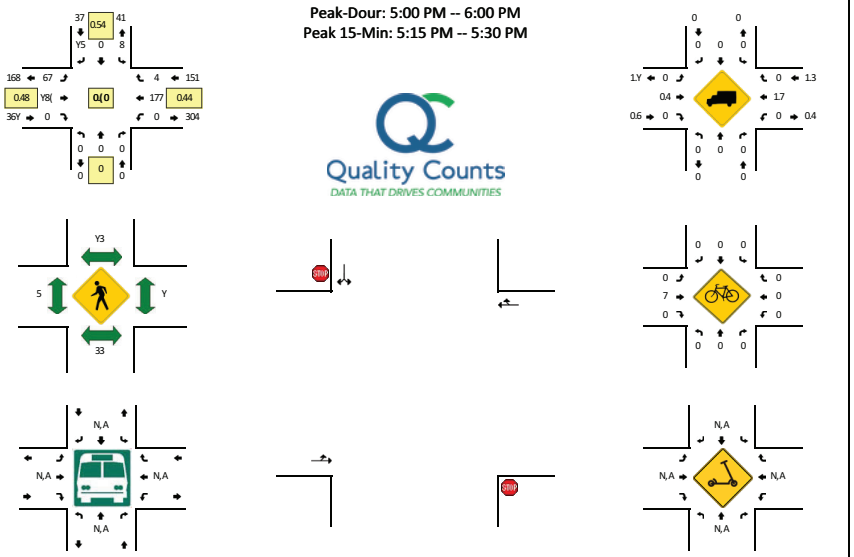
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulauku St -- Kaukama J d
CIT/, STATE: MailiHDI

R C QDB #: 1530661Y
2 ATE: TueH2 ec 1 Y0Y0

Peak-Dour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:15 PM -- 5:30 PM



5-Min Count Period Beginning At	Kulauku St)NorthboundW				Kulauku St)SouthboundW				Kaukama J d)EastboundW				Kaukama J d)U estboundW				Total	Dourly Totals
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9		
3:00 PM	0	0	0	0	1	0	0	0	7	18	0	0	0	8	0	0	33	
3:05 PM	0	0	0	0	1	0	5	0	5	Y6	0	0	0	11	0	0	7(	
3:10 PM	0	0	0	0	0	0	5	0	5	13	0	0	0	13	0	0	36	
3:15 PM	0	0	0	0	Y	0	7	0	7	17	0	0	0	13	1	0	3(	
3:Y0 PM	0	0	0	0	1	0	3	0	7	Y1	0	0	0	18	0	0	7(	
3:Y5 PM	0	0	0	0	1	0	1	0	5	13	0	0	0	15	1	0	36	
3:30 PM	0	0	0	0	0	0	5	0	10	Y1	0	0	0	8	0	0	75	
3:35 PM	0	0	0	0	1	0	7	0	5	Y7	0	0	0	6	0	0	70	
3:70 PM	0	0	0	0	0	0	1	0	Y	Y1	0	0	0	8	1	0	37	
3:75 PM	0	0	0	0	1	0	7	0	6	Y7	0	0	0	15	0	0	50	
3:50 PM	0	0	0	0	1	0	7	0	1Y	Y7	0	0	0	10	Y	0	53	
3:55 PM	0	0	0	0	1	0	3	0	(	Y0	0	0	0	4	0	0	38	500
7:00 PM	0	0	0	0	0	0	7	0	7	30	0	0	0	13	0	0	51	51(
7:05 PM	0	0	0	0	0	0	1	0	3	Y7	0	0	0	16	1	0	75	515
7:10 PM	0	0	0	0	Y	0	1	0	3	Y6	0	0	0	15	0	0	74	5Y6
7:15 PM	0	0	0	0	1	0	7	0	3	Y1	0	0	0	(	Y	0	38	5Y4
7:Y0 PM	0	0	0	0	Y	0	Y	0	3	Y1	0	0	0	6	0	0	37	513
7:Y5 PM	0	0	0	0	Y	0	1	0	(	Y6	0	1	0	13	1	0	5Y	5Y8
7:30 PM	0	0	0	0	1	0	3	0	(	16	0	0	0	16	1	0	75	5Y8
7:35 PM	0	0	0	0	1	0	0	0	7	17	0	0	0	13	0	0	3Y	5Y1
7:70 PM	0	0	0	0	1	0	1	0	5	16	0	0	0	11	1	0	35	5YY
7:75 PM	0	0	0	0	Y	0	3	0	1Y	18	0	0	0	(	0	0	77	516
7:50 PM	0	0	0	0	0	0	3	0	5	Y0	0	0	0	(	Y	0	3(	501
7:55 PM	0	0	0	0	1	0	3	0	5	18	0	0	0	10	1	0	38	501
5:00 PM	0	0	0	0	1	0	Y	0	5	YY	0	0	0	4	1	0	3(	7((
5:05 PM	0	0	0	0	1	0	Y	0	3	Y3	0	0	0	(	1	0	3(	7(1
5:10 PM	0	0	0	0	0	0	0	0	3	Y0	0	0	0	14	0	0	70	747
5:15 PM	0	0	0	0	0	0	Y	0	8	31	0	0	0	16	0	0	5(	783
5:Y0 PM	0	0	0	0	0	0	5	0	6	35	0	0	0	16	0	0	6Y	5Y1
5:Y5 PM	0	0	0	0	0	0	3	0	4	Y6	0	0	0	13	1	0	50	518
5:30 PM	0	0	0	0	Y	0	5	0	5	14	0	0	0	16	1	0	76	5Y0
5:35 PM	0	0	0	0	1	0	Y	0	0	14	0	0	0	8	1	0	30	51(
5:70 PM	0	0	0	0	1	0	Y	0	10	Y7	0	0	0	6	0	0	73	5Y6
5:75 PM	0	0	0	0	0	0	0	0	(	Y6	0	0	0	17	1	0	78	531
5:50 PM	0	0	0	0	1	0	1	0	6	30	0	0	0	1Y	0	0	50	573
5:55 PM	0	0	0	0	Y	0	1	0	Y	Y4	0	0	0	10	1	0	73	574

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	
All Vehicles	0	0	0	0	0	0	70	0	((	36(	0	0	0	1(0	7	0	6(0
Deavy Trucks	0	0	0		0	0	0		0	(	0		0	0	0		(
Buses																	
Pedestrians		Y0				1Y				7				0			36
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

J eport generated on 1Y, 4, Y0Y0 8:53 AM

SO9 J CE: R uality CountsHLLC)http:, , www.qualitycounts.netW1-(44-5(0-YY1Y

Appendix B: LOS Worksheets

FEHR PEERS

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	3	182	2	75	6	1057	213	48	1133	8
Future Volume (veh/h)	0	0	3	182	2	75	6	1057	213	48	1133	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	0	0	1	200	2	73	7	1162	219	53	1245	9
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	0	0	381	327	5	93	233	1505	282	233	1933	14
Arrive On Green	0.00	0.00	0.25	0.25	0.25	0.25	0.01	0.51	0.51	0.04	0.55	0.55
Sat Flow, veh/h	0	0	1529	1017	20	375	1767	2925	547	1767	3530	26
Grp Volume(v), veh/h	0	0	1	275	0	0	7	692	689	53	612	642
Grp Sat Flow(s),veh/h/ln	0	0	1529	1411	0	0	1767	1749	1723	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	15.3	0.0	0.0	0.2	27.0	27.5	1.2	21.0	21.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	15.4	0.0	0.0	0.2	27.0	27.5	1.2	21.0	21.0
Prop In Lane	0.00		1.00	0.73		0.27	1.00		0.32	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	381	425	0	0	233	900	887	233	950	997
V/C Ratio(X)	0.00	0.00	0.00	0.65	0.00	0.00	0.03	0.77	0.78	0.23	0.64	0.64
Avail Cap(c_a), veh/h	0	0	449	488	0	0	435	1912	1885	377	1897	1991
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	24.0	29.7	0.0	0.0	11.7	16.6	16.7	13.7	13.4	13.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	2.4	0.0	0.0	0.1	1.4	1.5	0.5	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	5.4	0.0	0.0	0.1	9.9	10.0	0.4	7.3	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	24.0	32.2	0.0	0.0	11.7	18.0	18.2	14.2	14.2	14.1
LnGrp LOS	A	A	C	C	A	A	B	B	B	B	B	B
Approach Vol, veh/h		1			275			1388			1307	
Approach Delay, s/veh		24.0			32.2			18.1			14.2	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	49.8		27.2	5.3	52.6		27.2
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.2	29.5		2.0	2.2	23.0		17.4
Green Ext Time (p_c), s	0.0	14.3		0.0	0.0	11.6		1.0

Intersection Summary			
HCM 6th Ctrl Delay			17.7
HCM 6th LOS			B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Existing (2020) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	136	88	55	11	116	18	40	29	10	12	15	89
Future Vol, veh/h	136	88	55	11	116	18	40	29	10	12	15	89
Conflicting Peds, #/hr	6	0	8	8	0	6	14	0	16	16	0	14
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	158	102	64	13	135	21	47	34	12	14	17	103

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	162	0	0	174	0	0	704	646	158	667	668	166
Stage 1	-	-	-	-	-	-	458	458	-	178	178	-
Stage 2	-	-	-	-	-	-	246	188	-	489	490	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1411	-	-	1397	-	-	350	389	885	371	378	876
Stage 1	-	-	-	-	-	-	581	565	-	821	750	-
Stage 2	-	-	-	-	-	-	756	743	-	559	547	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1403	-	-	1386	-	-	260	332	865	297	323	859
Mov Cap-2 Maneuver	-	-	-	-	-	-	260	332	-	297	323	-
Stage 1	-	-	-	-	-	-	504	490	-	714	738	-
Stage 2	-	-	-	-	-	-	634	731	-	442	475	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.8	0.6	21.2	12.6
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	1403	-	-	1386	-	-	609
HCM Lane V/C Ratio	0.293	0.113	-	-	0.009	-	-	0.221
HCM Control Delay (s)	21.2	7.9	0	-	7.6	0	-	12.6
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.2	0.4	-	-	0	-	-	0.8

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Existing (2020) Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	252	152	933	61	88	1306
Future Volume (veh/h)	252	152	933	61	88	1306
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841
Adj Flow Rate, veh/h	268	0	993	0	94	1389
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	5	4	3	4
Cap, veh/h	329		2569		471	2862
Arrive On Green	0.10	0.00	0.74	0.00	0.07	1.00
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589
Grp Volume(v), veh/h	268	0	993	0	94	1389
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749
Q Serve(g_s), s	10.7	0.0	14.6	0.0	1.7	0.0
Cycle Q Clear(g_c), s	10.7	0.0	14.6	0.0	1.7	0.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	329		2569		471	2862
V/C Ratio(X)	0.81		0.39		0.20	0.49
Avail Cap(c_a), veh/h	588		2569		586	2862
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.88	0.88
Uniform Delay (d), s/veh	62.1	0.0	6.6	0.0	4.3	0.0
Incr Delay (d2), s/veh	4.9	0.0	0.4	0.0	0.2	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	5.0	0.0	0.5	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	67.0	0.0	7.0	0.0	4.5	0.5
LnGrp LOS	E		A		A	A
Approach Vol, veh/h	268	A	993	A		1483
Approach Delay, s/veh	67.0		7.0			0.8
Approach LOS	E		A			A

Timer - Assigned Phs	1	2			6	8
Phs Duration (G+Y+Rc), s	10.9	109.7			120.6	19.4
Change Period (Y+Rc), s	6.0	6.0			6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0			104.0	24.0
Max Q Clear Time (g_c+I1), s	3.7	16.6			2.0	12.7
Green Ext Time (p_c), s	0.1	9.0			16.3	0.7

Intersection Summary	
HCM 6th Ctrl Delay	9.5
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Existing (2020) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	115	301	6	12	63
Future Vol, veh/h	39	115	301	6	12	63
Conflicting Peds, #/hr	12	0	0	13	13	12
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	48	140	367	7	15	77

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	387	0	-	0	633	396
Stage 1	-	-	-	-	384	-
Stage 2	-	-	-	-	249	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1166	-	-	-	442	651
Stage 1	-	-	-	-	686	-
Stage 2	-	-	-	-	790	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1152	-	-	-	412	636
Mov Cap-2 Maneuver	-	-	-	-	412	-
Stage 1	-	-	-	-	648	-
Stage 2	-	-	-	-	781	-

Approach	EB	WB	SB
HCM Control Delay, s	2.1	0	11.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1152	-	-	-	412	636
HCM Lane V/C Ratio	0.041	-	-	-	0.036	0.121
HCM Control Delay (s)	8.3	0	-	-	14.1	11.4
HCM Lane LOS	A	A	-	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	0.4

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Existing (2020) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	2	2	126	2	36	3	803	31	14	1205	2
Future Volume (veh/h)	3	2	2	126	2	36	3	803	31	14	1205	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	3	2	0	134	2	29	3	854	32	15	1282	2
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	7	5	0	163	2	35	316	2539	95	481	2689	4
Arrive On Green	0.01	0.01	0.00	0.12	0.12	0.12	0.00	0.73	0.73	0.02	0.74	0.74
Sat Flow, veh/h	1081	721	0	1400	21	303	1767	3465	130	1767	3611	6
Grp Volume(v), veh/h	5	0	0	165	0	0	3	434	452	15	626	658
Grp Sat Flow(s),veh/h/ln	1801	0	0	1724	0	0	1767	1763	1832	1767	1763	1854
Q Serve(g_s), s	0.4	0.0	0.0	13.1	0.0	0.0	0.1	12.2	12.2	0.3	19.7	19.7
Cycle Q Clear(g_c), s	0.4	0.0	0.0	13.1	0.0	0.0	0.1	12.2	12.2	0.3	19.7	19.7
Prop In Lane	0.60		0.00	0.81		0.18	1.00		0.07	1.00		0.00
Lane Grp Cap(c), veh/h	11	0	0	201	0	0	316	1292	1342	481	1312	1381
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.01	0.34	0.34	0.03	0.48	0.48
Avail Cap(c_a), veh/h	64	0	0	486	0	0	372	1292	1342	516	1312	1381
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.90	0.90	0.90	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.3	0.0	0.0	60.4	0.0	0.0	6.0	6.6	6.6	5.0	7.1	7.1
Incr Delay (d2), s/veh	24.5	0.0	0.0	8.1	0.0	0.0	0.0	0.6	0.6	0.0	1.2	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	6.2	0.0	0.0	0.0	4.4	4.6	0.1	7.1	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	93.8	0.0	0.0	68.5	0.0	0.0	6.0	7.3	7.2	5.0	8.3	8.3
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	A	A
Approach Vol, veh/h		5			165			889			1299	
Approach Delay, s/veh		93.8			68.5			7.3			8.3	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.7	107.1		5.4	5.1	108.7		20.8
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.3	14.2		2.4	2.1	21.7		15.1
Green Ext Time (p_c), s	0.0	6.6		0.0	0.0	11.7		1.0

Intersection Summary		
HCM 6th Ctrl Delay		12.3
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	4	75	0	62	4	1475	102	61	1049	4
Future Volume (veh/h)	2	0	4	75	0	62	4	1475	102	61	1049	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		1.00	0.95		0.94	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1411	1856	1856	1856	1411	1856	1856	1856	1841	1856
Adj Flow Rate, veh/h	2	0	0	81	0	18	4	1586	107	66	1128	4
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	33	3	3	3	33	3	3	3	4	3
Cap, veh/h	331	0	0	266	7	45	260	2014	135	220	2288	8
Arrive On Green	0.18	0.00	0.00	0.18	0.00	0.18	0.01	0.60	0.60	0.04	0.64	0.64
Sat Flow, veh/h	1404	0	0	1084	37	249	1344	3346	224	1767	3574	13
Grp Volume(v), veh/h	2	0	0	99	0	0	4	830	863	66	552	580
Grp Sat Flow(s),veh/h/ln	1404	0	0	1371	0	0	1344	1763	1807	1767	1749	1838
Q Serve(g_s), s	0.0	0.0	0.0	5.5	0.0	0.0	0.1	33.8	34.8	1.3	15.9	15.9
Cycle Q Clear(g_c), s	0.1	0.0	0.0	6.0	0.0	0.0	0.1	33.8	34.8	1.3	15.9	15.9
Prop In Lane	1.00		0.00	0.82		0.18	1.00		0.12	1.00		0.01
Lane Grp Cap(c), veh/h	331	0	0	318	0	0	260	1061	1088	220	1119	1176
V/C Ratio(X)	0.01	0.00	0.00	0.31	0.00	0.00	0.02	0.78	0.79	0.30	0.49	0.49
Avail Cap(c_a), veh/h	437	0	0	426	0	0	401	1716	1759	338	1702	1789
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.0	0.0	0.0	34.4	0.0	0.0	8.2	14.3	14.5	14.6	9.0	9.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.3	1.4	0.8	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	2.1	0.0	0.0	0.0	12.1	12.8	0.6	5.3	5.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	34.9	0.0	0.0	8.2	15.6	15.8	15.3	9.4	9.4
LnGrp LOS	C	A	A	C	A	A	A	B	B	B	A	A
Approach Vol, veh/h		2			99			1697			1198	
Approach Delay, s/veh		32.0			34.9			15.7			9.7	
Approach LOS		C			C			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	63.5		23.4	5.0	67.1		23.4
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.3	36.8		2.1	2.1	17.9		8.0
Green Ext Time (p_c), s	0.1	20.7		0.0	0.0	9.7		0.4

Intersection Summary		
HCM 6th Ctrl Delay		13.9
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	53	55	51	2	39	11	38	14	1	11	5	55
Future Vol, veh/h	53	55	51	2	39	11	38	14	1	11	5	55
Conflicting Peds, #/hr	9	0	7	7	0	8	7	0	6	8	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	57	59	55	2	42	12	41	15	1	12	5	59

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	63	0	0	121	0	0	301	275	102	278	296	66
Stage 1	-	-	-	-	-	-	208	208	-	61	61	-
Stage 2	-	-	-	-	-	-	93	67	-	217	235	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1533	-	-	1460	-	-	649	631	950	672	614	995
Stage 1	-	-	-	-	-	-	792	728	-	948	842	-
Stage 2	-	-	-	-	-	-	912	837	-	783	709	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1520	-	-	1450	-	-	578	596	936	628	580	978
Mov Cap-2 Maneuver	-	-	-	-	-	-	578	596	-	628	580	-
Stage 1	-	-	-	-	-	-	756	694	-	902	834	-
Stage 2	-	-	-	-	-	-	843	829	-	729	676	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.5	0.3	11.8	9.6
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	587	1520	-	-	1450	-	-	862
HCM Lane V/C Ratio	0.097	0.037	-	-	0.001	-	-	0.089
HCM Control Delay (s)	11.8	7.5	0	-	7.5	0	-	9.6
HCM Lane LOS	B	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Existing (2020) Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	148	91	1498	286	103	984	
Future Volume (veh/h)	148	91	1498	286	103	984	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	
Adj Flow Rate, veh/h	153	0	1544	0	106	1014	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	
Percent Heavy Veh, %	3	3	3	3	3	3	
Cap, veh/h	209		2734		313	3008	
Arrive On Green	0.06	0.00	0.78	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3618	1572	1767	3618	
Grp Volume(v), veh/h	153	0	1544	0	106	1014	
Grp Sat Flow(s),veh/h/ln	1714	1572	1763	1572	1767	1763	
Q Serve(g_s), s	6.1	0.0	24.5	0.0	1.6	0.0	
Cycle Q Clear(g_c), s	6.1	0.0	24.5	0.0	1.6	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	209		2734		313	3008	
V/C Ratio(X)	0.73		0.56		0.34	0.34	
Avail Cap(c_a), veh/h	588		2734		428	3008	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.94	0.94	
Uniform Delay (d), s/veh	64.6	0.0	6.3	0.0	5.7	0.0	
Incr Delay (d2), s/veh	4.9	0.0	0.9	0.0	0.6	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	2.9	0.0	8.1	0.0	0.7	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	69.5	0.0	7.1	0.0	6.3	0.3	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	153	A	1544	A		1120	
Approach Delay, s/veh	69.5		7.1			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	114.5				125.5	14.5
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.6	26.5				2.0	8.1
Green Ext Time (p_c), s	0.2	18.7				9.3	0.4

Intersection Summary	
HCM 6th Ctrl Delay	8.0
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Existing (2020) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	71	328	171	13	16	28
Future Vol, veh/h	71	328	171	13	16	28
Conflicting Peds, #/hr	28	0	0	25	25	28
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	89	410	214	16	20	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	258	0	-	0	863	278
Stage 1	-	-	-	-	250	-
Stage 2	-	-	-	-	613	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1301	-	-	-	324	758
Stage 1	-	-	-	-	789	-
Stage 2	-	-	-	-	539	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1266	-	-	-	279	718
Mov Cap-2 Maneuver	-	-	-	-	279	-
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	524	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	13.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1266	-	-	-	279	718
HCM Lane V/C Ratio	0.07	-	-	-	0.072	0.049
HCM Control Delay (s)	8.1	0	-	-	18.9	10.3
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Existing (2020) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	2	2	74	2	35	3	1367	135	42	991	2
Future Volume (veh/h)	3	2	2	74	2	35	3	1367	135	42	991	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	3	2	0	79	2	24	3	1454	140	45	1054	2
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	7	5	0	103	3	31	424	2456	235	280	2820	5
Arrive On Green	0.01	0.01	0.00	0.08	0.08	0.08	0.00	0.76	0.76	0.03	0.78	0.78
Sat Flow, veh/h	1081	721	0	1289	33	392	1767	3251	311	1767	3610	7
Grp Volume(v), veh/h	5	0	0	105	0	0	3	784	810	45	515	541
Grp Sat Flow(s),veh/h/ln	1801	0	0	1714	0	0	1767	1763	1799	1767	1763	1854
Q Serve(g_s), s	0.4	0.0	0.0	8.4	0.0	0.0	0.1	27.4	28.0	0.8	12.6	12.6
Cycle Q Clear(g_c), s	0.4	0.0	0.0	8.4	0.0	0.0	0.1	27.4	28.0	0.8	12.6	12.6
Prop In Lane	0.60		0.00	0.75		0.23	1.00		0.17	1.00		0.00
Lane Grp Cap(c), veh/h	11	0	0	137	0	0	424	1332	1359	280	1377	1448
V/C Ratio(X)	0.44	0.00	0.00	0.76	0.00	0.00	0.01	0.59	0.60	0.16	0.37	0.37
Avail Cap(c_a), veh/h	64	0	0	312	0	0	481	1332	1359	291	1377	1448
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.77	0.77	0.77	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.3	0.0	0.0	63.1	0.0	0.0	4.4	7.5	7.6	6.6	4.7	4.7
Incr Delay (d2), s/veh	24.5	0.0	0.0	8.5	0.0	0.0	0.0	1.5	1.5	0.3	0.8	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	4.0	0.0	0.0	0.0	9.6	10.0	0.3	4.2	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	93.8	0.0	0.0	71.6	0.0	0.0	4.4	9.0	9.1	6.9	5.5	5.5
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	A	A
Approach Vol, veh/h		5			105			1597			1101	
Approach Delay, s/veh		93.8			71.6			9.1			5.6	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	110.3		5.4	5.1	113.9		15.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	2.8	30.0		2.4	2.1	14.6		10.4
Green Ext Time (p_c), s	0.0	18.3		0.0	0.0	8.6		0.4

Intersection Summary		
HCM 6th Ctrl Delay		10.2
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	200	10	90	10	1150	240	60	1230	10
Future Volume (veh/h)	10	10	10	200	10	90	10	1150	240	60	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	3	220	11	89	11	1264	249	66	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	201	189	46	302	12	97	219	1585	308	211	2027	16
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.55	0.55	0.04	0.58	0.58
Sat Flow, veh/h	604	769	187	977	49	395	1767	2903	565	1767	3526	29
Grp Volume(v), veh/h	25	0	0	320	0	0	11	755	758	66	665	698
Grp Sat Flow(s),veh/h/ln	1561	0	0	1422	0	0	1767	1749	1719	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	20.7	0.0	0.0	0.3	34.4	35.7	1.6	26.3	26.3
Cycle Q Clear(g_c), s	1.1	0.0	0.0	21.8	0.0	0.0	0.3	34.4	35.7	1.6	26.3	26.3
Prop In Lane	0.44		0.12	0.69		0.28	1.00		0.33	1.00		0.02
Lane Grp Cap(c), veh/h	436	0	0	411	0	0	219	955	939	211	998	1046
V/C Ratio(X)	0.06	0.00	0.00	0.78	0.00	0.00	0.05	0.79	0.81	0.31	0.67	0.67
Avail Cap(c_a), veh/h	443	0	0	418	0	0	382	1632	1605	323	1619	1699
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.7	0.0	0.0	36.4	0.0	0.0	12.6	18.1	18.4	16.7	14.6	14.6
Incr Delay (d2), s/veh	0.1	0.0	0.0	9.0	0.0	0.0	0.1	1.5	1.7	0.8	0.8	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	8.5	0.0	0.0	0.1	13.0	13.3	0.6	9.5	10.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.8	0.0	0.0	45.4	0.0	0.0	12.7	19.6	20.1	17.5	15.4	15.3
LnGrp LOS	C	A	A	D	A	A	B	B	C	B	B	B
Approach Vol, veh/h		25			320			1524			1429	
Approach Delay, s/veh		28.8			45.4			19.8			15.4	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	60.4		30.5	5.8	63.3		30.5
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.6	37.7		3.1	2.3	28.3		23.8
Green Ext Time (p_c), s	0.1	16.8		0.1	0.0	13.5		0.3

Intersection Summary		
HCM 6th Ctrl Delay		20.4
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	9.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	60	20	130	20	50	40	20	20	20	100
Future Vol, veh/h	150	100	60	20	130	20	50	40	20	20	20	100
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	70	23	151	23	58	47	23	23	23	116

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	181	0	0	195	0	0	802	735	178	768	759	186
Stage 1	-	-	-	-	-	-	508	508	-	216	216	-
Stage 2	-	-	-	-	-	-	294	227	-	552	543	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1388	-	-	1372	-	-	301	346	862	317	335	854
Stage 1	-	-	-	-	-	-	546	537	-	784	722	-
Stage 2	-	-	-	-	-	-	712	714	-	516	518	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1379	-	-	1360	-	-	208	286	840	232	277	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	286	-	232	277	-
Stage 1	-	-	-	-	-	-	465	456	-	668	703	-
Stage 2	-	-	-	-	-	-	572	695	-	380	440	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.9	0.9	29.5	15.5
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	272	1379	-	-	1360	-	-	503
HCM Lane V/C Ratio	0.47	0.126	-	-	0.017	-	-	0.324
HCM Control Delay (s)	29.5	8	0	-	7.7	0	-	15.5
HCM Lane LOS	D	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	2.4	0.4	-	-	0.1	-	-	1.4

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	280	170	1020	70	100	1420	
Future Volume (veh/h)	280	170	1020	70	100	1420	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	298	0	1085	0	106	1511	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	360		2537		428	2831	
Arrive On Green	0.10	0.00	0.73	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	298	0	1085	0	106	1511	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	11.9	0.0	17.1	0.0	2.0	0.0	
Cycle Q Clear(g_c), s	11.9	0.0	17.1	0.0	2.0	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	360		2537		428	2831	
V/C Ratio(X)	0.83		0.43		0.25	0.53	
Avail Cap(c_a), veh/h	588		2537		542	2831	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.80	0.80	
Uniform Delay (d), s/veh	61.4	0.0	7.3	0.0	5.0	0.0	
Incr Delay (d2), s/veh	5.1	0.0	0.5	0.0	0.2	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	5.5	0.0	6.0	0.0	0.6	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	66.6	0.0	7.9	0.0	5.3	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	298	A	1085	A		1617	
Approach Delay, s/veh	66.6		7.9			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	108.4				119.3	20.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.0	19.1				2.0	13.9
Green Ext Time (p_c), s	0.2	10.3				19.4	0.8

Intersection Summary	
HCM 6th Ctrl Delay	9.9
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	130	330	10	20	70
Future Vol, veh/h	50	130	330	10	20	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	159	402	12	24	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	429	0	-	0	719	436
Stage 1	-	-	-	-	423	-
Stage 2	-	-	-	-	296	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1125	-	-	-	394	618
Stage 1	-	-	-	-	659	-
Stage 2	-	-	-	-	752	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1109	-	-	-	360	602
Mov Cap-2 Maneuver	-	-	-	-	360	-
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1109	-	-	-	360	602
HCM Lane V/C Ratio	0.055	-	-	-	0.068	0.142
HCM Control Delay (s)	8.4	0	-	-	15.7	12
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	40	10	870	40	20	1310	10
Future Volume (veh/h)	10	10	10	140	10	40	10	870	40	20	1310	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	34	11	926	41	21	1394	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	40	271	2403	106	426	2532	20
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.70	0.70	0.02	0.71	0.71
Sat Flow, veh/h	905	905	0	1327	98	303	1767	3438	152	1767	3584	28
Grp Volume(v), veh/h	22	0	0	194	0	0	11	475	492	21	685	720
Grp Sat Flow(s),veh/h/ln	1810	0	0	1728	0	0	1767	1763	1828	1767	1763	1850
Q Serve(g_s), s	1.7	0.0	0.0	15.4	0.0	0.0	0.3	15.5	15.5	0.5	26.2	26.2
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.4	0.0	0.0	0.3	15.5	15.5	0.5	26.2	26.2
Prop In Lane	0.50		0.00	0.77		0.18	1.00		0.08	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	228	0	0	271	1232	1277	426	1245	1306
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.39	0.39	0.05	0.55	0.55
Avail Cap(c_a), veh/h	65	0	0	488	0	0	312	1232	1277	453	1245	1306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.87	0.87	0.87	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.4	0.0	0.0	8.2	8.7	8.7	6.5	9.9	9.9
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.1	0.8	0.8	0.0	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.3	0.0	0.0	0.1	5.9	6.1	0.2	9.9	10.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	8.2	9.5	9.5	6.5	11.6	11.6
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			194			978			1426	
Approach Delay, s/veh		82.1			67.9			9.5			11.5	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.3	102.3		7.4	6.2	103.4		23.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.5	17.5		3.7	2.3	28.2		17.4
Green Ext Time (p_c), s	0.0	7.5		0.0	0.0	13.4		1.1

Intersection Summary			
HCM 6th Ctrl Delay			15.5
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	70	10	1600	120	70	1140	10
Future Volume (veh/h)	10	10	10	90	10	70	10	1600	120	70	1140	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	2	99	11	59	11	1758	128	77	1253	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	156	145	23	190	29	92	290	2097	151	180	2331	20
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.01	0.64	0.64	0.04	0.66	0.66
Sat Flow, veh/h	601	782	126	764	156	494	1767	3300	237	1767	3523	31
Grp Volume(v), veh/h	24	0	0	169	0	0	11	920	966	77	617	647
Grp Sat Flow(s),veh/h/ln	1509	0	0	1414	0	0	1767	1749	1789	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	11.5	0.0	0.0	0.3	47.7	50.4	1.7	22.0	22.0
Cycle Q Clear(g_c), s	1.3	0.0	0.0	12.9	0.0	0.0	0.3	47.7	50.4	1.7	22.0	22.0
Prop In Lane	0.46		0.08	0.59		0.35	1.00		0.13	1.00		0.02
Lane Grp Cap(c), veh/h	324	0	0	311	0	0	290	1111	1137	180	1148	1204
V/C Ratio(X)	0.07	0.00	0.00	0.54	0.00	0.00	0.04	0.83	0.85	0.43	0.54	0.54
Avail Cap(c_a), veh/h	365	0	0	348	0	0	425	1381	1413	268	1370	1437
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.6	0.0	0.0	44.2	0.0	0.0	8.9	16.5	17.0	22.6	10.5	10.5
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.5	0.0	0.0	0.1	3.6	4.2	1.6	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	4.7	0.0	0.0	0.1	18.3	19.8	1.3	7.7	8.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.7	0.0	0.0	45.7	0.0	0.0	8.9	20.1	21.2	24.2	10.9	10.8
LnGrp LOS	D	A	A	D	A	A	A	C	C	C	B	B
Approach Vol, veh/h		24			169			1897			1341	
Approach Delay, s/veh		39.7			45.7			20.6			11.6	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.1	80.8		27.8	6.0	83.9		27.8
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.7	52.4		3.3	2.3	24.0		14.9
Green Ext Time (p_c), s	0.1	22.5		0.1	0.0	11.7		0.7

Intersection Summary		
HCM 6th Ctrl Delay		18.5
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	60	60	10	50	20	50	20	10	20	10	60
Future Vol, veh/h	60	60	60	10	50	20	50	20	10	20	10	60
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	70	70	70	12	58	23	58	23	12	23	12	70

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	148	0	0	398	368	122	376	392	90
Stage 1	-	-	-	-	-	-	253	253	-	104	104	-
Stage 2	-	-	-	-	-	-	145	115	-	272	288	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1498	-	-	1427	-	-	560	559	926	579	542	965
Stage 1	-	-	-	-	-	-	749	696	-	899	807	-
Stage 2	-	-	-	-	-	-	855	798	-	732	672	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1484	-	-	1416	-	-	478	516	911	517	500	947
Mov Cap-2 Maneuver	-	-	-	-	-	-	478	516	-	517	500	-
Stage 1	-	-	-	-	-	-	705	654	-	844	792	-
Stage 2	-	-	-	-	-	-	766	783	-	655	632	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.5	0.9	13.5	10.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	518	1484	-	-	1416	-	-	737
HCM Lane V/C Ratio	0.18	0.047	-	-	0.008	-	-	0.142
HCM Control Delay (s)	13.5	7.5	0	-	7.6	0	-	10.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0	-	-	0.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	170	100	1630	310	120	1070	
Future Volume (veh/h)	170	100	1630	310	120	1070	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	181	0	1734	0	128	1138	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	239		2659		262	2954	
Arrive On Green	0.07	0.00	0.77	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	181	0	1734	0	128	1138	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.3	0.0	32.7	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	7.3	0.0	32.7	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	239		2659		262	2954	
V/C Ratio(X)	0.76		0.65		0.49	0.39	
Avail Cap(c_a), veh/h	588		2659		376	2954	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.89	0.89	
Uniform Delay (d), s/veh	64.0	0.0	7.6	0.0	9.9	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.3	0.0	1.3	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.4	0.0	10.8	0.0	1.5	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.9	0.0	8.9	0.0	11.2	0.3	
LnGrp LOS	E		A		B	A	
Approach Vol, veh/h	181	A	1734	A		1266	
Approach Delay, s/veh	68.9		8.9			1.4	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	11.0	113.3				124.3	15.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	34.7				2.0	9.3
Green Ext Time (p_c), s	0.2	22.1				11.3	0.5

Intersection Summary	
HCM 6th Ctrl Delay	9.3
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	360	190	20	20	40
Future Vol, veh/h	80	360	190	20	20	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	439	232	24	24	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	287	0	-	0	938	306
Stage 1	-	-	-	-	275	-
Stage 2	-	-	-	-	663	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1269	-	-	-	292	732
Stage 1	-	-	-	-	769	-
Stage 2	-	-	-	-	511	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1232	-	-	-	246	689
Mov Cap-2 Maneuver	-	-	-	-	246	-
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	496	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1232	-	-	-	246	689
HCM Lane V/C Ratio	0.079	-	-	-	0.099	0.071
HCM Control Delay (s)	8.2	0	-	-	21.2	10.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.3	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	40	10	1490	150	50	1080	10
Future Volume (veh/h)	10	10	10	90	10	40	10	1490	150	50	1080	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	32	11	1585	156	53	1149	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	40	367	2330	227	228	2635	25
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1184	136	395	1767	3245	316	1767	3577	34
Grp Volume(v), veh/h	22	0	0	139	0	0	11	853	888	53	566	594
Grp Sat Flow(s),veh/h/ln	1810	0	0	1714	0	0	1767	1763	1798	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	37.0	38.5	1.1	17.4	17.4
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	37.0	38.5	1.1	17.4	17.4
Prop In Lane	0.50		0.00	0.69		0.23	1.00		0.18	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	174	0	0	367	1266	1291	228	1299	1362
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.67	0.69	0.23	0.44	0.44
Avail Cap(c_a), veh/h	65	0	0	312	0	0	409	1266	1291	236	1299	1362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.64	0.64	0.64	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.5	0.0	0.0	5.9	10.8	11.0	11.1	7.1	7.1
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.1	0.0	0.0	0.0	1.9	1.9	0.5	1.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	13.6	14.5	0.5	6.3	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	5.9	12.6	12.9	11.6	8.2	8.2
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			139			1752			1213	
Approach Delay, s/veh		82.1			69.5			12.7			8.3	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.9	105.0		7.4	6.2	107.6		18.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5				
Max Q Clear Time (g_c+I1), s	3.1	40.5		3.7	2.2	19.4		13.1				
Green Ext Time (p_c), s	0.0	20.5		0.0	0.0	10.0		0.6				

Intersection Summary			
HCM 6th Ctrl Delay			14.1
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Future Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	3	320	12	105	11	1264	281	70	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	197	203	46	311	9	82	222	1575	345	206	2061	17
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.01	0.56	0.56	0.04	0.58	0.58
Sat Flow, veh/h	606	835	188	1034	39	339	1767	2835	621	1767	3526	29
Grp Volume(v), veh/h	26	0	0	437	0	0	11	772	773	70	665	698
Grp Sat Flow(s),veh/h/ln	1629	0	0	1412	0	0	1767	1749	1707	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	23.9	0.0	0.0	0.3	36.2	37.9	1.7	26.6	26.7
Cycle Q Clear(g_c), s	1.1	0.0	0.0	25.0	0.0	0.0	0.3	36.2	37.9	1.7	26.6	26.7
Prop In Lane	0.42		0.12	0.73		0.24	1.00		0.36	1.00		0.02
Lane Grp Cap(c), veh/h	445	0	0	403	0	0	222	972	948	206	1014	1064
V/C Ratio(X)	0.06	0.00	0.00	1.08	0.00	0.00	0.05	0.79	0.82	0.34	0.66	0.66
Avail Cap(c_a), veh/h	445	0	0	403	0	0	379	1577	1539	312	1564	1641
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.0	0.0	0.0	40.8	0.0	0.0	12.4	18.2	18.6	17.6	14.4	14.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	69.6	0.0	0.0	0.1	1.5	1.8	1.0	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	18.2	0.0	0.0	0.1	13.7	14.1	0.7	9.7	10.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.1	0.0	0.0	110.4	0.0	0.0	12.5	19.8	20.4	18.5	15.2	15.1
LnGrp LOS	C	A	A	F	A	A	B	B	C	B	B	B
Approach Vol, veh/h		26			437			1556			1433	
Approach Delay, s/veh		30.1			110.4			20.0			15.3	
Approach LOS		C			F			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.8	63.3		31.0	5.9	66.3		31.0
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.7	39.9		3.1	2.3	28.7		27.0
Green Ext Time (p_c), s	0.1	17.4		0.1	0.0	13.5		0.0

Intersection Summary		
HCM 6th Ctrl Delay		29.6
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	50.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Future Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	110	24	151	23	180	72	24	23	30	116

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	181	0	0	235	0	0	828	757	198	803	801	186
Stage 1	-	-	-	-	-	-	528	528	-	218	218	-
Stage 2	-	-	-	-	-	-	300	229	-	585	583	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1388	-	-	1326	-	-	289	336	841	301	317	854
Stage 1	-	-	-	-	-	-	532	526	-	782	721	-
Stage 2	-	-	-	-	-	-	707	713	-	495	497	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1379	-	-	1315	-	-	194	277	819	200	261	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	194	277	-	200	261	-
Stage 1	-	-	-	-	-	-	451	445	-	663	702	-
Stage 2	-	-	-	-	-	-	562	694	-	338	420	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.5	1	175.7	17.5
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	227	1379	-	-	1315	-	-	457
HCM Lane V/C Ratio	1.219	0.126	-	-	0.019	-	-	0.371
HCM Control Delay (s)	175.7	8	0	-	7.8	0	-	17.5
HCM Lane LOS	F	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	13.8	0.4	-	-	0.1	-	-	1.7

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline Plus Project Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	280	171	1048	70	103	1505	
Future Volume (veh/h)	280	171	1048	70	103	1505	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	298	0	1115	0	110	1601	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	360		2537		416	2831	
Arrive On Green	0.10	0.00	0.73	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	298	0	1115	0	110	1601	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	11.9	0.0	17.8	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	11.9	0.0	17.8	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	360		2537		416	2831	
V/C Ratio(X)	0.83		0.44		0.26	0.57	
Avail Cap(c_a), veh/h	588		2537		531	2831	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.76	0.76	
Uniform Delay (d), s/veh	61.4	0.0	7.4	0.0	5.2	0.0	
Incr Delay (d2), s/veh	5.1	0.0	0.6	0.0	0.3	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	5.5	0.0	6.2	0.0	0.6	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	66.6	0.0	8.0	0.0	5.4	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	298	A	1115	A		1711	
Approach Delay, s/veh	66.6		8.0			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	108.4				119.3	20.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	19.8				2.0	13.9
Green Ext Time (p_c), s	0.2	10.8				22.0	0.8

Intersection Summary	
HCM 6th Ctrl Delay	9.7
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline Plus Project Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	133	331	10	20	70
Future Vol, veh/h	50	133	331	10	20	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	162	404	12	24	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	431	0	-	0	724	438
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	299	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1123	-	-	-	391	617
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	750	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	357	601
Mov Cap-2 Maneuver	-	-	-	-	357	-
Stage 1	-	-	-	-	608	-
Stage 2	-	-	-	-	740	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	357	601
HCM Lane V/C Ratio	0.055	-	-	-	0.068	0.142
HCM Control Delay (s)	8.4	0	-	-	15.8	12
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline Plus Project Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	41	10	899	40	23	1398	10
Future Volume (veh/h)	10	10	10	140	10	41	10	899	40	23	1398	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	35	11	956	41	24	1487	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	41	246	2398	103	415	2531	19
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.70	0.70	0.02	0.71	0.71
Sat Flow, veh/h	905	905	0	1320	97	310	1767	3444	148	1767	3586	27
Grp Volume(v), veh/h	22	0	0	195	0	0	11	489	508	24	731	767
Grp Sat Flow(s),veh/h/ln	1810	0	0	1727	0	0	1767	1763	1829	1767	1763	1850
Q Serve(g_s), s	1.7	0.0	0.0	15.5	0.0	0.0	0.3	16.3	16.3	0.5	29.2	29.2
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.5	0.0	0.0	0.3	16.3	16.3	0.5	29.2	29.2
Prop In Lane	0.50		0.00	0.76		0.18	1.00		0.08	1.00		0.01
Lane Grp Cap(c), veh/h	37	0	0	229	0	0	246	1228	1273	415	1244	1305
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.40	0.40	0.06	0.59	0.59
Avail Cap(c_a), veh/h	65	0	0	487	0	0	287	1228	1273	439	1244	1305
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.86	0.86	0.86	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.3	0.0	0.0	8.8	8.9	8.9	6.6	10.4	10.4
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.1	0.8	0.8	0.1	2.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.4	0.0	0.0	0.1	6.2	6.4	0.2	11.1	11.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	8.9	9.8	9.7	6.7	12.4	12.3
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			195			1008			1522	
Approach Delay, s/veh		82.1			67.9			9.7			12.3	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.5	102.0		7.4	6.2	103.3		23.1
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.5	18.3		3.7	2.3	31.2		17.5
Green Ext Time (p_c), s	0.0	7.8		0.0	0.0	14.8		1.1

Intersection Summary			
HCM 6th Ctrl Delay			15.8
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	148	11	78	10	1600	218	86	1140	10
Future Volume (veh/h)	10	11	10	148	11	78	10	1600	218	86	1140	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	2	163	12	74	11	1758	233	95	1253	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	151	154	23	220	13	79	291	2009	259	154	2368	21
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.01	0.65	0.65	0.04	0.67	0.67
Sat Flow, veh/h	589	813	122	918	68	417	1767	3102	400	1767	3523	31
Grp Volume(v), veh/h	25	0	0	249	0	0	11	970	1021	95	617	647
Grp Sat Flow(s),veh/h/ln	1523	0	0	1402	0	0	1767	1749	1753	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	21.5	0.0	0.0	0.3	57.7	64.6	2.3	23.8	23.8
Cycle Q Clear(g_c), s	1.5	0.0	0.0	23.0	0.0	0.0	0.3	57.7	64.6	2.3	23.8	23.8
Prop In Lane	0.44		0.08	0.65		0.30	1.00		0.23	1.00		0.02
Lane Grp Cap(c), veh/h	329	0	0	312	0	0	291	1133	1136	154	1166	1223
V/C Ratio(X)	0.08	0.00	0.00	0.80	0.00	0.00	0.04	0.86	0.90	0.62	0.53	0.53
Avail Cap(c_a), veh/h	329	0	0	312	0	0	409	1236	1240	230	1226	1286
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.8	0.0	0.0	52.3	0.0	0.0	9.3	18.3	19.5	31.1	11.0	11.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	13.7	0.0	0.0	0.1	5.8	8.6	4.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	9.3	0.0	0.0	0.1	23.1	26.6	2.1	8.6	9.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.9	0.0	0.0	65.9	0.0	0.0	9.3	24.1	28.1	35.1	11.4	11.3
LnGrp LOS	D	A	A	E	A	A	A	C	C	D	B	B
Approach Vol, veh/h		25			249			2002			1359	
Approach Delay, s/veh		43.9			65.9			26.1			13.0	
Approach LOS		D			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	91.2		31.0	6.2	94.4		31.0
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.3	66.6		3.5	2.3	25.8		25.0
Green Ext Time (p_c), s	0.1	18.6		0.1	0.0	11.7		0.0

Intersection Summary		
HCM 6th Ctrl Delay		24.0
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	60	178	11	50	20	120	30	11	20	28	60
Future Vol, veh/h	60	60	178	11	50	20	120	30	11	20	28	60
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	70	70	207	13	58	23	140	35	13	23	33	70

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	285	0	0	479	439	191	453	531	90
Stage 1	-	-	-	-	-	-	322	322	-	106	106	-
Stage 2	-	-	-	-	-	-	157	117	-	347	425	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1498	-	-	1271	-	-	495	510	848	515	453	965
Stage 1	-	-	-	-	-	-	688	649	-	897	806	-
Stage 2	-	-	-	-	-	-	843	797	-	667	585	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1484	-	-	1261	-	-	402	467	834	445	415	947
Mov Cap-2 Maneuver	-	-	-	-	-	-	402	467	-	445	415	-
Stage 1	-	-	-	-	-	-	644	607	-	838	789	-
Stage 2	-	-	-	-	-	-	733	780	-	579	547	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	1.1	19.8	12.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	428	1484	-	-	1261	-	-	614
HCM Lane V/C Ratio	0.437	0.047	-	-	0.01	-	-	0.205
HCM Control Delay (s)	19.8	7.5	0	-	7.9	0	-	12.4
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.2	0.1	-	-	0	-	-	0.8

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline Plus Project Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	170	103	1722	310	122	1124	
Future Volume (veh/h)	170	103	1722	310	122	1124	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	181	0	1832	0	130	1196	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	239		2659		241	2954	
Arrive On Green	0.07	0.00	0.77	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	181	0	1832	0	130	1196	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.3	0.0	36.6	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	7.3	0.0	36.6	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	239		2659		241	2954	
V/C Ratio(X)	0.76		0.69		0.54	0.40	
Avail Cap(c_a), veh/h	588		2659		355	2954	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.88	0.88	
Uniform Delay (d), s/veh	64.0	0.0	8.1	0.0	12.7	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.5	0.0	1.6	0.4	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.4	0.0	12.2	0.0	2.0	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.9	0.0	9.6	0.0	14.3	0.4	
LnGrp LOS	E		A		B	A	
Approach Vol, veh/h	181	A	1832	A		1326	
Approach Delay, s/veh	68.9		9.6			1.7	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	11.0	113.3				124.3	15.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	38.6				2.0	9.3
Green Ext Time (p_c), s	0.2	23.4				12.3	0.5

Intersection Summary	
HCM 6th Ctrl Delay	9.7
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline Plus Project Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	362	193	20	20	40
Future Vol, veh/h	80	362	193	20	20	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	441	235	24	24	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	290	0	-	0	943	309
Stage 1	-	-	-	-	278	-
Stage 2	-	-	-	-	665	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1266	-	-	-	290	729
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1229	-	-	-	244	687
Mov Cap-2 Maneuver	-	-	-	-	244	-
Stage 1	-	-	-	-	665	-
Stage 2	-	-	-	-	494	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1229	-	-	-	244	687
HCM Lane V/C Ratio	0.079	-	-	-	0.1	0.071
HCM Control Delay (s)	8.2	0	-	-	21.4	10.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.3	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline Plus Project Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	43	10	1585	150	52	1136	10
Future Volume (veh/h)	10	10	10	90	10	43	10	1585	150	52	1136	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	34	11	1686	156	55	1209	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	42	346	2340	214	208	2633	24
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1165	134	413	1767	3266	298	1767	3579	33
Grp Volume(v), veh/h	22	0	0	141	0	0	11	900	942	55	595	625
Grp Sat Flow(s),veh/h/ln	1810	0	0	1711	0	0	1767	1763	1801	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	11.3	0.0	0.0	0.2	41.4	43.5	1.1	18.9	18.9
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.3	0.0	0.0	0.2	41.4	43.5	1.1	18.9	18.9
Prop In Lane	0.50		0.00	0.68		0.24	1.00		0.17	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	176	0	0	346	1263	1291	208	1297	1360
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.71	0.73	0.26	0.46	0.46
Avail Cap(c_a), veh/h	65	0	0	312	0	0	387	1263	1291	216	1297	1360
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.58	0.58	0.58	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.4	0.0	0.0	6.1	11.5	11.8	13.3	7.4	7.4
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.2	0.0	0.0	0.0	2.0	2.1	0.7	1.2	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	15.3	16.4	0.7	6.9	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	6.2	13.5	13.9	13.9	8.6	8.5
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			141			1853			1275	
Approach Delay, s/veh		82.1			69.5			13.7			8.8	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.9	104.8		7.4	6.2	107.5		18.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5				
Max Q Clear Time (g_c+I1), s	3.1	45.5		3.7	2.2	20.9		13.3				
Green Ext Time (p_c), s	0.0	21.6		0.0	0.0	10.9		0.6				

Intersection Summary			
HCM 6th Ctrl Delay			14.6
HCM 6th LOS			B

HCM 6th AWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Intersection	
Intersection Delay, s/veh	14.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Future Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	110	24	151	23	180	72	24	23	30	116
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.6	12.1	14.4	11.3
HCM LOS	C	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	65%	43%	12%	14%
Vol Thru, %	26%	29%	76%	18%
Vol Right, %	9%	28%	12%	68%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	238	345	171	146
LT Vol	155	150	21	20
Through Vol	62	100	130	26
RT Vol	21	95	20	100
Lane Flow Rate	277	401	199	170
Geometry Grp	1	1	1	1
Degree of Util (X)	0.466	0.622	0.336	0.281
Departure Headway (Hd)	6.172	5.581	6.078	5.958
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	587	642	595	606
Service Time	4.172	3.678	4.078	3.97
HCM Lane V/C Ratio	0.472	0.625	0.334	0.281
HCM Control Delay	14.4	17.6	12.1	11.3
HCM Lane LOS	B	C	B	B
HCM 95th-tile Q	2.5	4.3	1.5	1.1

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Future Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.98		0.98	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	4	320	12	105	11	1264	283	70	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	238	251	78	387	13	111	174	1441	318	153	1877	15
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.01	0.51	0.51	0.04	0.53	0.53
Sat Flow, veh/h	609	772	240	1037	39	340	1767	2831	624	1767	3526	29
Grp Volume(v), veh/h	27	0	0	437	0	0	11	773	774	70	665	698
Grp Sat Flow(s),veh/h/ln	1621	0	0	1417	0	0	1767	1749	1706	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	37.0	0.0	0.0	0.4	49.7	52.0	2.4	37.1	37.1
Cycle Q Clear(g_c), s	1.3	0.0	0.0	38.4	0.0	0.0	0.4	49.7	52.0	2.4	37.1	37.1
Prop In Lane	0.41		0.15	0.73		0.24	1.00		0.37	1.00		0.02
Lane Grp Cap(c), veh/h	568	0	0	510	0	0	174	890	868	153	924	969
V/C Ratio(X)	0.05	0.00	0.00	0.86	0.00	0.00	0.06	0.87	0.89	0.46	0.72	0.72
Avail Cap(c_a), veh/h	608	0	0	548	0	0	297	1000	975	235	992	1040
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.5	0.0	0.0	41.8	0.0	0.0	19.4	27.6	28.2	27.2	22.6	22.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	12.1	0.0	0.0	0.2	7.6	9.6	2.1	2.4	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	15.1	0.0	0.0	0.2	21.7	22.6	1.1	15.1	15.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.5	0.0	0.0	53.9	0.0	0.0	19.5	35.2	37.7	29.3	25.0	24.9
LnGrp LOS	C	A	A	D	A	A	B	D	D	C	C	C
Approach Vol, veh/h		27			437			1558			1433	
Approach Delay, s/veh		29.5			53.9			36.3			25.2	
Approach LOS		C			D			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.1	71.0		47.6	6.1	74.0		47.6
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	73.0		45.0	10.5	73.0		45.0
Max Q Clear Time (g_c+I1), s	4.4	54.0		3.3	2.4	39.1		40.4
Green Ext Time (p_c), s	0.1	11.0		0.1	0.0	11.9		1.2

Intersection Summary	
HCM 6th Ctrl Delay	33.9
HCM 6th LOS	C

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	445	11	1561	70	1363
v/c Ratio	0.07	1.02	0.06	0.92	0.45	0.73
Control Delay	26.2	92.8	11.8	40.9	24.6	26.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	92.8	11.8	40.9	24.6	26.3
Queue Length 50th (ft)	15	~452	4	662	25	421
Queue Length 95th (ft)	43	#689	12	814	61	603
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	512	436	233	1839	188	2003
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	1.02	0.05	0.85	0.37	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	160	10	110	10	1130	170	80	1210	10
Future Volume (veh/h)	10	10	10	160	10	110	10	1130	170	80	1210	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	3	176	11	107	11	1242	176	88	1330	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	199	186	45	272	19	130	218	1588	224	237	1954	16
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.52	0.52	0.05	0.55	0.55
Sat Flow, veh/h	567	747	179	836	78	523	1767	3064	432	1767	3525	29
Grp Volume(v), veh/h	25	0	0	294	0	0	11	705	713	88	654	687
Grp Sat Flow(s),veh/h/ln	1493	0	0	1437	0	0	1767	1749	1747	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	16.4	0.0	0.0	0.3	29.4	29.9	2.0	24.3	24.4
Cycle Q Clear(g_c), s	0.9	0.0	0.0	17.4	0.0	0.0	0.3	29.4	29.9	2.0	24.3	24.4
Prop In Lane	0.44		0.12	0.60		0.36	1.00		0.25	1.00		0.02
Lane Grp Cap(c), veh/h	430	0	0	422	0	0	218	906	906	237	962	1009
V/C Ratio(X)	0.06	0.00	0.00	0.70	0.00	0.00	0.05	0.78	0.79	0.37	0.68	0.68
Avail Cap(c_a), veh/h	472	0	0	462	0	0	401	1804	1802	356	1789	1877
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	0.0	31.8	0.0	0.0	12.5	17.5	17.7	15.3	14.4	14.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	4.1	0.0	0.0	0.1	1.5	1.6	1.0	0.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	6.4	0.0	0.0	0.1	11.0	11.2	0.8	8.7	9.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.8	0.0	0.0	35.9	0.0	0.0	12.6	19.0	19.2	16.3	15.2	15.2
LnGrp LOS	C	A	A	D	A	A	B	B	B	B	B	B
Approach Vol, veh/h		25			294			1429			1429	
Approach Delay, s/veh		25.8			35.9			19.1			15.3	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	52.7		28.5	5.7	56.0		28.5
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.0	31.9		2.9	2.3	26.4		19.4
Green Ext Time (p_c), s	0.1	14.8		0.1	0.0	13.1		0.9

Intersection Summary			
HCM 6th Ctrl Delay			19.0
HCM 6th LOS			B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Intersection	
Int Delay, s/veh	10.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	60	30	120	20	50	70	40	20	30	90
Future Vol, veh/h	120	80	60	30	120	20	50	70	40	20	30	90
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	70	35	140	23	58	81	47	23	35	105

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	172	0	0	725	657	155	719	681	175
Stage 1	-	-	-	-	-	-	417	417	-	229	229	-
Stage 2	-	-	-	-	-	-	308	240	-	490	452	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1401	-	-	1399	-	-	339	383	888	342	371	866
Stage 1	-	-	-	-	-	-	611	590	-	772	713	-
Stage 2	-	-	-	-	-	-	700	705	-	558	569	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1392	-	-	1387	-	-	238	325	865	229	315	847
Mov Cap-2 Maneuver	-	-	-	-	-	-	238	325	-	229	315	-
Stage 1	-	-	-	-	-	-	538	519	-	681	688	-
Stage 2	-	-	-	-	-	-	557	680	-	389	501	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.6	1.4	27.8	16.1
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	339	1392	-	-	1387	-	-	485
HCM Lane V/C Ratio	0.549	0.1	-	-	0.025	-	-	0.336
HCM Control Delay (s)	27.8	7.9	0	-	7.7	0	-	16.1
HCM Lane LOS	D	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	3.1	0.3	-	-	0.1	-	-	1.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	290	100	1010	80	60	1410
Future Volume (veh/h)	290	100	1010	80	60	1410
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841
Adj Flow Rate, veh/h	309	0	1074	0	64	1500
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	5	4	3	4
Cap, veh/h	371		2534		427	2819
Arrive On Green	0.11	0.00	0.73	0.00	0.07	1.00
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589
Grp Volume(v), veh/h	309	0	1074	0	64	1500
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749
Q Serve(g_s), s	12.4	0.0	16.9	0.0	1.2	0.0
Cycle Q Clear(g_c), s	12.4	0.0	16.9	0.0	1.2	0.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	371		2534		427	2819
V/C Ratio(X)	0.83		0.42		0.15	0.53
Avail Cap(c_a), veh/h	588		2534		546	2819
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.82	0.82
Uniform Delay (d), s/veh	61.2	0.0	7.4	0.0	4.9	0.0
Incr Delay (d2), s/veh	5.8	0.0	0.5	0.0	0.1	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	5.9	0.0	0.4	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	67.0	0.0	7.9	0.0	5.0	0.6
LnGrp LOS	E		A		A	A
Approach Vol, veh/h	309	A	1074	A		1564
Approach Delay, s/veh	67.0		7.9			0.8
Approach LOS	E		A			A

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.6	108.3				118.9	21.1
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.2	18.9				2.0	14.4
Green Ext Time (p_c), s	0.1	10.1				19.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	10.3
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	100	270	70	50	70
Future Vol, veh/h	50	100	270	70	50	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	122	329	85	61	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	429	0	-	0	646	400
Stage 1	-	-	-	-	387	-
Stage 2	-	-	-	-	259	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1125	-	-	-	435	648
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	782	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1109	-	-	-	398	631
Mov Cap-2 Maneuver	-	-	-	-	398	-
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	771	-

Approach	EB	WB	SB
HCM Control Delay, s	2.8	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1109	-	-	-	398	631
HCM Lane V/C Ratio	0.055	-	-	-	0.153	0.135
HCM Control Delay (s)	8.4	0	-	-	15.7	11.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	40	10	790	30	10	1260	10
Future Volume (veh/h)	10	10	10	140	10	40	10	790	30	10	1260	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	34	11	840	31	11	1340	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	40	286	2449	90	460	2531	21
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.71	0.71	0.01	0.71	0.71
Sat Flow, veh/h	905	905	0	1327	98	303	1767	3467	128	1767	3583	29
Grp Volume(v), veh/h	22	0	0	194	0	0	11	427	444	11	659	692
Grp Sat Flow(s),veh/h/ln	1810	0	0	1728	0	0	1767	1763	1832	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	15.4	0.0	0.0	0.2	13.1	13.1	0.2	24.6	24.6
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.4	0.0	0.0	0.2	13.1	13.1	0.2	24.6	24.6
Prop In Lane	0.50		0.00	0.77		0.18	1.00		0.07	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	228	0	0	286	1245	1294	460	1245	1306
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.34	0.34	0.02	0.53	0.53
Avail Cap(c_a), veh/h	65	0	0	488	0	0	327	1245	1294	501	1245	1306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.90	0.90	0.90	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.4	0.0	0.0	7.8	8.0	8.0	6.2	9.6	9.6
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.0	0.7	0.7	0.0	1.6	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.3	0.0	0.0	0.1	4.9	5.1	0.1	9.3	9.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	7.8	8.6	8.6	6.2	11.3	11.2
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			194			882			1362	
Approach Delay, s/veh		82.1			67.9			8.6			11.2	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	103.4		7.4	6.2	103.4		23.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.2	15.1		3.7	2.2	26.6		17.4
Green Ext Time (p_c), s	0.0	6.4		0.0	0.0	12.6		1.1

Intersection Summary	
HCM 6th Ctrl Delay	15.4
HCM 6th LOS	B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	50	10	90	10	1580	80	90	1120	10
Future Volume (veh/h)	10	10	10	50	10	90	10	1580	80	90	1120	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	2	55	11	61	11	1736	86	99	1231	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	159	147	23	144	40	127	297	2116	104	199	2308	21
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.01	0.62	0.62	0.04	0.66	0.66
Sat Flow, veh/h	611	808	129	535	219	697	1767	3387	166	1767	3522	31
Grp Volume(v), veh/h	24	0	0	127	0	0	11	890	932	99	606	636
Grp Sat Flow(s),veh/h/ln	1548	0	0	1452	0	0	1767	1749	1804	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	5.7	0.0	0.0	0.2	42.7	44.0	2.1	20.3	20.3
Cycle Q Clear(g_c), s	1.2	0.0	0.0	8.4	0.0	0.0	0.2	42.7	44.0	2.1	20.3	20.3
Prop In Lane	0.46		0.08	0.43		0.48	1.00		0.09	1.00		0.02
Lane Grp Cap(c), veh/h	329	0	0	311	0	0	297	1093	1127	199	1136	1192
V/C Ratio(X)	0.07	0.00	0.00	0.41	0.00	0.00	0.04	0.81	0.83	0.50	0.53	0.53
Avail Cap(c_a), veh/h	398	0	0	376	0	0	443	1482	1529	292	1470	1542
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.2	0.0	0.0	40.1	0.0	0.0	8.6	15.7	16.0	21.0	10.0	10.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.9	0.0	0.0	0.1	2.6	2.9	1.9	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	3.2	0.0	0.0	0.1	15.9	16.9	1.6	7.0	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.3	0.0	0.0	40.9	0.0	0.0	8.6	18.3	18.8	22.9	10.4	10.4
LnGrp LOS	D	A	A	D	A	A	A	B	B	C	B	B
Approach Vol, veh/h		24			127			1833			1341	
Approach Delay, s/veh		37.3			40.9			18.5			11.3	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	74.6		25.9	5.9	77.9		25.9
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.1	46.0		3.2	2.2	22.3		10.4
Green Ext Time (p_c), s	0.1	22.6		0.1	0.0	11.4		0.6

Intersection Summary		
HCM 6th Ctrl Delay		16.6
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	50	60	20	40	20	50	30	20	20	20	50
Future Vol, veh/h	50	50	60	20	40	20	50	30	20	20	20	50
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	58	58	70	23	47	23	58	35	23	23	23	58

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	80	0	0	136	0	0	372	343	110	362	367	79
Stage 1	-	-	-	-	-	-	217	217	-	115	115	-
Stage 2	-	-	-	-	-	-	155	126	-	247	252	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1512	-	-	1442	-	-	583	578	941	592	560	979
Stage 1	-	-	-	-	-	-	783	721	-	887	798	-
Stage 2	-	-	-	-	-	-	845	790	-	755	697	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1498	-	-	1431	-	-	497	535	926	515	518	960
Mov Cap-2 Maneuver	-	-	-	-	-	-	497	535	-	515	518	-
Stage 1	-	-	-	-	-	-	745	685	-	842	776	-
Stage 2	-	-	-	-	-	-	750	769	-	663	662	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.3	1.9	13.1	11.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	561	1498	-	-	1431	-	-	695
HCM Lane V/C Ratio	0.207	0.039	-	-	0.016	-	-	0.151
HCM Control Delay (s)	13.1	7.5	0	-	7.6	0	-	11.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.8	0.1	-	-	0.1	-	-	0.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	180	60	1620	320	80	1060	
Future Volume (veh/h)	180	60	1620	320	80	1060	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	191	0	1723	0	85	1128	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	249		2652		261	2943	
Arrive On Green	0.07	0.00	0.76	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	191	0	1723	0	85	1128	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.7	0.0	32.6	0.0	1.3	0.0	
Cycle Q Clear(g_c), s	7.7	0.0	32.6	0.0	1.3	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	249		2652		261	2943	
V/C Ratio(X)	0.77		0.65		0.33	0.38	
Avail Cap(c_a), veh/h	588		2652		377	2943	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.91	0.91	
Uniform Delay (d), s/veh	63.7	0.0	7.7	0.0	8.3	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.2	0.0	0.7	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.5	0.0	10.8	0.0	0.8	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.6	0.0	9.0	0.0	8.9	0.3	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	191	A	1723	A		1213	
Approach Delay, s/veh	68.6		9.0			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.8	113.0				123.8	16.2
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.3	34.6				2.0	9.7
Green Ext Time (p_c), s	0.1	21.9				11.1	0.5

Intersection Summary			
HCM 6th Ctrl Delay			9.5
HCM 6th LOS			A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	330	160	50	50	40
Future Vol, veh/h	80	330	160	50	50	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	402	195	61	61	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	287	0	-	0	883	288
Stage 1	-	-	-	-	257	-
Stage 2	-	-	-	-	626	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1269	-	-	-	315	749
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	531	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1232	-	-	-	266	705
Mov Cap-2 Maneuver	-	-	-	-	266	-
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	515	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	17.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1232	-	-	-	266	705
HCM Lane V/C Ratio	0.079	-	-	-	0.229	0.069
HCM Control Delay (s)	8.2	0	-	-	22.5	10.5
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.9	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	40	10	1440	140	40	1030	10
Future Volume (veh/h)	10	10	10	90	10	40	10	1440	140	40	1030	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	32	11	1532	145	43	1096	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	40	387	2346	220	240	2634	26
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1184	136	395	1767	3257	306	1767	3575	36
Grp Volume(v), veh/h	22	0	0	139	0	0	11	823	854	43	540	567
Grp Sat Flow(s),veh/h/ln	1810	0	0	1714	0	0	1767	1763	1800	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	34.3	35.4	0.9	16.3	16.3
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	34.3	35.4	0.9	16.3	16.3
Prop In Lane	0.50		0.00	0.69		0.23	1.00		0.17	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	174	0	0	387	1270	1296	240	1299	1362
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.65	0.66	0.18	0.42	0.42
Avail Cap(c_a), veh/h	65	0	0	312	0	0	428	1270	1296	251	1299	1362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.66	0.66	0.66	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.5	0.0	0.0	5.7	10.3	10.4	9.7	7.0	7.0
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.1	0.0	0.0	0.0	1.7	1.7	0.4	1.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	12.6	13.2	0.4	5.9	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	5.8	12.0	12.2	10.1	8.0	7.9
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			139			1688			1150	
Approach Delay, s/veh		82.1			69.5			12.0			8.0	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	105.3		7.4	6.2	107.6		18.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	2.9	37.4		3.7	2.2	18.3		13.1
Green Ext Time (p_c), s	0.0	19.5		0.0	0.0	9.3		0.6

Intersection Summary		
HCM 6th Ctrl Delay		13.7
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Connection
1: Farrington Hwy & St John's Rd
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	174	11	123	10	1130	175	84	1210	10
Future Volume (veh/h)	10	11	10	174	11	123	10	1130	175	84	1210	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	3	191	12	120	11	1242	181	92	1330	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	194	198	44	276	17	137	215	1579	229	232	1949	16
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.01	0.52	0.52	0.05	0.55	0.55
Sat Flow, veh/h	542	775	172	839	65	534	1767	3052	442	1767	3525	29
Grp Volume(v), veh/h	26	0	0	323	0	0	11	708	715	92	654	687
Grp Sat Flow(s),veh/h/ln	1488	0	0	1439	0	0	1767	1749	1745	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	18.9	0.0	0.0	0.3	30.5	31.0	2.2	25.1	25.1
Cycle Q Clear(g_c), s	1.0	0.0	0.0	19.9	0.0	0.0	0.3	30.5	31.0	2.2	25.1	25.1
Prop In Lane	0.42		0.12	0.59		0.37	1.00		0.25	1.00		0.02
Lane Grp Cap(c), veh/h	436	0	0	430	0	0	215	905	903	232	959	1006
V/C Ratio(X)	0.06	0.00	0.00	0.75	0.00	0.00	0.05	0.78	0.79	0.40	0.68	0.68
Avail Cap(c_a), veh/h	457	0	0	450	0	0	392	1754	1751	346	1740	1825
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.0	0.0	0.0	33.0	0.0	0.0	12.9	18.2	18.3	16.1	14.9	14.9
Incr Delay (d2), s/veh	0.1	0.0	0.0	6.7	0.0	0.0	0.1	1.5	1.6	1.1	0.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	7.7	0.0	0.0	0.1	11.5	11.7	0.8	9.1	9.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.1	0.0	0.0	39.7	0.0	0.0	13.0	19.7	19.9	17.2	15.7	15.7
LnGrp LOS	C	A	A	D	A	A	B	B	B	B	B	B
Approach Vol, veh/h		26			323			1434			1433	
Approach Delay, s/veh		26.1			39.7			19.7			15.8	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.0	54.0		29.7	5.7	57.3		29.7
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.2	33.0		3.0	2.3	27.1		21.9
Green Ext Time (p_c), s	0.1	14.9		0.1	0.0	13.1		0.6

Intersection Summary		
HCM 6th Ctrl Delay		20.0
HCM 6th LOS		C

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Connection
2: Kulaaupuni St & St John's Rd
AM Peak Hour

Intersection	
Int Delay, s/veh	17.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Future Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	81	36	140	23	91	107	48	23	42	105

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	183	0	0	736	665	161	740	694	175
Stage 1	-	-	-	-	-	-	423	423	-	231	231	-
Stage 2	-	-	-	-	-	-	313	242	-	509	463	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1401	-	-	1386	-	-	333	379	881	331	365	866
Stage 1	-	-	-	-	-	-	607	586	-	770	711	-
Stage 2	-	-	-	-	-	-	696	704	-	545	562	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1392	-	-	1374	-	-	229	322	858	204	310	847
Mov Cap-2 Maneuver	-	-	-	-	-	-	229	322	-	204	310	-
Stage 1	-	-	-	-	-	-	534	516	-	679	685	-
Stage 2	-	-	-	-	-	-	548	679	-	356	495	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.5	1.4	48	17.5
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	1392	-	-	1374	-	-	456
HCM Lane V/C Ratio	0.784	0.1	-	-	0.026	-	-	0.372
HCM Control Delay (s)	48	7.9	0	-	7.7	0	-	17.5
HCM Lane LOS	E	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	6.3	0.3	-	-	0.1	-	-	1.7

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Connection
3: Farrington Hwy & Kaukama Rd — AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	339	100	1022	96	60	1446	
Future Volume (veh/h)	339	100	1022	96	60	1446	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	361	0	1087	0	64	1538	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	423		2482		411	2766	
Arrive On Green	0.12	0.00	0.72	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	361	0	1087	0	64	1538	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	14.4	0.0	18.2	0.0	1.3	0.0	
Cycle Q Clear(g_c), s	14.4	0.0	18.2	0.0	1.3	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	423		2482		411	2766	
V/C Ratio(X)	0.85		0.44		0.16	0.56	
Avail Cap(c_a), veh/h	588		2482		530	2766	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.80	0.80	
Uniform Delay (d), s/veh	60.1	0.0	8.3	0.0	5.6	0.0	
Incr Delay (d2), s/veh	8.7	0.0	0.6	0.0	0.1	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	6.9	0.0	6.5	0.0	0.4	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.8	0.0	8.8	0.0	5.7	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	361	A	1087	A		1602	
Approach Delay, s/veh	68.8		8.8			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.6	106.2				116.7	23.3
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.3	20.2				2.0	16.4
Green Ext Time (p_c), s	0.1	10.3				20.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	11.7
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Connection
4: Kaukama Rd & Kulauku St — AM Peak Hour

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	66	100	270	71	53	119
Future Vol, veh/h	66	100	270	71	53	119
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	80	122	329	87	65	145

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	431	0	-	0	685	401
Stage 1	-	-	-	-	388	-
Stage 2	-	-	-	-	297	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1123	-	-	-	412	647
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	752	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	369	630
Mov Cap-2 Maneuver	-	-	-	-	369	-
Stage 1	-	-	-	-	621	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	13.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	369	630
HCM Lane V/C Ratio	0.073	-	-	-	0.175	0.23
HCM Control Delay (s)	8.5	0	-	-	16.8	12.4
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.6	0.9

HCM 6th Signalized Intersection Summary Baseline Plus Project with Kulaaupuni Connection
5: Farrington Hwy & Hookele St AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	162	10	40	10	795	37	10	1274	10
Future Volume (veh/h)	10	10	10	162	10	40	10	795	37	10	1274	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	172	11	36	11	846	37	11	1355	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	200	13	42	272	2379	104	442	2478	20
Arrive On Green	0.02	0.02	0.00	0.15	0.15	0.15	0.01	0.69	0.69	0.01	0.69	0.69
Sat Flow, veh/h	905	905	0	1359	87	285	1767	3440	150	1767	3583	29
Grp Volume(v), veh/h	22	0	0	219	0	0	11	433	450	11	666	700
Grp Sat Flow(s),veh/h/ln	1810	0	0	1731	0	0	1767	1763	1828	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	17.3	0.0	0.0	0.3	14.1	14.1	0.3	26.3	26.3
Cycle Q Clear(g_c), s	1.7	0.0	0.0	17.3	0.0	0.0	0.3	14.1	14.1	0.3	26.3	26.3
Prop In Lane	0.50		0.00	0.79		0.16	1.00		0.08	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	254	0	0	272	1219	1264	442	1219	1279
V/C Ratio(X)	0.59	0.00	0.00	0.86	0.00	0.00	0.04	0.36	0.36	0.02	0.55	0.55
Avail Cap(c_a), veh/h	65	0	0	488	0	0	313	1219	1264	483	1219	1279
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.89	0.89	0.89	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	58.3	0.0	0.0	8.7	8.8	8.8	6.9	10.7	10.7
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.4	0.0	0.0	0.1	0.7	0.7	0.0	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	8.2	0.0	0.0	0.1	5.3	5.5	0.1	10.1	10.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	66.7	0.0	0.0	8.8	9.6	9.5	6.9	12.5	12.4
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			219			894			1377	
Approach Delay, s/veh		82.1			66.7			9.5			12.4	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	101.3		7.4	6.2	101.3		25.1
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.3	16.1		3.7	2.3	28.3		19.3
Green Ext Time (p_c), s	0.0	6.5		0.0	0.0	12.7		1.3

Intersection Summary			
HCM 6th Ctrl Delay			16.7
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	59	11	98	10	1580	95	106	1120	10
Future Volume (veh/h)	10	11	10	59	11	98	10	1580	95	106	1120	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	2	65	12	72	11	1736	101	116	1231	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	151	152	22	146	38	129	296	2100	121	194	2312	21
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.01	0.63	0.63	0.04	0.66	0.66
Sat Flow, veh/h	569	825	121	543	206	700	1767	3354	193	1767	3522	31
Grp Volume(v), veh/h	25	0	0	149	0	0	11	897	940	116	606	636
Grp Sat Flow(s),veh/h/ln	1515	0	0	1449	0	0	1767	1749	1798	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	7.7	0.0	0.0	0.3	44.4	46.1	2.6	20.8	20.8
Cycle Q Clear(g_c), s	1.3	0.0	0.0	10.3	0.0	0.0	0.3	44.4	46.1	2.6	20.8	20.8
Prop In Lane	0.44		0.08	0.44		0.48	1.00		0.11	1.00		0.02
Lane Grp Cap(c), veh/h	325	0	0	313	0	0	296	1095	1126	194	1139	1194
V/C Ratio(X)	0.08	0.00	0.00	0.48	0.00	0.00	0.04	0.82	0.83	0.60	0.53	0.53
Avail Cap(c_a), veh/h	382	0	0	366	0	0	438	1442	1483	283	1431	1501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.0	0.0	0.0	41.6	0.0	0.0	8.8	16.2	16.5	23.2	10.2	10.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.1	0.0	0.0	0.1	2.9	3.3	2.9	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	3.9	0.0	0.0	0.1	16.7	18.0	2.1	7.3	7.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.1	0.0	0.0	42.7	0.0	0.0	8.8	19.1	19.8	26.1	10.6	10.6
LnGrp LOS	D	A	A	D	A	A	A	B	B	C	B	B
Approach Vol, veh/h		25			149			1848			1358	
Approach Delay, s/veh		38.1			42.7			19.4			11.9	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	76.6		26.8	6.0	80.0		26.8
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.6	48.1		3.3	2.3	22.8		12.3
Green Ext Time (p_c), s	0.1	22.5		0.1	0.0	11.4		0.7

Intersection Summary		
HCM 6th Ctrl Delay		17.6
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	50	92	21	40	20	68	44	21	20	41	50
Future Vol, veh/h	50	50	92	21	40	20	68	44	21	20	41	50
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	58	58	107	24	47	23	79	51	24	23	48	58

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	80	0	0	173	0	0	406	364	129	391	406	79
Stage 1	-	-	-	-	-	-	236	236	-	117	117	-
Stage 2	-	-	-	-	-	-	170	128	-	274	289	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1512	-	-	1398	-	-	554	562	918	566	533	979
Stage 1	-	-	-	-	-	-	765	708	-	885	797	-
Stage 2	-	-	-	-	-	-	830	788	-	730	671	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1498	-	-	1387	-	-	452	519	903	477	492	960
Mov Cap-2 Maneuver	-	-	-	-	-	-	452	519	-	477	492	-
Stage 1	-	-	-	-	-	-	727	672	-	839	775	-
Stage 2	-	-	-	-	-	-	712	766	-	623	637	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2	2	15	12.2
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	515	1498	-	-	1387	-	-	626
HCM Lane V/C Ratio	0.3	0.039	-	-	0.018	-	-	0.206
HCM Control Delay (s)	15	7.5	0	-	7.6	0	-	12.2
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.3	0.1	-	-	0.1	-	-	0.8

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Extension
3: Farrington Hwy & Kaukama Rd — PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	211	60	1660	372	80	1083	
Future Volume (veh/h)	211	60	1660	372	80	1083	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	224	0	1766	0	85	1152	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	284		2617		246	2908	
Arrive On Green	0.08	0.00	0.75	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	224	0	1766	0	85	1152	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	9.0	0.0	35.7	0.0	1.4	0.0	
Cycle Q Clear(g_c), s	9.0	0.0	35.7	0.0	1.4	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	284		2617		246	2908	
V/C Ratio(X)	0.79		0.67		0.35	0.40	
Avail Cap(c_a), veh/h	588		2617		362	2908	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.90	0.90	
Uniform Delay (d), s/veh	63.0	0.0	8.6	0.0	9.8	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.4	0.0	0.7	0.4	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	4.2	0.0	12.1	0.0	0.9	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	67.9	0.0	10.0	0.0	10.5	0.4	
LnGrp LOS	E		B		B	A	
Approach Vol, veh/h	224	A	1766	A		1237	
Approach Delay, s/veh	67.9		10.0			1.1	
Approach LOS	E		B			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.8	111.6				122.4	17.6
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.4	37.7				2.0	11.0
Green Ext Time (p_c), s	0.1	22.2				11.5	0.6

Intersection Summary	
HCM 6th Ctrl Delay	10.6
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Extension
4: Kaukama Rd & Kulauku St — PM Peak Hour

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	132	330	160	53	52	71
Future Vol, veh/h	132	330	160	53	52	71
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	161	402	195	65	63	87

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	291	0	-	0	1011	290
Stage 1	-	-	-	-	259	-
Stage 2	-	-	-	-	752	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1265	-	-	-	264	747
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	464	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1228	-	-	-	206	704
Mov Cap-2 Maneuver	-	-	-	-	206	-
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	450	-

Approach	EB	WB	SB
HCM Control Delay, s	2.4	0	19
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1228	-	-	-	206	704
HCM Lane V/C Ratio	0.131	-	-	-	0.308	0.123
HCM Control Delay (s)	8.4	0	-	-	30.1	10.8
HCM Lane LOS	A	A	-	-	D	B
HCM 95th %tile Q(veh)	0.5	-	-	-	1.2	0.4

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Extension

5: Farrington Hwy & Hookele St — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	104	10	40	10	1455	165	40	1039	10
Future Volume (veh/h)	10	10	10	104	10	40	10	1455	165	40	1039	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	111	11	33	11	1548	171	43	1105	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	135	13	40	377	2282	249	225	2605	26
Arrive On Green	0.02	0.02	0.00	0.11	0.11	0.11	0.01	0.71	0.71	0.03	0.73	0.73
Sat Flow, veh/h	905	905	0	1231	122	366	1767	3204	350	1767	3575	36
Grp Volume(v), veh/h	22	0	0	155	0	0	11	844	875	43	545	571
Grp Sat Flow(s),veh/h/ln	1810	0	0	1719	0	0	1767	1763	1792	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	12.4	0.0	0.0	0.2	37.0	38.5	0.9	17.0	17.0
Cycle Q Clear(g_c), s	1.7	0.0	0.0	12.4	0.0	0.0	0.2	37.0	38.5	0.9	17.0	17.0
Prop In Lane	0.50		0.00	0.72		0.21	1.00		0.20	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	189	0	0	377	1255	1276	225	1284	1347
V/C Ratio(X)	0.59	0.00	0.00	0.82	0.00	0.00	0.03	0.67	0.69	0.19	0.42	0.42
Avail Cap(c_a), veh/h	65	0	0	313	0	0	419	1255	1276	237	1284	1347
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.63	0.63	0.63	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.0	0.0	0.0	6.1	11.1	11.3	11.1	7.5	7.5
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.6	0.0	0.0	0.0	1.8	1.9	0.4	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.9	0.0	0.0	0.1	13.8	14.5	0.4	6.2	6.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	6.2	13.0	13.3	11.5	8.5	8.4
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			155			1730			1159	
Approach Delay, s/veh		82.1			69.5			13.1			8.6	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	104.2		7.4	6.2	106.5		19.9
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	2.9	40.5		3.7	2.2	19.0		14.4
Green Ext Time (p_c), s	0.0	20.1		0.0	0.0	9.4		0.6

Intersection Summary			
HCM 6th Ctrl Delay			14.7
HCM 6th LOS			B

HCM 6th AWSC — Baseline Plus Project with Kulaaupuni Connection Mitigated
2: Kulaaupuni St & St John's Rd — AM Peak Hour

Intersection	
Intersection Delay, s/veh	12
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Future Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	81	36	140	23	91	107	48	23	42	105
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13.2	11.2	12.2	10.4
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	37%	44%	18%	14%
Vol Thru, %	44%	30%	70%	25%
Vol Right, %	19%	26%	12%	62%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	211	270	171	146
LT Vol	78	120	31	20
Through Vol	92	80	120	36
RT Vol	41	70	20	90
Lane Flow Rate	245	314	199	170
Geometry Grp	1	1	1	1
Degree of Util (X)	0.383	0.47	0.31	0.258
Departure Headway (Hd)	5.62	5.395	5.616	5.474
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	638	666	638	654
Service Time	3.675	3.446	3.673	3.534
HCM Lane V/C Ratio	0.384	0.471	0.312	0.26
HCM Control Delay	12.2	13.2	11.2	10.4
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.8	2.5	1.3	1

Queues — Existing (2020) Conditions
1: Farrington Hwy & St John's Rd — AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	3	284	7	1396	53	1254
v/c Ratio	0.01	0.78	0.03	0.81	0.26	0.63
Control Delay	0.0	50.9	6.3	23.2	9.3	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.0	50.9	6.3	23.2	9.3	14.6
Queue Length 50th (ft)	0	158	1	357	11	223
Queue Length 95th (ft)	0	#376	6	450	24	368
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	557	364	343	3154	277	3208
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.02	0.44	0.19	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	6	148	4	1696	66	1132
v/c Ratio	0.03	0.62	0.01	0.76	0.31	0.46
Control Delay	0.2	40.5	4.2	16.0	7.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.2	40.5	4.2	16.0	7.4	7.3
Queue Length 50th (ft)	0	51	1	356	8	114
Queue Length 95th (ft)	0	152	4	615	26	303
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	397	426	366	3121	291	3133
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.35	0.01	0.54	0.23	0.36

Intersection Summary

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	330	11	1528	66	1363
v/c Ratio	0.08	1.00	0.05	0.83	0.34	0.65
Control Delay	28.5	91.1	5.9	23.2	10.8	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.5	91.1	5.9	23.2	10.8	14.2
Queue Length 50th (ft)	12	~236	2	422	14	256
Queue Length 95th (ft)	45	#524	8	523	27	414
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	392	330	318	2952	254	3006
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	1.00	0.03	0.52	0.26	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	187	11	1890	77	1264
v/c Ratio	0.12	0.80	0.04	0.84	0.46	0.52
Control Delay	37.5	70.7	4.9	22.1	23.3	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	70.7	4.9	22.1	23.3	10.4
Queue Length 50th (ft)	16	138	2	632	16	218
Queue Length 95th (ft)	50	#273	7	822	65	359
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	334	292	375	2630	212	2686
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.64	0.03	0.72	0.36	0.47

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	445	11	1561	70	1363
v/c Ratio	0.09	1.39	0.05	0.83	0.37	0.64
Control Delay	30.0	228.7	5.8	23.2	12.3	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	228.7	5.8	23.2	12.3	13.8
Queue Length 50th (ft)	13	~423	2	440	15	256
Queue Length 95th (ft)	47	#775	8	543	33	412
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	393	319	319	2884	248	2946
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	1.39	0.03	0.54	0.28	0.46

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	261	11	1998	95	1264
v/c Ratio	0.12	1.05	0.04	0.92	0.60	0.53
Control Delay	38.5	122.4	4.9	30.2	38.8	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	122.4	4.9	30.2	38.8	11.1
Queue Length 50th (ft)	18	~262	2	771	34	226
Queue Length 95th (ft)	52	#453	7	947	97	359
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	291	248	357	2312	185	2466
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	1.05	0.03	0.86	0.51	0.51

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	308	11	1429	88	1341
v/c Ratio	0.08	0.88	0.05	0.80	0.41	0.65
Control Delay	26.0	63.5	6.3	23.1	13.1	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.0	63.5	6.3	23.1	13.1	14.7
Queue Length 50th (ft)	11	181	2	379	19	249
Queue Length 95th (ft)	42	#434	8	478	40	407
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	407	349	322	3108	269	3144
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.88	0.03	0.46	0.33	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaapuni Extension
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	165	11	1824	99	1242
v/c Ratio	0.15	0.72	0.03	0.84	0.52	0.51
Control Delay	37.3	54.9	4.5	21.0	25.4	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.3	54.9	4.5	21.0	25.4	9.2
Queue Length 50th (ft)	14	84	2	487	16	162
Queue Length 95th (ft)	50	190	7	760	85	350
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	358	342	412	2836	237	2853
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.48	0.03	0.64	0.42	0.44

Intersection Summary

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaapuni Connection
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	338	11	1434	92	1341
v/c Ratio	0.09	1.00	0.05	0.82	0.43	0.64
Control Delay	26.5	88.2	6.3	24.7	14.4	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.5	88.2	6.3	24.7	14.4	14.3
Queue Length 50th (ft)	11	~208	2	382	20	249
Queue Length 95th (ft)	43	#491	8	481	46	406
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	391	337	327	3099	264	3134
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	1.00	0.03	0.46	0.35	0.43

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	185	11	1840	116	1242
v/c Ratio	0.14	0.77	0.03	0.85	0.62	0.51
Control Delay	38.0	61.8	4.8	22.8	38.1	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.0	61.8	4.8	22.8	38.1	9.7
Queue Length 50th (ft)	16	112	2	570	38	185
Queue Length 95th (ft)	52	#225	7	774	114	350
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	341	324	398	2712	222	2748
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.57	0.03	0.68	0.52	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

APPENDIX C

Preliminary Geotechnical Engineering Exploration, June 15, 2020

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE

NANAKULI, OAHU, HAWAII

W.O. 8017-00 JUNE 15, 2020

Prepared for

GRAY HONG NOJIMA & ASSOCIATES, INC.

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE

NANAKULI, OAHU, HAWAII

W.O. 8017-00 JUNE 15, 2020

Prepared for

GARY HONG NOJIMA & ASSOCIATES, INC.

JOHN Y. L. CHEN
LICENSED PROFESSIONAL ENGINEER
No. 10029-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

SIGNATURE — EXPIRATION DATE OF THE LICENSE: 4-30-22

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
94-429 Koaki Street, Suite 200 • Waipahu, HI 96797

Hawaii • California

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

June 15, 2020
W.O. 8017-00

Ms. Sheryl Nojima
Gary Hong Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, HI 96813

Dear **Ms. Nojima:**

Geolabs, Inc. is pleased to submit our report entitled "Preliminary Geotechnical Engineering Exploration, Residential Development at Former Voice America Site, Nanakuli, Oahu, Hawaii," prepared for the design of the project.

Our work was performed in general accordance with the scope of services outlined in our revised fee proposal dated July 3, 2019.

Please note that the soil samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific design recommendations are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

John Y.L. Chen, P.E.
Vice President

JC:TO:cj

94-429 Koaki Street, Suite 200 • Waipahu, Hawaii 96797
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Hawaii • California

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION
RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE
NANAKULI, OAHU, HAWAII
W.O. 8017-00 JUNE 15, 2020

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PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE

NANAKULI, OAHU, HAWAII

W.O. 8017-00 JUNE 15, 2020

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The field exploration consisted of drilling and sampling six borings within the planned development. Our field exploration at the project site generally encountered alluvium overlying loose to dense coralline material extending down to the maximum depth explored of about 21.5 feet below the existing ground surface.

Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 to -3.3 feet Mean Sea Level (MSL), at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Our laboratory tests indicate that the near-surface clayey/silty soils exhibit low to moderate shrink-swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials.

We recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the bottom of the footing onto the coralline material. Placement of the non-expansive select granular fill layer would reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the on-site soils due to fluctuations in the moisture content.

Field infiltration tests were performed at a depth of about 5 feet below the existing ground surface. Based on the results of the field infiltration testing, the average infiltration rates at these locations indicate that an infiltration/detention system and similar methods of stormwater management would be feasible for this development. Due to the variability of the subsurface conditions, the absorption capacity of the selected stormwater disposal system should be confirmed by conducting additional infiltration tests during construction

The text of this report should be referred to for detailed discussions and specific geotechnical recommendations.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1. GENERAL

This report presents the results of our preliminary geotechnical engineering exploration performed for the *Residential Development at Former Voice America Site* project in the Nanakuli area on the Island of Oahu, Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings and geotechnical recommendations resulting from our field exploration, laboratory testing, and engineering analyses for the project. These findings and geotechnical recommendations are intended for the design of site grading, slabs-on-grade, and pavements only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.1 Project Considerations

The proposed development is located to the west of the Sea Country subdivision, north of the Kamehameha School Community Learning Center, and east of Kulaaupuni Street in the Nanakuli area on the Island of Oahu, Hawaii. We understand that the proposed residential development project encompasses approximately 40 acres of Hawaiian Home Lands. A layout of the project site is shown on the Site Plan, Plate 2.

We understand that the envisioned new development includes about 250 single-family residential lots and multi-family residential units with new roadways and underground utilities, such as water, sewer and drainage lines. The roadway system will include the extension of Kulaaupuni Street to Kulawae Street and improvements to St. John's Road.

Details of the development design were not available at the time this report was prepared. We understand a detailed geotechnical exploration program will be conducted for detailed foundation and earthwork design and construction.

1.2 Purpose and Scope

The purpose of our exploration was to obtain an overview of the surface and subsurface conditions to develop an idealized soil data set to formulate preliminary geotechnical engineering recommendations for conceptual design of the development

project. The work was performed in general accordance with our revised fee proposal dated July 3, 2019. The scope of work for this exploration included the following tasks and work efforts:

1. Review of available in-house soil and geologic information for areas around the subdivision development.
2. Coordination of site access, boring stakeout, and utility clearances by our engineer and geologist.
3. Mobilization and demobilization of a backhoe for mechanized trail clearing, supervised by our geologist.
4. Mobilization and demobilization of a truck-mounted drill rig, water truck, and two operators to the project site and back.
5. Drilling and sampling of six boreholes to a depth of about 21.5 feet below the existing ground surface.
6. Coordination of the field exploration and logging of the borings by our geologist.
7. Performing four Low Impact Development (LID) infiltration tests to characterize the ground permeability for the stormwater management design.
8. Laboratory testing of selected samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.
9. Analyses of the field and laboratory data to formulate preliminary geotechnical engineering recommendations for the design of the project.
10. Preparation of this report summarizing our work and presenting our findings and preliminary geotechnical recommendations.
11. Coordination of our work on the project by our engineer.
12. Quality assurance of our work and client/design team consultation by our principal engineer.
13. Miscellaneous work efforts, such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration methodology and the Logs of Borings are presented in Appendix A. Results of the laboratory tests performed on selected soil

samples are presented in Appendix B. Results of the infiltration tests performed at selected locations are presented in Appendix C.

END OF GENERAL

SECTION 2. SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Oahu was built by the extrusion of basalt and basaltic lava from the Waianae and Koolau shield volcanoes. The older Waianae Volcano is estimated to be middle to late Pliocene in age, and Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. As the volcanic activity in Waianae Volcano ceased, lava flows from Koolau Volcano banked against its eroded eastern slope forming a broad plateau, now known as the Schofield Plateau. The project site is located on the southwestern flank of the Waianae Volcano.

Physical and chemical weathering followed by erosion of Schofield Plateau generated sediments, which were transported to the coast. In the project vicinity and to the south, these sediments have accumulated and are interbedded with marine sediments and coral/algal reef formations, forming a sedimentary wedge. The thickness of the sedimentary wedge ranges from zero in the area of the Interstate Route H-1 Highway to over 1,000 feet at Ewa Beach. This wedge forms the Ewa Plain and serves as the confining formation, or "caprock," over the artesian basal aquifers of Southern Oahu. Deposition of sediments has continued from earlier geologic time through the present.

During the Pleistocene Epoch, sea levels fluctuated in response to the cycles of continental glaciation. As the glaciers grew and advanced, less water was available to fill the oceanic basins such that sea levels fell below the present stands of the sea. When the glaciers melted and receded, an excess of water became available such that the sea levels rose to above the present sea level.

The higher sea level stands caused the formation of deltas and fans of accumulated terrigenous sediments in the heads of old bays, accumulated reef deposits at correspondingly higher elevations, and deposited lagoonal/marine sediments in the quiet waters protected by fringing reefs. The lower sea stands caused streams to carve valleys in the sediments and reef deposits. Subaerial exposure of the sediments and calcareous materials caused consolidation of the lagoonal deposits and induration of the

calcareous reef materials. Agricultural development within the last 100 years and recent mass grading work brought the Kapolei area to its present form.

2.2 Subsurface Conditions

We explored the subsurface conditions by drilling and sampling six borings, designated as Boring Nos. 1 through 6, extending to the maximum depth drilled of about 21.5 feet below the existing ground surface. In addition, four boreholes, designated as LID-1 through LID-4, were drilled to a depth of about 5 feet below the existing ground surface for the access of the infiltration testing. Results of the infiltration tests performed at selected locations are presented in Appendix C. The approximate boring locations are shown on the Site Plan, Plate 2.

Based on our field exploration, the project site is generally underlain by a thin alluvium layer overlying coralline deposits extending to the maximum depths explored. The alluvial material generally consisted of medium stiff clayey and/or silty soils extending to depths between about 1 and 4.5 feet below the ground surface. Below the alluvial material, we encountered coralline deposits consisting of medium dense to dense coral formation and loose to dense coralline detritus extending to the maximum depth explored of about 21.5 feet below the ground surface. It should be noted that weathered sandstone consisting of loose to medium dense silty sand were encountered in Boring Nos. 3 and 6 at about 4.5 and 18 feet below the ground surface.

Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 and -3.3 feet MSL at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

2.3 Seismic Design Considerations

Based on the International Building Code (2012 Edition), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. The following sections provide discussions on the soil profile type for seismic design and liquefaction design consideration at the project site.

Based on the subsurface materials anticipated at the project site and the geologic setting of the area, we believe that the project site may be classified as “Stiff Soil Profile” from a seismic analysis standpoint. Therefore, we believe the seismic design of the building structures may be designed based on a Site Class D soil profile in accordance with Chapter 20, Site Classification Procedure for Seismic Design, contained in ASCE Minimum Design Loads for Buildings and Other Structures, 2010 Edition (ASCE 7-10).

Based on the subsurface conditions encountered, the phenomenon of soil liquefaction is not a design consideration for this project site due to coralline formation encountered in the relatively shallow depth.

END OF SITE CHARACTERIZATION

SECTION 3. DISCUSSION AND RECOMMENDATIONS

Based on the results from our field exploration, the project site is generally underlain by a thin layer of clayey/silty alluvial material overlying coralline deposits extending to the maximum depth explored of about 21.5 feet below the existing ground surface. Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 to -3.3 feet MSL, at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Our laboratory tests indicate that the near-surface clayey/silty soils exhibit low to moderate shrink-swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials.

We recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the bottom of the footing directly onto the coralline material, to reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from swelling/shrinking of the on-site soils due to the changes in the moisture content.

Detailed discussions and recommendations for these items and other geotechnical aspects of the project are presented in the following sections.

3.1 Site Grading

Based on the relatively gently sloping topography across the project site, we anticipate site grading with cuts and fills of less than about 10 feet thick will be required to achieve the design finished grades for the project. Items of grading addressed in the subsequent subsections include the following:

1. Site Preparation
2. Fills and Backfills
3. Fill Placement and Compaction Requirements
4. Excavations
5. Cut and Fill Slopes
6. Erosion Control Measures (Landscape)

A Geolabs representative should monitor site grading operations to observe whether undesirable materials are encountered during the excavation and scarification process, and to confirm whether the exposed soil conditions are similar to those assumed in this report.

3.1.1 Site Preparation

At the on-set of earthwork, the area within the contract grading limits should be cleared and grubbed thoroughly. Vegetation, debris, deleterious and other unsuitable materials should be removed and disposed of properly off-site. Soft and/or yielding areas encountered during clearing and grubbing below areas designated to receive fill should be over-excavated to expose firm material, and the resulting excavation should be backfilled with well-compacted fills.

After clearing and grubbing, finished subgrades and areas designated to receive fills should be scarified to a depth of about 12 inches, where possible, moisture-conditioned to about 2 percent above the optimum moisture, and recompacted to a minimum of 90 percent relative compaction.

Where shrinkage cracks are observed at the ground surface after compaction of the subgrade, we recommend preparing the subgrade soil again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted fill. A Geolabs representative should evaluate the need for over-excavation due to soft subgrade soil conditions.

3.1.2 Fills and Backfills

In general, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials and the material has particles with a maximum size of no greater than 6 inches. Imported fill materials, if required, should consist of non-expansive select granular materials, such as crushed coralline or basaltic materials. The materials should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension and should contain between 10 and 30 percent particles passing the No. 200 sieve. The

materials should have a laboratory California Bearing Ratio (CBR) value of 20 or more and should have a maximum swell of 1 percent or less.

3.1.3 Fill Placement and Compaction Requirements

General fill materials should be placed in level lifts not exceeding 8 inches in loose thickness, moisture-conditioned to at least 2 percent above the optimum moisture content, and compacted to at least 90 percent relative compaction. The non-expansive select granular fill materials should be placed in level lifts of about 8 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 90 percent relative compaction.

Aggregate subbase and base course materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by weight) corresponding to the maximum dry density.

Compaction should be accomplished by sheepsfoot rollers, vibratory rollers, or other types of acceptable compaction equipment. Water tamping, jetting, or ponding should not be allowed to compact the fills.

Where compaction is less than required, additional compactive effort should be applied with adjustment of moisture content, as necessary, to obtain the specified compaction. It should be noted that the moisture requirement of the general fills and subgrades (at least 2 percent above the optimum moisture) is an important requirement for the use of the on-site clayey soils.

3.1.4 Excavations

It is anticipated that the on-site alluvial soils and coralline deposits may be excavated with conventional heavy excavation equipment. However, our past experience in the project area indicates that isolated hard coralline detritus/formation and

cobbles/boulders could be encountered. Therefore, excavation for subsurface infrastructure construction may encounter hard coral and/or cobbles/boulders which may require the use of hoerams.

The above discussion regarding the rippability of the surface materials is based on data obtained from the field borings and test pits. Contractors bidding on this project should be encouraged to examine the site conditions and soil data to make their own interpretation.

3.1.5 Cut and Fill Slopes

We envision the cut slopes at the project site generally will expose the stiff to hard silty and clayey soils and/or dense coralline deposits encountered in the borings. In general, cut slopes and permanent fill slopes constructed of the on-site soils may be designed with a slope inclination of two horizontal to one vertical (2H:1V) or flatter. Fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill embankment against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above general fill placement recommendations.

Fill slopes should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Surface water should be diverted away from the tops of slopes, and slope planting should be provided as soon as possible to reduce the potential for erosion of the finished slopes.

3.1.6 Erosion Control Measures (Landscape)

We anticipate shrinkage cracks will occur on the moderately expansive clayey/silty soils in the project site. In general, shrinkage cracks will develop in the ground due to the lack of maintenance of the soil moisture content as the soils start to dry out under the sun and dry weather conditions. The development of shrinkage cracks in the ground will be intensified by the prolonged dry climatic conditions in the Nanakuli area resulting in large fluctuations in the soil moisture content.

We recommend grassing the graded surfaces (including cut and fill slopes) to reduce the potential for significant soil erosion soon after completion of the site grading. The relatively dry climatic conditions of the Nanakuli area likely will require controlled irrigation of the graded surfaces to maintain the moisture contents and to keep graded surfaces free of large shrinkage cracks. However, over-watering of the graded surfaces should be avoided to reduce the potential for saturation and softening of the surface soils.

3.2 Slabs-On-Grade

Based on the results of our field exploration, the on-site clayey/silty soils have a low to moderate expansion potential when subjected to moisture fluctuations. To reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the on-site soils due to changes in the moisture content, we recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the slab subgrade directly onto the coralline deposits.

Prior to placing the non-expansive select granular fill, we recommend moisture-conditioning the subgrade soils to at least 2 percent above the optimum moisture content and compacting to a minimum of 90 percent relative compaction, where possible. The underlying subgrade soils and select granular fill should be wetted and kept moist until the final placement of slab concrete. Where shrinkage cracks are observed after compaction of the subgrade, we recommend preparing the soils again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with engineered fill.

For interior building slabs (not subjected to vehicular traffic or machinery vibration), we recommend placing a minimum 4-inch thick layer of cushion fill consisting of open-graded gravel, such as No. 3 Fine gravel (ASTM C33, No. 67 gradation), below the slabs and above the non-expansive select granular fill layer. The open-graded gravel cushion fill would provide uniform support of the slabs and would serve as a capillary moisture break. To reduce the potential for future moisture infiltration through the slab

and subsequent damage to floor coverings, an impervious moisture barrier is recommended on top of the open-graded gravel cushion layer

Where the slabs will be subjected to equipment vibration and/or vehicular traffic, we recommend placing the floor slab over 6 inches of aggregate subbase in lieu of the minimum 4-inch thick layer of open-graded gravel cushion fill. The aggregate subbase should be compacted to a minimum of 95 percent relative compaction. The impervious moisture barrier may be omitted for these slabs.

A Geolabs representative should observe footing excavations prior to placement of reinforcing steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

3.3 Corrosion Potential

One set of laboratory corrosivity tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), were performed (by our office and Test America Laboratories, Inc.) on selected soil samples obtained from our field exploration to evaluate the corrosivity of the on-site soils. The results of the corrosivity tests are presented in Appendix B.

Resistivity is generally recognized as one of the most significant soil characteristics with regard to the corrosivity of the soil to buried metallic objects. In general, the lower the resistivity the greater the potential for corrosion of the buried metallic structure. Conversely, the higher the resistivity, the less likely the soil will contribute to the corrosion of metallic objects.

On the basis of the laboratory resistivity and pH results, the subsurface soils at the project site have resistivity and pH values on the order of magnitude 300 ohm-cm and 8.5 within the upper clayey/silty soils, corresponding to a corrosion rating of 1 (Extremely Corrosive) based on the guidelines provided by the City & County of Honolulu – Board of Water Supply.

Based on the results of the laboratory corrosivity tests, we believe that a corrosion rating of 1 (Extremely Corrosive) may be used for the proposed development. Design of

metallic substructures, such as waterline pipes or other metallic piping, should consider the effects of the corrosive environment on the substructure.

Levels of the chloride and sulfate content of the on-site soils encountered near the existing ground surface are moderately high on the order of about 1,600 parts per million (ppm) and 400 ppm or less, respectively. We recommend consulting with a professional corrosion engineer to review the test results and provide detailed recommendations for corrosion protection.

3.4 Utility Trenches

It is anticipated that the utilities for the proposed development project will consist of primarily electrical, water, drain, and sewer lines. In general, good construction practices should be utilized for the installation and backfilling of the trenches for the proposed utilities. The contractor should determine the method and equipment to be used for excavation, subject to practical limits and safety considerations. The excavation should comply with all applicable local, state, and federal safety requirements. The contractor should be responsible for trench shoring design and installation. Trench shoring and bracing should conform to the appropriate health and safety requirements.

In general, we recommend using granular bedding consisting of 6 inches of open-graded gravel (ASTM C33, No. 67 gradation) for support of the utility lines. The initial trench backfill up to about 12 inches above the pipes should consist of free-draining backfills, such as open-graded gravel, to reduce the potential for damaging the pipes from compaction of the backfill. It is critical to use a free-draining granular material to reduce the potential for the formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. The use of on-site clayey soils as backfill directly around the utility pipes is not recommended and should not be allowed.

The upper portion of the trench backfill from the level 12 inches above the pipes to the finished subgrade may consist of on-site soils or select granular fill material. The granular or on-site soil backfill materials should be moisture-conditioned to above the optimum moisture content or about 2 percent above the optimum moisture content, respectively, placed in level lifts not exceeding 8 inches in loose thickness, and

compacted to a minimum of 90 percent relative compaction to reduce the potential for appreciable future ground subsidence. The finished subgrade of the trench backfill below the pavement grade should be compacted to no less than 95 percent relative compaction.

3.5 Field Infiltration Testing

Based on the current preliminary development concept, we envision that the project may require the on-site stormwater runoff management. We conducted falling head infiltration tests at four selected locations to evaluate the infiltration characteristics of the subsurface materials encountered. The tests were performed in general accordance with the procedures in Appendix C of the State of Maryland, Department of the Environment “Stormwater Design Manual, Volumes I and II” (rev. 2009). These procedures are consistent with other state’s procedures and may generally be considered an industry standard. Results of the infiltration tests performed at selected locations are presented in Appendix C.

The field infiltration tests were performed by drilling boreholes utilizing a 4-inch solid stem auger to a selected test depth of about 5 feet below the existing ground surface. Upon reaching the test depth, a 4-inch diameter PVC solid casing was set to the bottom of the drilled borehole to allow infiltration only through the soil exposed on the bottom of the borehole. Falling head infiltration tests were performed to determine the average infiltration rates of the underlying subsurface materials. Each test consisted of four trials of filling the casing with 24 inches of water and taking periodic readings until the water drained out or up to one hour. The infiltration rates are then calculated based on the results of the fourth and/or last trial for each test location. The calculated infiltration rates at each test location are summarized in the table below.

Based on the results of the field infiltration testing, the average infiltration rates at these locations indicate that an infiltration/detention system and similar methods of stormwater management would be feasible for this development.

FIELD INFILTRATION TESTING RESULTS		
Testing Location	**Testing Depth** (feet)	**Average Measured Infiltration Rate** (inches/hour)
LID-1	5.0	2.08
LID-2	5.0	2.00
LID-3	5.0	7.00
LID-4	5.0	13.00

It should be noted that the infiltration values presented above are the rates of infiltration through the soil exposed at the bottom of the tested boreholes, which may not represent the actual infiltration condition within a typical infiltration chamber footprint or an open basin. Therefore, the absorption capacity of the selected stormwater disposal system should be confirmed by conducting additional infiltration tests during construction. A Geolabs representative should observe the excavation for the detention/infiltration chambers and/or detention basins to confirm the anticipated infiltration substrata conditions.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4. LIMITATIONS

The preliminary analyses and recommendations submitted herein are based, in part, upon information obtained from the drilled borings. Variations of the subsurface conditions between and beyond the field data points may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations provided herein. A design-level geotechnical engineering exploration should be conducted to confirm and/or modify the preliminary geotechnical recommendations provided herein.

The field boring locations indicated herein are approximate, having been estimated by using a handheld Global Positioning System (GPS) to field-locate selected locations from referenced points shown on the topographic survey map transmitted by KN Surveying, LLC on February 12, 2020. Elevations of the borings were estimated from contours and spot elevations on the same plan. The field boring locations and elevations should be considered accurate only to the degree implied by the methods used.

The stratification breaks shown on the graphic representations of the borings depict the approximate boundaries between soil types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text herein. These data have been reviewed and interpretations made in the formulation of this report. It should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

This report has been prepared for the exclusive use of Gray Hong Nojima & Associates, Inc. and their project consultants for specific application to the conceptual design of the *Residential Development at Former Voice of America Site* project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the architect and design engineers in the conceptual design of the proposed project. Therefore, this report

may not contain sufficient data, or the proper information, to serve as a basis for detailed construction cost estimates.

The owner/client should be aware that unanticipated soil conditions are commonly encountered. Unforeseen subsurface conditions, such as perched groundwater, soft deposits, hard layers or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

This geotechnical engineering exploration conducted at the project site was not intended to investigate the potential presence of hazardous materials existing at the project site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

Project Location Map..... Plate 1

Site Plan..... Plate 2

Field Exploration ..... Appendix A

Laboratory Tests ..... Appendix B

Infiltration Test Data ..... Appendix C

-ΩΩΩΩΩΩΩΩΩ-

Respectfully submitted,

GEOLABS, INC.

By _____
John Y.L. Chen, P.E.
Vice President

JC:TO:cj

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PLATES

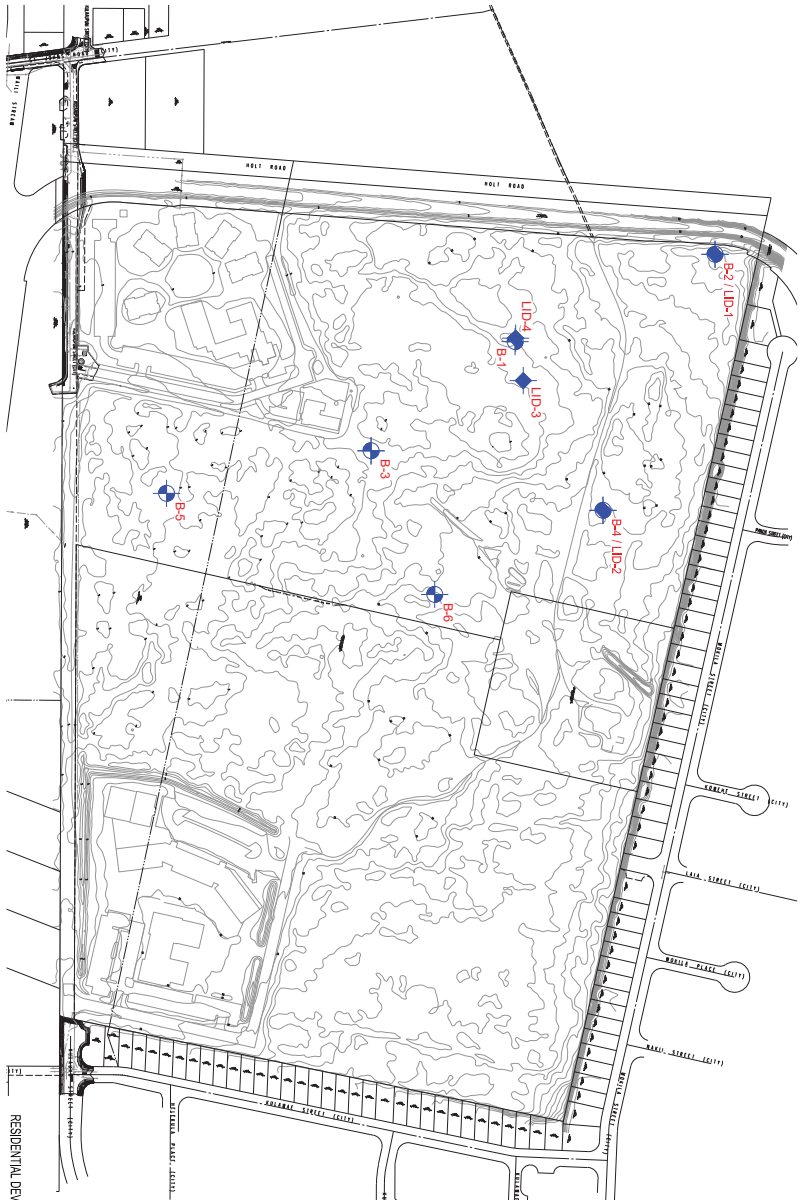
PROJECT LOCATION MAP

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2020	HYC	1
SCALE 1" = 2,000'	W.O. 8017-00	

CAD User: HENRY File Last Updated: June 10, 2020 4:29:42pm Plot Date: June 10, 2020 - 4:30:31pm
File: A:\Drafting\Drafting\Working\8017-00_Residential_Development_At_Former_Voice_Of_America\8017-00SitePlan.dwg\2
Plotter: DWG To PDF-GEO.pc3 Plotstyle: GEOLABS-Standard-Half.ctb



LEGEND:

APPROXIMATE BORING LOCATION

APPROXIMATE LID TEST LOCATION

REFERENCE: TOPOGRAPHIC SURVEY DATED OCTOBER 28, 2019
PREPARED BY KN SURVEYING, INC.

0 125 250 500 750 FT.
GRAPHIC SCALE

SITE PLAN

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2020	HYC	2
SCALE	W.O.	
1" = 250'	8017-00	

Appendix C: Geotechnical Report

APPENDIX A

APPENDIX A

Field Exploration

We explored the subsurface conditions at the project site by drilling and sampling six borings, designated as Boring Nos. 1 through 6, extending to the maximum depth explored of about 21.5 feet below the existing ground surface. The approximate boring locations are shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with continuous flight augers.

Our geologist classified the materials encountered in the borings by visual and textural examination in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils, and monitored the drilling operations on a near-continuous (full-time) basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), as shown on the Soil Log Legend, Plate A-0.1. Deviations made to the soil classification in accordance with ASTM D2487 are described on the Soil Classification Log Key, Plate A-0.2. Graphic representations of the materials encountered are presented on the Logs of Borings, Plates A-1 through A-10.

Relatively “undisturbed” soil samples were obtained in general accordance with ASTM D3550, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM D1586, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the “Penetration Resistance” on the Logs of Borings at the appropriate sample depths. The penetration resistance shown on the Logs of Borings indicates the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.

Pocket penetrometer tests were performed on selected cohesive soil samples retrieved in the field. The pocket penetrometer test provides an indication of the unconfined compressive strength of the sample. Pocket penetrometer test results are summarized on the Logs of Borings at the appropriate sample depths.

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Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE	GRAVELS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS LESS THAN 5% FINES	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES MORE THAN 12% FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS 50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE	CLEAN SANDS LESS THAN 5% FINES	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES MORE THAN 12% FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS 50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE	MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

- (2-INCH) O.D. STANDARD PENETRATION TEST
- (3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE
- SHELBY TUBE SAMPLE
- GRAB SAMPLE
- CORE SAMPLE
- WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING
- WATER LEVEL OBSERVED IN BORING AFTER DRILLING
- WATER LEVEL OBSERVED IN BORING OVERNIGHT

LL LIQUID LIMIT (NP=NON-PLASTIC)

PI PLASTICITY INDEX (NP=NON-PLASTIC)

TV TORVANE SHEAR (tsf)

UC UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH

TXUU UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)

Plate

A-0.1

LOG LEGEND FOR SOIL 8017-00.GPJ GEOLABS.GDT 2/14/20

GEOLABS, INC.

Geotechnical Engineering

Soil Classification Log Key

(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)	COHESIVE SOIL (- #200 ≥50%)
• **PRIMARY** constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., **GRAVEL, SAND**) • **SECONDARY** constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (**SILTY** or **CLAYEY**); otherwise, a granular constituent is used (**GRAVELLY** or **SANDY**) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** GRAVEL, **CLAYEY** SAND) and precede the primary constituent. • **accessory descriptions** compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY GRAVEL **with a little sand**)	• **PRIMARY** constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., **CLAY, SILT**) • **SECONDARY** constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** CLAY, **SILTY** CLAY, **CLAYEY** SILT) and precede the primary constituent. • **accessory descriptions** compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY CLAY **with some sand**)

EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: **SILTY GRAVEL** with some sand

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

PP: Pocket Penetrometer

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

**Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).*

Plate

A-0.2

SOIL CLASS LOG KEY 8017-00.GPJ GEOLABS.GDT 2/14/20

GEOLABS, INC.
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Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		CONGLOMERATE
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive: Greater than 24 inches apart

Slightly Fractured: 12 to 24 inches apart

Moderately Fractured: 6 to 12 inches apart

Closely Fractured: 3 to 6 inches apart

Severely Fractured: Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered: Rock shows no sign of discoloration or loss of strength.

Slightly Weathered: Slight discoloration inwards from open fractures.

Moderately Weathered: Discoloration throughout and noticeably weakened though not able to break by hand.

Highly Weathered: Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.

Extremely Weathered: Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard: Specimen breaks with difficulty after several "pinging" hammer blows.
Example: Dense, fine grain volcanic rock

Hard: Specimen breaks with some difficulty after several hammer blows.
Example: Vesicular, vugular, coarse-grained rock

Medium Hard: Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce.
Example: Porous rock such as clinker, cinder, and coral reef

Soft: Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot.
Example: Weathered rock, chalk-like coral reef

Very Soft: Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure.
Example: Saprolite

Plate
A-0.3

LOG LEGEND FOR ROCK 8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
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RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
1

Approximate Ground Surface Elevation (feet): 8.5 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Density (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	7	95			22/6" +60/4" 15/1" Ref.			GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to very dense, moist (coral formation)
TXUU S_u=0.8 ksf	23	101			49		5		
Sieve - #200 = 14.5%	16				15		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose to medium dense, moist (coralline detritus)
								GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to dense (coral formation)
	20	108			33		15		
	18				32		20		
							25		Boring terminated at 21.5 feet
							30		* Elevations estimated from Topographic Survey dated October 27, 2019 prepared by KN Surveying, Inc.
							35		

Date Started:	December 17, 2019	Water Level: 10.8 ft. 12/17/2019 1459 HRS	
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 91.5%)*
Total Depth:	21.5 feet	Drilling Method:	4" Solid-Stem Auger
Work Order:	8017-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate
A - 1

BORING_LOG 8017-00.GPJ GEOLABS.GDT 6/10/20

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RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
2

Approximate Ground Surface Elevation (feet): 16 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	25	79			20			CL	Brown with tan **SANDY CLAY** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
LL=69 PI=44	22				19			CH	Brown **SILTY CLAY** with a little sand (coralline), very stiff, moist (alluvium)
	78	65			49		5	GW-GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to dense, moist (coral formation)
	8				26		10		
Sieve - #200 = 6.9%	13	121			70		15		
	13				34		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 17, 2019	Water Level: ▼ 12.5 ft. 12/17/2019 1048 HRS	Plate
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 2
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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NANAKULI, OAHU, HAWAII

Log of Boring
3

Approximate Ground Surface Elevation (feet): 6 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	13	92			50/3"			ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
Sieve - #200 = 17.6%	20				40			GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), dense, moist (coral formation)
	28	92			15		5	SM	Tan **SILTY SAND (CORALLINE)** with some gravel, loose (weathered sandstone)
	20				10		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose (coralline detritus)
Sieve - #200 = 19.0%	16	115			17		15	GM	Brown with tan **SILTY GRAVEL (CORALLINE)** with some sand, loose (alluvium w/coral debris)
Sieve - #200 = 16.1%	21				26		20	SM	Tan **SILTY SAND (CORALLINE)**, medium dense (weathered sandstone)
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 18, 2019	Water Level: ▼ 4.5 ft. 12/18/2019 1046 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 3
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
4

Approximate Ground Surface Elevation (feet): 11 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	15	84			78			SM	Tan with brown **SILTY SAND (CORALLINE)** with some gravel (coralline), medium dense to dense, moist (coral formation)
Sieve - #200 = 27.5%	9				48				
	16	96			24		5		
	11				29		10		
	14	112			70/6" +25/1"		15		
	15				28		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 17, 2019	Water Level: 10.5 ft. 12/17/2019 1323 HRS	Plate
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	A - 4
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
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RESIDENTIAL DEVELOPMENT AT FORMER
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NANAKULI, OAHU, HAWAII

Log of Boring
5

Approximate Ground Surface Elevation (feet): 4.5 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
Direct Shear	37	71			8			SM	Tan **SILTY SAND (CORALLINE)** with some gravel (coralline), medium dense to dense, moist (coral formation)
Sieve - #200 = 16.7%	18				17				
	26	101			38		5		
					10/0" Ref.		10		
Sieve - #200 = 19.0%	16	115			50/3"		15		
					25/1"		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 18, 2019	Water Level: 4.0 ft. 12/18/2019 1428 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	A - 5
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
6

Approximate Ground Surface Elevation (feet): 10 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	18	93			37			GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense, moist (coral formation)
Sieve - #200 = 22.6%	10				27				
	27	93			27		5		
	14				9		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose (coralline detritus)
					25/1"		15	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), dense (coral formation)
Sieve - #200 = 16.5%	19				20		20	SM	Tan **SANDY SAND (CORALLINE)**, medium dense (weathered sandstone)
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 18, 2019	Water Level: ▼ 9.5 ft. 12/18/2019 1205 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 6
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
LID-1

Approximate Ground Surface Elevation (feet): 16 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), stiff, dry to damp (alluvium w/coral debris)
								CH	Brown with trace tan **SILTY CLAY** with traces of gravel (coralline), very stiff, moist (older alluvium)
							5		Light tannish White **CORAL**, moderately to closely fractured, slightly to moderately weathered, medium hard to hard (coral formation)
									Boring terminated at 5 feet
							10		
							15		
							20		
							25		
							30		
							35		

Date Started:	June 5, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 5, 2020		
Logged By:	S. Latronic	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	A - 7
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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NANAKULI, OAHU, HAWAII

Log of Boring
LID-2

Laboratory			Field				Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 11 * Description
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)					
										ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), stiff, dry to damp (alluvium w/coral debris)
											Light tannish White **CORAL**, moderately to closely fractured, slightly to moderately weathered, medium hard to hard (coral formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 5, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 5, 2020		
Logged By:	S. Latronic	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	A - 8
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
LID-3

Laboratory			Field				Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 7 * Description
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)					
										ML	Brown **SANDY SILT**, medium stiff, moist (alluvium)
											grades with traces of gravel
										GM	Tannish brown **SILTY GRAVEL (CORALLLINE)** with a little sand, medium dense, moist (coral formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 9, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 9, 2020		
Logged By:	R. Yang	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	A - 9
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring

LID-4

Approximate Ground Surface Elevation (feet): 9 *

Laboratory			Field				Depth (feet)	Sample	Graphic	USCS	Description
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)					
										ML	Brown **SANDY SILT** with traces of gravel, medium stiff, moist (alluvium w/coral debris)
										GM	Brown with tan **SILTY GRAVEL (CORALLINE)** with a little sand, medium dense, moist
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 9, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 9, 2020		
Logged By:	R. Yang	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 10
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

APPENDIX B

APPENDIX B

Laboratory Tests

Moisture Content (ASTM D2216) and Unit Weight (ASTM D2937) determinations were performed on selected samples as an aid in the classification and evaluation of soil properties. The test results are presented on the Logs of Borings at the appropriate sample depths.

One Atterberg Limits test (ASTM D4318) was performed on a selected soil sample to evaluate the liquid and plastic limits. The test results are summarized on the Logs of Borings at the appropriate sample depth. Graphic presentation of the test results is provided on Plate B-1.

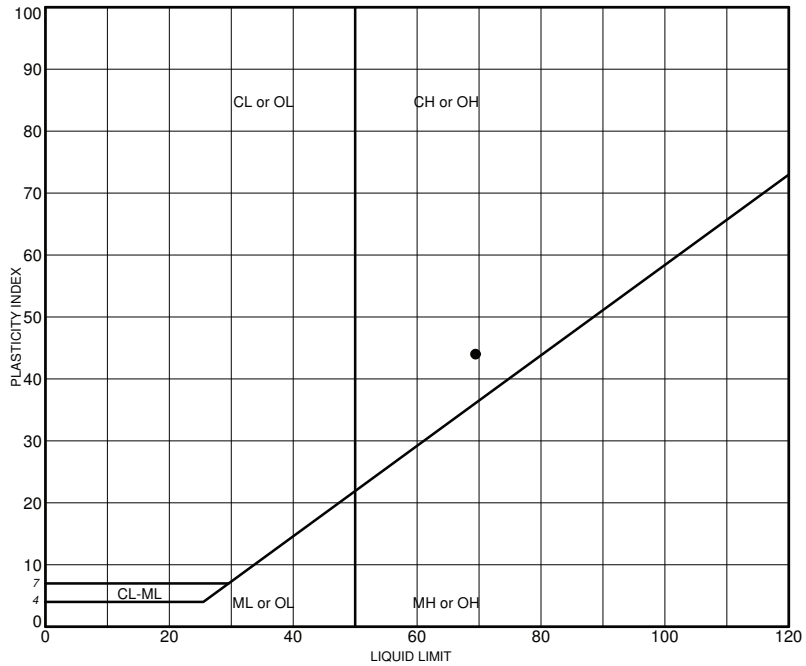
Ten Sieve Analysis tests (ASTM C117 & C136) were performed on selected soil samples to evaluate the gradation characteristics of the soils and to aid in soil classification. In addition, three hydrometer tests (ASTM D422) were conducted on the samples to further evaluate the finer grain materials of the soils. Graphic presentations of the grain size distributions are provided on Plates B-2 and B-3.

One one-inch Ring Swell test was performed on a relatively undisturbed sample to evaluate the swelling potential of the on-site soils. The test results are summarized on Plate B-4.

One Direct Shear test (ASTM D3080) was performed on a selected sample to evaluate the shear strength characteristics of the materials tested. The test results are presented on Plate B-5.

To evaluate the undrained shear strength of the soils, one Unconsolidated Undrained Triaxial Compression (TXUU) test was performed on selected in-situ soil samples in accordance with ASTM D2850. The approximate in-situ effective overburden pressure was used as the applied confining pressure for the “undisturbed” sample. The test results and the stress-strain curves are presented on Plate B-6.

One set of Corrosivity tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), was performed by our office and TestAmerica Laboratories, Inc. an on selected soil sample obtained from our field exploration. The test results are summarized on Plate B-7.



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-2	2.5-4.0	69	25	44	Brown silty clay (CH) with some gravel

NP = NON-PLASTIC

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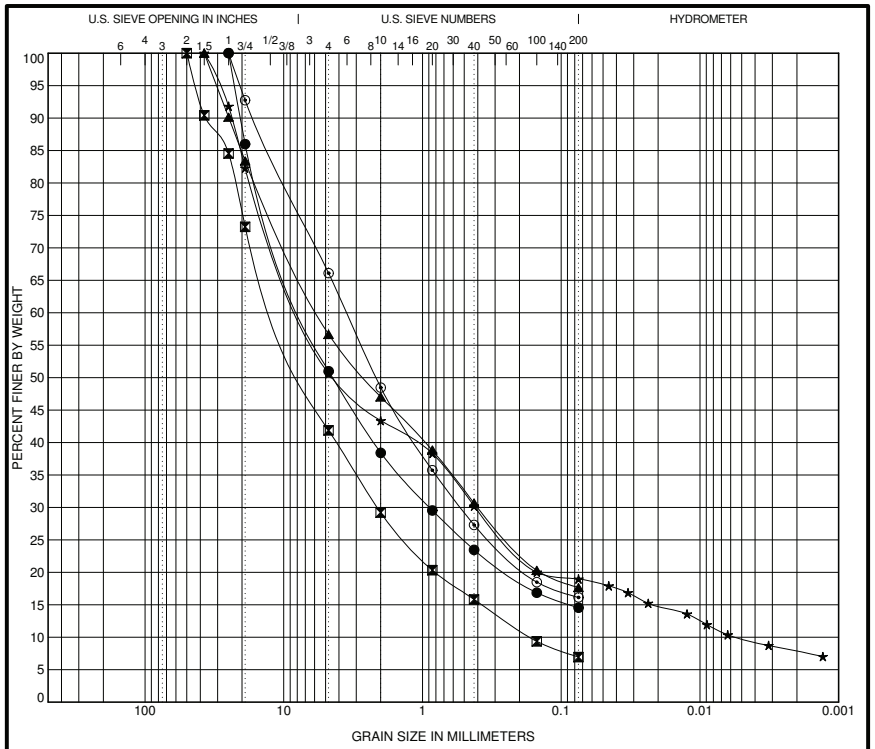
ATTERBERG LIMITS TEST RESULTS - ASTM D4318

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 1

G ATTERBERG PI-100 LL-120 8017-00.GPJ GEOLABS.GDT 2/14/20



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	B-1	10.0-11.5	Tan silty gravel (GM) with some sand					
⊠	B-2	15.0-16.5	Brownish tan sandy gravel (GW-GM) with a little silt				2.5	63.6
▲	B-3	2.5-4.0	Whitish tan silty gravel (GM) with some sand					
★	B-3	15.0-16.5	Tannish brown silty gravel (GM) with some sand				4.5	1321.4
⊙	B-3	20.0-21.5	Tan silty sand (SM) with some gravel					

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	B-1	10.0-11.5	25	6.788	0.889		49.0	36.4	14.5
⊠	B-2	15.0-16.5	50	10.58	2.113	0.166	58.1	34.9	6.9
▲	B-3	2.5-4.0	37.5	5.649	0.398		43.3	39.0	17.6
★	B-3	15.0-16.5	37.5	7.166	0.416	0.005	49.4	31.6	19.0
⊙	B-3	20.0-21.5	25	3.522	0.531		33.9	50.0	16.1

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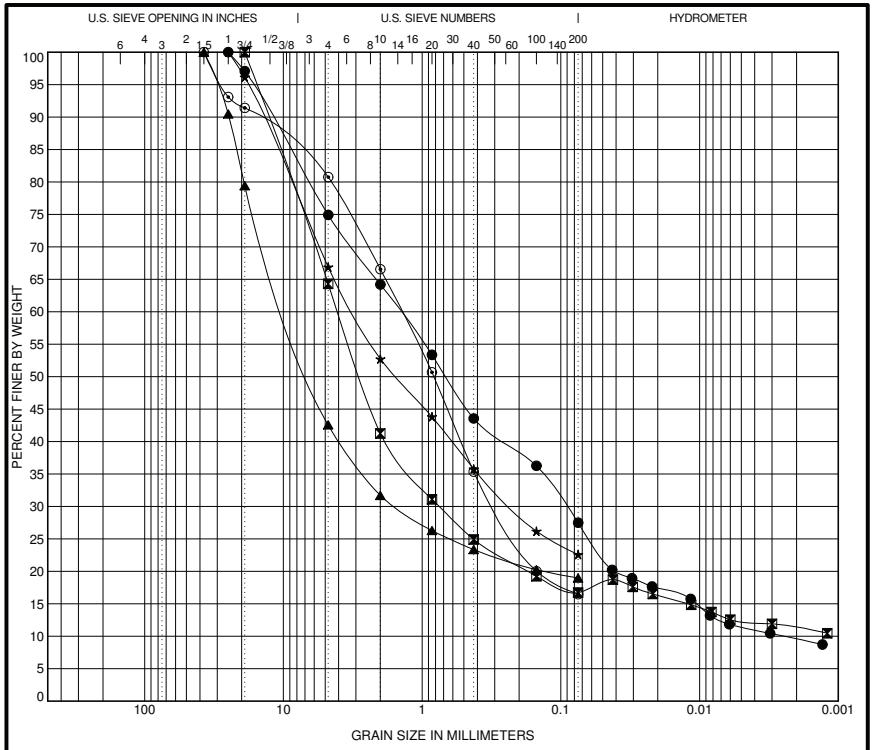
GRAIN SIZE DISTRIBUTION - ASTM C117 & C136

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 2

G GRAIN SIZE MOD 8017-00.GPJ GEOLABS.GDT 6/1/20



	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	B-4	2.5-4.0	Whitish tan silty sand (SM) with some gravel				2.3	578.5
⊠	B-5	2.5-4.0	Grayish tan silty sand (SM) with some gravel					
▲	B-5	15.0-16.5	Tannish brown sandy gravel (GM) with a little silt					
★	B-6	2.5-4.0	Tan silty sand (SM) with some weathered gravel					
⊙	B-6	20.0-21.5	Tan silty sand (SM) with some gravel					

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	B-4	2.5-4.0	25	1.436	0.091	0.002	25.1	47.4	27.5
⊠	B-5	2.5-4.0	19	4.041	0.751		35.7	47.6	16.7
▲	B-5	15.0-16.5	37.5	9.152	1.529		57.4	23.6	19.0
★	B-6	2.5-4.0	25	3.121	0.227		33.1	44.3	22.6
⊙	B-6	20.0-21.5	37.5	1.406	0.296		19.2	64.3	16.5

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GRAIN SIZE DISTRIBUTION - ASTM C117 & C136

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 3

G GRAIN SIZE MOD 8017-00.GPJ GEOLABS.GDT 6/1/20

Location	Depth (feet)	Soil Description	Dry Density (pcf)	Moisture Contents Initial (%)	Air-Dried (%)	Final (%)	Ring Swell (%)
B-2*	1.0 - 2.5	Brown sandy clay with traces of rootlets	71.3	25.1	21.7	53.0	2.1

NOTE: Samples tested were either relatively undisturbed or remolded in 2.4-inch diameter by 1-inch high rings. They were air-dried overnight and then saturated for 24 hours under a surcharge pressure of 55 psf.

* Relatively Undisturbed
** Remolded

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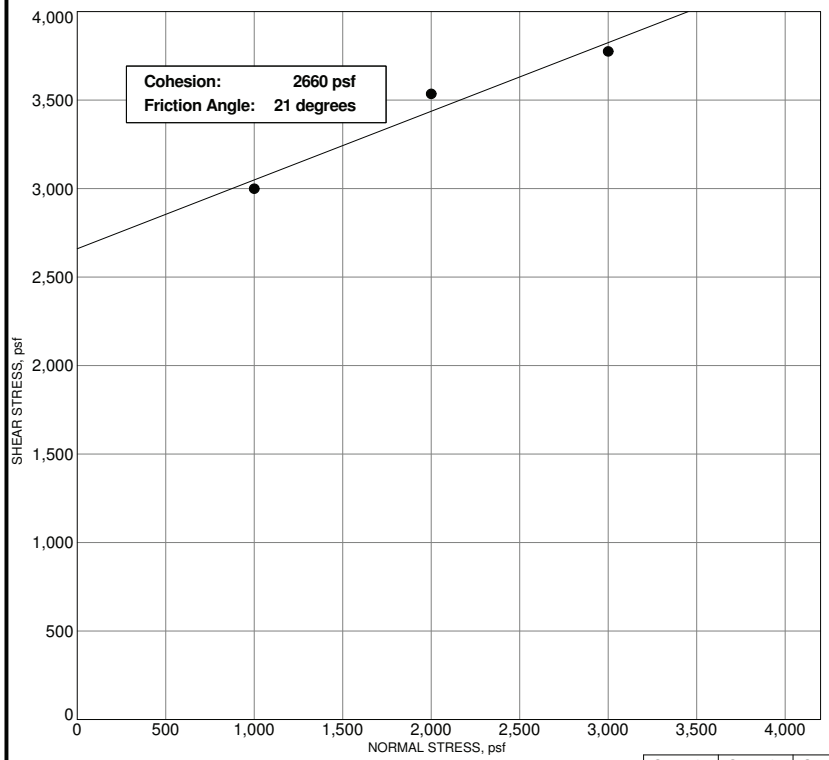
W.O. 8017-00

SUMMARY OF RING SWELL TESTS

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 4

G RING SWELL TEST 8017-00.GPJ GEOLABS.GDT 2/21/20



		Sample #1	Sample #2	Sample #3
INITIAL	Moisture Content, %	34.3	31.7	45.1
	Dry Density, pcf	75.1	77.9	69.1
	Height, inches	1.00	1.00	1.00
FINAL	Moisture Content, %	52.0	46.6	56.6
	Dry Density, pcf	79.1	81.3	69.5
	Height, inches	0.949	0.958	0.994
	Diameter, inches	2.42	2.42	2.42
	Deformation Rate, inch/minute	0.0025	0.0023	0.0022
	Normal Stress, psf	**1000**	**2000**	**3000**
	Peak Shear Stress, psf	**2999**	**3535**	**3775**
	Shear Displacement, inches	0.43	0.40	0.40

Sample: B-5
Depth: 1.0 - 2.5 feet
Description: Grayish tan silty sand with some highly weathered gravel

G DIRECT SHEAR 8017-00.GPJ GEOLABS.GDT 2/14/20

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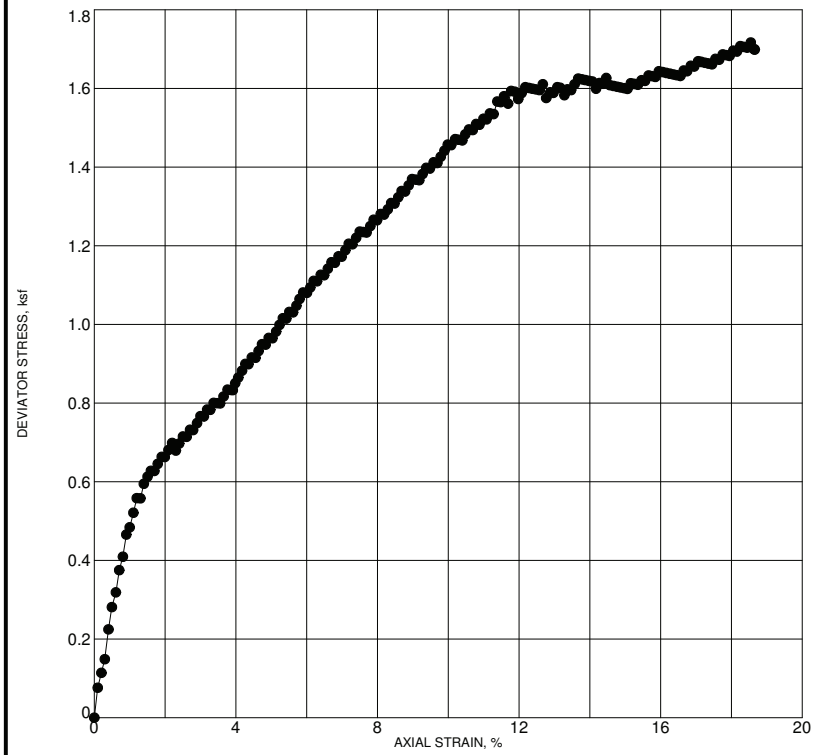
W.O. 8017-00

DIRECT SHEAR TEST - ASTM D3080

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 5



Max. Deviator Stress (ksf):	1.6
Confining Stress (ksf):	0.5

Location: B-1
Depth: 5.0 - 6.5 feet
Description: Brownish tan silty gravel some sand
Test Date: 12/30/2019

Dry Density (pcf)	100.8	Sample Diameter (inches)	2.403
Moisture (%)	22.6	Sample Height (inches)	5.067
Axial Strain at Failure (%)	15.0	Strain Rate (% / minute)	1.00

G TXUU 8017-00.GPJ GEOLABS.GDT 2/21/20

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 6

Location	Depth (feet)	pH Value	Minimum Resistivity (ohm-cm)	Chloride Content (mg/kg)	Sulfate Content (mg/kg)
B-6	1.0 - 2.5	8.66*	270*	1600	400

TEST METHODS (by TestAmerica Laboratories, Inc.)

pH Value	Method 9045C
Minimum Resistivity	SM 2510B
Chloride Content	EPA 300.0
Sulfate Content	EPA 300.0

ND: Not Detected Within Reporting Limits

TEST METHODS (by Geolabs, Inc.)*

pH Value	ASTM G51
Minimum Resistivity	ASTM G57
Chloride Content	N/A
Sulfate Content	N/A

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W.O. 8017-00

SUMMARY OF CORROSIVITY TESTS

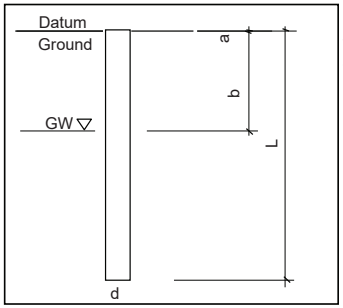
RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 7

G SUMMARY OF CORROSIVITY TESTS 8017-00.GPJ GEOLABS.GDT 2/14/20

APPENDIX C

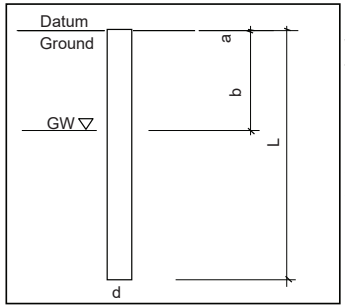
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-1	
Date of Testing:	12/18/2019	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.0	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	5.0	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	10:12	36.00	
	15	10:27	36.00	
	30	10:42	36.50	
	45	10:57	36.50	
	60	11:12	37.00	1.00
Trial 2	0	11:13	36.00	
	15	11:28	37.00	
	30	11:43	37.50	
	45	11:58	38.00	
	60	12:13	38.00	2.00
Trial 3	0	12:15	36.00	
	15	12:30	36.42	
	30	12:45	37.00	
	45	13:00	37.25	
	60	13:15	38.00	2.00
Trial 4	0	13:17	36.00	
	15	13:32	37.00	
	30	13:47	37.50	
	45	14:02	38.00	
	60	14:17	38.08	2.08

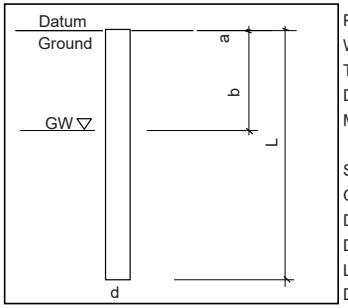
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-2	
Date of Testing:	12/18/2019	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.2	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	5.2	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:00	36.00	
	15	9:15	37.00	
	30	9:30	38.00	
	45	9:45	39.50	
	60	10:00	41.00	5.00
Trial 2	0	10:02	36.00	
	15	10:17	36.00	
	30	10:32	36.25	
	45	10:47	36.50	
	60	11:02	37.00	1.00
Trial 3	0	11:04	36.00	
	15	11:19	36.50	
	30	11:34	37.00	
	45	11:49	37.50	
	60	12:04	38.00	2.00
Trial 4	0	12:07	36.00	
	15	12:22	36.50	
	30	12:37	37.00	
	45	12:52	37.50	
	60	13:07	38.00	2.00

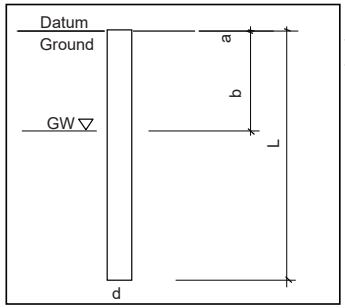
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-3	
Date of Testing:	6/10/2020	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	1.6	feet
Depth of Boring:	4.8	feet
Length, L (from datum):	6.4	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:11	52.00	
	15	9:26	55.00	
	30	9:41	56.50	
	45	9:56	58.00	
	60	10:11	59.00	7.00
Trial 2	0	10:13	52.00	
	15	10:28	55.25	
	30	10:43	56.50	
	45	10:58	58.00	
	60	11:13	59.50	7.50
Trial 3	0	11:14	52.00	
	15	11:29	54.25	
	30	11:44	56.00	
	45	11:59	58.00	
	60	12:14	59.00	7.00
Trial 4	0	12:15	52.00	
	15	12:30	53.50	
	30	12:45	55.00	
	45	13:00	57.50	
	60	13:15	59.00	7.00

INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-4	
Date of Testing:	6/10/2020	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	1.5	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	6.5	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:06	53.00	
	15	9:21	57.50	
	30	9:36	60.50	
	45	9:51	63.25	
	60	10:06	66.00	13.00
Trial 2	0	10:08	53.00	
	15	10:23	57.50	
	30	10:38	61.00	
	45	10:53	64.00	
	60	11:08	66.25	13.25
Trial 3	0	11:09	53.00	
	15	11:24	58.00	
	30	11:39	60.00	
	45	11:54	63.75	
	60	12:09	66.00	13.00
Trial 4	0	12:10	53.00	
	15	12:25	56.50	
	30	12:40	60.00	
	45	12:55	62.50	
	60	13:10	66.00	13.00

APPENDIX D

State Historic Preservation Division Reconnaissance Level Survey,
March 2021

RLS Form 2/2018

State Historic Preservation Division
Reconnaissance Level Survey – Survey Form

Instructions: Submit this completed form with the completed SIHP request form and 6E Filing Fee Form **electronically** to: dlnr.intake.shpd@hawaii.gov

For additionally guidance on completing this form, please see the Architecture Branch Survey Guidelines available on the SHPD website.

---

1. Review Type: Indicate which review process this survey was requested under

(●) HRS 6E-08, HAR 13-275 ( ) HRS 6E-42, HAR 13-284

2. Project Information: Indicate the document in which this survey was requested

2.1) Log No. [e.g. 2017.1234] Log No. 2017.00028

2.2) Doc No. [e.g. 1708MB27] Doc No. 1709SH05

2.3) Other:

3. Contact Information:

3.1) Name: Timothy Rieth 3.2) Company: International Archaeol., LLC

3.3) Street Address: 2081 Young St.

3.4) County: Honolulu 3.5) State: HI 3.6) Zip Code: 96826

3.7) Phone: 808 551 3090 3.8) Email: trieth@internationalarchaeologyllc.com

4. Property Location:

4.1) TMK [e.g. (3) 1-2-003:004]: [1] 8-7-010: 031

4.2) Street Address: vicinity of St. Johns Road, Maili

4.3) County: Honolulu 4.4) State: HI 4.5) Zip Code: 96792

5. Property Classification:

5.1) Ownership:

( ) Private (●) Public

5.2) Classification

( ) Building ( ) District (●) Site ( ) Structure ( ) Object

6. Property Function:

6.1) Current: Demolished

6.2) Historic: Voice of America radio transmitting station, KRHO

RLS Form 2/2018

7. Property Description:

7.1) Date of Construction: 1944

7.2) Provide a description of the property, including the character defining features, summarize alterations to the property, and provide an evaluation of the property's integrity of materials, design, feeling, location, association, workmanship, and setting.

The 4.86-acre parcel of this TMK [1] 8-7-010: 031 was formerly a part of a 89-acre parcel (TMK [1] 8-7-010: 007), which was split into -031 and -030 (84.42 acres) ca. 2017. Today's 4.86-acre parcel (-031) is the site of the four resources intended to be evaluated in this RLS. The four features were remnants from the former Voice of America (VoA) radio transmitting station that had the call letters KRHO. In 2009, these four features were assigned the Hawaii State Inventory of Historic Places (SIHP) numbers 50-80-07-7082, as Features 7, 14, 19, and 20 (Rieth, 2009), and described (below). However, these features are no longer extant today.

As described in 2009, these four features included:
Feature 7, which was several concrete bases for wood fence posts;
Feature 14, which was a concrete slab, with a foot print of approximately 10'-2" x 3'-11";
Feature 19, which was a ruin. It had fragments of CMU structure on a concrete slab that had a footprint measuring about 22' x 10';
Feature 20, which was a ruin. It had fragments of CMU structure on a concrete slab that had a footprint measuring about 105' x 33'-50'. Cable troughs were cast in the concrete slab. This ruin was a remnant of the former main transmitter building for VoA station KRHO.

During the site visit conducted on November 9, 2020 for this RLS it was observed that these four features are no longer extant. The site of these features was grubbed to a depth of 1' to 2', which has removed earth and all traces of these features except for the exposed top edges of a dis-connected series of below-grade foundation walls. All concrete slabs and all above-grade structures and CMU remnants have been removed. Judging from the size of some of the saplings sprouting from the ruins, the grubbing appears to have been accomplished about 1-2 years prior to the November 9, 2020 site visit. The grubbing was begun at the edge of the asphalt-surfaced road leading to the features where earth was scraped away to a depth of about 2'. At the south margin of the grubbing, south of where the features were located, the grubbing reaches a depth of about 1'. The remaining foundation walls are a combination of concrete and CMU with concrete mortar.

A sketch plan of the remaining foundation walls is included in this RLS.

The site is demolished, no character defining features of the four target resources remain.

Alterations are not known, the structures and buildings are demolished.

Except for location, no aspects of integrity are retained.

NOTE: The 2009 Archaeological Inventory Survey (Rieth, 2009) included information on SIHP #50-80-07-7081, a series of sixteen antenna foundations in the area to the west of the four targets of this RLS. These sixteen foundations were not part of the scope of this RLS and were not surveyed. However, these antenna foundations were part of the VoA transmitting equipment, they held poles that supported a series of several rhombic antenna. See the following historic context for more information.

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

Historic context:
The Voice of America facility (VoA) at Maili was built in 1944 and began broadcasting on December 26, 1944. ("OWI Central Pacific Operations," Radio Heritage Foundation website radioheritage.com/story103. Seehaas, 1945 Findeisen, HSB Jan 19, 1945. 8). The programming was directed to Japan and the Philippines and consisted of American music and announcements in English, Japanese, and Filipino. The station was assigned the call letters KRHO and the construction of the facility and its programming were part of the US Office of War Information (OWI) efforts to provide shortwave radio news and information to the populations in World War II combat theaters. (Schneider, 2014) The facility operated a 100 kilowatt (kW) transmitter that broadcast at a frequency of 1778 kHz (kilo-hertz) over a system of rhombic antenna that were strung on tall wood poles in the open area immediately west of the transmitter building. (Portzer, 2020)

The VoA facility at Maili was part of a network of VoA radio stations that were developed during World War II to communicate America's views abroad. The network was established in mid-1941 under the newly created US Foreign Information Service (FIS). The first broadcasts were made from San Francisco to Asia in December 1941. On February 1, 1942, the first broadcast to Europe was prefaced by an announcement that became the network's name, Voice of America. "We bring you voices from America, we shall speak to you about America and the war. The news may be good for us. The news may be bad. But we shall tell you the truth." (VOA, 2017)

During the first year of World War II, VoA established a reputation for honesty by reporting on the startling advancements and successes of the Japanese and German military. In 1942 the US Coordinator of Information (COI) took over VoA administration from the FIS and studios were set up in New York and San Francisco to produce programming. Later in 1942, the Office of War Information (OWI) was created as VoA's overseeing agency. As combat in the Pacific progressed and the US theater of operations grew, VoA programming included more broadcasting that was of interest to American service members, such as popular music and sports like the World Series. During the war VoA added seventeen transmitters on the US west coast and additional stations in the west Pacific. The VoA station KRHO at Maili and station KSAI on Saipan began broadcasting on the same day in 1944.

VoA station KRHO was established in temporary offices in downtown Honolulu on March 21, 1944, with workers transferred from Washington DC. In July, the station moved into permanent offices and studios in the KGMB (Honolulu radio station AM 590 kHz) building at 1534 Kapiolani Boulevard. This building, and a Quonset hut added beside it, became the administrative headquarters for all VoA Central Pacific Operations during World War II. Radio shows were produced and recorded at the studio, then relayed to the main transmitter facility at Maili for broadcast to the western pacific. Some broadcasts were relayed programming that was produced on the mainland. The 100 kW power of the transmitter at Maili was the most powerful shortwave transmitter in the Pacific when it was built. ("Huge Transmitter," HSB March 2, 1946. 1. Seehass, 1945. Portzer, 2020)

The broadcast frequency (1778 kHz) of VoA station KRHO that was transmitted from the facility at Maili is within the short wave band of radio frequencies. Short wave is very useful for long distance communication because a signal can be aimed to be reflected off the ionosphere. This bounces the signal back to earth multiple times and enables reception at great distances, far beyond the line of sight propagation of about 40 miles that is typical of other radio bands. Directional transmissions of shortwave broadcasts that are intended for long range reception typically use rhombic antenna, which is the type installed on tall wood poles at VoA KRHO in Maili in 1944. (Portzer, 2020) Rhombic antenna are a series of four wires, suspended parallel to the ground in a diamond shape.

Broadcasts from the station that were produced on the mainland were obtained from the west coast via radio transmission to a receiver in Kailua, Oahu and then sent by phone lines to VoA at Maili for re-broadcast transmission to the west Pacific. KSAI in Saipan would pick up these signals and re-transmit in standard wavelengths for those that did not have shortwave receivers. Some broadcasts were produced at the KRHO studio on Kapiolani Boulevard in Honolulu and sent over phone lines to Maili for transmittal. ("Huge Transmitter," HSB March 2, 1946. 1)

RLS Form 2/2018

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

After World War II, administration of the VoA was transferred to the US State Department Office of Information and Cultural Affairs (OIC). KHRO stopped producing its own content after World War II and reverted to a relay station to Asia for programming that was broadcast from the mainland. In 1946, KRHO was one of thirty-eight OIC transmitters world wide that broadcast VoA programming, which was considered "radio statesmanship" by the State Department and designed to disseminate information about the United States and "unbiased news" of other nations. Broadcast languages included; English, French, Japanese, Cantonese, Thai (Siamese), Vietnamese, Korean, Malaysian, and two Indonesian dialects. Broadcast times from KRHO were tailored to typical listening hours in various Asian nations, the station did not broadcast around the clock. ("Oahu Radio Station to Help Give Asia Picture of US Way of Life," Honolulu Star Bulletin. March 25, 1946. P. 11)

In 1947, VoA in Honolulu (KRHO) had a staff of sixteen, including ten engineers. Its administrative offices were at Aloha Tower. Although KRHO station announcements and fill-ins with Hawaiian music were made locally, most programming was produced in New York City. Broadcast from the west coast to a receiver in Kailua that was leased by VoA, the shows were sent via wire to the transmitter at Maili. By April 1947, no Japanese language programming was broadcast from Maili. General Mac Aurthur, Allied Commander of the Japanese Occupation handled radio programming in Japan. (Keyes Beech, "Hawaii's Most Powerful Radio Station - KRHO," Honolulu Star Bulletin. April 23, 1947. P. 5. "State Department Radio Here Plugs Islands Along With UN," Honolulu Star Bulletin)

A 1951 aerial photograph showed the Maili VoA site with a gable-roofed main building that had an L-shaped foot print, a Quonset hut to the north and a small shed-roofed structure to the south. Tall poles for the rhombic antenna were in a large open area to the west. (UH MAGIS Collection, Photo # 2685. June 29, 1951) By 1957, a second 100 kW transmitter had been added at KRHO at Maili and the station's receiver for broadcasts from the mainland had been changed to a receiver at Barbers Point. Some shows were tape recorded at Maili when received, and re-broadcast later. Also by that year, a number of programs were broadcast to the Soviet Union in Russian language. These broadcasts, begun ca. 1947, had their frequencies jammed by the Soviet government, with about fifty percent effectiveness. The facilities at Maili in 1957 included a main building housing the transmitters and a Quonset that was set on a low post foundation. ("Maili Transmitters Send Truth to Far East," Honolulu Star Bulletin. August 7, 1957. P. 15)

The VoA operated Station KRHO at Maili until at least 1964. By 1971 the VoA had ceased broadcasting from Maili and the property was turned over to the Coast Guard, which used it as a transmitting station for their communication system. The Coast Guard discontinued use of the property in 1977 and it was turned over to the US General Services Administration (GSA). In 1983, the GSA offered the approximately 89 acre parcel (TMK [1] 8-7-010: 007) for sale. The VoA buildings were demolished in the late 1980s. A sale of the property was never made and in 1996, negotiations began to transferred the property to the State of Hawaii in exchange for various parcels then under the control of the Department of Hawaiian Home Lands (DHHL). This exchange was accomplished in 2009, but it did not include the approximately 4.86 acres of TMK [1] 8-7-010: 031 that includes the four demolished resources covered in this RLS report. This 4.86 acre parcel was not transferred because of hazardous materials, including PCB, asbestos, and lead based paint among the debris field of the ruins that needed remediation (Kaiini Kaloi, "Environmental Assessment, Proposed Maili Land Exchange." 2009). In 2018, funding for the remediation of hazardous materials in the soil of the site was secured and a clean up was to be initiated. (Bianca Smallwood, "Toxic Lot In Maili May Finally Get Cleaned Up." Civil Beat. May 17, 2018.

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

Although the Voice of America facility at Maili was significant (under Hawaii State Register of Historic Places Criterion a) for its association with the Office of War Information and the Voice of America radio network, its demolition has rendered it not eligible. It does not retain the necessary aspects of integrity to support listing.

In addition, the remaining foundations at the site are not considered (under Hawaii State Register of Historic Places Criterion d) likely to yield information important in history or to have the potential to answer any important research questions.

Sources:

Findeisen, Paul "Around the Dial in Hawaii." Honolulu Star Bulletin. January 19, 1945. P. 8.

Hashiro, Ron. "History of Broadcasting in Hawaii." website qsl.net/ah6rh/am-radio/hawaii/history, accessed on October 15, 2020.

"Huge Transmitter Built at Waianae." Honolulu Star Bulletin. March 2, 1946. P. 1.

Portzer, Bruce. "Radio History - KRHO Honolulu 1944." From website Radio Heritage Foundation. 2020.

Rieth, Timothy (IARII). An Archaeological Inventory Survey of the Former Voice of America Site, Maili, Lualualei Ahupuaa, Waianae District, Oahu. Prepared for Element Environmental LLC. August 2009.

Schneider, John. "Dixon California, A United States Shortwave Mecca." website theradiohistoran.org/Dixon/Dixon1, accessed on October 15, 2020.

Seehaas, John C., estate of. "OWI Central Pacific Operations." Booklet from the collection in the estate of John C. Seehaas. From website Radio Heritage Foundation. Ca. 1945.

Smallwood, Bianca. "Toxic Lot In Maili May Finally Get Cleaned Up." Civil Beat. May 17, 2018.

Voice of America. "VoA Through the Years." website insidevoa.com/a/3794247, accessed on October 15, 2020. April 3, 2017.

RLS Form 2/2018

9. Attach Photographs: provide sufficient photographs to illustrate the property's main features. At a minimum provide the following:

Quantity	Description
1-2	Street view(s) of the resource and setting
1-2	Main Facades
1-2	interior photos(s) if applicable

10. Attach Map showing the location of the property

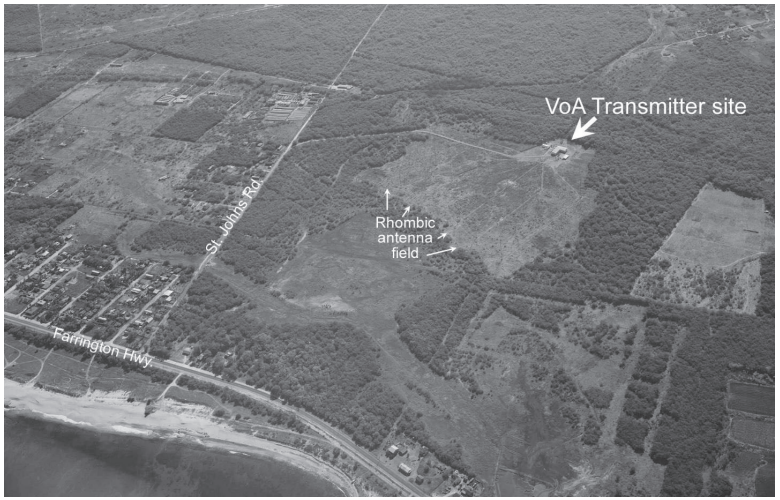
CHECKLIST

- ☐ **Reconnaissance Level Survey Form** (this form)
- ☐ **Photographs**
- ☐ **Map**
- ☐ **Filing Fee Form**
- ☐ **SIHP Request Form**

Location map showing TMK [1] 8-7-010: 031 in Maili. Aerial photo shows the site conditions in 2013.

Site map of VoA Transmitter Maili. Aerial photo shows the site conditions in 2013. Grubbed area has been cleared of all structures, only dis-connected, below grade foundation walls remain.

Historic 1951 aerial photo, view facing northeast, showing the VoA Transmitter Maili site. Labeling added. June 29, 1951. Photo: UH Manoa MAGIS Collection, #2685.



Sketch plan of existing, below grade foundation walls at VoA Transmitter Maili. November 9, 2020.

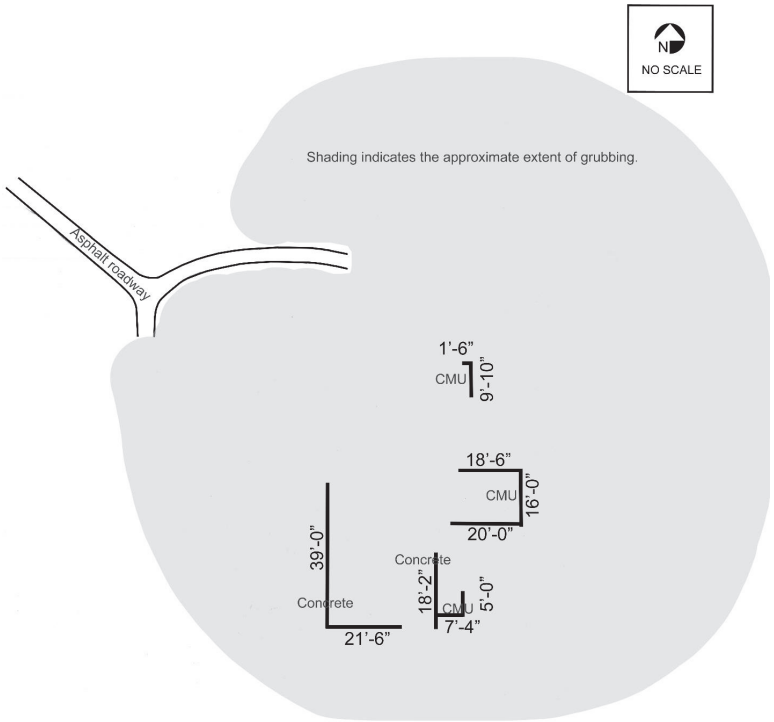


Photo key for November 9, 2020 field photos.

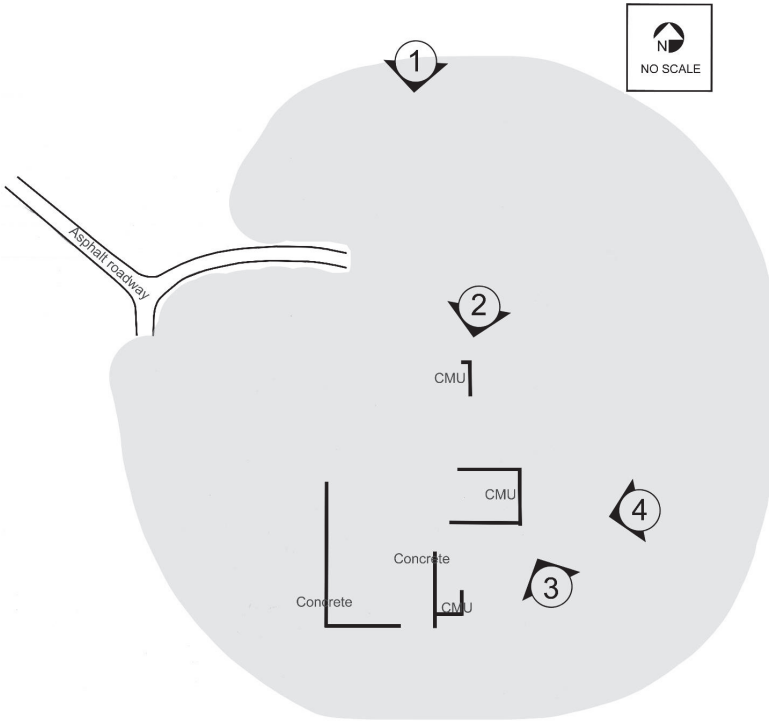


Photo 1

Photo 2

Photo 3

Photo 4

APPENDIX E

Māʻili Residential Development (Former Voice of America Site)
Preliminary Engineering Report, November 2021

MĀʻILI RESIDENTIAL DEVELOPMENT (FORMER VOICE OF AMERICA SITE)

PRELIMINARY ENGINEERING REPORT (FINAL SUBMITTAL)

TMK (1) 8-7-010: 30 & 31
Mā'ili, Wai'anae, O'ahu, Hawai'i

November 2021

Prepared for:

State of Hawai'i
Department of Hawaiian Home Lands
Land Development Division

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900 / Honolulu, HI 96813 / Phone: (808) 521-0306 / Fax: (808) 531-8018

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Appendix A: Preliminary Geotechnical Engineering Exploration, June 15, 2020

Appendix B: State Historic Preservation Division Reconnaissance Level Survey, March 2021

Appendix C: Draft Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, February 2021

Appendix D: Report on UAV-Based Magnetic Survey, August 2020

Appendix E: Geophysical Survey Anomaly Verification Letter Report, August 31, 2021

Appendix F: A natural resources assessment of the former Voice of America Site, May 27, 2021

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Appendix K: Approved Sewer Connection Application

Appendix L: Wastewater System Calculations

Chapter 1 – INTRODUCTION

1.1 OVERVIEW AND PURPOSE OF THE PROJECT

The purpose of the project is to develop approximately 40 acres of vacant land in Mā'ili, O'ahu into a homestead community for the Department of Hawaiian Home Lands (DHHL) beneficiaries (refer to Figure 1). The development will take place in two separate phases. DHHL will initially construct the backbone road and utility infrastructure that will support the proposed homestead community. In the second phase, DHHL will solicit proposals to develop the residential units, which will be constructed after the backbone infrastructure has been completed.

The existing conditions of the project site have been assessed based on the following investigations, surveys, and consultations:

- Review of readily available City records and data including record and as-built information, studies, and reports
- Site observations and aerial topographical survey of existing surface conditions
- Preliminary geotechnical engineering exploration to obtain an overview of the subsurface conditions and storm water quality infiltration capacity
- Transportation planning and mobility analysis report to accommodate the increased traffic volumes and developing preliminary concepts for offsite road improvements
- Archaeological services in support of the proposed development
- Magnetic survey and geophysical survey anomaly verification
- Environmental site assessment and update, if necessary
- Natural resources assessment (flora and fauna)
- Development of alternative site and utility plan concepts to optimize the number of units given the existing conditions
- Consultations with various federal, state and city agencies, and private utilities regarding the proposed development

1.2 SCOPE OF THE REPORT

Based on the tasks outlined above, the Preliminary Engineering Report will address the following:

- Describe existing site conditions including topography, utilities and subsurface conditions

- Identify infrastructure requirements as well as discuss rules and requirements relating to the project
- Propose preservation plans for previously identified historical sites
- Discuss potential environmental impacts and mitigation measures, along with a determination of the project's impact on protected species and habitats
- Provide opinion of probable cost for the proposed improvements
- Identify additional investigation, fieldwork, analysis, and consultation that may be required prior to the design phase

It should be noted that prior to the start of the backbone infrastructure design, a land-based topographical survey will be conducted to supplement the aerial survey that was completed as part of the initial field work mentioned above. The updated survey will provide greater accuracy of the actual ground elevations. Thus, the conceptual plans provided in this preliminary report are subject to change pending the final topographical survey.

Chapter 2 – BACKGROUND AND EXISTING CONDITIONS

2.1 BACKGROUND AND OVERVIEW OF THE PROJECT

The proposed 40-acre project site is located in Mā'ili, Wai'anae on the leeward side of the island of O'ahu (refer to Figures 1 – 3). The site is currently situated within two parcels, which will be consolidated and subdivided as part of the project. The larger of the two parcels is an 84.4-acre lot designated as tax map key (TMK): 8-7-010: 30 (refer to Figure 4) and owned by DHHL. The smaller parcel is a 4.9-acre lot designated as TMK: 8-7-010: 31, previously owned by the U.S. government, and was managed by the United States Coast Guard (USCG). Ownership of the parcel was transferred to the State of Hawai'i, DHHL in July 2021. Both parcels are zoned AG-2 (General Agriculture) under the City and County of Honolulu Land Use Ordinance and are within the Agriculture State Land Use District. Re-zoning will not be required, since Hawaiian home lands are not subject to county land use regulations.

The 40-acre project site is bordered by Mā'ili Channel to the north, Sea Country residential development to the east, the Kamehameha Schools Community Learning Center to the south, and additional residential developments to the west. The project site is located approximately 1,600 feet inland from the shoreline and mouth of Mā'ili Channel. Adjacent to the northwestern edge of the site are Ulu Ke Kukui (transitional housing facility) and Ho'omalu O Nā Kamali'i (receiving home), both of which will remain. Kamehameha Schools recently constructed the Kamehameha Schools Community Learning Center located at the southwestern corner of the parcel. The future subdivision of the two consolidated parcels will also create separate parcels for Ulu Ke Kukui, Ho'omalu O Nā Kamali'i, and the Kamehameha Schools Community Learning Center.

As mentioned previously, DHHL will initially construct the backbone road and utility infrastructure that will support the proposed homestead community development. They will also be requesting separate proposals to develop the residential units, which will then be constructed after the backbone infrastructure has been completed.

2.2 OVERVIEW OF PREVIOUS STUDIES

DHHL has been investigating the potential site as a homestead residential development since 2010 when the department formally received the property. There are previous studies and reports that have been conducted in conjunction with the subject property. A summary of several of the more recent studies and reports may be found below.

2.2.1 ARCHAEOLOGICAL REVIEW

On January 12, 2017, International Archaeological Research Institute, Inc. (IARII) submitted to the State Historic Preservation Division (SHPD) the *Request for a Historic Preservation Review per Hawai'i Revised Statutes 6E-8 for the Department of Hawaiian Homelands Voice of America*

Property. The letter request includes a history of the site, background information on the property and a summary of previous archaeological inventory surveys (AISs) completed for the project area. The previous AISs were completed by International Archaeological Research Institute, Inc. (2009) and Scientific Consultant Services, Inc. (2013).

The AISs document three archaeological sites:

- Eighteen (18) concrete pedestal foundations for antenna and a historical trash dump
- Four (4) features of remnants from the Voice of America transmitter building and support structures
- Elevated railroad bed

The letter requested SHPD's concurrence of the following:

- Information provided regarding the land transfer of ownership from the U.S. Government to DHHL is sufficient (4.9-acre parcel)
- Preservation of the eastern section of the railroad bed is acceptable provided an approved preservation plan
- Data recovery of the western and central sections of the railroad bed is acceptable provided an approved data recovery plan

SHPD's response (September 19, 2017) indicated that details of the proposed development would be required as well as the status of the proposed land transfer. SHPD also requested a meeting with DHHL, the U.S. Government, and any additional appropriate parties.

As part of the current project, in a follow up conversation with the SHPD in November 2019, additional tasks were required by the SHPD in order to move the project forward. Those tasks involved details regarding the land transfer and authorization to conduct consultations as well as additional site assessments of the archaeological sites. The site assessments would require documentation by a historical architect or architectural historian.

2.2.2 ENVIRONMENTAL STUDY

Prior to the start of this project, the most recent environmental study for the project site was conducted by Element Environmental entitled *Limited Phase II Environmental Site Assessment 80-Acre Former Voice of America Site*, dated July 2017. The site assessment included the history and description of the site along with obtaining and testing samples in order to evaluate the amount of contamination, if any, in the surface soils. The study covered the 84.4-acre site exclusive of the existing developments (Kamehameha Schools Community Learning Center, Ulu Ke Kukui and Ho'omalu O Nā Kamali'i). The study excluded the 4.9-acre parcel, which has now been turned over from the U.S. Government to DHHL, to be included as part of the proposed development.

The results from the soil samples concluded that there are two areas of interest. Both areas are located on the southeast portion of the parcel outside of the proposed development area. The first area detected lead that will need to be addressed prior to development. The second area was found to be a potential dumpsite that would warrant further investigation.

Because the site will be developed for residential/community use, the State of Hawai'i Department of Health (HDOH) Hazard Evaluation and Emergency Response (HEER) Office is requesting additional characterization to achieve a "no further action" (NFA) status.

2.2.3 TRAFFIC STUDY

Prior to the start of the current project, a traffic study was conducted by Fehr & Peers entitled *Kamehameha Schools Community Learning Center in Mā'ili, Hawai'i – Transportation Impact Analysis Report (TIAR)*, dated May 23, 2013. The report was conducted in conjunction with the Kamehameha Schools Community Learning Center project. The project included a three-phase buildout of the learning center and assumed a three-phase buildout of the current DHHL project site. However, it is now anticipated that Kamehameha Schools will not develop beyond the current learning center footprint. A traffic study has been conducted as part of the current project in order to update recommendations of the 2013 study that will include the Kamehameha Schools Community Learning Center and DHHL's proposed homestead community.

2.3 EXISTING SITE CONDITIONS

2.3.1 TOPOGRAPHY

The project site is located in an agricultural district with existing ground elevations ranging from approximately 3 feet to 20 feet mean sea level (MSL). The higher elevations located on the eastern boundary of the site gradually slope in the southwesterly direction toward the coast. The average slope of the site is approximately 0.7%. The undeveloped site contains existing vegetation consisting of native brush and sporadic barren areas.

Photograph 1: Project site (looking southeast)

Photograph 2: Project site (looking southwest)

2.3.2 SOILS AND SUBSURFACE

As part of this initial phase of the current project, Geolabs, Inc. prepared a *Preliminary Geotechnical Engineering Exploration* dated June 15, 2020. This subsurface investigation involved drilling and sampling of six boreholes spaced throughout the site (refer to Appendix A).

Based on the laboratory testing of soil samples from the borings, the soil composition consists of a thin alluvium layer overlying coralline deposits. Geolabs, Inc. (page 5, 2020) observed the following:

> *"Based on our field exploration, the project site is generally underlain by a thin alluvium layer overlying coralline deposits extending to the maximum depths explored. The alluvial material generally consisted of medium stiff clayey and/or silty soils extending to depths between about 1 and 4.5 feet below the ground surface. Below the alluvial material, we encountered coralline deposits consisting of medium dense to dense coral formation and loose to dense coralline detritus extending to the maximum depth explored of about 21.5 feet below the ground surface. It should be noted that weathered sandstone consisting of loose to medium dense silty sand were encountered in Boring Nos. 3 and 6 at about 4.5 and 18 feet below the ground surface.*
>
> *Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 and -3.3 feet MSL at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors."*

Once the final site plan has been determined, additional borings will be taken at appropriate locations within the project site. This will provide more detailed design recommendations for excavation, fills, trenching, and pavement design.

2.3.3 ARCHAEOLOGICAL REVIEW

To address part of SHPD's site assessment requirement, MASON Architects prepared a Reconnaissance Level Survey (RLS) in March 2021 (refer to Appendix B). The RLS documents the current status of four historical features identified in the 2009 AIS. The RLS evaluated remnant features of the former Voice of America radio transmitting station previously assigned State Site number 50-80-07-7082 (Features 7, 14, 19, and 20). As part of the survey, MASON Architects conducted a site visit in November 2020, and observed that the four features were no longer extant. It was reported that the site was grubbed to a depth of one to two feet, removing all traces of the features except for the exposed top edges of a disconnected series of below-grade foundation walls. Although the site was previously considered significant for its association with the Office of War Information and the Voice of America radio network, the facility is no longer eligible because it has already been demolished (MASON Architects, 2021). Furthermore, the remaining foundations are also not considered likely to yield information of historical importance or to have the potential to answer important research questions.

In addition, an archaeological survey was completed by International Archaeology, LLC within the existing 40-foot-wide roadway easement on the western border of the project site. There was no archaeological site(s) documented in the draft report (refer to Appendix C).

2.3.4 GEOPHYSICAL SURVEY

As part of this initial phase of the current project, Dudek prepared a *Report on UAV-Based Magnetic Survey* dated August 5, 2020. Dudek used a Geometrics MFAM magnetometer system mounted on an unmanned aerial vehicle (UAV) platform (refer to Appendix D) to perform the survey. The purpose of the survey was to identify ferro-metallic object magnetic anomalies, which could potentially be buried waste or unexploded ordnance (UXO).

The magnetometer survey registered 133 analytic signal anomalies throughout the site and the report identified seven higher priority targets (page 9, 2020). The report also noted that there was influence on the results from the concrete channel along the north boundary as well as the residential structures along the east boundary.

Element Environmental prepared a letter report titled *Geophysical Survey Anomaly Verification*, dated August 31, 2021 (refer to Appendix E). A site evaluation was subsequently performed on July 12 to 15, 2021, to verify the registered anomalies indicated in the magnetometer survey. Element Environmental observed the following:

- Antenna supports structures and guy-wire remnants associated with the former Coast Guard VOA station are located throughout the property.
- A suspect underground utility line is likely located immediately east of the unimproved dirt roadway that bisects the subject property from the north to the south along points M-12, -21, -27, -33, -37, -43, -54, -58, -66, -70, -78, and -89.
- The higher priority targets located at M-39, -63, -73, -74, -77, -87, and -116 were determined to be surface debris.
- With the exception of the suspected underground utility line, no magnetic sub-surface items or structures were observed during the magnetometer survey and subsequent anomaly verification inspection.
- The results of this survey and inspection apply only to magnetic items. Furthermore, certain metals such as aluminum, brass, copper, and lead have weak magnetic properties and the presence or absence of these materials cannot be confidently confirmed.

Based on research of available documents, the "suspect underground utility line" appears to be in the vicinity of a former communication line associated with the former Voice of America facility. Coordination with the U.S. Army's 30th Signal Battalion is currently ongoing to determine whether the "suspect underground utility line" belongs to the U.S. Government and if the line can be abandoned.

2.3.5 NATURAL RESOURCES ASSESSMENT

As part of this initial phase of the current project, AECOS prepared a report entitled *A natural resources assessment of the former Voice of America Site* dated May 27, 2021. The report included a discussion on jurisdictional waters and wetlands as well as flora and fauna found within the project site and the surrounding area. The following is a brief summary of some of the key findings (refer to Appendix F):

- The jurisdictional limits of Mā'ili Stream may be drawn at the top of bank. The preliminary delineation may require a site visit by the U.S. Army Corps of Engineers (USACE) to confirm the jurisdictional boundary.
- Mā'ili Stream's concrete channel is not a wetland; however, prior to the start of construction, a wetland survey should be conducted along the west end of the project site. Pickleweed and a possible hydric soil type were observed in this area which may require further assessment of federal jurisdiction where water forms ephemeral pools after heavy rains.
- No plants of conservation interest were found during a survey of the project area.
- The project site is absent of federally designated Critical Habitat for any species. However, the project site does contain a bufflegrass grassland which is a typical habitat for the short-eared owl. This owl is an endangered species in the State of Hawai'i. Thus, in order to avoid disturbance of the owl's nesting area, a nesting survey should be conducted by a qualified biologist immediately prior to the start of construction.
- The project's impact to any Essential Fish Habitat (EFH) would be limited to the transport of sediment and/or pollutants in runoff to Mā'ili Stream. With effective implementation of best management practices (BMPs) the project will have a minimal adverse impact on the EFH.

2.3.6 FLOOD HAZARD

According to the *Flood Insurance Rate Map (FIRM) Map Number 15003C0192J*, dated November 5, 2014, the project site is situated in either Flood Zone X or Flood Zone XS (refer to Figure 5). Flood Zone X are areas outside the special flood hazard area and higher than the elevation of the 0.2% annual chance (or 500-year) flood. Flood Zone XS are areas of 0.2% annual (or 500-year) 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. The floodwater elevations for the Flood Zone XS areas at sections B, C, and D (refer to Figure 5) are 4.54 feet, 4.64 feet, and 4.55 feet, respectively. It is anticipated that the finish elevations of the proposed site will exceed the floodwater elevations.

2.3.7 EXISTING INFRASTRUCTURE

2.3.7.1 EXISTING ROADWAY SYSTEM AND TRANSIT SERVICES

An evaluation of the impacts of the proposed development to mobility and access surrounding the project site was completed by Fehr & Peers, entitled *Mobility Analysis Report (MAR) for the Voice of America Site in Mā'ili*, dated October 29, 2021 (refer to Appendix G). The key roadways providing acces to or in the vicinity of the project site are described below.

> *"Farrington Highway (Route 93) is a principal arterial that largely is under the jurisdiction of HDOT. It extends as a four-lane facility from H-1/Queen Lili'oukalani Freeway to Makaha Valley Road, where it becomes a two-lane facility to its northern terminus at Kaena Point State Park. From 0.22 miles north of the Na Ohi Kilolo Stream bridge, Farrington Highway is under the jurisdiction of the City & County of Honolulu. Adjacent to the project, the posted speed limit is 35 miles per hour (mph). A continuous sidewalk is provided on the mauka side of the roadway, and a painted shoulder is provided on the makai side of the roadway. Farrington Highway is also a designated bike route, and on-street parking is prohibited primarily in the four-lane section of roadway.*
>
> *St John's Road is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Kaukamana Road and includes approximately 22 feet of pavement width makai of Kulaaupuni Street with unpaved shoulders. The posted speed limit is 15 mph makai of Kulaaupuni Street and 25 mph mauka of Kulaaupuni Street. A narrow asphalt path is only provided on the north side of the street between Kulaaupuni Street and Manuaihue Street. On-street parking was observed on the unpaved shoulder areas.*
>
> *Kaukama Road (Route 8750) is a two-lane minor collector that is under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Pakeke Street. The posted speed limit is 25 mph. Sidewalks are provided on both sides of the roadway, and on-street parking is permitted on both sides as well.*
>
> *Kulaaupuni Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Mamoalii Place (adjacent to the project site) to a terminus at the Mā'ili'ilii Stream. The posted speed limit is 25 mph. A sidewalk is provided on the makai side of the road between Mamoalii Place and the Mā'ili Channel, and a raised curb designates a street-level walking path on the mauka side of the road for the same segment, with sidewalk provided on the Mā'ili Channel bridge. A sidewalk is also provided on the makai side of the road between St John's Road and approximately 200 feet south of Maliona Street. No sidewalk or formal path is provided on the other segments of Kulaaupuni Street,*

> *including the segment between the Mā'ili Channel and St John's Road. On-street parking is provided adjacent to the sidewalk, and parking was observed in the unpaved shoulder immediately adjacent to the roadway. No parking is permitted on the mauka side of the roadway between Mamoalii Place and the Mā'ili Channel as designated by red curb.*
>
> *Kulauku Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Kaukama Road to Kulawae Street. Kulauku Street has the potential to be extended to the north along the makai edge of the project site and the Kamehameha Schools Community Learning Center to connect with Kulaaupuni Street, but there are no plans to make that connection at this time. The posted speed limit is 25 mph. A sidewalk is provided on both sides of the roadway, and on-street parking is permitted on both sides as well.*

Photograph 3: Existing 40-foot wide easement at Kulaaupuni Street (looking south)

Photograph 4: Intersection of Holt Road and Kulaaupuni Street

The MAR also described the public transportation service within the vicinity of the project site as stated below.

> *"TheBus is the main public transportation service on the Island of O'ahu, where it served over 60 million riders in the fiscal year of 2019 on its fixed-route service. Within the project study area, Routes 40, 93, C, and PH1 provide service along Farrington Highway.*
>
> *Routes 93, C, and PH1 are express routes, while Route 40 is a regular service bus route.*
>
> *All routes serve the bus stops located at Farrington Highway/St John's Road, located approximately 2/3-mile walk from the proposed project site. The northbound bus stop is provided with a bench, and the southbound bus stop is provided with a shelter and a bench. Both bus stops also have a painted shoulder to allow for bus pull-outs, so buses stopping to pick up or drop off passengers will not block vehicles traveling on Farrington Highway."*

The existing transit schedules are summarized in Table 1 below.

Table 1: Existing Transit Services

Route	From	To	Weekdays			Weekends	
			Operating Hours	Headway (minutes)		Operating Hours	Headway (minutes)
				Peak	Midday		
40	Honolulu	Makaha	12:00 am – 12:00 am	30 min	30 min	12:00 am – 12:00 am	30 min
93	Downtown Honolulu	Makaha	Eastbound: 3:45 am – 8:16 am; Westbound: 3:23 pm – 7:34 pm	27 min	-	-	-
C	Honolulu	Makaha	3:03 am – 11:02 pm	30 min	30 min	3:04 am – 11:09 pm	30 min
PH1	Pearl Harbor	Makaha	Eastbound: one departure from Makaha at 4:25 am; Westbound: one departure from Pearl Harbor at 3:10 pm	-	-	-	-

Source: Fehr & Peers, 2021; TheBus.org.

2.3.7.2 *EXISITNG DRAINAGE SYSTEM*

Mā'ili Channel begins east of the project site bordering the Sea Country residential development (refer to Figure 3). The channel runs north parallel with the project site and then turns west along the project's north border. After crossing the Kulaaupuni Street Bridge, the channel runs south, then southwest towards the coast. The channel discharges into the Pacific Ocean downstream of the crossing at Farrington Highway.

There is no internal drainage system within the project site. Storm runoff generated at the site presently sheet flows towards the west in the direction of an existing drain intake connected to a 48-inch drain line. The 48-inch drain line traverses through the neighboring Mā'ili Holiday residential development within a 10-foot-wide drainage easement in favor of the City and County of Honolulu. The drain line discharges into the Mā'ili Channel approximately 250 feet west of the project site.

The existing drainage concept within the project site is generally consistent with *the Hydrologic Report for Mā'ili Holiday* prepared by William Hee & Associates, Inc. (1973). The drain intake and 48-inch drain line were constructed under the Mā'ili Holiday Project in order to intercept runoff flowing from the project site in the westerly direction of the Mā'ili Holiday residential development. The Kamehameha Schools Community Learning Center, south of the site, also contributes runoff to the existing drain intake. The *Hydrologic Report for Mā'ili Holiday* did not account for the flow from this portion of the project parcel. The Hydrologic Report accounted for intercepting runoff from only the north portion of the project parcel. Therefore, the future (post-construction) drainage pattern will not follow the existing drainage pattern due to limited capacity of the drainage system at the western border.

Photograph 5: Existing drain intake

Photograph 6: Mā'ili Channel

2.3.7.3 *EXISTING POTABLE WATER SYSTEM*

The Board of Water Supply (BWS) provides most of the water servicing the Wai'anae District. Approximately half of the water comes from wells within Wai'anae while the other half is conveyed to Wai'anae from the Pearl Harbor aquifer. Due to the water system running near maximum capacity, the BWS is currently constructing the Lualualei Line Booster System Improvements, increasing the water supply servicing Wai'anae.

While water infrastructure can be found in adjacent roadways and developments, there is no water system currently serving the vacant project site. An 8-inch water line runs within Kulaaupuni Street, which services both the Ulu Ke Kukui (transitional housing facility) and Ho'omalu O Nā Kamali'i (receiving home). The 8-inch line then continues parallel with the Mā'ili Channel along Mamoalii Place servicing the Mā'ili Holiday residential development, just west of the project site.

2.3.7.4 *EXISTING WASTEWATER SYSTEM*

There is no wastewater system currently serving the project site. Similar to the water system, existing sewer infrastructure can be found in adjacent roadways and developments. There is a private sewer line in Mamoalii Place within the Mā'ili Holiday residential development. A 6-inch sewer line leads to an 8-inch sewer line servicing the residential units. The 8-inch sewer line eventually connects to the 36-inch sewer interceptor along the edge of Mā'ili Channel. The 36-inch sewer interceptor travels north along the Mā'ili Channel and Kulaaupuni Street and is redirected west after crossing the Mā'ili'ilii Stream toward Farrington Highway. Once in Farrington Highway the 36-inch sewer interceptor continues north until it reaches the Wai'anae Wastewater Treatment Plant.

There are also wastewater systems servicing existing developments within the project's 84.4-acre parcel. The Kamehameha Schools Community Learning Center is served by an onsite wastewater system containing 4-, 6-, 8- and 12-inch sewer lines connecting to an 18-inch sewer line in Kulauku Street.

The wastewater system servicing the Ulu Ke Kukui (transitional housing facility) and Hoʻomalu O Nā Kamaliʻi (receiving home) consists of 4-, 6- and 10-inch sewer lines. The onsite private sewer system crosses under the Mā'ili Channel utilizing a 10-inch sewer line to a sewer manhole just south of the channel property line. The sewer transitions to a municipal system under the jurisdiction of the City and County of Honolulu north of the channel property line. The 10-inch sewer continues west along Holt Road until reaching Kulaaupuni Street. In Kulaaupuni Street, the sewer is redirected north and connects to a 10-inch sewer in St. John's Road. In St. John's Road, the sewer travels west and connects to the 36-inch sewer interceptor.

2.3.7.5 *EXISTING ELECTRICAL, TELEPHONE AND CABLE IMPROVEMENTS*

The proposed project site is not currently served by electrical, telephone, and cable services. Hawaiian Electric Company (HECO) has a mix of existing overhead and underground distribution systems servicing the adjacent developments. The existing Mā'ili Holiday development, west of the site, is serviced through a single-phase underground system along Kulaaupuni Street and Mamoalii Place. The existing Ulu Ke Kukui development and Hoʻomalu O Nā Kamaliʻi facility, north of the site, is serviced by an overhead three-phase system from St. Johns Road to pole 4/9Y on Kulaaupuni Street. A riser at pole 4/9Y and underground system is provided to service the site. The existing overhead lines along Kulaaupuni Street extend beyond Ulu Ke Kukui to service the Kamehameha Schools Community Learning Center, located south of the site.

Photograph 7 – HTCO, Charter and HECO pull boxes along Kulaaupuni Street.

Photograph 8 – Existing overhead lines and street light along Kulaaupuni Street.

The existing Sandwich Isles Communication (SIC), Hawaiian Telcom (HTCO) and Charter Communications (Charter) distribution is through underground infrastructure along Kulaaupuni Street and via the overhead lines along St Johns Road. The existing utility boxes (refer to Photograph 7) on Kulaaupuni Street service Mā'ili Holiday development, Ulu Ke Kukui, and Hoʻomalu O Nā Kamaliʻi.

The existing street lighting system along the makai side of Kulaaupuni Street consists of unmetered City and County of Honolulu street lights (refer to Photograph 8).

Chapter 3 – PROJECT SITE IMPROVEMENTS

3.1 PREFERRED CONCEPTUAL SITE PLAN

Upon consultation with beneficiaries of Hawaiian Home Lands, the Department selected a conceptual site plan that allows both single-family and multi-family units for the project site. The preferred conceptual site plan includes 136 multi-family units centrally located within the project site surrounded by 145 single-family lots totaling 281 units.

A potential connection to the Kamehameha Schools Community Learning Center will be located at the south end of the project site approximately 700 feet east of the site entry. The proposed infiltration basin will be situated in the northwestern corner of the site, and will be bordered by Ulu Ke Kukui to the west and the Mā'ili Channel to the north. A proposed open area park will be located south of the infiltration basin (refer to Figure 6).

3.2 SITE GRADING

The existing ground elevations range from approximately 3 feet to 20 feet MSL. Higher elevations are found on the eastern boundary of the site, which gradually slope in the southwesterly direction. In contrast, the general slope of the development will flow south to north in the direction of the bordering Mā'ili Channel; thus, the existing drainage pattern will be altered as a result of the proposed development. Instead of directing runoff to the southwest corner of the project site in the direction of an existing drain intake, the majority of the flow will be directed to a new infiltration basin located in the northwest corner of the property, directly adjacent to Ulu Ke Kukui (refer to Figure 6). The basin will provide treatment of storm water in accordance with the City and County of Honolulu's Water Quality Rules (refer to Section 3.5 below).

In order to construct the infiltration basin and provide onsite utility systems, import of fill material will be required to fill the site. It is anticipated that the existing grades will be raised approximately 5-10 feet along the eastern boundary and roughly 10-15 feet along the southwestern boundary of the property. Located on the east border and towards the center of the site, an existing archaeological site consisting of a portion of a sugarcane railroad bed may need to remain undisturbed. The railroad bed will be filled over and preserved in place, and utilities within the area will be installed in a manner that will attempt to minimize disturbance of the railroad bed (refer to Figure 7).

Photograph 9: Existing railroad bed to be filled over

It is likely that the elevation difference at the project borders will require slopes or retaining walls in order to build up to final grades (refer to Figure 8). Depending upon the elevation difference, terraces or benches may also be necessary in accordance with government regulations. Any grading within existing residential properties, such as Sea County, will require prior consultation and approval by property owners.

To the extent possible, site grading will be in accordance with the Revised Ordinances of the City and County of Honolulu, as well as the geotechnical engineer's site-specific recommendations. In addition, erosion control measures and good housekeeping best management practices (BMPs) will be implemented during grading and construction to limit pollutant discharge to offsite areas.

3.3 ROADWAY IMPROVEMENTS

As discussed in Chapter 2, there are various roadways within the vicinity of the project site. Kulaaupuni Street and Mamoalii Place are both located just west of the project site and are maintained by the City and County of Honolulu. St. John's Road connects to both Kulaaupuni Street and Farrington Highway northwest of the project site. The project's proposed primary access will be serviced by a new entry off Kulaaupuni Street.

The Mobility Analysis Report (MAR) completed by Fehr & Peers entitled *Mobility Analysis Report (MAR) for the Voice of America Site in Mā'ili*, dated October 29, 2021 considered various modes of transportation assuming the single-entry access off Kulaaupuni Street. The MAR also provided an update to the recommendations of the 2013 Transportation Impact Analysis Report (TIAR) study which included both the Kamehameha Schools Community Learning Center and the proposed project.

The MAR indicated that the proposed project would have a significant impact to the Kulaaupuni Street/St. John's Road intersection, particularly during the morning peak hours. The required improvements at the intersection include the implementation of an all-way stop in order to reduce delays and improve operations to more desirable levels. The all-way stop control is not expected to substantially affect operations at adjacent intersections and would also enhance safety for pedestrians.

Additionally, signal timing modifications at the Farrington Highway/St. John's Road intersection will need to be coordinated with the State's Department of Transportation, Highways Division (DOTH), prior to occupancy of the residential units. Although the overall intersection is projected to operate at a desirable level, a signal timing study will need to be completed and coordinated with DOTH that will help reduce delays by improving westbound and southbound left-turn queuing. The signal timing study should not be conducted at this point in time, but rather further along in the design process as the signals are likely to be retimed prior to project completion.

The MAR included optional considerations including two pedestrian paths adjacent to the proposed project site. The first path would be located on the mauka side of Kulaaupuni Street between the Mā'ili Channel bridge and St. John's Road. The path would help to provide project-related pedestrians access to key destinations (Mā'ili Elementary School and Community Park, Leeward Community College Wai'anae Moku campus, and bus stops on Farrington Highway). The second path would be located to the east just south of the project site that would provide a connection to the proposed project and the makai terminus of Laia Street within the Sea Country residential development. It should be noted that these pedestrian paths are considerations and are not required for the project (refer to Appendix G for a more comprehensive roadway analysis).

3.4 DRAINAGE IMPROVEMENTS

To the extent possible, the new drainage system will be designed in accordance with the City and County of Honolulu's *Storm Drainage Standards* (refer to Appendix H for Hydrologic Calculations). The onsite drainage system will consist of swales and catch basins (and/or drain inlets) which will intercept a majority of the runoff produced onsite (refer to Figure 9). The site runoff will be conveyed through an underground piped system which will lead to a box culvert. The box culvert will then discharge to an infiltration basin where runoff will be treated. The basin will be designed with an overflow to convey the peak flow rate, which will discharge into the Mā'ili Channel.

Due to the elevated site, site runoff from slivers of peripheral areas bordering the property will not be captured by the primary onsite drainage system. The north, south and west borders will allow runoff to flow away from the property. The east border will be filled to match the adjacent Sea Country residential development.

Additional offsite drainage improvements will be required in order to address changes in the drainage flow pattern resulting from the development (refer to Figure 9).

- The existing drain intake structure at the southwestern corner of the project site will be replaced with a new structure which will be located further east. This new intake structure will no longer be situated within the existing 40-foot-wide roadway easement.
- The existing 48-inch reinforced concrete pipe (RCP) drain that currently connects to the existing drain intake structure mentioned above will be lengthened so that it connects to the new drain intake structure. The existing RCP drain will also be replaced entirely by a 4' x 6' box culvert and manholes to accommodate the proposed onsite and additional offsite flows. As mentioned previously, this drain line is maintained by the City and County of Honolulu and is located in a 10-foot-wide easement.
- Drain inlets will be constructed along the south border of Ulu Ke Kukui to intercept runoff flowing toward the proposed DHHL site along with the construction of drainage structures along the proposed Kulaaupuni Street extension fronting the proposed site entrance.

For design purposes, onsite and offsite peak flows are calculated using the Rational Method and the City's *Storm Drainage Standards*. These design flows were used to approximate the drain line sizes and develop the onsite and offsite drainage concept (refer to Appendix H for preliminary drainage system calculations).

It should be noted that Plate 6 from the City and County of Honolulu's *Storm Drainage Standards* is used for drainage areas greater than 100 acres with a 100-year recurrence interval. Design flows derived using Plate 6 are based solely on the drainage area and independent of land use. Therefore, the Plate 6 quantity of flow calculated for the drainage basin contributing to the Mā'ili Channel remains unchanged regardless of the construction of this project.

3.5 STORM WATER QUALITY IMPROVEMENTS

To the extent possible, the project will comply with the City and County of Honolulu's *Rules Relating to Water Quality* requirements. Listed below are Low Impact Development (LID) site design strategies as well as source control and treatment control best management practices (BMPs) that will be utilized to meet water quality criteria.

- LID Site Design Strategies
  - Minimize Impervious Surfaces
  - Direct Roof Runoff to Landscape Areas
  - Minimize Soil Compaction
- Source Control BMPs
  - Limit Runoff from Landscaped Areas to Impervious Areas
  - Storm Drain Markers on Catch Basins
- Treatment Control BMPs
  - Infiltration Basin
  - Biofiltration Systems

A proposed infiltration basin will provide treatment control for the majority of the project's stormwater, allowing pollutants to settle and infiltrate through the soil matrix. As discussed in Section 3.2, the proposed site will be raised to construct the infiltration basin. The basin footprint of approximately 200 feet square is based on the required water quality volume calculated in accordance with Water Quality Rules (refer to Appendix H). An infiltration rate of 2 inches/hour provided in the project's geotechnical study conducted by Geolabs, Inc. (refer to Appendix A) was used in the water quality volume calculation. The overflow from the basin will discharge into the Mā'ili Channel.

A horizontal flow biofiltration system is being proposed to treat the stormwater generated in the southwest peripheral area of the site that cannot be conveyed to the primary infiltration system. This runoff will discharge to the new 4' x 6' box culvert near the existing drain intake. Biofiltration is being proposed because infiltration methods such as drywells and subsurface infiltration chambers require minimum a 3-foot clearance from the seasonally high groundwater table. Due to the low elevations in this area and existing groundwater levels as high as +3 feet MSL, the minimum clearance is unattainable rendering these infiltration methods infeasible.

The horizontal flow biofiltration system will provide pretreatment and removal of pollutants through pre-filter boxes and bio-media. This pre-packaged subsurface flow system also allows for a smaller unit footprint. Systems such as Bioclean's Modular Wetlands Linear has been approved by the Washington State Department of Ecology Technology Assessment Protocol Ecology (TAPE) and meets the biofiltration requirements for the City and County of Honolulu's *Rules Relating to Water Quality*. The anticipated device model and size will be based on the required water quality flow calculations (refer to Appendix H). The devices will include an overflow bypass system for flows exceeding the design capacity.

3.6 POTABLE WATER IMPROVEMENTS

As discussed in Chapter 2, there is no existing water system serving the project site. Water infrastructure can be found in adjacent roadways and developments. There are 8-inch water lines within Kulaaupuni Street and Mamoalii Place, which service the neighboring residential areas.

As part of the Environmental Assessment process, an Early Consultation Letter was submitted to the BWS in September of 2021, providing BWS an opportunity to comment on the proposed project. BWS responded (October 6, 2021) that the existing water system is adequate to accommodate the proposed homestead development (refer to Appendix I).

BWS also indicated that the *Lualualei Line Booster Upgrade* project is currently in construction and is projected to be completed in the upcoming months. The project will increase both pumping capacity and overall water supply to the leeward side of O'ahu. This would help to provide adequate water supply for increasing demands required by the proposed project and other future developments. It was suggested that the project status be confirmed in the beginning of 2022. BWS also identified a current project in the neighboring roadways. The project entitled, *Farrington Highway Water System Improvements, Hookele Street Vicinity Project*, is currently in the design phase and is likely to impact waterlines in the vicinity of the project site.

To the extent possible, the onsite water system for the development will be designed in accordance with the BWS *Water System Standards*. A proposed connection off the 242' Service Zone via an existing 8-inch water line within Kulaaupuni Street is anticipated. The onsite water system will consist of an underground piped system sized to accommodate the domestic demand and fire flow, and will also include the installation of pressure reducing valves, as needed (refer to Figure 10). Fire hydrants will be installed along the roadways to provide adequate fire protection within the development. The water system will be designed to accommodate the more stringent Multi-Family condition utilizing a higher fire flow and closer fire hydrant spacing to allow for site layout flexibility. A summary of the estimated domestic water demand and fire flow requirements are as follows (refer to Appendix J for more comprehensive water system calculations).

- Domestic Consumption
  - Average Daily Demand = 126,900 gallons per day (gpd)
  - Maximum Daily Demand = 190,350 gpd
  - Peak Hour Flow = 380,700 gpd

- Fire Flow Requirements (Table 100-19, *BWS Water System Standards)*
  - Single Family
    - Fire Flow = 1,000 gallons per minute (GPM)
    - Fire Flow Duration = 1 hour
    - Fire Hydrant Spacing = 350 feet
  - Multi-Family
    - Fire Flow = 1,500 GPM
    - Fire Flow Duration = 1 hour
    - Fire Hydrant Spacing = 250 feet

3.7 WASTEWATER IMPROVEMENTS

As discussed in Chapter 2, there is no wastewater system currently serving the project site. Similar to the water system, existing sewer infrastructure can be found in adjacent roadways and developments.

A sewer connection was approved by the City and County of Honolulu for the development of up to 450 units at the project site (refer to Appendix K). The approval indicated that sewer connections are allowable on Holt Road and Kulawae Street. The Kulawae Street connection, located approximately 1,400 feet south of the project site, would require pumping due to the proximity of the Kulawae Street sewer and the elevation difference. Thus, the preferred option is on Holt Road. The Holt Road connection will be located a few hundred feet north of the project site and is not expected to require pumping.

To the extent possible, the project's wastewater collection system will be designed in accordance with the City and County of Honolulu's, Department of Environmental Services (ENV) *Wastewater System Design Standards* and *Wastewater System Standard Details*. As discussed above, a proposed connection within the Ulu Ke Kukui development is anticipated. Approximately 300 feet of offsite sewer line will be required to convey the project's wastewater to the closest available existing sewer manhole. This manhole is located along the northern border of the Ulu Ke Kukui site. The sewer crosses below Mā'ili Channel, and the subsequent downstream sewer lines will convey the project's onsite flows to the City's 36-inch sewer interceptor mentioned above. The onsite sewer system will consist of underground gravity sewers sized to accommodate the onsite peak wet weather wastewater flows (refer to Figure 11). The design wastewater flow for the proposed development is approximately 333,800 gallons per day (gpd) based on 281 dwelling units (refer to Appendix L for wastewater system calculations).

3.8 ELECTRICAL IMPROVEMENTS

Based on a recent field investigation, it was observed that existing electrical infrastructure is available to serve the site via the existing overhead lines along Kulaaupuni Street. It is anticipated that a riser will be installed at an existing utility pole to provide underground Hawaiian Electric Company (HECO) service to the site. The site service will include underground electrical ductlines, handholes and concrete pads for HECO transformers and switchgears.

The existing underground Hawaiian Telcom and Charter underground infrastructure (4-inch conduit) on Kulaaupuni Street is capable of accommodating the new infrastructure but a new fiber hub or power supply will be needed on site to distribute the communication services. Another potential source of communication is to extend communication service feeding the Kamehameha Schools Community Learning Center. With either option, underground service will be provided to the site which includes communication ductlines, handholes and concrete pads for power supplies.

New street light bases, poles, luminaires and concrete bases will be installed with underground electrical feeds along the Kulaaupuni Street extension and onsite. City light standards will be installed, since the roadways are expected to be dedicated to the City and County of Honolulu in the future.

Chapter 4 – OPINION OF PROBABLE COST

An opinion of probable cost and breakdown for the proposed project infrastructure is provided in Table 2 below. It should be noted that this estimate is not based on actual design and will be updated during the design phase of the project. Due to the ongoing pandemic, it is likely that the cost of materials and equipment will continue to climb thereby increasing the project's ultimate construction costs.

Table 2: Opinion of Probable Cost (0% Design)

	TOTAL
1. Grading	$28,300,000
2. Roadway and Driveway Construction	$8,300,000
3. Storm Drain System	$8,600,000
4. Sanitary Sewer System	$4,400,000
5. Water System	$2,700,000
6. Electrical/Communication Systems	$3,000,000
Total:	**$55,300,000**

Chapter 5 – PERMITTING REQUIREMENTS

5.1 ANTICIPATED PERMITS AND APPROVALS

The project will require construction plan reviews and permits from various governmental agencies and utility companies. Prior to construction, applicable permits and approvals will be coordinated with the respective agencies. Potential reviews/approvals and permits for the project include, but are not limited to, the following:

5.1.1 FEDERAL GOVERNMENT

- U.S. Army Corps of Engineers
  - Department of the Army (DA) Permit for Section 404 Activities of the Clean Water Act

5.1.2 STATE OF HAWAI'I

- State of Hawai'i, Department of Health
  - Hawai'i Revised Statutes Chapter 343 Environmental Review Process for non-exempt activities involving the use of state/county funds or state/county lands
  - Clean Water Act, Section 401 Certification
  - National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) Form C for discharges of storm water associated with construction activities
  - NPDES NOI Form F for discharges of hydrotesting waters
  - NPDES NOI Form G for discharges of construction activity dewatering
  - Disability and Communication Access Board review for compliance with Hawai'i Revised Statutes §103-50
  - Community Noise Permit
- State of Hawai'i, Office of Planning and Sustainable Development
  - Federal Consistency for Coastal Zone Management
- State of Hawai'i, Department of Land and Natural Resources
  - Stream Channel Alteration Permit (SCAP)

5.1.3 CITY AND COUNTY OF HONOLULU

- City and County of Honolulu, Department of Planning and Permitting
  - Building Permit
  - Grading Permit
  - Trenching Permit

- Sewer Connection Application (refer to Appendix K)
- Site Development Division Approval
- Subdivision Application
- Surface Runoff from Construction Activities entering into City's Storm Sewer System

- City and County of Honolulu, Department of Transportation Services
  - Construction plan review
  - Street Usage Permit
- City and County of Honolulu, Department of Design and Construction, Mechanical/Electrical Division
  - Construction plan review
- Board of Water Supply
  - Water Availability Approval
  - Construction plan review

5.1.4 UTILITY COMPANIES

- AT&T review for location of any fiber optic cables, if applicable
- Hawaiian Electric Company, Hawaiian Telcom, Spectrum and Sandwich Isle Communication

Chapter 6 – SUMMARY

6.1 EXISTING CONDITIONS

The proposed development for the Department of Hawaiian Home Lands includes approximately 40 acres of vacant land in Mā'ili, O'ahu. The project site is situated on two parcels, TMK 8-7-010: 30 (84.4 acres) and TMK: 8-7-010: 31 (4.9 acres) and is bordered by Mā'ili Channel to the north, Sea Country residential development to the east, Kamehameha Schools Community Learning Center to the south, and other residential developments to the west. The preferred conceptual site plan includes 145 single-family lots surrounding 136 multi-family units totaling 281 units; however, this is subject to adjustment during the future design phase.

The existing ground elevations at the project site range from approximately 3 feet to 20 feet mean sea level (MSL) and gradually slopes southwesterly. In the *Preliminary Geotechnical Engineering Exploration* dated June 15, 2020 prepared by Geolabs, Inc., the existing onsite soils consist of a thin alluvium layer overlying coralline deposits. Groundwater was encountered at elevations between approximately +3 and -3.3 feet MSL but could be subject to change depending on weather and seasonal factors.

The site has no existing water or wastewater service and will need to be connected to existing infrastructure in adjacent roadways and developments. The existing drainage concept within the project site is generally consistent with the *Hydrologic Report for Mā'ili Holiday* prepared by William Hee & Associates, Inc. (January 29, 1973). There is an existing drain intake that services the property and connects to a 48-inch drain line on the western border of the site. The drain intake and 48-inch drain line were constructed under the Mā'ili Holiday Project in order to intercept runoff flowing from the project site in the westerly direction of the Mā'ili Holiday residential development. However, the recently constructed Kamehameha Schools Community Learning Center, south of the site, contributes additional runoff to the existing drain intake.

6.2 PROPOSED ON-SITE IMPROVEMENTS

6.2.1 DRAINAGE AND GRADING

The proposed development will alter the existing drainage pattern due to unaccounted flow from the Kamehameha Schools Community Learning Center. Instead of directing runoff towards the existing drain intake, the flow will be directed to a new infiltration basin located in the northwest corner of the property, directly adjacent to Ulu Ke Kukui (transitional housing facility). Fill material will be required to raise the site in order to provide onsite utility systems and to construct the proposed infiltration basin. The eastern boundary of the property will be raised approximately 5-10 feet and the southwestern boundary will be raised approximately 10-15 feet. The railroad beds will be preserved in place (burial), and utilities within the area will be installed in a manner that will attempt to minimize disturbance of the railroad bed.

To the extent possible, the drainage system will be designed in accordance with the City and County of Honolulu's *Storm Drainage Standards*. The onsite drainage system will consist of swales and catch basins (and/or drain inlets) and will include an underground piped system which will lead to a box culvert which will discharge to an infiltration basin. The basin will be designed with an overflow to convey the peak flow rate, which will discharge into the Mā'ili Channel. To the extent possible, the project will also comply with the City and County of Honolulu's *Rules Relating to Water Quality* requirements. The infiltration basin will be utilized as a treatment control BMP for the project and will be sized based on the required water quality volume calculations.

6.2.2 ROADWAY

The Mobility Analysis Report (MAR) completed by Fehr & Peers entitled *Mobility Analysis Report (MAR) for the Voice of America Site in Mā'ili*, dated October 29, 2021 indicated that the proposed project would have a significant impact to the Kulaaupuni Street/St. John's Road intersection. The required improvements at the intersection include the implementation of an all-way stop in order to reduce delays and improve operations to desirable levels. Additionally, signal timing modifications at the Farrington Highway/St. John's Road intersection will require the completion of a signal timing study and coordination with the State's Department of Transportation, Highways Division (DOTH) prior to occupancy of the residential units. This is expected to help alleviate delays by improving westbound and southbound left-turn queuing.

6.2.3 WASTEWATER

A sewer connection was approved on September 14, 2021 (refer to Appendix K). The approval indicated that sewer connections are allowable on Holt Road and Kulawae Street. The Holt Road connection is preferred due to the proximity to the site, and the entire system would flow by gravity. Offsite improvements to connect the proposed wastewater system to the existing sewer manhole along the northern border of the Ulu Ke Kukui site will include the installation of approximately 300 feet of sewer line.

In accordance with the City and County of Honolulu's, Department of Environmental Services (ENV) *Wastewater System Design Standards,* the design wastewater flow for the proposed development is approximately 333,800 gallons per day (gpd).

6.2.4 POTABLE WATER

As part of the Environmental Assessment process, an Early Consultation Letter was submitted to the BWS in September of 2021. In a response letter from the BWS dated October 6, 2021, the BWS indicated that the existing water system is adequate to accommodate the proposed homestead development. It was also suggested to check back with BWS in the beginning of 2022 to confirm the status of the Lualualei Line Booster Upgrade project which is currently in construction.

To the extent possible, the onsite water system will be designed in accordance with the BWS *Water System Standards*. A new onsite water system will provide water for the development with a proposed connection to the 8-inch water line within Kulaaupuni Street.

6.2.5 ELECTRICAL

Based on a field investigation, HECO does have the infrastructure to feed the site via the existing overhead lines along Kulaaupuni Street. The site service will include underground electrical ductlines, handholes and concrete pads for HECO transformers and switchgears. New street light bases, poles, luminaires and concrete bases will be installed with underground electrical feeds along the Kulaaupuni Street extension and onsite.

The existing underground Hawaiian Telcom and Charter infrastructure on Kulaaupuni Street is capable of accommodating the new infrastructure but a new fiber hub and power supply will be needed on site to distribute the communication services.

6.3 PROPOSED OFF-SITE IMPROVEMENTS

Offsite drainage improvements will include reconstructing the existing drain intake structure out of the existing 40-foot-wide roadway easement and replacing the existing 48-inch drain line with a 4' x 6' box culvert and manholes to accommodate the additional flows. Improvements will also include adding drain inlets along the south border of the Ulu Ke Kukui site and drainage structures along the Kulaaupuni Street extension all of which will be piped and connected to the upsized box culvert to allow flows to discharge to the Mā'ili Channel.

6.4 FURTHER ACTIONS AND INVESTIGATION

The following are some of the key items that comprise the next steps prior to the start of the project's infrastructure design:

- Confirm the project status and completion of the Board of Water Supply's Lualualei Line Booster Upgrade

- Confirm preservation plans with the State Historic Preservation Division
- Additional survey work
  - Land-based topographical survey
  - Additional soil borings to supplement geotechnical recommendations
- Prepare Environmental Assessment under Hawai'i Revised Statutes, Chapter 343 Environmental Review Process

Chapter 7 – REFERENCES

AECOS Inc., *A natural resources assessment of the former Voice of America Site (TMK: 8-7-010:030 & 031) Lualualei, Leeward O'ahu,* May 27, 2021.

Belt Collins Hawai'i, *Lualualei Flood Study Environmental Survey, Wai'anae, O'ahu, Hawai'i*, September 2001.

Belt Collins Hawai'i, *Lualualei Flood Study Executive Summary, Wai'anae, O'ahu, Hawai'i,* September 2001.

Belt Collins Hawai'i, *Lualualei Flood Study Hydraulic Analysis, Mitigation Alternatives, and Cost Estimate, Wai'anae, O'ahu, Hawai'i*, September 2001.

Belt Collins Hawai'i, *Lualualei Flood Study Hydrologic Analysis, Wai'anae, O'ahu, Hawai'i*, September 2001.City and County of Honolulu, Board of Water Supply, *Water Distribution Maps, Map R27C18*, 3/2000.

City and County of Honolulu, Board of Water Supply, *Water System Standards*, 2002.

City and County of Honolulu, Board of Water Supply, *Your Letter Dated September 16, 2021 Requesting Comments on the Environmental Assessment Pre-Consultation for a Residential Development at the Former Voice of America Site off Kulaaupuni Street – Tax Map Key: 8-7-010: 030 & 031,* October 6, 2021.

City and County of Honolulu, Department of Environmental Services, *Wastewater System Design Standards*, July 2017.

City and County of Honolulu, Department of Environmental Services, *Wastewater System Standard Details*, July 2017.

City and County of Honolulu, Department of Planning and Permitting, *Storm Water BMP Guide for New and Redevelopment*, July 2017.

City and County of Honolulu, Department of Planning and Permitting, *Rules Relating to Water Quality*, December 24, 2018.

City and County of Honolulu, Department of Planning and Permitting, *Sewer Connection Application*, September 14, 2021

City and County of Honolulu, Department of Planning and Permitting, *Storm Drainage Standards*, August 2017.

Dudek, *Report on UAV-Based Magnetic survey for the purpose of UXO and other ferrous material detection in the Ma'ili site,* August 5, 2020.

Element Environmental, LLC, *Letter Report Geophysical Survey Anomaly Verification*, August 31, 2021.

Element Environmental, LLC, *Limited Phase II Environmental Site Assessment 80-Acre Former Voice of America Site*, July 2017.

Fehr & Peers, *Kamehameha Schools Community Learning Center in Mā'ili, Hawai'i – Transportation Impact Analysis Report (TIAR)*, May 23, 2013.

Fehr & Peers, *Mobility Analysis Report (MAR) for the Voice of America Site in Mā'ili,* October 29, 2021.

Geolabs, Inc., *Preliminary Geotechnically Engineering Exploration Residential Development at Former Voice of America Site,* June 15, 2020.

International Archaeological Research Institute, Inc., *An Archaeological Inventory Survey of the Former Voice of America Site, Mā'ili, Lualualei Ahupua'a, Wai'anae District, O'ahu*, August 2009.

International Archaeological Research Institute, Inc., *Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā'ili, Lualualei Ahupua'a, Wai'anae Moku, Island of O'ahu*, February 2021.

International Archaeological Research Institute, Inc., *Request for a Historic Preservation Review per Hawai'i Revised Statutes 6E-8 for the Department of Hawaiian Homelands Voice of America Property*, January 12, 2017.

Lyon Associates, Inc., *Drainage Report for Sea Country Subdivision Area 7 Phase 1 (formerly Mā'ili Kai Subdivision), Mā'ili, O'ahu, Hawai'i, TMK: 8-7-010:002*, May 27, 2007.

MASON Architects, *State Historic Preservation Division Reconnaissance Level Survey*, March 2021.

PBR Hawai'i & Associates, Inc., *Kamehameha Schools Community Learning Center at Mā'ili Final Environmental Assessment*, May 2013.

Scientific Consultant Services, Inc., *Kamehameha Schools Community Learning Center Archaeological Inventory Survey, 2013*

Townscape, Inc., *Wai'anae Watershed Management Plan*, August 2009.

U.S. Federal Emergency Management Agency, *FIRM, Flood Insurance Rate Map, City and County of Honolulu, Hawai'i, Panel 192 of 395, Map Number 15003C0192J*, November 5, 2014.

William Hee & Associates, Inc., *A Hydrologic Report for Mā'ili Holiday*, Revised January 29, 1973.

Websites Used in Preparation of this Report:

City and County of Honolulu, Department of Planning and Permitting
Interactive GIS Maps and Data
http://gis.hicentral.com, May 2021.

State of Hawai'i, Department of Land and Natural Resources
Flood Hazard Assessment Tool
http://gis.hawaiinfip.org/FHAT/, May 2021.

United States Geological Survey
TNM Download (v2.0)
https://apps.nationalmap.gov/downloader/#/, May 2021

U.S. National Oceanic and Atmospheric Administration, National Weather Service
Hydrometeorological Design Studies Center, Precipitation Frequency Data Server
https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_hi.html, May 2021.

Construction Plans Used in Preparation of this Report:

Alakea Design Group, LLC. (Dated 3/31/08). *Mā'ili Receiving Home*. Prepared for Stanford Carr Development, LLC.

M&E Pacific, Inc. (Approved 2/25/08). *Villages of Mā'ili (Offsite Sewerline), O'ahu, Hawai'i, TMK: 8-7-010: 007*. Prepared for Stanford Carr Development, LLC.

M&E Pacific, Inc. (Dated July 2008). *Villages of Mā'ili, O'ahu, Hawai'i, TMK: 8-7-010: 007*. Prepared for Stanford Carr Development, LLC.

Mitsunaga & Associates, Inc. (Approved 4/4/2014). *Kamehameha Schools Community Learning Center at Mā'ili*. Prepared for Kamehameha Schools.

William Hee & Associates, Inc. (As Built Tracings Certified 3/19/75). *Mā'ili Holiday Public Improvements, Lualualei, Wai'anae, O'ahu, Hawai'i*. Prepared for Edwin Yee, Limited.

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Figure 7 Railroad Bed Utility Cross Section
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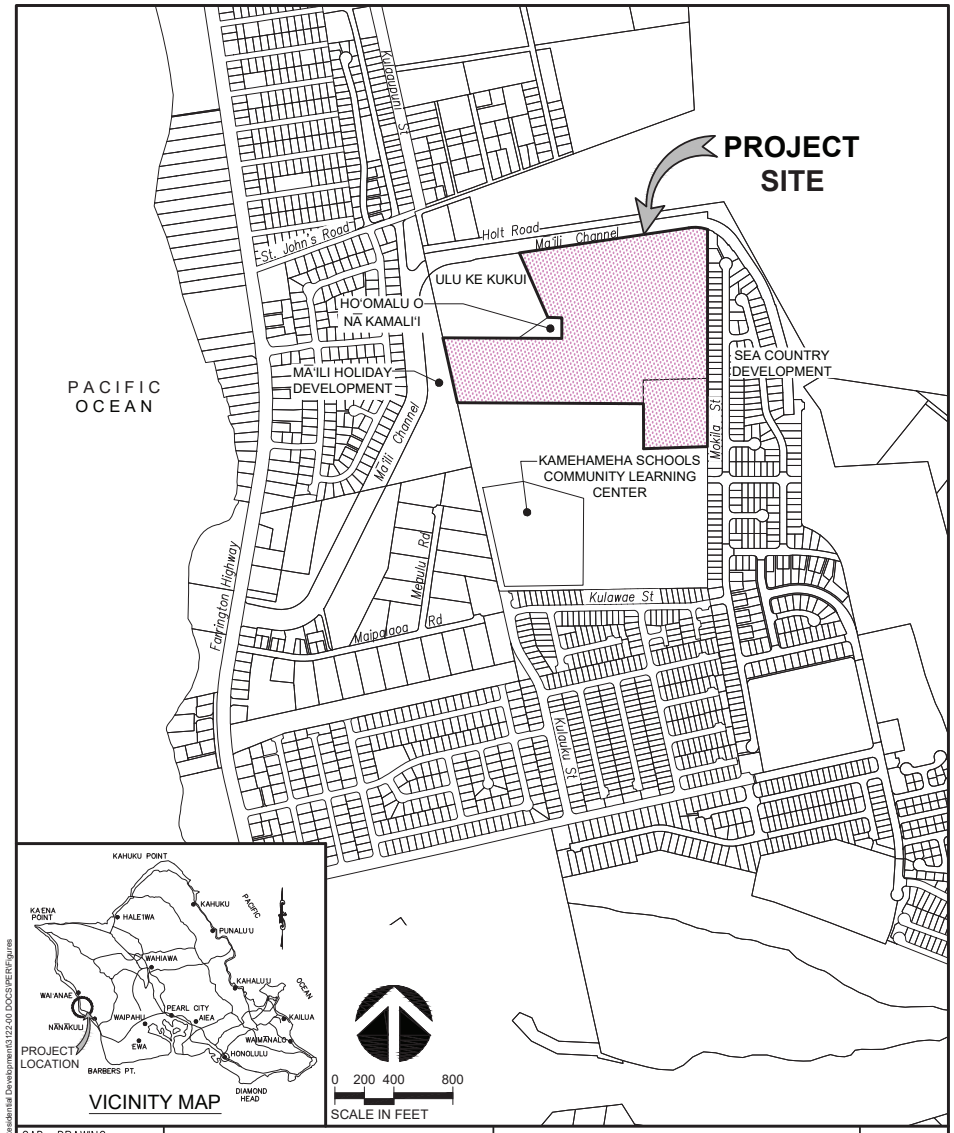
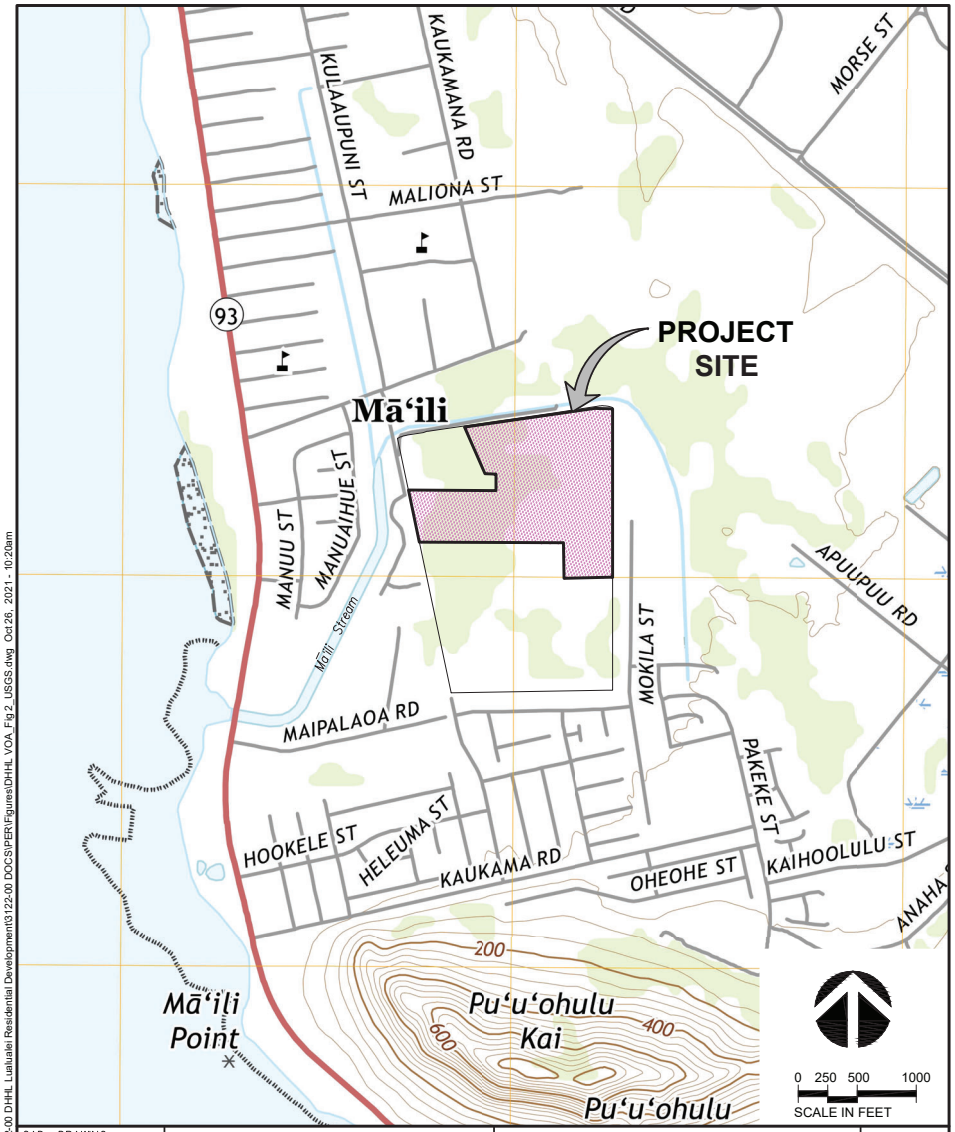
Figure 9 Drainage and Storm Water Quality Improvements
Figure 10 Water Improvements
Figure 11 Sewer Improvements





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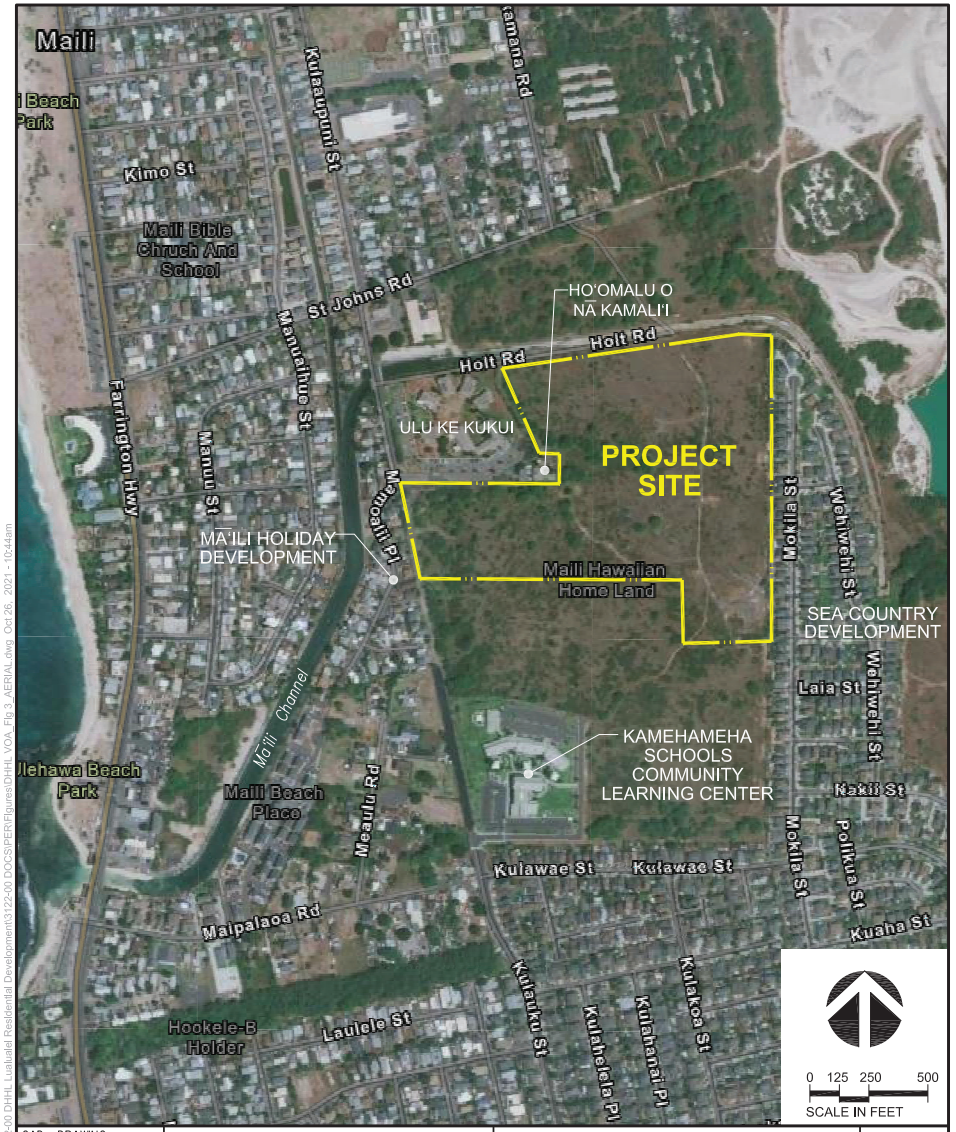
DATE: OCTOBER 2021	CONSULTING ENGINEERS	USGS MAP	2
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			



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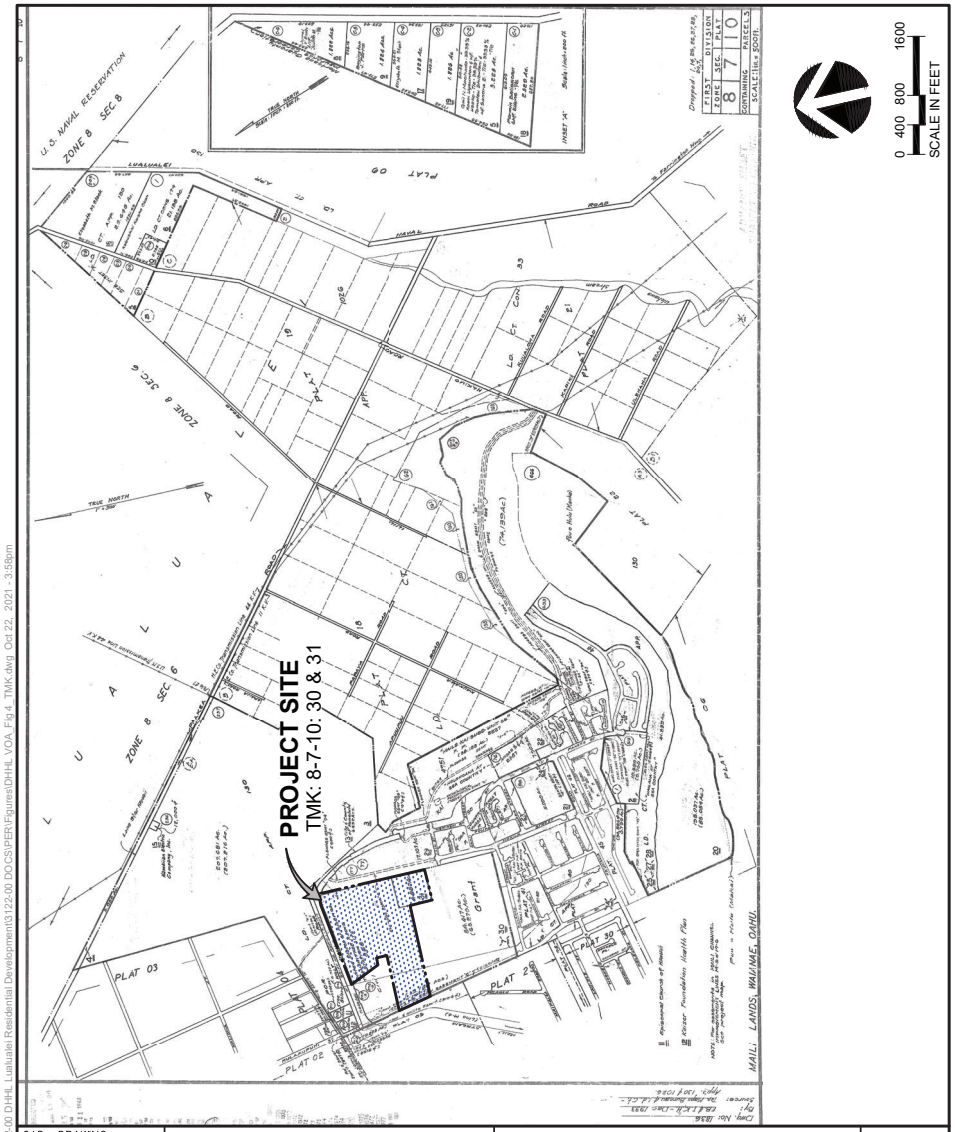

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PROJECT #: 3122-00			

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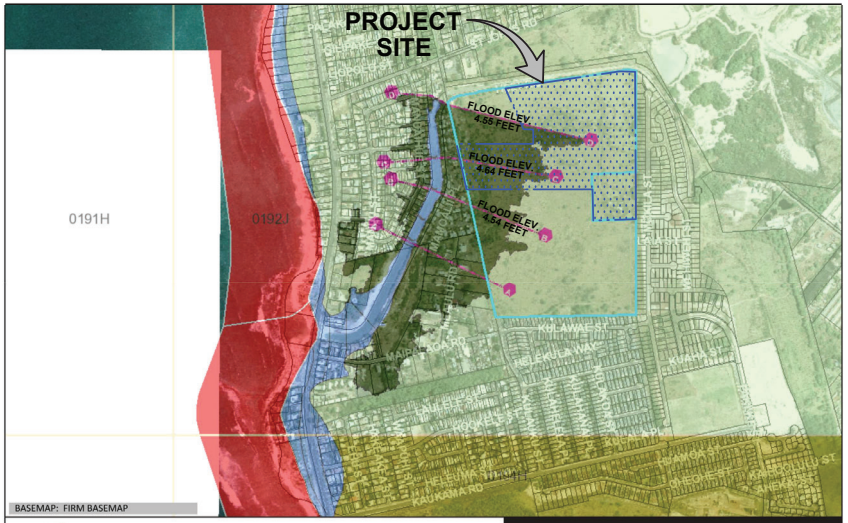

Flood Hazard Assessment Report

www.hawaiinfip.org

Property Information

COUNTY:	HONOLULU
TMK NO:	(1) 8-7-010:030
WATERSHED:	MAILILI
PARCEL ADDRESS:	ADDRESS NOT DETERMINED WAIANAE, HI 96792

Flood Hazard Information

FIRM INDEX DATE:	NOVEMBER 05, 2014
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	15003C0192J
PANEL EFFECTIVE DATE:	NOVEMBER 05, 2014

Notes:

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: YES
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 600 1,200 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.

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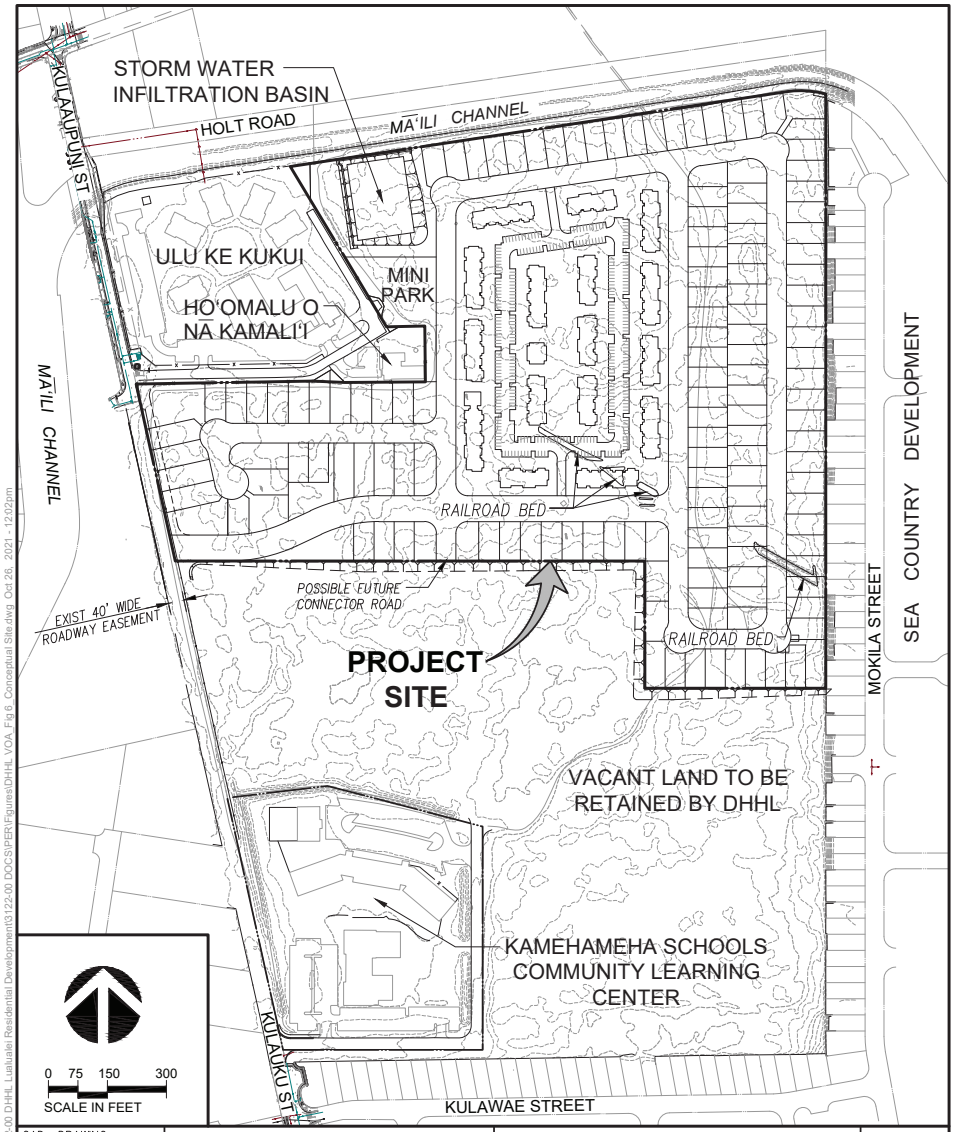

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DATE: OCTOBER 2021	CONSULTING ENGINEERS	CONCEPTUAL SITE PLAN	6
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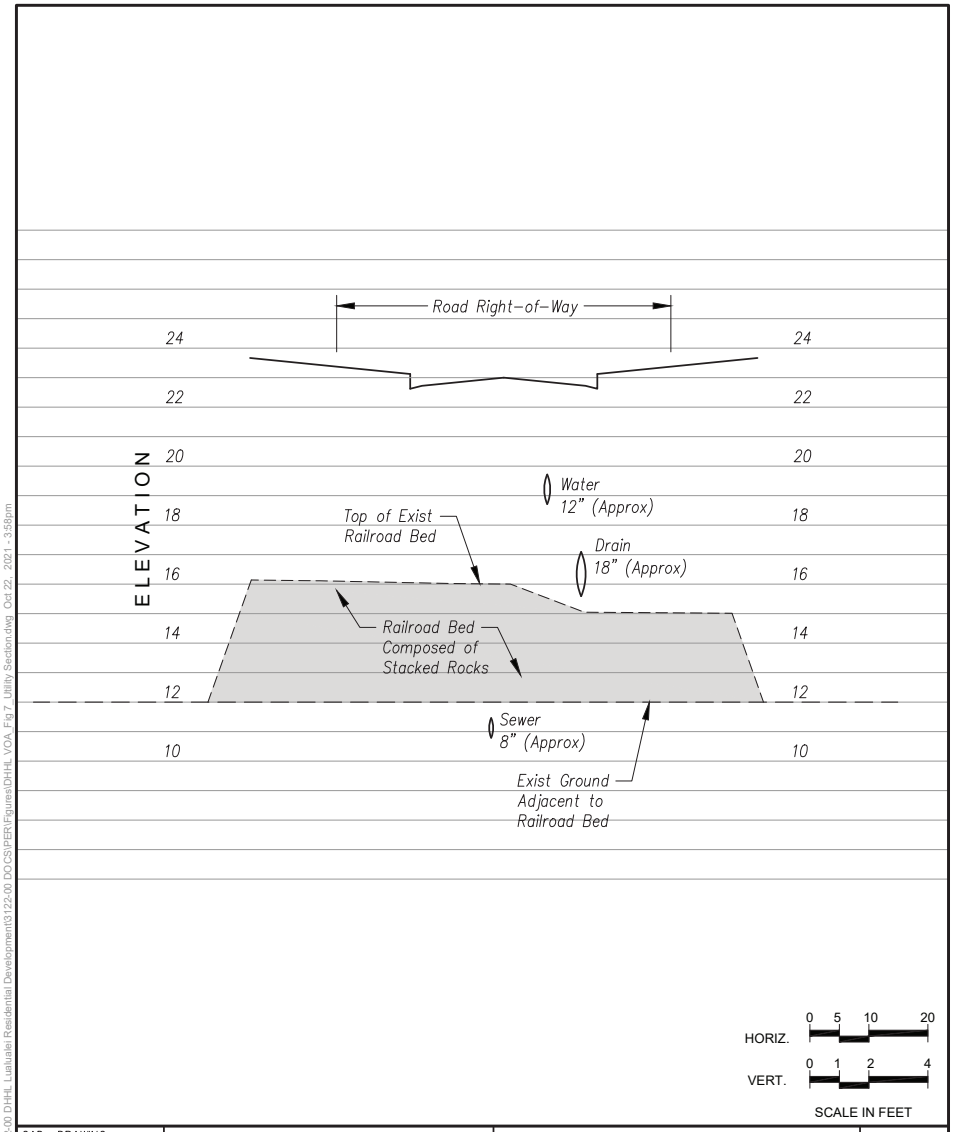

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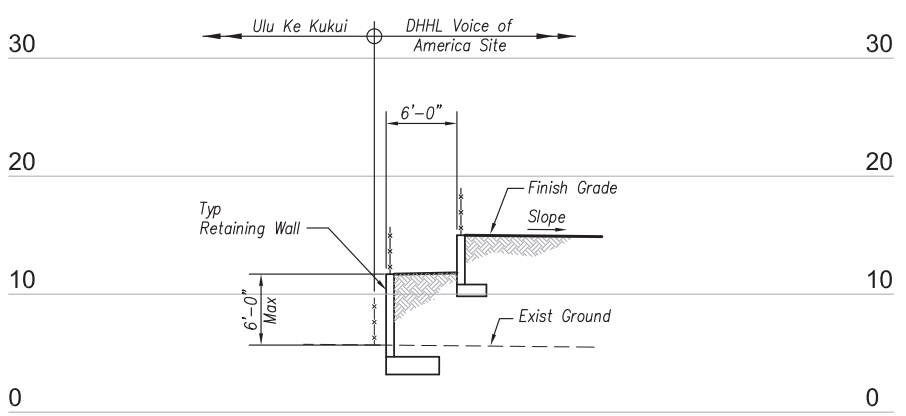
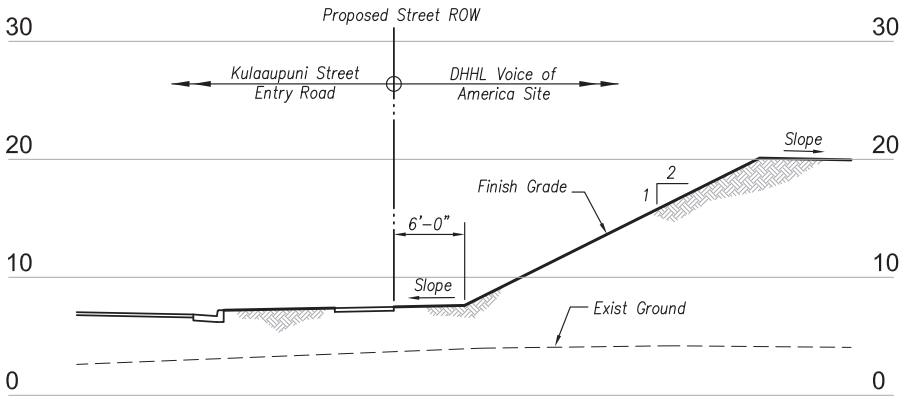


RETAINING WALL SECTION



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DATE: OCTOBER 2021	CONSULTING ENGINEERS	TYPICAL CONCEPTUAL SECTIONS	8
SCALE: AS NOTED	201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018		
PROJECT #: 3122-00			

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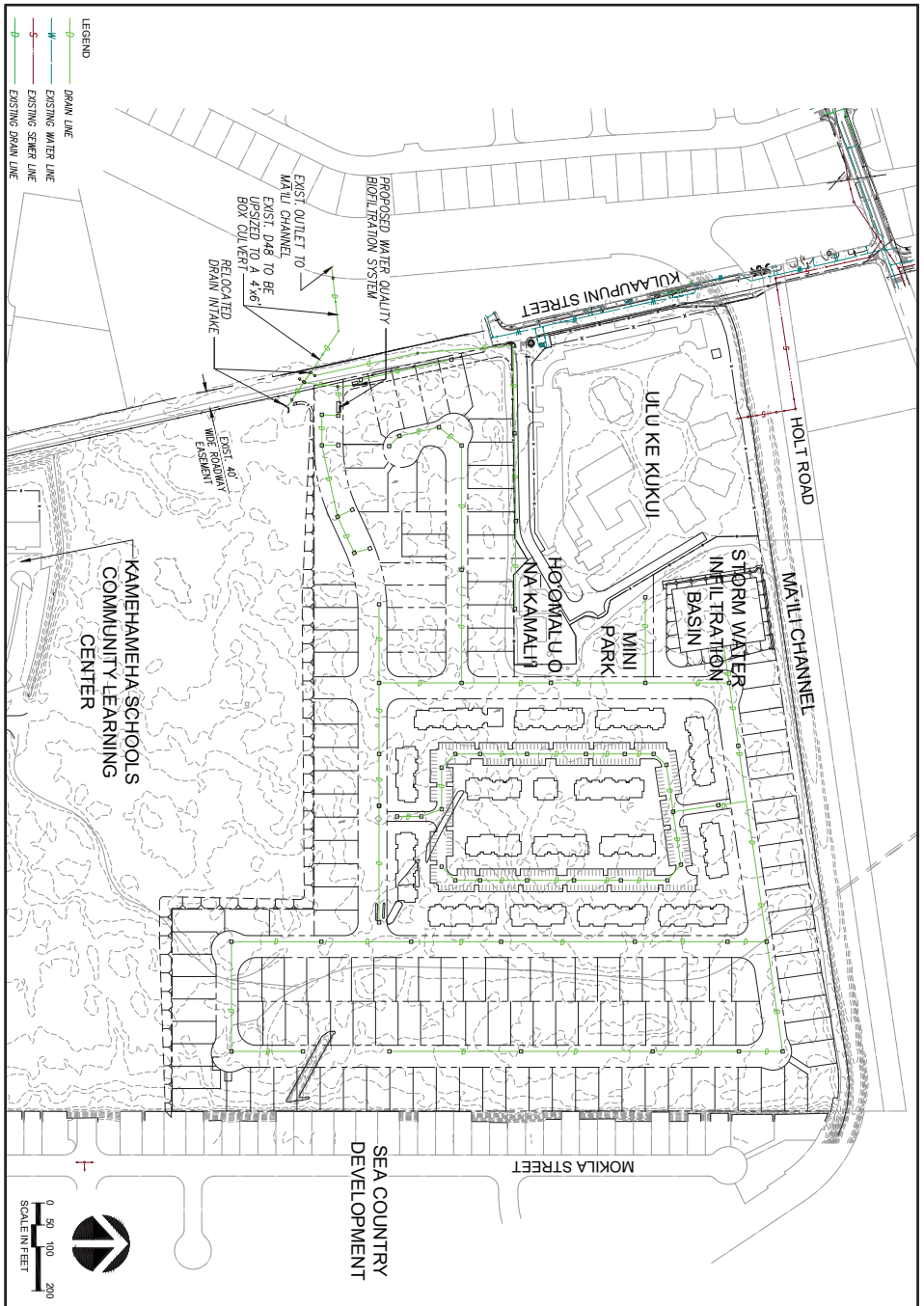

FIGURE 9	CAD DRAWING: DHHL VOA_Fig 9_Drainage & SWQ	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE	Gray, Hong, Nojima & Associates, Inc.
	SCALE: AS NOTED	DRAINAGE AND STORM WATER QUALITY IMPROVEMENTS	CONSULTING ENGINEERS
	DATE: OCTOBER 2021		201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018
	PROJECT #: 3122-00		

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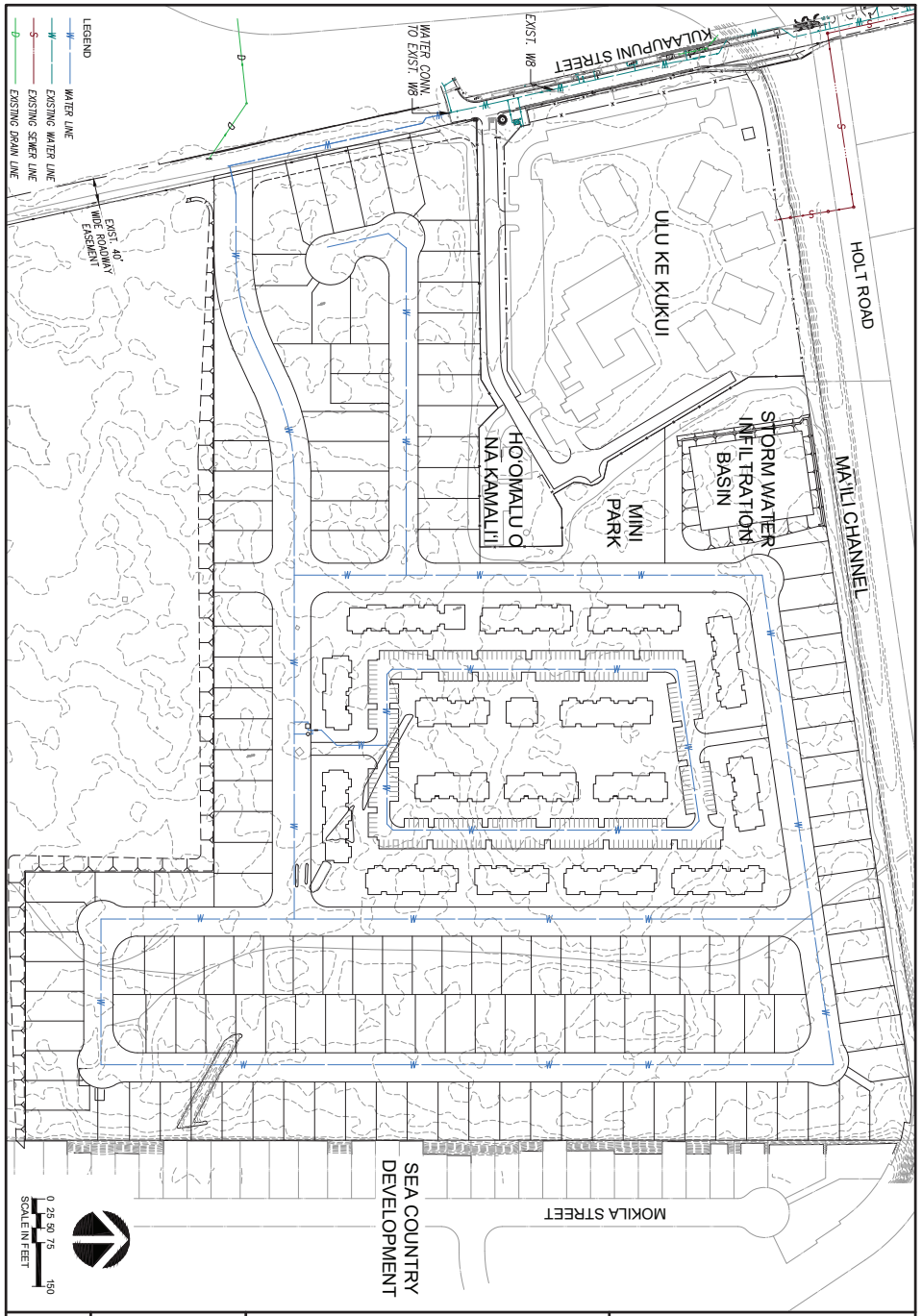

FIGURE 10	CAD DRAWING: DHHL VOA_Fig 10_Water SCALE: AS NOTED DATE: OCOTBER 2021 PROJECT #: 3122-00	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE WATER IMPROVEMENTS	Gray, Hong, Nojima & Associates, Inc. CONSULTING ENGINEERS 201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018

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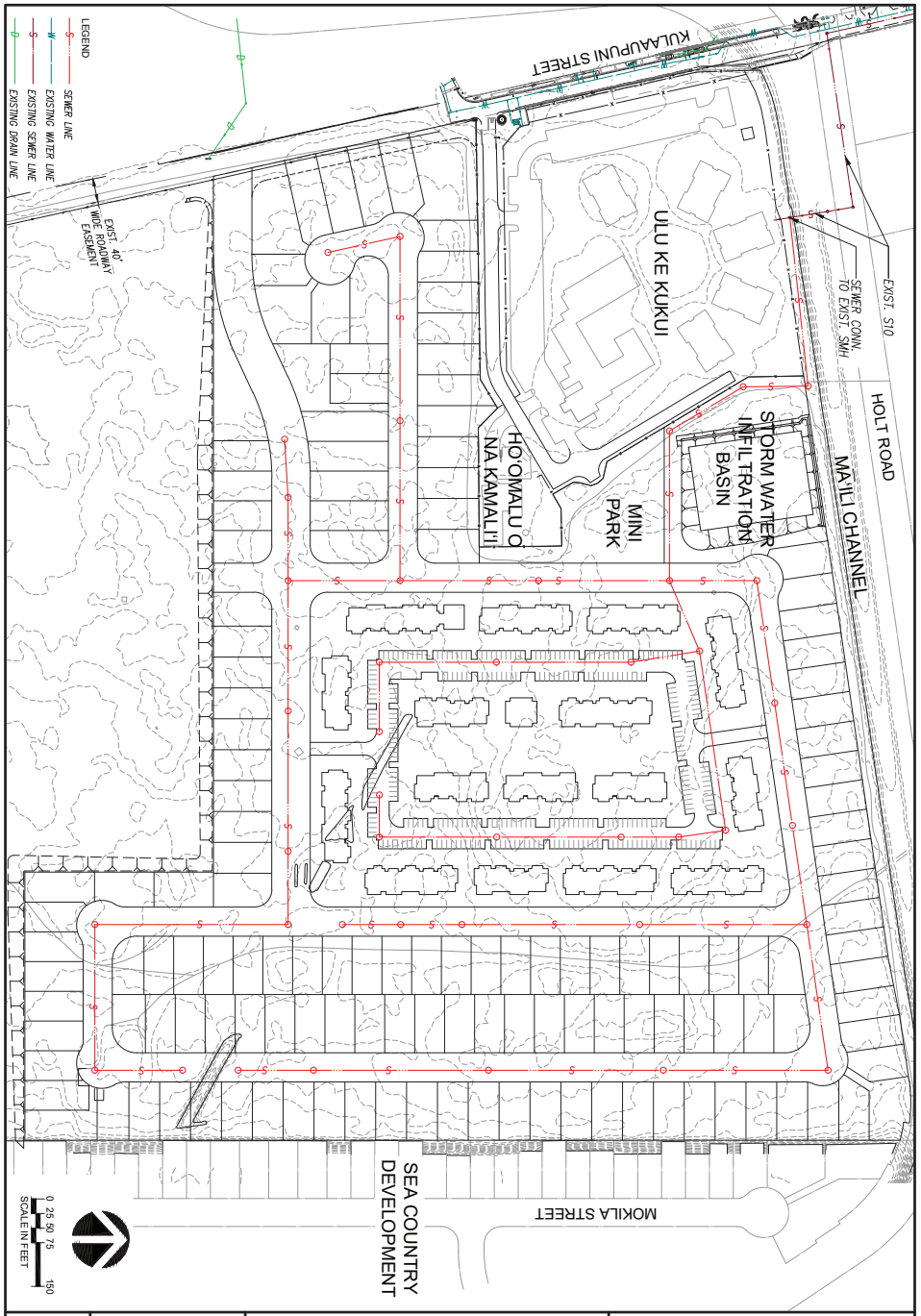

FIGURE 11	CAD DRAWING: DHHL VOA_Fig 11_Sewer SCALE: AS NOTED DATE: OCTOBER 2021 PROJECT #: 3122-00	RESIDENTIAL DEVELOPMENT AT THE FORMER VOICE OF AMERICA SITE SEWER IMPROVEMENTS	Gray, Hong, Nojima & Associates, Inc. CONSULTING ENGINEERS 201 Merchant Street, Suite 1900 Honolulu, Hawaii 96813 Telephone: (808) 521-0306 Fax: (808) 531-8018

APPENDICES

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Appendix B: State Historic Preservation Division Reconnaissance Level Survey, March 2021

Appendix C: Draft Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, February 2021

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Appendix L: Wastewater System Calculations

Mā'ili Residential Development (Former Voice of America Site)

APPENDIX A

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION, JUNE 15, 2020

Gray • Hong • Nojima & Associates, Inc. *APPENDICES*

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE

NANAKULI, OAHU, HAWAII

W.O. 8017-00 JUNE 15, 2020

Prepared for

GRAY HONG NOJIMA & ASSOCIATES, INC.

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION

RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE

NANAKULI, OAHU, HAWAII

W.O. 8017-00 JUNE 15, 2020

Prepared for

GARY HONG NOJIMA & ASSOCIATES, INC.

JOHN Y.L. CHEN
LICENSED PROFESSIONAL ENGINEER
No. 10029-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

SIGNATURE — EXPIRATION DATE OF THE LICENSE: 4-30-22

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
94-429 Koaki Street, Suite 200 • Waipahu, HI 96797

Hawaii • California

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

June 15, 2020
W.O. 8017-00

Ms. Sheryl Nojima
Gary Hong Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, HI 96813

Dear **Ms. Nojima:**

Geolabs, Inc. is pleased to submit our report entitled "Preliminary Geotechnical Engineering Exploration, Residential Development at Former Voice America Site, Nanakuli, Oahu, Hawaii," prepared for the design of the project.

Our work was performed in general accordance with the scope of services outlined in our revised fee proposal dated July 3, 2019.

Please note that the soil samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific design recommendations are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

John Y.L. Chen, P.E.
Vice President

JC:TO:cj

94-429 Koaki Street, Suite 200 • Waipahu, Hawaii 96797
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Hawaii • California

PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION
RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE
NANAKULI, OAHU, HAWAII
W.O. 8017-00 JUNE 15, 2020

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PRELIMINARY GEOTECHNICAL ENGINEERING EXPLORATION
RESIDENTIAL DEVELOPMENT AT FORMER VOICE AMERICA SITE
NANAKULI, OAHU, HAWAII
W.O. 8017-00 JUNE 15, 2020

SUMMARY OF FINDINGS AND RECOMMENDATIONS

The field exploration consisted of drilling and sampling six borings within the planned development. Our field exploration at the project site generally encountered alluvium overlying loose to dense coralline material extending down to the maximum depth explored of about 21.5 feet below the existing ground surface.

Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 to -3.3 feet Mean Sea Level (MSL), at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Our laboratory tests indicate that the near-surface clayey/silty soils exhibit low to moderate shrink-swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials.

We recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the bottom of the footing onto the coralline material. Placement of the non-expansive select granular fill layer would reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the on-site soils due to fluctuations in the moisture content.

Field infiltration tests were performed at a depth of about 5 feet below the existing ground surface. Based on the results of the field infiltration testing, the average infiltration rates at these locations indicate that an infiltration/detention system and similar methods of stormwater management would be feasible for this development. Due to the variability of the subsurface conditions, the absorption capacity of the selected stormwater disposal system should be confirmed by conducting additional infiltration tests during construction

The text of this report should be referred to for detailed discussions and specific geotechnical recommendations.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1. GENERAL

This report presents the results of our preliminary geotechnical engineering exploration performed for the *Residential Development at Former Voice America Site* project in the Nanakuli area on the Island of Oahu, Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings and geotechnical recommendations resulting from our field exploration, laboratory testing, and engineering analyses for the project. These findings and geotechnical recommendations are intended for the design of site grading, slabs-on-grade, and pavements only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.1 Project Considerations

The proposed development is located to the west of the Sea Country subdivision, north of the Kamehameha School Community Learning Center, and east of Kulaaupuni Street in the Nanakuli area on the Island of Oahu, Hawaii. We understand that the proposed residential development project encompasses approximately 40 acres of Hawaiian Home Lands. A layout of the project site is shown on the Site Plan, Plate 2.

We understand that the envisioned new development includes about 250 single-family residential lots and multi-family residential units with new roadways and underground utilities, such as water, sewer and drainage lines. The roadway system will include the extension of Kulaaupuni Street to Kulawae Street and improvements to St. John's Road.

Details of the development design were not available at the time this report was prepared. We understand a detailed geotechnical exploration program will be conducted for detailed foundation and earthwork design and construction.

1.2 Purpose and Scope

The purpose of our exploration was to obtain an overview of the surface and subsurface conditions to develop an idealized soil data set to formulate preliminary geotechnical engineering recommendations for conceptual design of the development

project. The work was performed in general accordance with our revised fee proposal dated July 3, 2019. The scope of work for this exploration included the following tasks and work efforts:

1. Review of available in-house soil and geologic information for areas around the subdivision development.
2. Coordination of site access, boring stakeout, and utility clearances by our engineer and geologist.
3. Mobilization and demobilization of a backhoe for mechanized trail clearing, supervised by our geologist.
4. Mobilization and demobilization of a truck-mounted drill rig, water truck, and two operators to the project site and back.
5. Drilling and sampling of six boreholes to a depth of about 21.5 feet below the existing ground surface.
6. Coordination of the field exploration and logging of the borings by our geologist.
7. Performing four Low Impact Development (LID) infiltration tests to characterize the ground permeability for the stormwater management design.
8. Laboratory testing of selected samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.
9. Analyses of the field and laboratory data to formulate preliminary geotechnical engineering recommendations for the design of the project.
10. Preparation of this report summarizing our work and presenting our findings and preliminary geotechnical recommendations.
11. Coordination of our work on the project by our engineer.
12. Quality assurance of our work and client/design team consultation by our principal engineer.
13. Miscellaneous work efforts, such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration methodology and the Logs of Borings are presented in Appendix A. Results of the laboratory tests performed on selected soil

samples are presented in Appendix B. Results of the infiltration tests performed at selected locations are presented in Appendix C.

END OF GENERAL

SECTION 2. SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Oahu was built by the extrusion of basalt and basaltic lava from the Waianae and Koolau shield volcanoes. The older Waianae Volcano is estimated to be middle to late Pliocene in age, and Koolau Volcano is estimated to be late Pliocene to early Pleistocene in age. As the volcanic activity in Waianae Volcano ceased, lava flows from Koolau Volcano banked against its eroded eastern slope forming a broad plateau, now known as the Schofield Plateau. The project site is located on the southwestern flank of the Waianae Volcano.

Physical and chemical weathering followed by erosion of Schofield Plateau generated sediments, which were transported to the coast. In the project vicinity and to the south, these sediments have accumulated and are interbedded with marine sediments and coral/algal reef formations, forming a sedimentary wedge. The thickness of the sedimentary wedge ranges from zero in the area of the Interstate Route H-1 Highway to over 1,000 feet at Ewa Beach. This wedge forms the Ewa Plain and serves as the confining formation, or "caprock," over the artesian basal aquifers of Southern Oahu. Deposition of sediments has continued from earlier geologic time through the present.

During the Pleistocene Epoch, sea levels fluctuated in response to the cycles of continental glaciation. As the glaciers grew and advanced, less water was available to fill the oceanic basins such that sea levels fell below the present stands of the sea. When the glaciers melted and receded, an excess of water became available such that the sea levels rose to above the present sea level.

The higher sea level stands caused the formation of deltas and fans of accumulated terrigenous sediments in the heads of old bays, accumulated reef deposits at correspondingly higher elevations, and deposited lagoonal/marine sediments in the quiet waters protected by fringing reefs. The lower sea stands caused streams to carve valleys in the sediments and reef deposits. Subaerial exposure of the sediments and calcareous materials caused consolidation of the lagoonal deposits and induration of the

calcareous reef materials. Agricultural development within the last 100 years and recent mass grading work brought the Kapolei area to its present form.

2.2 Subsurface Conditions

We explored the subsurface conditions by drilling and sampling six borings, designated as Boring Nos. 1 through 6, extending to the maximum depth drilled of about 21.5 feet below the existing ground surface. In addition, four boreholes, designated as LID-1 through LID-4, were drilled to a depth of about 5 feet below the existing ground surface for the access of the infiltration testing. Results of the infiltration tests performed at selected locations are presented in Appendix C. The approximate boring locations are shown on the Site Plan, Plate 2.

Based on our field exploration, the project site is generally underlain by a thin alluvium layer overlying coralline deposits extending to the maximum depths explored. The alluvial material generally consisted of medium stiff clayey and/or silty soils extending to depths between about 1 and 4.5 feet below the ground surface. Below the alluvial material, we encountered coralline deposits consisting of medium dense to dense coral formation and loose to dense coralline detritus extending to the maximum depth explored of about 21.5 feet below the ground surface. It should be noted that weathered sandstone consisting of loose to medium dense silty sand were encountered in Boring Nos. 3 and 6 at about 4.5 and 18 feet below the ground surface.

Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 and -3.3 feet MSL at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

2.3 Seismic Design Considerations

Based on the International Building Code (2012 Edition), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. The following sections provide discussions on the soil profile type for seismic design and liquefaction design consideration at the project site.

Based on the subsurface materials anticipated at the project site and the geologic setting of the area, we believe that the project site may be classified as “Stiff Soil Profile” from a seismic analysis standpoint. Therefore, we believe the seismic design of the building structures may be designed based on a Site Class D soil profile in accordance with Chapter 20, Site Classification Procedure for Seismic Design, contained in ASCE Minimum Design Loads for Buildings and Other Structures, 2010 Edition (ASCE 7-10).

Based on the subsurface conditions encountered, the phenomenon of soil liquefaction is not a design consideration for this project site due to coralline formation encountered in the relatively shallow depth.

END OF SITE CHARACTERIZATION

SECTION 3. DISCUSSION AND RECOMMENDATIONS

Based on the results from our field exploration, the project site is generally underlain by a thin layer of clayey/silty alluvial material overlying coralline deposits extending to the maximum depth explored of about 21.5 feet below the existing ground surface. Groundwater was encountered at about 4 to 12.5 feet below the existing ground surface, equivalent to elevations ranging from +3 to -3.3 feet MSL, at the time of our field exploration. However, it should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

Our laboratory tests indicate that the near-surface clayey/silty soils exhibit low to moderate shrink-swell characteristics when subjected to fluctuations in the soil moisture contents. Therefore, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials.

We recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the bottom of the footing directly onto the coralline material, to reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from swelling/shrinking of the on-site soils due to the changes in the moisture content.

Detailed discussions and recommendations for these items and other geotechnical aspects of the project are presented in the following sections.

3.1 Site Grading

Based on the relatively gently sloping topography across the project site, we anticipate site grading with cuts and fills of less than about 10 feet thick will be required to achieve the design finished grades for the project. Items of grading addressed in the subsequent subsections include the following:

1. Site Preparation
2. Fills and Backfills
3. Fill Placement and Compaction Requirements
4. Excavations
5. Cut and Fill Slopes
6. Erosion Control Measures (Landscape)

A Geolabs representative should monitor site grading operations to observe whether undesirable materials are encountered during the excavation and scarification process, and to confirm whether the exposed soil conditions are similar to those assumed in this report.

3.1.1 Site Preparation

At the on-set of earthwork, the area within the contract grading limits should be cleared and grubbed thoroughly. Vegetation, debris, deleterious and other unsuitable materials should be removed and disposed of properly off-site. Soft and/or yielding areas encountered during clearing and grubbing below areas designated to receive fill should be over-excavated to expose firm material, and the resulting excavation should be backfilled with well-compacted fills.

After clearing and grubbing, finished subgrades and areas designated to receive fills should be scarified to a depth of about 12 inches, where possible, moisture-conditioned to about 2 percent above the optimum moisture, and recompacted to a minimum of 90 percent relative compaction.

Where shrinkage cracks are observed at the ground surface after compaction of the subgrade, we recommend preparing the subgrade soil again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with well-compacted fill. A Geolabs representative should evaluate the need for over-excavation due to soft subgrade soil conditions.

3.1.2 Fills and Backfills

In general, the excavated on-site materials may be reused as a source of general fill materials provided that the materials are free of deleterious materials and the material has particles with a maximum size of no greater than 6 inches. Imported fill materials, if required, should consist of non-expansive select granular materials, such as crushed coralline or basaltic materials. The materials should be well-graded from coarse to fine with particles no larger than 3 inches in largest dimension and should contain between 10 and 30 percent particles passing the No. 200 sieve. The

materials should have a laboratory California Bearing Ratio (CBR) value of 20 or more and should have a maximum swell of 1 percent or less.

3.1.3 Fill Placement and Compaction Requirements

General fill materials should be placed in level lifts not exceeding 8 inches in loose thickness, moisture-conditioned to at least 2 percent above the optimum moisture content, and compacted to at least 90 percent relative compaction. The non-expansive select granular fill materials should be placed in level lifts of about 8 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 90 percent relative compaction.

Aggregate subbase and base course materials should be moisture-conditioned to above the optimum moisture content, placed in level lifts not exceeding 8 inches in loose thickness, and compacted to a minimum of 95 percent relative compaction.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by weight) corresponding to the maximum dry density.

Compaction should be accomplished by sheepsfoot rollers, vibratory rollers, or other types of acceptable compaction equipment. Water tamping, jetting, or ponding should not be allowed to compact the fills.

Where compaction is less than required, additional compactive effort should be applied with adjustment of moisture content, as necessary, to obtain the specified compaction. It should be noted that the moisture requirement of the general fills and subgrades (at least 2 percent above the optimum moisture) is an important requirement for the use of the on-site clayey soils.

3.1.4 Excavations

It is anticipated that the on-site alluvial soils and coralline deposits may be excavated with conventional heavy excavation equipment. However, our past experience in the project area indicates that isolated hard coralline detritus/formation and

cobbles/boulders could be encountered. Therefore, excavation for subsurface infrastructure construction may encounter hard coral and/or cobbles/boulders which may require the use of hoerams.

The above discussion regarding the rippability of the surface materials is based on data obtained from the field borings and test pits. Contractors bidding on this project should be encouraged to examine the site conditions and soil data to make their own interpretation.

3.1.5 Cut and Fill Slopes

We envision the cut slopes at the project site generally will expose the stiff to hard silty and clayey soils and/or dense coralline deposits encountered in the borings. In general, cut slopes and permanent fill slopes constructed of the on-site soils may be designed with a slope inclination of two horizontal to one vertical (2H:1V) or flatter. Fills placed on slopes steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill embankment against sliding. The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above general fill placement recommendations.

Fill slopes should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Surface water should be diverted away from the tops of slopes, and slope planting should be provided as soon as possible to reduce the potential for erosion of the finished slopes.

3.1.6 Erosion Control Measures (Landscape)

We anticipate shrinkage cracks will occur on the moderately expansive clayey/silty soils in the project site. In general, shrinkage cracks will develop in the ground due to the lack of maintenance of the soil moisture content as the soils start to dry out under the sun and dry weather conditions. The development of shrinkage cracks in the ground will be intensified by the prolonged dry climatic conditions in the Nanakuli area resulting in large fluctuations in the soil moisture content.

We recommend grassing the graded surfaces (including cut and fill slopes) to reduce the potential for significant soil erosion soon after completion of the site grading. The relatively dry climatic conditions of the Nanakuli area likely will require controlled irrigation of the graded surfaces to maintain the moisture contents and to keep graded surfaces free of large shrinkage cracks. However, over-watering of the graded surfaces should be avoided to reduce the potential for saturation and softening of the surface soils.

3.2 Slabs-On-Grade

Based on the results of our field exploration, the on-site clayey/silty soils have a low to moderate expansion potential when subjected to moisture fluctuations. To reduce the potential for future distress to the lightly loaded slabs-on-grade resulting from shrinking and swelling of the on-site soils due to changes in the moisture content, we recommend capping the slab subgrade with a minimum 6-inch thick layer of non-expansive select granular fill or lowering the slab subgrade directly onto the coralline deposits.

Prior to placing the non-expansive select granular fill, we recommend moisture-conditioning the subgrade soils to at least 2 percent above the optimum moisture content and compacting to a minimum of 90 percent relative compaction, where possible. The underlying subgrade soils and select granular fill should be wetted and kept moist until the final placement of slab concrete. Where shrinkage cracks are observed after compaction of the subgrade, we recommend preparing the soils again as recommended above. Saturation and subsequent yielding of the exposed subgrade due to inclement weather and poor drainage may require over-excavation of the soft areas and replacement with engineered fill.

For interior building slabs (not subjected to vehicular traffic or machinery vibration), we recommend placing a minimum 4-inch thick layer of cushion fill consisting of open-graded gravel, such as No. 3 Fine gravel (ASTM C33, No. 67 gradation), below the slabs and above the non-expansive select granular fill layer. The open-graded gravel cushion fill would provide uniform support of the slabs and would serve as a capillary moisture break. To reduce the potential for future moisture infiltration through the slab

and subsequent damage to floor coverings, an impervious moisture barrier is recommended on top of the open-graded gravel cushion layer

Where the slabs will be subjected to equipment vibration and/or vehicular traffic, we recommend placing the floor slab over 6 inches of aggregate subbase in lieu of the minimum 4-inch thick layer of open-graded gravel cushion fill. The aggregate subbase should be compacted to a minimum of 95 percent relative compaction. The impervious moisture barrier may be omitted for these slabs.

A Geolabs representative should observe footing excavations prior to placement of reinforcing steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

3.3 Corrosion Potential

One set of laboratory corrosivity tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), were performed (by our office and Test America Laboratories, Inc.) on selected soil samples obtained from our field exploration to evaluate the corrosivity of the on-site soils. The results of the corrosivity tests are presented in Appendix B.

Resistivity is generally recognized as one of the most significant soil characteristics with regard to the corrosivity of the soil to buried metallic objects. In general, the lower the resistivity the greater the potential for corrosion of the buried metallic structure. Conversely, the higher the resistivity, the less likely the soil will contribute to the corrosion of metallic objects.

On the basis of the laboratory resistivity and pH results, the subsurface soils at the project site have resistivity and pH values on the order of magnitude 300 ohm-cm and 8.5 within the upper clayey/silty soils, corresponding to a corrosion rating of 1 (Extremely Corrosive) based on the guidelines provided by the City & County of Honolulu – Board of Water Supply.

Based on the results of the laboratory corrosivity tests, we believe that a corrosion rating of 1 (Extremely Corrosive) may be used for the proposed development. Design of

metallic substructures, such as waterline pipes or other metallic piping, should consider the effects of the corrosive environment on the substructure.

Levels of the chloride and sulfate content of the on-site soils encountered near the existing ground surface are moderately high on the order of about 1,600 parts per million (ppm) and 400 ppm or less, respectively. We recommend consulting with a professional corrosion engineer to review the test results and provide detailed recommendations for corrosion protection.

3.4 Utility Trenches

It is anticipated that the utilities for the proposed development project will consist of primarily electrical, water, drain, and sewer lines. In general, good construction practices should be utilized for the installation and backfilling of the trenches for the proposed utilities. The contractor should determine the method and equipment to be used for excavation, subject to practical limits and safety considerations. The excavation should comply with all applicable local, state, and federal safety requirements. The contractor should be responsible for trench shoring design and installation. Trench shoring and bracing should conform to the appropriate health and safety requirements.

In general, we recommend using granular bedding consisting of 6 inches of open-graded gravel (ASTM C33, No. 67 gradation) for support of the utility lines. The initial trench backfill up to about 12 inches above the pipes should consist of free-draining backfills, such as open-graded gravel, to reduce the potential for damaging the pipes from compaction of the backfill. It is critical to use a free-draining granular material to reduce the potential for the formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. The use of on-site clayey soils as backfill directly around the utility pipes is not recommended and should not be allowed.

The upper portion of the trench backfill from the level 12 inches above the pipes to the finished subgrade may consist of on-site soils or select granular fill material. The granular or on-site soil backfill materials should be moisture-conditioned to above the optimum moisture content or about 2 percent above the optimum moisture content, respectively, placed in level lifts not exceeding 8 inches in loose thickness, and

compacted to a minimum of 90 percent relative compaction to reduce the potential for appreciable future ground subsidence. The finished subgrade of the trench backfill below the pavement grade should be compacted to no less than 95 percent relative compaction.

3.5 Field Infiltration Testing

Based on the current preliminary development concept, we envision that the project may require the on-site stormwater runoff management. We conducted falling head infiltration tests at four selected locations to evaluate the infiltration characteristics of the subsurface materials encountered. The tests were performed in general accordance with the procedures in Appendix C of the State of Maryland, Department of the Environment “Stormwater Design Manual, Volumes I and II” (rev. 2009). These procedures are consistent with other state’s procedures and may generally be considered an industry standard. Results of the infiltration tests performed at selected locations are presented in Appendix C.

The field infiltration tests were performed by drilling boreholes utilizing a 4-inch solid stem auger to a selected test depth of about 5 feet below the existing ground surface. Upon reaching the test depth, a 4-inch diameter PVC solid casing was set to the bottom of the drilled borehole to allow infiltration only through the soil exposed on the bottom of the borehole. Falling head infiltration tests were performed to determine the average infiltration rates of the underlying subsurface materials. Each test consisted of four trials of filling the casing with 24 inches of water and taking periodic readings until the water drained out or up to one hour. The infiltration rates are then calculated based on the results of the fourth and/or last trial for each test location. The calculated infiltration rates at each test location are summarized in the table below.

Based on the results of the field infiltration testing, the average infiltration rates at these locations indicate that an infiltration/detention system and similar methods of stormwater management would be feasible for this development.

FIELD INFILTRATION TESTING RESULTS		
Testing Location	**Testing Depth** (feet)	**Average Measured Infiltration Rate** (inches/hour)
LID-1	5.0	2.08
LID-2	5.0	2.00
LID-3	5.0	7.00
LID-4	5.0	13.00

It should be noted that the infiltration values presented above are the rates of infiltration through the soil exposed at the bottom of the tested boreholes, which may not represent the actual infiltration condition within a typical infiltration chamber footprint or an open basin. Therefore, the absorption capacity of the selected stormwater disposal system should be confirmed by conducting additional infiltration tests during construction. A Geolabs representative should observe the excavation for the detention/infiltration chambers and/or detention basins to confirm the anticipated infiltration substrata conditions.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4. LIMITATIONS

The preliminary analyses and recommendations submitted herein are based, in part, upon information obtained from the drilled borings. Variations of the subsurface conditions between and beyond the field data points may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations provided herein. A design-level geotechnical engineering exploration should be conducted to confirm and/or modify the preliminary geotechnical recommendations provided herein.

The field boring locations indicated herein are approximate, having been estimated by using a handheld Global Positioning System (GPS) to field-locate selected locations from referenced points shown on the topographic survey map transmitted by KN Surveying, LLC on February 12, 2020. Elevations of the borings were estimated from contours and spot elevations on the same plan. The field boring locations and elevations should be considered accurate only to the degree implied by the methods used.

The stratification breaks shown on the graphic representations of the borings depict the approximate boundaries between soil types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text herein. These data have been reviewed and interpretations made in the formulation of this report. It should be noted that groundwater levels are subject to change due to rainfall, time of year, seasonal precipitation, surface water runoff, and other factors.

This report has been prepared for the exclusive use of Gray Hong Nojima & Associates, Inc. and their project consultants for specific application to the conceptual design of the *Residential Development at Former Voice of America Site* project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the architect and design engineers in the conceptual design of the proposed project. Therefore, this report

may not contain sufficient data, or the proper information, to serve as a basis for detailed construction cost estimates.

The owner/client should be aware that unanticipated soil conditions are commonly encountered. Unforeseen subsurface conditions, such as perched groundwater, soft deposits, hard layers or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

This geotechnical engineering exploration conducted at the project site was not intended to investigate the potential presence of hazardous materials existing at the project site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

Project Location Map..... Plate 1

Site Plan..... Plate 2

Field Exploration ..... Appendix A

Laboratory Tests ..... Appendix B

Infiltration Test Data ..... Appendix C

-ΩΩΩΩΩΩΩΩΩ-

Respectfully submitted,

GEOLABS, INC.

By _____
John Y.L. Chen, P.E.
Vice President

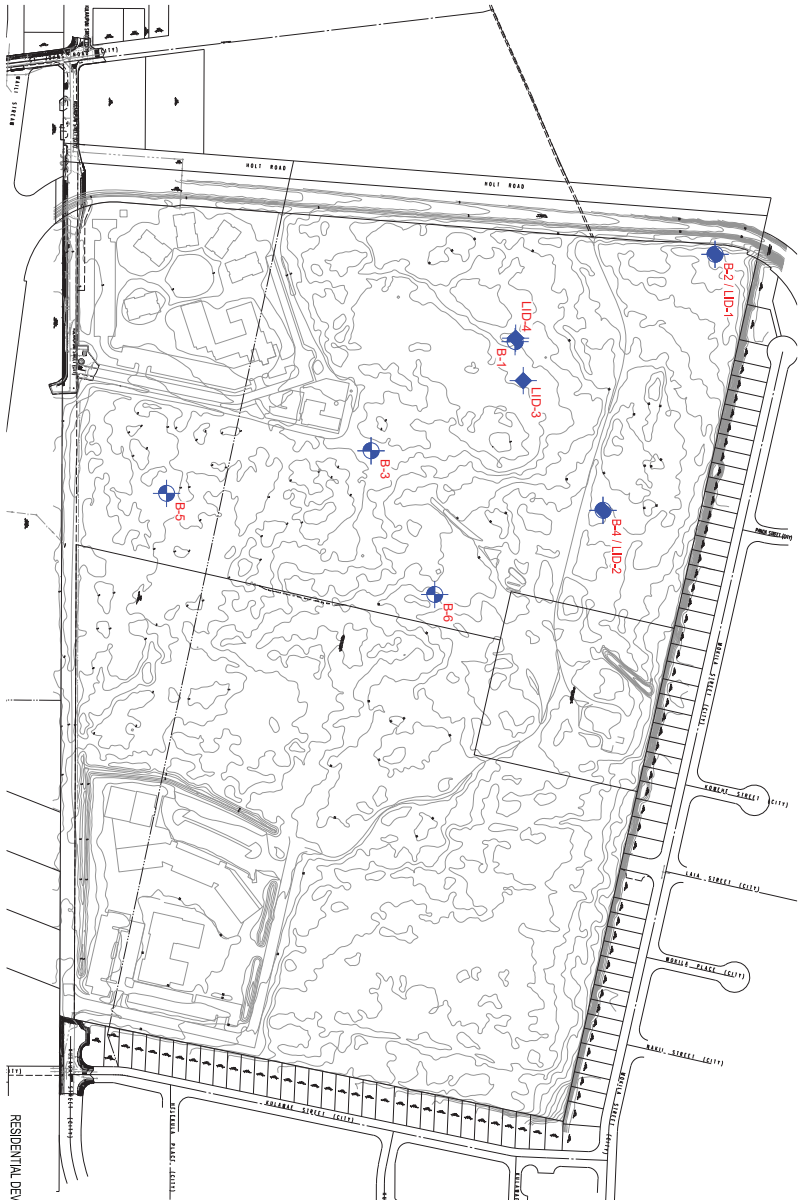
JC:TO:cj

h:\8000Series\8017-00.to1

PLATES

PACIFIC OCEAN
KAHUKU POINT
HAUULA
KAENA POINT
HALEIWA
WAIALUA
PUNALUU
WAHIAWA
KAHALUU
WAIANAE
KANEOHE
PEARL CITY
AIEA
KAILUA
NANAKULI
WAIPAHU
EWA
WAIMANALO
HONOLULU
HAWAII KAI
BARBERS POINT
DIAMOND HEAD
WAIKIKI
ISLAND MAP
NO SCALE
GENERAL PROJECT LOCATION
PROJECT LOCATION
MĀILI
Shopping Center
Leihoku Sch
LEIHOKU ST
Puʻumaʻiʻili
LUALUALEI BEACH PARK
JETTY
LUALUALEI HOMESTEADS
MĀILI BEACH PARK
Māili Com Park
ST JOHNS ROAD
Quarry
Towers
Tower
Sand
ULEHAWA BEACH PARK
Māili Kai Community Park
KAʻUKUMA ROAD
Māili Point
Puʻuohulu Kai
Puʻuohulu Uka
Water Tank
FARRINGTON
ULEHAWA
HAKIMA
N
2000 1000 0 2000 FT.
GRAPHIC SCALE
REFERENCE: MAP CREATED WITH TOPO!® ©2010 NATIONAL GEOGRAPHIC; ©2007 TELE ATLAS, REL. 1/2007.
PROJECT LOCATION MAP
RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII
GEOLABS, INC.
Geotechnical Engineering
DATE
FEBRUARY 2020
DRAWN BY
HYC
PLATE
SCALE
1" = 2,000'
W.O.
8017-00
1
CAD User: HENRY File Last Updated: February 14, 2020 3:37:30pm Plot Date: February 14, 2020 - 3:37:44pm
File: T:\Drawings\8017-00 Residential Development At Former Voice Of America\8017-00PLM.dwg\PLM
Plotter: DWG to PDF.PC3\DJ-D Resolution.CTB Newport Layout Setup: Bearing.pc3

CAD User: HENRY File Last Updated: June 10, 2020 4:29:42pm Plot Date: June 10, 2020 - 4:30:31pm
File: A:\Drafting\Drafting\Working\8017-00_Residential_Development_At_Former_Voice_Of_America\8017-00SitePlan.dwg\2
Plotter: DWG To PDF-GEO.pc3 Plotstyle: GEOLABS-Standard-Half.ctb



LEGEND:

APPROXIMATE BORING LOCATION

APPROXIMATE LID TEST LOCATION

REFERENCE: TOPOGRAPHIC SURVEY DATED OCTOBER 28, 2019
PREPARED BY KN SURVEYING, INC.

0 125 250 500 750 FT.
GRAPHIC SCALE

SITE PLAN

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2020	HYC	2
SCALE	W.O.	
1" = 250'	8017-00	

Appendix E: Preliminary Engieering Report

APPENDIX A

APPENDIX A

Field Exploration

We explored the subsurface conditions at the project site by drilling and sampling six borings, designated as Boring Nos. 1 through 6, extending to the maximum depth explored of about 21.5 feet below the existing ground surface. The approximate boring locations are shown on the Site Plan, Plate 2. The borings were drilled using a truck-mounted drill rig equipped with continuous flight augers.

Our geologist classified the materials encountered in the borings by visual and textural examination in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils, and monitored the drilling operations on a near-continuous (full-time) basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), as shown on the Soil Log Legend, Plate A-0.1. Deviations made to the soil classification in accordance with ASTM D2487 are described on the Soil Classification Log Key, Plate A-0.2. Graphic representations of the materials encountered are presented on the Logs of Borings, Plates A-1 through A-10.

Relatively “undisturbed” soil samples were obtained in general accordance with ASTM D3550, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM D1586, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the “Penetration Resistance” on the Logs of Borings at the appropriate sample depths. The penetration resistance shown on the Logs of Borings indicates the number of blows required for the specific sampler type used. The blow counts may need to be factored to obtain the Standard Penetration Test (SPT) blow counts.

Pocket penetrometer tests were performed on selected cohesive soil samples retrieved in the field. The pocket penetrometer test provides an indication of the unconfined compressive strength of the sample. Pocket penetrometer test results are summarized on the Logs of Borings at the appropriate sample depths.

GEOLABS, INC.

Geotechnical Engineering

Soil Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS	GRAVELS	CLEAN GRAVELS	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		LESS THAN 5% FINES	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
		MORE THAN 12% FINES	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS	CLEAN SANDS	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE		LESS THAN 5% FINES	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE	SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES
		MORE THAN 12% FINES	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE	SILTS AND CLAYS	LIQUID LIMIT 50 OR MORE	MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

- (2-INCH) O.D. STANDARD PENETRATION TEST
- (3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE
- SHELBY TUBE SAMPLE
- GRAB SAMPLE
- CORE SAMPLE
- WATER LEVEL OBSERVED IN BORING AT TIME OF DRILLING
- WATER LEVEL OBSERVED IN BORING AFTER DRILLING
- WATER LEVEL OBSERVED IN BORING OVERNIGHT

LL LIQUID LIMIT (NP=NON-PLASTIC)

PI PLASTICITY INDEX (NP=NON-PLASTIC)

TV TORVANE SHEAR (tsf)

UC UNCONFINED COMPRESSION OR UNIAXIAL COMPRESSIVE STRENGTH

TXUU UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (ksf)

Plate

A-0.1

LOG LEGEND FOR SOIL 8017-00.GPJ GEOLABS.GDT 2/14/20

GEOLABS, INC.

Geotechnical Engineering

Soil Classification Log Key

(with deviations from ASTM D2488)

GEOLABS, INC. CLASSIFICATION*

GRANULAR SOIL (- #200 <50%)	COHESIVE SOIL (- #200 ≥50%)
• **PRIMARY** constituents are composed of the largest percent of the soil mass. Primary constituents are capitalized and bold (i.e., **GRAVEL, SAND**)	• **PRIMARY** constituents are based on plasticity. Primary constituents are capitalized and bold (i.e., **CLAY, SILT**)
• **SECONDARY** constituents are composed of a percentage less than the primary constituent. If the soil mass consists of 12 percent or more fines content, a cohesive constituent is used (**SILTY** or **CLAYEY**); otherwise, a granular constituent is used (**GRAVELLY** or **SANDY**) provided that the secondary constituent consists of 20 percent or more of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** GRAVEL, **CLAYEY** SAND) and precede the primary constituent.	• **SECONDARY** constituents are composed of a percentage less than the primary constituent, but more than 20 percent of the soil mass. Secondary constituents are capitalized and bold (i.e., **SANDY** CLAY, **SILTY** CLAY, **CLAYEY** SILT) and precede the primary constituent.
• **accessory descriptions** compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY GRAVEL **with a little sand**)	• **accessory descriptions** compose of the following: with some: >12% with a little: 5 - 12% with traces of: <5% accessory descriptions are lower cased and follow the Primary and Secondary Constituents (i.e., SILTY CLAY **with some sand**)

EXAMPLE: Soil Containing 60% Gravel, 25% Sand, 15% Fines. Described as: **SILTY GRAVEL** with some sand

RELATIVE DENSITY / CONSISTENCY

Granular Soils			Cohesive Soils			
N-Value (Blows/Foot)		Relative Density	N-Value (Blows/Foot)		PP Readings (tsf)	Consistency
SPT	MCS		SPT	MCS		
0 - 4	0 - 7	Very Loose	0 - 2	0 - 4		Very Soft
4 - 10	7 - 18	Loose	2 - 4	4 - 7	< 0.5	Soft
10 - 30	18 - 55	Medium Dense	4 - 8	7 - 15	0.5 - 1.0	Medium Stiff
30 - 50	55 - 91	Dense	8 - 15	15 - 27	1.0 - 2.0	Stiff
> 50	> 91	Very Dense	15 - 30	27 - 55	2.0 - 4.0	Very Stiff
			> 30	> 55	> 4.0	Hard

MOISTURE CONTENT DEFINITIONS

Dry: Absence of moisture, dry to the touch

Moist: Damp but no visible water

Wet: Visible free water

ABBREVIATIONS

WOH: Weight of Hammer

WOR: Weight of Drill Rods

SPT: Standard Penetration Test Split-Spoon Sampler

MCS: Modified California Sampler

PP: Pocket Penetrometer

GRAIN SIZE DEFINITION

Description	Sieve Number and / or Size
Boulders	> 12 inches (305-mm)
Cobbles	3 to 12 inches (75-mm to 305-mm)
Gravel	3-inch to #4 (75-mm to 4.75-mm)
Coarse Gravel	3-inch to 3/4-inch (75-mm to 19-mm)
Fine Gravel	3/4-inch to #4 (19-mm to 4.75-mm)
Sand	#4 to #200 (4.75-mm to 0.075-mm)
Coarse Sand	#4 to #10 (4.75-mm to 2-mm)
Medium Sand	#10 to #40 (2-mm to 0.425-mm)
Fine Sand	#40 to #200 (0.425-mm to 0.075-mm)

**Soil descriptions are based on ASTM D2488-09a, Visual-Manual Procedure, with the above modifications by Geolabs, Inc. to the Unified Soil Classification System (USCS).*

Plate

A-0.2

SOIL CLASS LOG KEY 8017-00.GPJ GEOLABS.GDT 2/14/20

GEOLABS, INC.
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Rock Log Legend

ROCK DESCRIPTIONS

	BASALT		CONGLOMERATE
	BOULDERS		LIMESTONE
	BRECCIA		SANDSTONE
	CLINKER		SILTSTONE
	COBBLES		TUFF
	CORAL		VOID/CAVITY

ROCK DESCRIPTION SYSTEM

ROCK FRACTURE CHARACTERISTICS

The following terms describe general fracture spacing of a rock:

Massive: Greater than 24 inches apart

Slightly Fractured: 12 to 24 inches apart

Moderately Fractured: 6 to 12 inches apart

Closely Fractured: 3 to 6 inches apart

Severely Fractured: Less than 3 inches apart

DEGREE OF WEATHERING

The following terms describe the chemical weathering of a rock:

Unweathered: Rock shows no sign of discoloration or loss of strength.

Slightly Weathered: Slight discoloration inwards from open fractures.

Moderately Weathered: Discoloration throughout and noticeably weakened though not able to break by hand.

Highly Weathered: Most minerals decomposed with some corestones present in residual soil mass. Can be broken by hand.

Extremely Weathered: Saprolite. Mineral residue completely decomposed to soil but fabric and structure preserved.

HARDNESS

The following terms describe the resistance of a rock to indentation or scratching:

Very Hard: Specimen breaks with difficulty after several "pinging" hammer blows.
Example: Dense, fine grain volcanic rock

Hard: Specimen breaks with some difficulty after several hammer blows.
Example: Vesicular, vugular, coarse-grained rock

Medium Hard: Specimen can be broked by one hammer blow. Cannot be scraped by knife. SPT may penetrate by ~25 blows per inch with bounce.
Example: Porous rock such as clinker, cinder, and coral reef

Soft: Can be indented by one hammer blow. Can be scraped or peeled by knife. SPT can penetrate by ~100 blows per foot.
Example: Weathered rock, chalk-like coral reef

Very Soft: Crumbles under hammer blow. Can be peeled and carved by knife. Can be indented by finger pressure.
Example: Saprolite

Plate
A-0.3

LOG LEGEND FOR ROCK 8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
1

Approximate Ground Surface Elevation (feet): 8.5 *

Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	7	95			22/6" +60/4" 15/1" Ref.			GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to very dense, moist (coral formation)
TXUU S_u=0.8 ksf	23	101			49		5		
Sieve - #200 = 14.5%	16				15		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose to medium dense, moist (coralline detritus)
								GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to dense (coral formation)
	20	108			33		15		
	18				32		20		
							25		Boring terminated at 21.5 feet
							30		* Elevations estimated from Topographic Survey dated October 27, 2019 prepared by KN Surveying, Inc.
							35		

Date Started:	December 17, 2019	Water Level:	10.8 ft. 12/17/2019 1459 HRS
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig:	CME-75DG2 *(Energy Transfer Ratio = 91.5%)*
Total Depth:	21.5 feet	Drilling Method:	4" Solid-Stem Auger
Work Order:	8017-00	Driving Energy:	140 lb. wt., 30 in. drop

Plate
A - 1

BORING_LOG 8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring 2

Approximate Ground Surface Elevation (feet): 16 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	25	79			20			CL	Brown with tan **SANDY CLAY** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
LL=69 PI=44	22				19			CH	Brown **SILTY CLAY** with a little sand (coralline), very stiff, moist (alluvium)
	78	65			49		5	GW-GM	Tan with brown **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense to dense, moist (coral formation)
	8				26		10		
Sieve - #200 = 6.9%	13	121			70		15		
	13				34		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 17, 2019	Water Level: 12.5 ft. 12/17/2019 1048 HRS	Plate
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 2
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring 3

Approximate Ground Surface Elevation (feet): 6 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
	13	92			50/3"			ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
Sieve - #200 = 17.6%	20				40			GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), dense, moist (coral formation)
	28	92			15		5	SM	Tan **SILTY SAND (CORALLINE)** with some gravel, loose (weathered sandstone)
	20				10		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose (coralline detritus)
Sieve - #200 = 19.0%	16	115			17		15	GM	Brown with tan **SILTY GRAVEL (CORALLINE)** with some sand, loose (alluvium w/coral debris)
Sieve - #200 = 16.1%	21				26		20	SM	Tan **SILTY SAND (CORALLINE)**, medium dense (weathered sandstone)
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 18, 2019	Water Level: 4.5 ft. 12/18/2019 1046 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 3
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

GEOLABS, INC.
Geotechnical Engineering

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
4

Approximate Ground Surface Elevation (feet): 11 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	15	84			78			SM	Tan with brown **SILTY SAND (CORALLINE)** with some gravel (coralline), medium dense to dense, moist (coral formation)
Sieve - #200 = 27.5%	9				48				
	16	96			24		5		
	11				29		10		
	14	112			70/6" +25/1"		15		
	15				28		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 17, 2019	Water Level: 10.5 ft. 12/17/2019 1323 HRS	Plate
Date Completed:	December 17, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 4
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
5

Approximate Ground Surface Elevation (feet): 4.5 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
Direct Shear	37	71			8			SM	Tan **SILTY SAND (CORALLINE)** with some gravel (coralline), medium dense to dense, moist (coral formation)
Sieve - #200 = 16.7%	18				17				
	26	101			38		5		
					10/0" Ref.		10		
Sieve - #200 = 19.0%	16	115			50/3"		15		
					25/1"		20		
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Date Started:	December 18, 2019	Water Level: 4.0 ft. 12/18/2019 1428 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	A - 5
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Log of Boring
6

Approximate Ground Surface Elevation (feet): 10 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), medium stiff, moist (alluvium w/coral debris)
	18	93			37			GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), medium dense, moist (coral formation)
Sieve - #200 = 22.6%	10				27				
	27	93			27		5		
	14				9		10	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), loose (coralline detritus)
					25/1"		15	GM	Tan **SILTY GRAVEL (CORALLINE)** with some sand (coralline), dense (coral formation)
Sieve - #200 = 16.5%	19				20		20	SM	Tan **SANDY SAND (CORALLINE)**, medium dense (weathered sandstone)
									Boring terminated at 21.5 feet
							25		
							30		
							35		

Sample | Graphic

Date Started:	December 18, 2019	Water Level: ▼ 9.5 ft. 12/18/2019 1205 HRS	Plate
Date Completed:	December 18, 2019		
Logged By:	B. Aiu	Drill Rig: CME-75DG2 *(Energy Transfer Ratio = 91.5%)*	A - 6
Total Depth:	21.5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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VOICE OF AMERICA SITE
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Log of Boring
LID-1

Approximate Ground Surface Elevation (feet): 16 *

Other Tests (Laboratory)	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	USCS	Description
								ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), stiff, dry to damp (alluvium w/coral debris)
								CH	Brown with trace tan **SILTY CLAY** with traces of gravel (coralline), very stiff, moist (older alluvium)
							5		Light tannish White **CORAL**, moderately to closely fractured, slightly to moderately weathered, medium hard to hard (coral formation)
									Boring terminated at 5 feet
							10		
							15		
							20		
							25		
							30		
							35		

Sample | Graphic

Date Started:	June 5, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 5, 2020		
Logged By:	S. Latronic	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 7
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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Log of Boring
LID-2

Approximate Ground Surface Elevation (feet): 11 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Density (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
										ML	Brown with tan **SANDY SILT** with traces of gravel (coralline), stiff, dry to damp (alluvium w/coral debris)
											Light tannish White **CORAL**, moderately to closely fractured, slightly to moderately weathered, medium hard to hard (coral formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 5, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 5, 2020		
Logged By:	S. Latronic	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	A - 8
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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Log of Boring
LID-3

Approximate Ground Surface Elevation (feet): 7 *

Laboratory: Other Tests	Laboratory: Moisture Content (%)	Laboratory: Dry Density (pcf)	Field: Core Recovery (%)	Field: RQD (%)	Field: Penetration Resistance (blows/foot)	Field: Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
										ML	Brown **SANDY SILT**, medium stiff, moist (alluvium)
											grades with traces of gravel
										GM	Tannish brown **SILTY GRAVEL (CORALLLINE)** with a little sand, medium dense, moist (coral formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 9, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 9, 2020		
Logged By:	R. Yang	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	A - 9
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

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Log of Boring

LID-4

Laboratory			Field								
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Approximate Ground Surface Elevation (feet): 9 * Description
										ML	Brown **SANDY SILT** with traces of gravel, medium stiff, moist (alluvium w/coral debris)
										GM	Brown with tan **SILTY GRAVEL (CORALLINE)** with a little sand, medium dense, moist
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				
							30				
							35				

Date Started:	June 9, 2020	Water Level: ▼ Not Encountered	Plate
Date Completed:	June 9, 2020		
Logged By:	R. Yang	Drill Rig: CME-45C TRUCK *(Energy Transfer Ratio = 78%)*	A - 10
Total Depth:	5 feet	Drilling Method: 4" Solid-Stem Auger	
Work Order:	8017-00	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG_8017-00.GPJ GEOLABS.GDT 6/10/20

APPENDIX B

APPENDIX B

Laboratory Tests

Moisture Content (ASTM D2216) and Unit Weight (ASTM D2937) determinations were performed on selected samples as an aid in the classification and evaluation of soil properties. The test results are presented on the Logs of Borings at the appropriate sample depths.

One Atterberg Limits test (ASTM D4318) was performed on a selected soil sample to evaluate the liquid and plastic limits. The test results are summarized on the Logs of Borings at the appropriate sample depth. Graphic presentation of the test results is provided on Plate B-1.

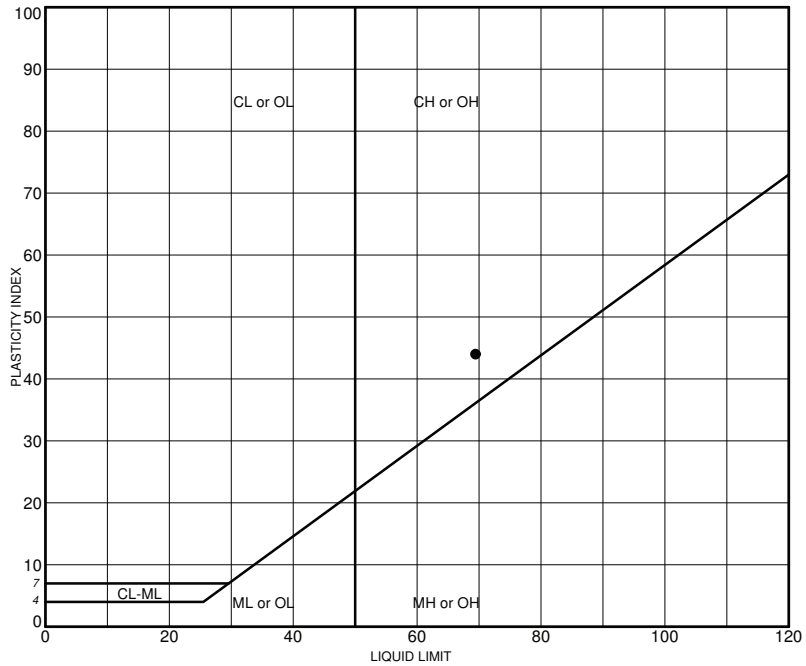
Ten Sieve Analysis tests (ASTM C117 & C136) were performed on selected soil samples to evaluate the gradation characteristics of the soils and to aid in soil classification. In addition, three hydrometer tests (ASTM D422) were conducted on the samples to further evaluate the finer grain materials of the soils. Graphic presentations of the grain size distributions are provided on Plates B-2 and B-3.

One one-inch Ring Swell test was performed on a relatively undisturbed sample to evaluate the swelling potential of the on-site soils. The test results are summarized on Plate B-4.

One Direct Shear test (ASTM D3080) was performed on a selected sample to evaluate the shear strength characteristics of the materials tested. The test results are presented on Plate B-5.

To evaluate the undrained shear strength of the soils, one Unconsolidated Undrained Triaxial Compression (TXUU) test was performed on selected in-situ soil samples in accordance with ASTM D2850. The approximate in-situ effective overburden pressure was used as the applied confining pressure for the “undisturbed” sample. The test results and the stress-strain curves are presented on Plate B-6.

One set of Corrosivity tests, including pH (ASTM G51), Minimum Resistivity (ASTM G57), Chloride Content (EPA 300.0), and Sulfate Content (EPA 300.0), was performed by our office and TestAmerica Laboratories, Inc. an on selected soil sample obtained from our field exploration. The test results are summarized on Plate B-7.



	Sample	Depth (ft)	LL	PL	PI	Description
●	B-2	2.5-4.0	69	25	44	Brown silty clay (CH) with some gravel

NP = NON-PLASTIC

G ATTERBERG PI-100 LL-120 8017-00.GPJ GEOLABS.GDT 2/14/20

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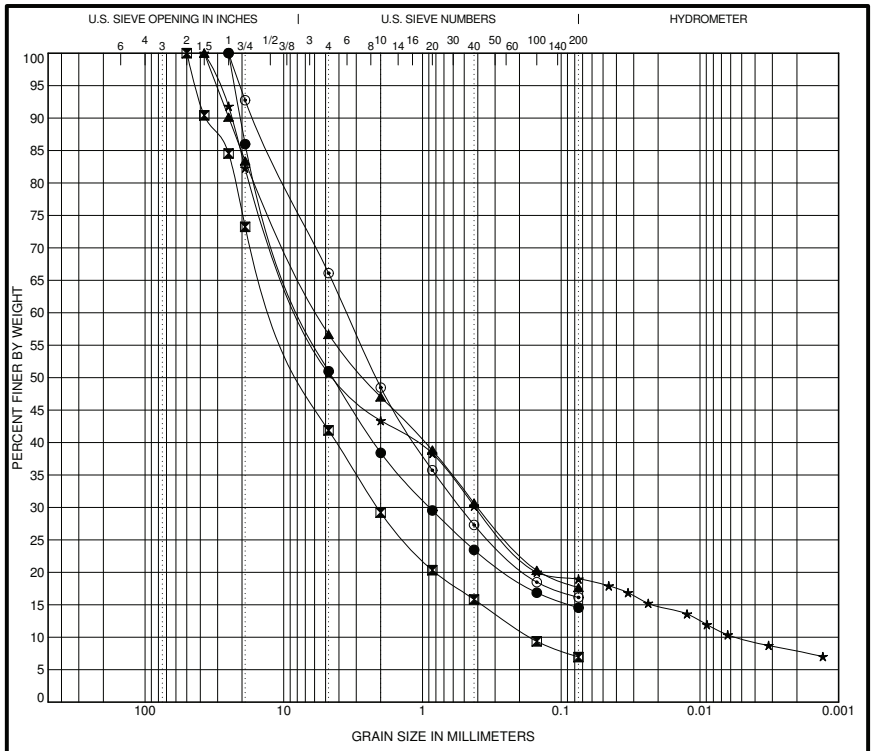
W.O. 8017-00

ATTERBERG LIMITS TEST RESULTS - ASTM D4318

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	B-1	10.0-11.5	Tan silty gravel (GM) with some sand					
⊠	B-2	15.0-16.5	Brownish tan sandy gravel (GW-GM) with a little silt				2.5	63.6
▲	B-3	2.5-4.0	Whitish tan silty gravel (GM) with some sand					
★	B-3	15.0-16.5	Tannish brown silty gravel (GM) with some sand				4.5	1321.4
⊙	B-3	20.0-21.5	Tan silty sand (SM) with some gravel					

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	B-1	10.0-11.5	25	6.788	0.889		49.0	36.4	14.5
⊠	B-2	15.0-16.5	50	10.58	2.113	0.166	58.1	34.9	6.9
▲	B-3	2.5-4.0	37.5	5.649	0.398		43.3	39.0	17.6
★	B-3	15.0-16.5	37.5	7.166	0.416	0.005	49.4	31.6	19.0
⊙	B-3	20.0-21.5	25	3.522	0.531		33.9	50.0	16.1

G GRAIN SIZE MOD 8017-00.GPJ GEOLABS.GDT 6/1/20

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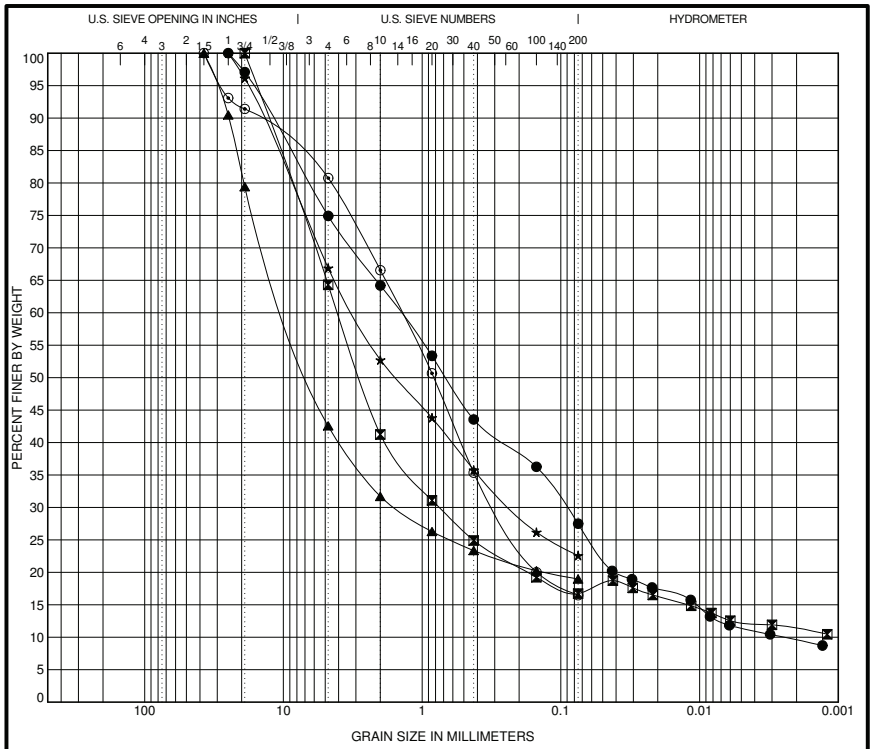
GRAIN SIZE DISTRIBUTION - ASTM C117 & C136

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 2



	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	B-4	2.5-4.0	Whitish tan silty sand (SM) with some gravel				2.3	578.5
⊠	B-5	2.5-4.0	Grayish tan silty sand (SM) with some gravel					
▲	B-5	15.0-16.5	Tannish brown sandy gravel (GM) with a little silt					
★	B-6	2.5-4.0	Tan silty sand (SM) with some weathered gravel					
⊙	B-6	20.0-21.5	Tan silty sand (SM) with some gravel					

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	B-4	2.5-4.0	25	1.436	0.091	0.002	25.1	47.4	27.5
⊠	B-5	2.5-4.0	19	4.041	0.751		35.7	47.6	16.7
▲	B-5	15.0-16.5	37.5	9.152	1.529		57.4	23.6	19.0
★	B-6	2.5-4.0	25	3.121	0.227		33.1	44.3	22.6
⊙	B-6	20.0-21.5	37.5	1.406	0.296		19.2	64.3	16.5

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GRAIN SIZE DISTRIBUTION - ASTM C117 & C136

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 3

G GRAIN SIZE MOD 8017-00.GPJ GEOLABS.GDT 6/1/20

Location	Depth (feet)	Soil Description	Dry Density (pcf)	Moisture Contents Initial (%)	Air-Dried (%)	Final (%)	Ring Swell (%)
B-2*	1.0 - 2.5	Brown sandy clay with traces of rootlets	71.3	25.1	21.7	53.0	2.1

NOTE: Samples tested were either relatively undisturbed or remolded in 2.4-inch diameter by 1-inch high rings. They were air-dried overnight and then saturated for 24 hours under a surcharge pressure of 55 psf.

* Relatively Undisturbed
** Remolded

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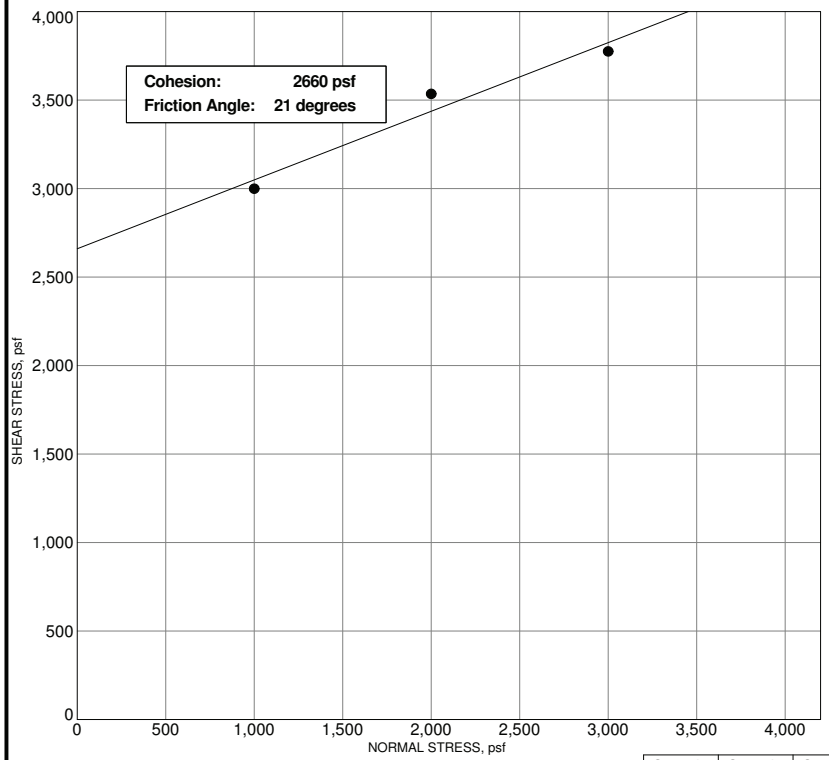
SUMMARY OF RING SWELL TESTS

RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 4

G RING SWELL TEST 8017-00.GPJ GEOLABS.GDT 2/21/20



		Sample #1	Sample #2	Sample #3
INITIAL	Moisture Content, %	34.3	31.7	45.1
	Dry Density, pcf	75.1	77.9	69.1
	Height, inches	1.00	1.00	1.00
FINAL	Moisture Content, %	52.0	46.6	56.6
	Dry Density, pcf	79.1	81.3	69.5
	Height, inches	0.949	0.958	0.994
	Diameter, inches	2.42	2.42	2.42
	Deformation Rate, inch/minute	0.0025	0.0023	0.0022
	Normal Stress, psf	**1000**	**2000**	**3000**
	Peak Shear Stress, psf	**2999**	**3535**	**3775**
	Shear Displacement, inches	0.43	0.40	0.40

Sample: B-5
Depth: 1.0 - 2.5 feet
Description: Grayish tan silty sand with some highly weathered gravel

G DIRECT SHEAR 8017-00.GPJ GEOLABS.GDT 2/14/20

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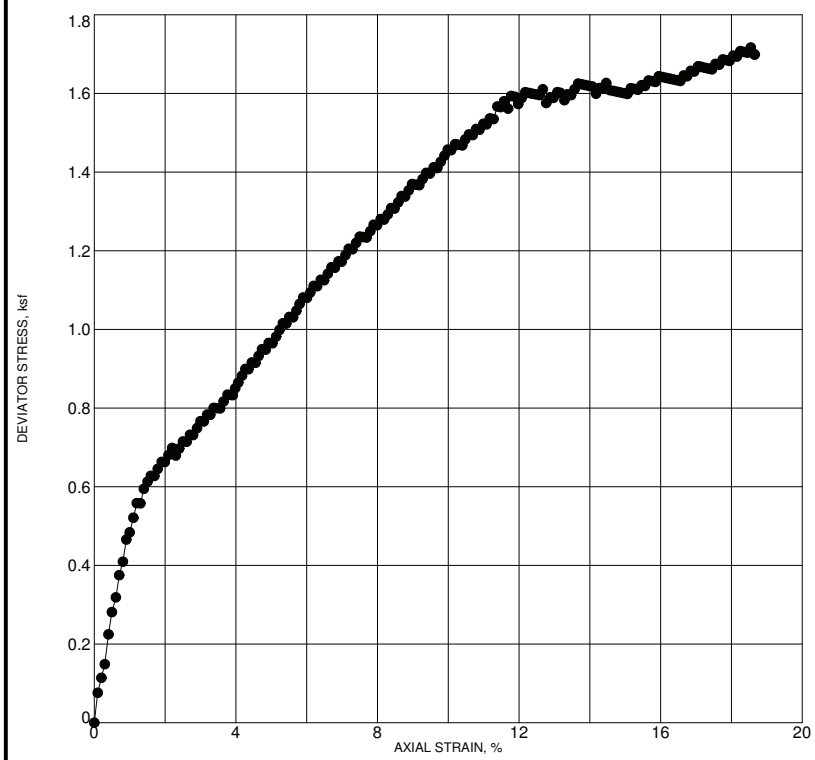
DIRECT SHEAR TEST - ASTM D3080

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 5



Max. Deviator Stress (ksf):	1.6
Confining Stress (ksf):	0.5

Location: B-1
Depth: 5.0 - 6.5 feet
Description: Brownish tan silty gravel some sand
Test Date: 12/30/2019

Dry Density (pcf)	100.8	Sample Diameter (inches)	2.403
Moisture (%)	22.6	Sample Height (inches)	5.067
Axial Strain at Failure (%)	15.0	Strain Rate (% / minute)	1.00

G TXUU 8017-00.GPJ GEOLABS.GDT 2/21/20

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TRIAXIAL UU COMPRESSION TEST - ASTM D2850

RESIDENTIAL DEVELOPMENT AT FORMER VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 6

Location	Depth (feet)	pH Value	Minimum Resistivity (ohm-cm)	Chloride Content (mg/kg)	Sulfate Content (mg/kg)
B-6	1.0 - 2.5	8.66*	270*	1600	400

TEST METHODS (by TestAmerica Laboratories, Inc.)

pH Value	Method 9045C
Minimum Resistivity	SM 2510B
Chloride Content	EPA 300.0
Sulfate Content	EPA 300.0

TEST METHODS (by Geolabs, Inc.)*

pH Value	ASTM G51
Minimum Resistivity	ASTM G57
Chloride Content	N/A
Sulfate Content	N/A

ND: Not Detected Within Reporting Limits

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GEOTECHNICAL ENGINEERING
W.O. 8017-00

SUMMARY OF CORROSIVITY TESTS

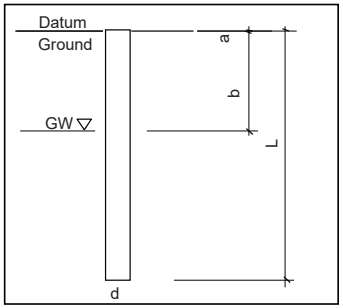
RESIDENTIAL DEVELOPMENT AT FORMER
VOICE OF AMERICA SITE
NANAKULI, OAHU, HAWAII

Plate
B - 7

G SUMMARY OF CORROSIVITY TESTS 8017-00.GPJ GEOLABS.GDT 2/14/20

APPENDIX C

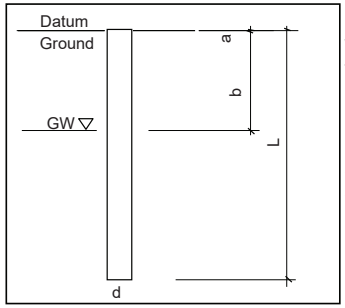
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-1	
Date of Testing:	12/18/2019	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.0	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	5.0	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	10:12	36.00	
	15	10:27	36.00	
	30	10:42	36.50	
	45	10:57	36.50	
	60	11:12	37.00	1.00
Trial 2	0	11:13	36.00	
	15	11:28	37.00	
	30	11:43	37.50	
	45	11:58	38.00	
	60	12:13	38.00	2.00
Trial 3	0	12:15	36.00	
	15	12:30	36.42	
	30	12:45	37.00	
	45	13:00	37.25	
	60	13:15	38.00	2.00
Trial 4	0	13:17	36.00	
	15	13:32	37.00	
	30	13:47	37.50	
	45	14:02	38.00	
	60	14:17	38.08	2.08

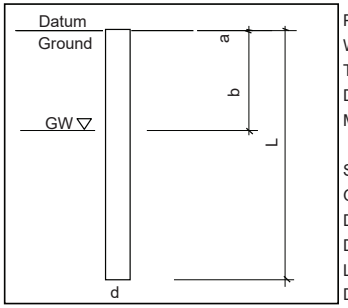
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-2	
Date of Testing:	12/18/2019	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	0.2	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	5.2	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:00	36.00	
	15	9:15	37.00	
	30	9:30	38.00	
	45	9:45	39.50	
	60	10:00	41.00	5.00
Trial 2	0	10:02	36.00	
	15	10:17	36.00	
	30	10:32	36.25	
	45	10:47	36.50	
	60	11:02	37.00	1.00
Trial 3	0	11:04	36.00	
	15	11:19	36.50	
	30	11:34	37.00	
	45	11:49	37.50	
	60	12:04	38.00	2.00
Trial 4	0	12:07	36.00	
	15	12:22	36.50	
	30	12:37	37.00	
	45	12:52	37.50	
	60	13:07	38.00	2.00

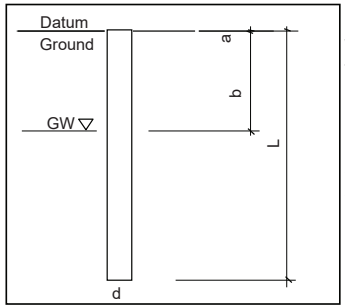
INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-3	
Date of Testing:	6/10/2020	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	1.6	feet
Depth of Boring:	4.8	feet
Length, L (from datum):	6.4	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:11	52.00	
	15	9:26	55.00	
	30	9:41	56.50	
	45	9:56	58.00	
	60	10:11	59.00	7.00
Trial 2	0	10:13	52.00	
	15	10:28	55.25	
	30	10:43	56.50	
	45	10:58	58.00	
	60	11:13	59.50	7.50
Trial 3	0	11:14	52.00	
	15	11:29	54.25	
	30	11:44	56.00	
	45	11:59	58.00	
	60	12:14	59.00	7.00
Trial 4	0	12:15	52.00	
	15	12:30	53.50	
	30	12:45	55.00	
	45	13:00	57.50	
	60	13:15	59.00	7.00

INFILTRATION TEST RECORD



Project:	Voice of America	
W.O.:	8017-00	
Test No.:	LID-4	
Date of Testing:	6/10/2020	
Method of Testing:	BMP Falling Head (Flush Bottom)	
Source of Water:	Bucket	
GW level, b (from ground):	N/A	feet
Datum, a (above ground):	1.5	feet
Depth of Boring:	5.0	feet
Length, L (from datum):	6.5	feet
Diameter of Casing, d (I.D.):	4.0	inches

Testing Trial	Elapsed Time (minutes)	Time (hh:mm)	Depth to Water (measured from datum) (inches)	Percolation Rate (inches per hour)
Trial 1	0	9:06	53.00	
	15	9:21	57.50	
	30	9:36	60.50	
	45	9:51	63.25	
	60	10:06	66.00	13.00
Trial 2	0	10:08	53.00	
	15	10:23	57.50	
	30	10:38	61.00	
	45	10:53	64.00	
	60	11:08	66.25	13.25
Trial 3	0	11:09	53.00	
	15	11:24	58.00	
	30	11:39	60.00	
	45	11:54	63.75	
	60	12:09	66.00	13.00
Trial 4	0	12:10	53.00	
	15	12:25	56.50	
	30	12:40	60.00	
	45	12:55	62.50	
	60	13:10	66.00	13.00

APPENDIX B

STATE HISTORIC PRESERVATION DIVISION RECONNAISSANCE LEVEL SURVEY
MARCH 2021

RLS Form 2/2018

State Historic Preservation Division
Reconnaissance Level Survey – Survey Form

Instructions: Submit this completed form with the completed SIHP request form and 6E Filing Fee Form **electronically** to: dlnr.intake.shpd@hawaii.gov

For additionally guidance on completing this form, please see the Architecture Branch Survey Guidelines available on the SHPD website.

---

1. **Review Type: Indicate which review process this survey was requested under**

   ◉ HRS 6E-08, HAR 13-275 ○ HRS 6E-42, HAR 13-284

2. **Project Information: Indicate the document in which this survey was requested**

   2.1) Log No. [e.g. 2017.1234] Log No. 2017.00028

   2.2) Doc No. [e.g. 1708MB27] Doc No. 1709SH05

   2.3) Other:

3. **Contact Information:**

   3.1) Name: Timothy Rieth 3.2) Company: International Archaeol., LLC

   3.3) Street Address: 2081 Young St.

   3.4) County: Honolulu 3.5) State: HI 3.6) Zip Code: 96826

   3.7) Phone: 808 551 3090 3.8) Email: trieth@internationalarchaeologyllc.com

4. **Property Location:**

   4.1) TMK [e.g. (3) 1-2-003:004]: [1] 8-7-010: 031

   4.2) Street Address: vicinity of St. Johns Road, Maili

   4.3) County: Honolulu 4.4) State: HI 4.5) Zip Code: 96792

5. **Property Classification:**

   5.1) Ownership:

   ○ Private ◉ Public

   5.2) Classification

   ○ Building ○ District ◉ Site ○ Structure ○ Object

6. **Property Function:**

   6.1) Current: Demolished

   6.2) Historic: Voice of America radio transmitting station, KRHO

7. Property Description:

7.1) Date of Construction: 1944

7.2) Provide a description of the property, including the character defining features, summarize alterations to the property, and provide an evaluation of the property's integrity of materials, design, feeling, location, association, workmanship, and setting.

The 4.86-acre parcel of this TMK [1] 8-7-010: 031 was formerly a part of a 89-acre parcel (TMK [1] 8-7-010: 007), which was split into -031 and -030 (84.42 acres) ca. 2017. Today's 4.86-acre parcel (-031) is the site of the four resources intended to be evaluated in this RLS. The four features were remnants from the former Voice of America (VoA) radio transmitting station that had the call letters KRHO. In 2009, these four features were assigned the Hawaii State Inventory of Historic Places (SIHP) numbers 50-80-07-7082, as Features 7, 14, 19, and 20 (Rieth, 2009), and described (below). However, these features are no longer extant today.

As described in 2009, these four features included:
Feature 7, which was several concrete bases for wood fence posts;
Feature 14, which was a concrete slab, with a foot print of approximately 10'-2" x 3'-11";
Feature 19, which was a ruin. It had fragments of CMU structure on a concrete slab that had a footprint measuring about 22' x 10';
Feature 20, which was a ruin. It had fragments of CMU structure on a concrete slab that had a footprint measuring about 105' x 33'-50'. Cable troughs were cast in the concrete slab. This ruin was a remnant of the former main transmitter building for VoA station KRHO.

During the site visit conducted on November 9, 2020 for this RLS it was observed that these four features are no longer extant. The site of these features was grubbed to a depth of 1' to 2', which has removed earth and all traces of these features except for the exposed top edges of a dis-connected series of below-grade foundation walls. All concrete slabs and all above-grade structures and CMU remnants have been removed. Judging from the size of some of the saplings sprouting from the ruins, the grubbing appears to have been accomplished about 1-2 years prior to the November 9, 2020 site visit. The grubbing was begun at the edge of the asphalt-surfaced road leading to the features where earth was scraped away to a depth of about 2'. At the south margin of the grubbing, south of where the features were located, the grubbing reaches a depth of about 1'. The remaining foundation walls are a combination of concrete and CMU with concrete mortar.

A sketch plan of the remaining foundation walls is included in this RLS.

The site is demolished, no character defining features of the four target resources remain.

Alterations are not known, the structures and buildings are demolished.

Except for location, no aspects of integrity are retained.

NOTE: The 2009 Archaeological Inventory Survey (Rieth, 2009) included information on SIHP #50-80-07-7081, a series of sixteen antenna foundations in the area to the west of the four targets of this RLS. These sixteen foundations were not part of the scope of this RLS and were not surveyed. However, these antenna foundations were part of the VoA transmitting equipment, they held poles that supported a series of several rhombic antenna. See the following historic context for more information.

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

Historic context:
The Voice of America facility (VoA) at Maili was built in 1944 and began broadcasting on December 26, 1944. ("OWI Central Pacific Operations," Radio Heritage Foundation website radioheritage.com/story103. Seehaas, 1945 Findeisen, HSB Jan 19, 1945. 8). The programming was directed to Japan and the Philippines and consisted of American music and announcements in English, Japanese, and Filipino. The station was assigned the call letters KRHO and the construction of the facility and its programming were part of the US Office of War Information (OWI) efforts to provide shortwave radio news and information to the populations in World War II combat theaters. (Schneider, 2014) The facility operated a 100 kilowatt (kW) transmitter that broadcast at a frequency of 1778 kHz (kilo-hertz) over a system of rhombic antenna that were strung on tall wood poles in the open area immediately west of the transmitter building. (Portzer, 2020)

The VoA facility at Maili was part of a network of VoA radio stations that were developed during World War II to communicate America's views abroad. The network was established in mid-1941 under the newly created US Foreign Information Service (FIS). The first broadcasts were made from San Francisco to Asia in December 1941. On February 1, 1942, the first broadcast to Europe was prefaced by an announcement that became the network's name, Voice of America. "We bring you voices from America, we shall speak to you about America and the war. The news may be good for us. The news may be bad. But we shall tell you the truth." (VOA, 2017)

During the first year of World War II, VoA established a reputation for honesty by reporting on the startling advancements and successes of the Japanese and German military. In 1942 the US Coordinator of Information (COI) took over VoA administration from the FIS and studios were set up in New York and San Francisco to produce programming. Later in 1942, the Office of War Information (OWI) was created as VoA's overseeing agency. As combat in the Pacific progressed and the US theater of operations grew, VoA programming included more broadcasting that was of interest to American service members, such as popular music and sports like the World Series. During the war VoA added seventeen transmitters on the US west coast and additional stations in the west Pacific. The VoA station KRHO at Maili and station KSAI on Saipan began broadcasting on the same day in 1944.

VoA station KRHO was established in temporary offices in downtown Honolulu on March 21, 1944, with workers transferred from Washington DC. In July, the station moved into permanent offices and studios in the KGMB (Honolulu radio station AM 590 kHz) building at 1534 Kapiolani Boulevard. This building, and a Quonset hut added beside it, became the administrative headquarters for all VoA Central Pacific Operations during World War II. Radio shows were produced and recorded at the studio, then relayed to the main transmitter facility at Maili for broadcast to the western pacific. Some broadcasts were relayed programming that was produced on the mainland. The 100 kW power of the transmitter at Maili was the most powerful shortwave transmitter in the Pacific when it was built. ("Huge Transmitter," HSB March 2, 1946. 1. Seehass, 1945. Portzer, 2020)

The broadcast frequency (1778 kHz) of VoA station KRHO that was transmitted from the facility at Maili is within the short wave band of radio frequencies. Short wave is very useful for long distance communication because a signal can be aimed to be reflected off the ionosphere. This bounces the signal back to earth multiple times and enables reception at great distances, far beyond the line of sight propagation of about 40 miles that is typical of other radio bands. Directional transmissions of shortwave broadcasts that are intended for long range reception typically use rhombic antenna, which is the type installed on tall wood poles at VoA KRHO in Maili in 1944. (Portzer, 2020) Rhombic antenna are a series of four wires, suspended parallel to the ground in a diamond shape.

Broadcasts from the station that were produced on the mainland were obtained from the west coast via radio transmission to a receiver in Kailua, Oahu and then sent by phone lines to VoA at Maili for re-broadcast transmission to the west Pacific. KSAI in Saipan would pick up these signals and re-transmit in standard wavelengths for those that did not have shortwave receivers. Some broadcasts were produced at the KRHO studio on Kapiolani Boulevard in Honolulu and sent over phone lines to Maili for transmittal. ("Huge Transmitter," HSB March 2, 1946. 1)

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

After World War II, administration of the VoA was transferred to the US State Department Office of Information and Cultural Affairs (OIC). KHRO stopped producing its own content after World War II and reverted to a relay station to Asia for programming that was broadcast from the mainland. In 1946, KRHO was one of thirty-eight OIC transmitters world wide that broadcast VoA programming, which was considered "radio statesmanship" by the State Department and designed to disseminate information about the United States and "unbiased news" of other nations. Broadcast languages included; English, French, Japanese, Cantonese, Thai (Siamese), Vietnamese, Korean, Malaysian, and two Indonesian dialects. Broadcast times from KRHO were tailored to typical listening hours in various Asian nations, the station did not broadcast around the clock. ("Oahu Radio Station to Help Give Asia Picture of US Way of Life," Honolulu Star Bulletin. March 25, 1946. P. 11)

In 1947, VoA in Honolulu (KRHO) had a staff of sixteen, including ten engineers. Its administrative offices were at Aloha Tower. Although KRHO station announcements and fill-ins with Hawaiian music were made locally, most programming was produced in New York City. Broadcast from the west coast to a receiver in Kailua that was leased by VoA, the shows were sent via wire to the transmitter at Maili. By April 1947, no Japanese language programming was broadcast from Maili. General Mac Aurthur, Allied Commander of the Japanese Occupation handled radio programming in Japan. (Keyes Beech, "Hawaii's Most Powerful Radio Station - KRHO," Honolulu Star Bulletin. April 23, 1947. P. 5. "State Department Radio Here Plugs Islands Along With UN," Honolulu Star Bulletin)

A 1951 aerial photograph showed the Maili VoA site with a gable-roofed main building that had an L-shaped foot print, a Quonset hut to the north and a small shed-roofed structure to the south. Tall poles for the rhombic antenna were in a large open area to the west. (UH MAGIS Collection, Photo # 2685. June 29, 1951) By 1957, a second 100 kW transmitter had been added at KRHO at Maili and the station's receiver for broadcasts from the mainland had been changed to a receiver at Barbers Point. Some shows were tape recorded at Maili when received, and re-broadcast later. Also by that year, a number of programs were broadcast to the Soviet Union in Russian language. These broadcasts, begun ca. 1947, had their frequencies jammed by the Soviet government, with about fifty percent effectiveness. The facilities at Maili in 1957 included a main building housing the transmitters and a Quonset that was set on a low post foundation. ("Maili Transmitters Send Truth to Far East," Honolulu Star Bulletin. August 7, 1957. P. 15)

The VoA operated Station KRHO at Maili until at least 1964. By 1971 the VoA had ceased broadcasting from Maili and the property was turned over to the Coast Guard, which used it as a transmitting station for their communication system. The Coast Guard discontinued use of the property in 1977 and it was turned over to the US General Services Administration (GSA). In 1983, the GSA offered the approximately 89 acre parcel (TMK [1] 8-7-010: 007) for sale. The VoA buildings were demolished in the late 1980s. A sale of the property was never made and in 1996, negotiations began to transferred the property to the State of Hawaii in exchange for various parcels then under the control of the Department of Hawaiian Home Lands (DHHL). This exchange was accomplished in 2009, but it did not include the approximately 4.86 acres of TMK [1] 8-7-010: 031 that includes the four demolished resources covered in this RLS report. This 4.86 acre parcel was not transferred because of hazardous materials, including PCB, asbestos, and lead based paint among the debris field of the ruins that needed remediation (Kaiini Kaloi, "Environmental Assessment, Proposed Maili Land Exchange." 2009). In 2018, funding for the remediation of hazardous materials in the soil of the site was secured and a clean up was to be initiated. (Bianca Smallwood, "Toxic Lot In Maili May Finally Get Cleaned Up." Civil Beat. May 17, 2018.

RLS Form 2/2018

8. Eligibility Recommendation:

8.1) Provide a recommendation of eligibility to the Hawai'i Register of Historic Places including applicable criteria and areas of significance.

Although the Voice of America facility at Maili was significant (under Hawaii State Register of Historic Places Criterion a) for its association with the Office of War Information and the Voice of America radio network, its demolition has rendered it not eligible. It does not retain the necessary aspects of integrity to support listing.

In addition, the remaining foundations at the site are not considered (under Hawaii State Register of Historic Places Criterion d) likely to yield information important in history or to have the potential to answer any important research questions.

Sources:

Findeisen, Paul "Around the Dial in Hawaii." Honolulu Star Bulletin. January 19, 1945. P. 8.

Hashiro, Ron. "History of Broadcasting in Hawaii." website qsl.net/ah6rh/am-radio/hawaii/history, accessed on October 15, 2020.

"Huge Transmitter Built at Waianae." Honolulu Star Bulletin. March 2, 1946. P. 1.

Portzer, Bruce. "Radio History - KRHO Honolulu 1944." From website Radio Heritage Foundation. 2020.

Rieth, Timothy (IARII). An Archaeological Inventory Survey of the Former Voice of America Site, Maili, Lualualei Ahupuaa, Waianae District, Oahu. Prepared for Element Environmental LLC. August 2009.

Schneider, John. "Dixon California, A United States Shortwave Mecca." website theradiohistoran.org/Dixon/Dixon1, accessed on October 15, 2020.

Seehaas, John C., estate of. "OWI Central Pacific Operations." Booklet from the collection in the estate of John C. Seehaas. From website Radio Heritage Foundation. Ca. 1945.

Smallwood, Bianca. "Toxic Lot In Maili May Finally Get Cleaned Up." Civil Beat. May 17, 2018.

Voice of America. "VoA Through the Years." website insidevoa.com/a/3794247, accessed on October 15, 2020. April 3, 2017.

RLS Form 2/2018

9. Attach Photographs: provide sufficient photographs to illustrate the property's main features. At a minimum provide the following:

Quantity	Description
1-2	Street view(s) of the resource and setting
1-2	Main Facades
1-2	interior photos(s) if applicable

10. Attach Map showing the location of the property

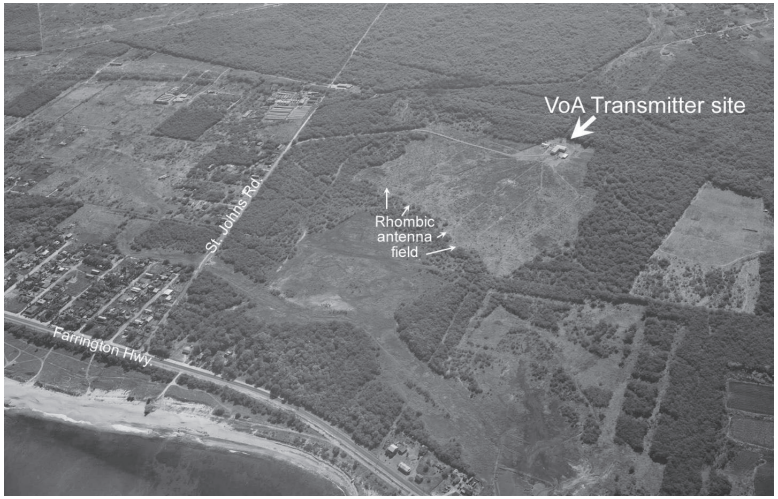
CHECKLIST

- ☐ **Reconnaissance Level Survey Form** (this form)
- ☐ **Photographs**
- ☐ **Map**
- ☐ **Filing Fee Form**
- ☐ **SIHP Request Form**

Location map showing TMK [1] 8-7-010: 031 in Maili. Aerial photo shows the site conditions in 2013.

Site map of VoA Transmitter Maili. Aerial photo shows the site conditions in 2013. Grubbed area has been cleared of all structures, only dis-connected, below grade foundation walls remain.

Historic 1951 aerial photo, view facing northeast, showing the VoA Transmitter Maili site. Labeling added. June 29, 1951. Photo: UH Manoa MAGIS Collection, #2685.



Sketch plan of existing, below grade foundation walls at VoA Transmitter Maili. November 9, 2020.

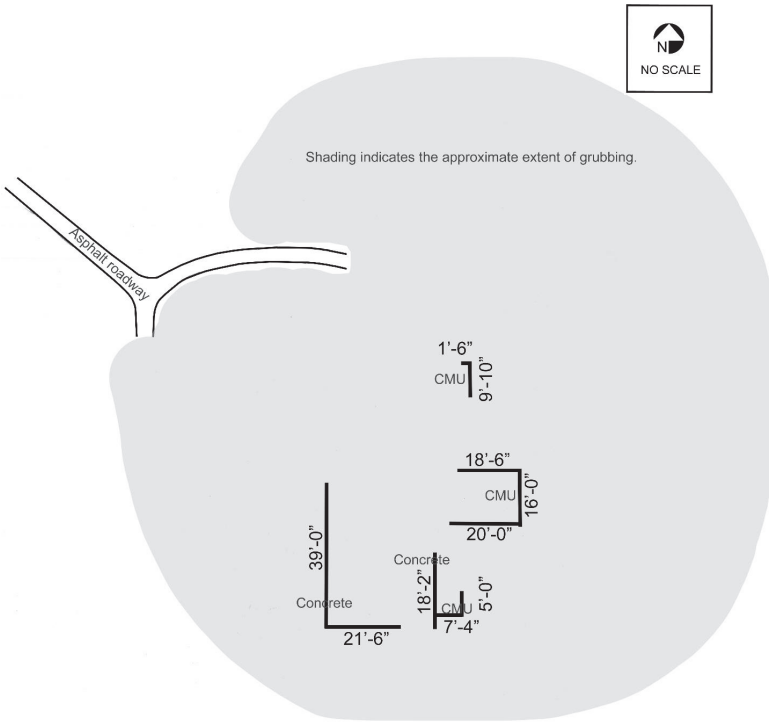


Photo key for November 9, 2020 field photos.

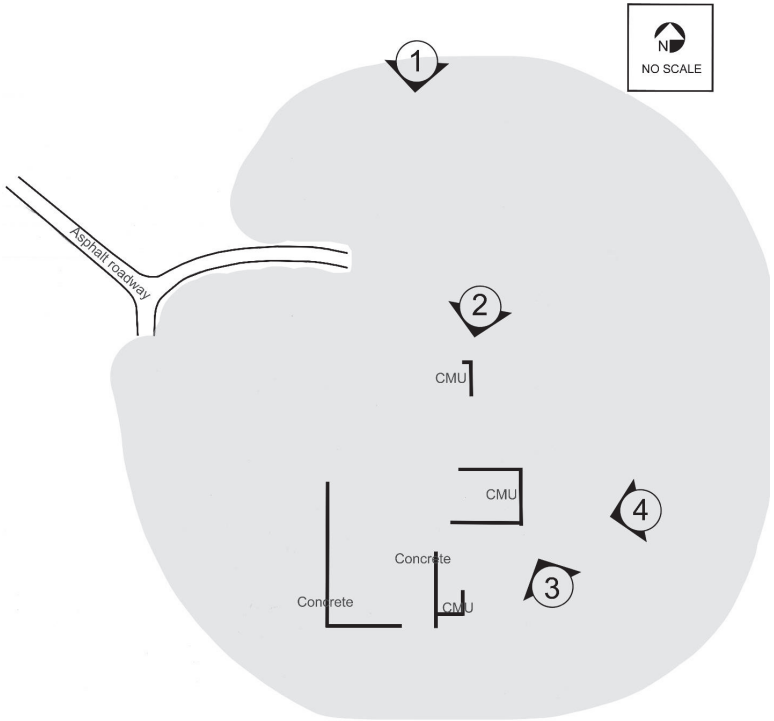


Photo 1

Photo 2

Photo 3

Photo 4

APPENDIX C

DRAFT ARCHAEOLOGICAL ASSESSMENT FOR THE DEPARTMENT OF HAWAIIAN HOME LANDS VOICE OF AMERICA PROPERTY, KULAAUPUNI STREET ROAD CORRIDOR EXTENSION, FEBRUARY 2021

— Draft —

Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā‘ili, Lualualei Ahupua‘a, Wai‘anae Moku, Island of O‘ahu

TMK (1) 8-7-010:030

Prepared by:
Carly Walker
Darby Filimoehala

Prepared for:
Department of Hawaiian Home Lands
Land Development Division
91-5420 Kapolei Parkway
Kapolei, Hawai‘i 96707

Under Contract to:
Gray, Hong, Nojima & Associates
201 Merchant Street, Suite 1900
Honolulu, Hawai‘i 96813

INTERNATIONAL ARCHAEOLOGY, LLC

FEBRUARY 2021

IA201947

— DRAFT —

ARCHAEOLOGICAL ASSESSMENT FOR THE DEPARTMENT OF HAWAIIAN HOME LANDS VOICE OF AMERICA PROPERTY, KULAAUPUNI STREET ROAD CORRIDOR EXTENSION, MĀ‘ILI, LUALUALEI AHUPUA‘A, WAI‘ANAE MOKU, ISLAND OF O‘‘AHU

TMK (1) 8-7-010:030

Prepared by:
Carly Walker, B.A.
Darby Filimoehala, M.A.

Prepared for:
Department of Hawaiian Home Lands
Land Development Division
91-5420 Kapolei Parkway
Kapolei, Hawai‘i 96707

Under Contract to:
Gray, Hong, Nojima & Associates
201 Merchant Street, Suite 1900
Honolulu, Hawai‘i 96813

International Archaeology, LLC
2081 Young Street
Honolulu, Hawai‘i 96826

February 2021

ABSTRACT

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands (DHHL), International Archaeology, LLC completed an archaeological inventory survey (AIS) of the proposed Kulaaupuni Street extension within the former Voice of America (VOA) property. The project area is 1.8 acres in Māʻili, Oʻahu (TMK [1] 8-7-010:030). The sole landowner is the DHHL. The planned residential development at the former VOA site includes a road extension from the intersection of Kulaaupuni Street and Holt Road potentially to the Kulawae and Kulauku Streets intersection 525 m to the south. Survey and testing was limited to the road corridor and included mechanical excavation of four trenches.

No archaeological sites were documented by the pedestrian survey and subsurface testing. The depositional sequence for the road corridor consists of a basal reef-derived Pleistocene limestone bedrock below multiple alluvial deposits, which are capped by modern fills deposited by 20th century activities. No further work is recommended for the project area. However, if finds are encountered during construction, the State Historic Preservation Division should be contacted immediately.

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I. INTRODUCTION

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands (DHHL), International Archaeology, LLC (IA) completed an archaeological inventory survey (AIS) of the proposed Kulaaupuni Street extension within the former Voice of America (VOA) property. The project area is 1.8 acres in Mā‘ili, O‘ahu (TMK [1] 8-7-010:030) (Figure 1 and Figure 2). The sole landowner is the DHHL. The AIS testing plan was sent to the State Historic Preservation Department (SHPD) via email on November 2, 2020, and the SHPD concurred with the fieldwork strategy on November 19, 2020 (email confirmation by S. Hemenway to D. Filimoehala). Due to negative findings during the AIS, this report is presented as an archaeological assessment (AA) pursuant to Hawaii Administrative Rules (HAR) §13-284-5(b)(5)(A). This AA meets the minimum standards specified in HAR §13-276 pertaining to AIS reports.

The planned residential development at the former VOA site includes a road extension from the intersection of Kulaaupuni Street and Holt Road possibly to the Kulawae and Kulauku Streets intersection 525 m to the south. Survey and testing was limited to the road corridor and included mechanical excavation of four trenches.

PROJECT LOCATION

The project area is in Lualualei Ahupua‘a on the leeward side of O‘ahu. The corridor runs along the west side of the DHHL VOA property and is approximately 500 m inland from the shore. The western edge of the corridor is bordered by residential houses. The currently undeveloped DHHL VOA property and the Kamehameha Schools' Community Learning Center abut the east side of the corridor.

PROJECT PERSONNEL AND DATES OF FIELDWORK

Timothy M. Rieth, M.A., was the Principal Investigator for the project and was responsible for overall management, ensuring that appropriate research standards were maintained, and providing research direction and oversight. Darby Filimoehala, M.A., was the Project Director. Ms. Filimoehala directed the fieldwork and was assisted in the field by Field Technician Carly Walker, B.A. Fieldwork was conducted on November 30, 2020.

DISPOSITION OF FIELD NOTES AND OTHER MATERIALS

Project field notes and electronic files produced during the project are temporarily stored at the IA Honolulu office. The final disposition of these materials will be determined through consultation with the DHHL and the SHPD.

ORGANIZATION OF THE REPORT

This report is organized as follows. Section I provides an overview of the project. Section II summarizes the physical environmental characteristics and important cultural background information, and describes the archaeological resources that have been documented in the area. Section III presents the

research questions that guided the fieldwork and describes the field methods. Section IV presents the results of the investigation. Section V is a discussion of the results as they relate to the project's research questions. Section VI presents the conclusions and recommendations. All references cited in the body of the report are presented after Section VI. A glossary of Hawaiian words used in the report follows the references. Appendix A provides copies of correspondence with the SHPD. Test trench soil and sediment descriptions are provided in Appendix B.

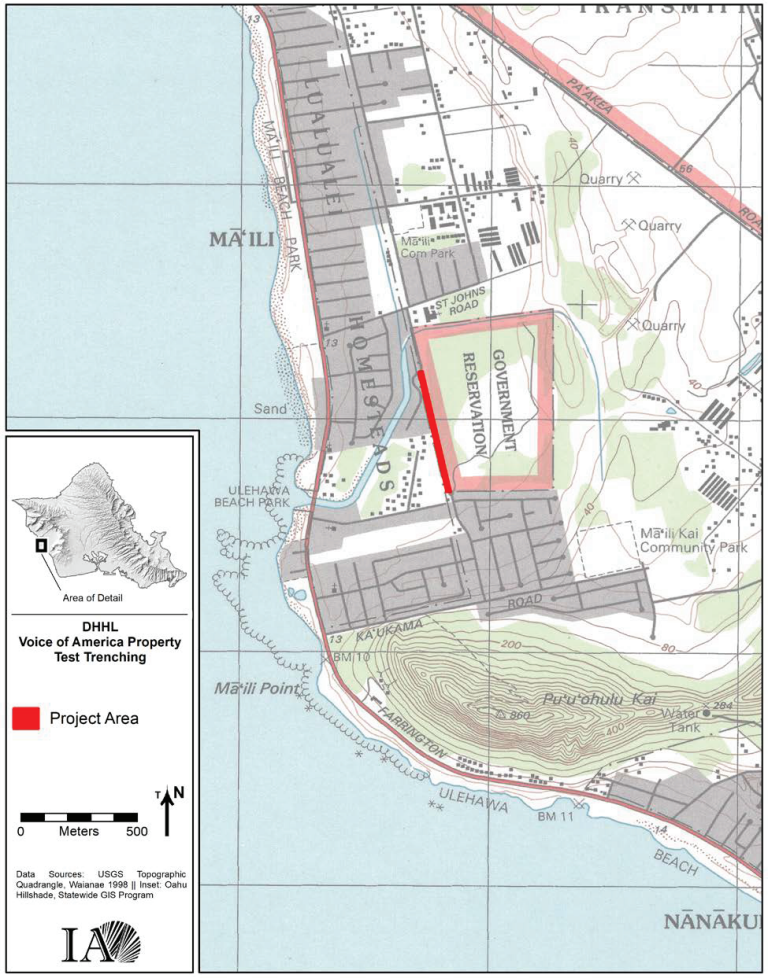

Figure 1. Location of the Kulaaupuni Street extension corridor project area overlaid on the 1998 USGS Waiʻanae topographic quadrangle.

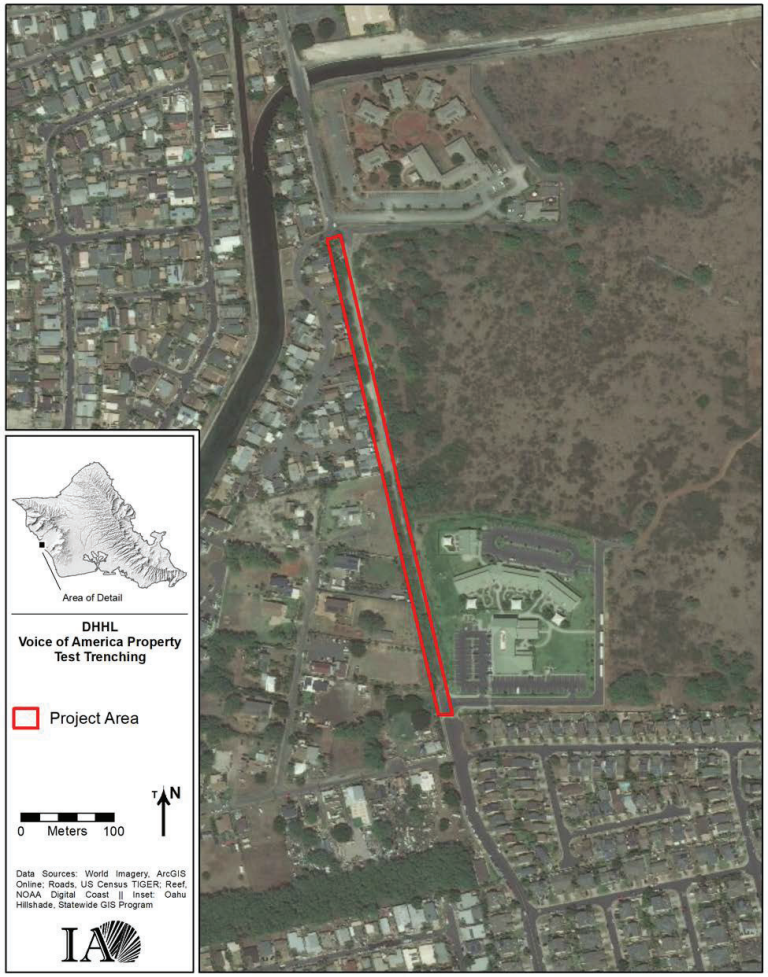

Figure 2. Detail of the Kulaaupuni Street extension corridor overlaid on the World Imagery Aerial.

II. BACKGROUND

This section provides environmental, cultural, historical, and archaeological background information to contextualize the project.

PHYSICAL ENVIRONMENT

The project area is within the remnant caldera of the Wai‘anae Volcano, which formed the Wai‘anae Range. The broad amphitheater valleys of the western Wai‘anae Range are characteristic of late-stage valley development (Macdonald et al. 1983:430). Thin, often discontinuous, ridges separate the valleys, which have broad, flat bases. The flat valley bottoms have been formed by massive accumulations of alluvial and colluvial sediment, which in Lualualei Valley is up to 360 m in thickness (Macdonald et al. 1983:429). Reef limestone substrate is present in the valley, particularly in the project area and adjacent near-shore areas. Limestone exposures and escarpments are common.

Soils in the project area are primarily Mokuleia clay (Mtb)and Mamala stony silty clay loam (MnC), 0 to 12 percent slopes, with a smaller area of Keaau clay (KmbA), saline, 0 to 2 percent slopes (Figure 3). Mokuleia clay is nearly level at the surface and is characterized by a dark grayish brown clay surface layer about 41 cm thick with an underlying layer of dark brown and light gray single grain sand and loamy sand 86-122 cm thick (Foote et al. 1972:95). The surface permeability is slow and the clay is extremely sticky and plastic. Mamala stony silty clay loam, 0 to 12 percent slopes, has a representative profile with a surface layer of dark reddish brown stony silty clay loam approximately 20 cm thick. This layer is underlain by coral limestone and consolidated calcareous sand (Foote et al. 1972:93). Keaau clay, saline, 0 to 2 percent slopes, has a very dark grayish brown clay surface layer measuring about 38 cm thick underlain by a very dark grayish brown and dark brown mottled clay subsoil. The subsoil is deposited atop reef limestone or consolidated coral sand. This soil is strongly affected by salt (Foote et al. 1972:65).

Twentieth-century earth-moving and construction activities for the construction of the former VOA antenna station significantly modified the terrain within the corridor and adjoining parcel. Sediment and stone berms created during previous bulldozing are numerous across the area, often extending for over 10 m in length and greater than 1 m in height.

Precipitation in the project area and surrounding valleys is limited by the rain-shadow effect of the Ko‘olau and Wai‘anae Ranges. The annual adjusted mean rainfall for two of the closest rain gauges are 548 mm (Mikilua, Station No. 725.00) and 654 mm (Lualualei, Station No. 804.00) (Giambelluca et al. 1986). In general, the average mean annual rainfall for this region ranges from less than 600 mm to 800 mm (Giambelluca et al. 1986:138). The greater amount falls during the winter months, particularly December to February. Winter storms associated with Kona winds often produce rapid and abundant rainfall.

Average minimum temperatures for Wai‘anae range from the low 60°s to 70° Fahrenheit (approximately 16-22° Celsius) with average maximum temperatures from the low to upper 80° Fahrenheit (approximately 31° Celsius) (Price 1973:58).

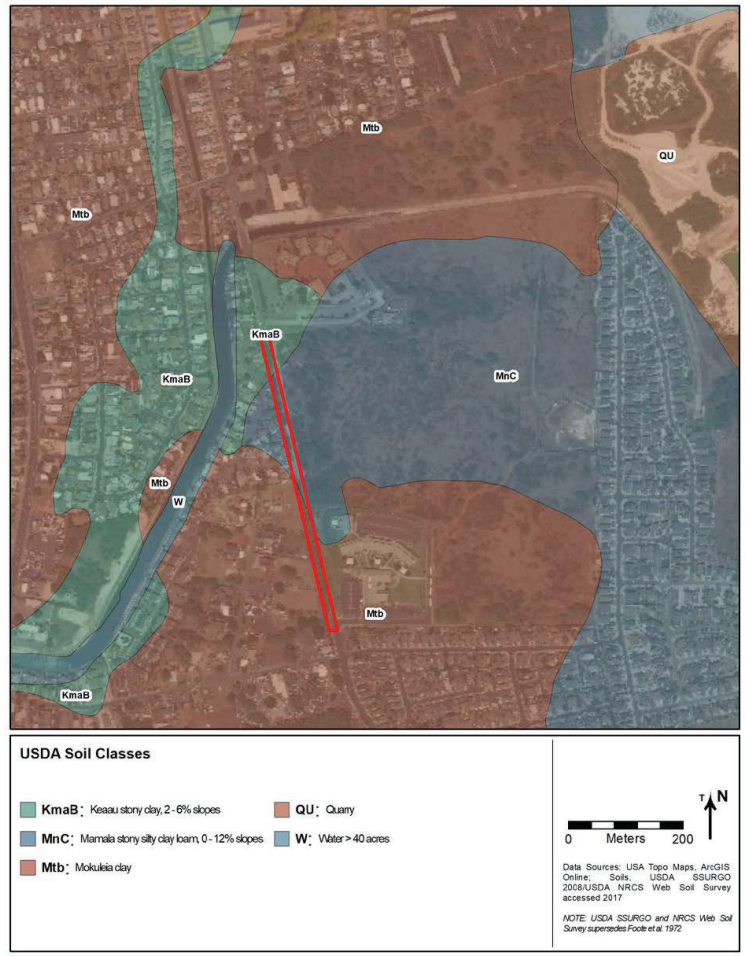

Figure 3. Overlay of Kulaaupuni Street extension corridor project area on the soils map for O‘ahu (data source: U.S. Department of Agriculture, Natural Resources, Conservation Services; Soil Survey Geographic [SSURGO] database for Island of O‘ahu, Hawai‘i file hi990 http://websoilsurvey.nrcs.usda.gov. Accessed December 8, 2020).

No perennial stream flow is present in the surrounding area of Lualualei. The channelized Mā‘ili Stream borders the DHHL parcel along its northern boundary before discharging to the west at Ulehawa Beach. The intermittent Mā‘ili‘ili Stream, with its multiple branches and tributaries, is to the north and east of the project area with Ulehawa Stream to the south.

Historically introduced grasses, *koa haole* (*Leucaena leucocephala*), and *kiawe* (*Prosopis pallida*) are the dominant vegetation in the area. Multiple historically introduced bird taxa, pigs (*Sus scrofa*), dogs (*Canis familiaris*), cats (*Felis catus*), mice (*Mus musculus*), rats (*Rattus* spp.), and mongoose (*Herpestes javanicus*) have been observed on the parcel.

CULTURAL GEOGRAPHY

The project area is towards the center, near-shore area of Lualualei Ahupua‘a (Photo 1) within the *moku* of Wai‘anae along the western coast of O‘ahu. Although currently recognized as an *ahupua‘a*, Lualualei was not designated as such during the mid-19th century Mahele, which created a system of private land ownership in the archipelago. Traditionally, Lualualei appears to have been an *‘ili ‘aina* of Wai‘anae Ahupua‘a (see Nakamura and Pantaleo 1994:5-8). Hālona, Pūhāwai, Mikilua, and Pāhoa are additional *‘ili ‘aina* within Lualualei Valley that are now considered subdivisions of Lualualei Ahupua‘a (Kelly 1991: 313-314; Soehren 2002-2004). Mā‘ili, the current name for the residential area and beach park surrounding the project area, may have originally been an *‘ili ‘aina* as well (Soehren 2002-2004).

Photo 1. View of Lualualei Valley from Pu‘u O Hulu, view to the north (All Trails,` https://www.alltrails.com/trail/hawaii/oahu/puu-o-hulu?u=i, accessed December 4, 2020).

The surrounding Wai‘anae Range and inter-valley ridges are prominent components of the landscape, which define the cultural boundaries of the land at multiple scales from a district level to smaller land holdings. Along the Wai‘anae Range, which forms the eastern boundary for Wai‘anae Moku and Lualualei Valley, Mount Ka‘ala and Kolekole Pass are complementary geographical places. Mount Ka‘ala, at the head of Wai‘anae Ahupua‘a immediately north of Lualualei Ahupua‘a, is the highest peak on O‘ahu. This peak forms a topographic contrast with Kolekole Pass at the northeastern boundary of Lualualei, which provides access to the central plateau of O‘ahu. Mauna Kuwale, Pu‘u Kailio, Kaua‘ōpu‘u, and Pu‘u Pāhe‘ehe‘e are topographical features of the ridge separating the Wai‘anae and Lualualei Valleys, with Pu‘u Heleakalā dividing Lualualei and Nānākuli to the south. The discontinuous ridge Pu‘u O Hulu Kai and Pu‘u O Hulu Uka incompletely divides the southern half of Lualualei Valley.

HISTORICAL BACKGROUND

The following section summarizes the traditional, pre-Contact Hawaiian history and post-Contact history of Lualalei based on oral traditions, archaeological research, and written documents.

TRADITIONAL HISTORY

The traditional history of the Wai‘anae District is rooted in stories of Hawaiian *akua*. One tradition identifies ‘Ulehawa in southern Lualualei as the birthplace of the heroic demigod Māui (Sterling and Summers 1978:65). Māui pulled the Hawaiian Islands from the waters off the Wai‘anae coast with his magic fishhook and learned the secret of fire making in this area. His mother, the moon goddess Hina, made *kapa* in Kāneana Cave along the coast (Sterling and Summers 1978:64). The goddess Hi‘iaka, sister of the volcano goddess Pele, also visited this district when she climbed Pōhākea Pass. The normally subservient younger sister viewed Pele’s destruction of her beloved forests on Hawai‘i Island from this vantage point, thus providing her courage to resist Pele (Kelly 1991:316). Kamapua‘a is also referenced to this area (Pukui et al. 1974:174).

Multiple radiocarbon determinations obtained from archaeological deposits in Wai‘anae and Mākaha Ahupua‘a calibrating between the 12th and 15th centuries provide the earliest possible evidence for occupation and/or activities in this area (contra Cordy 2002). However, these dates were obtained from unidentified charcoal, and therefore may reflect inbuilt age (Allen and Huebert 2014; Rieth and Athens 2013); corroborating dates from charcoal of short-lived taxa are required. Initial settlement may have centered along the coast, emphasizing the procurement of marine resources, with dryland agriculture immediately inland (Green 1980). Permanent settlement and agriculture in mid- and upper valley areas of Mākaha (Green 1980) and Nānākuli Valleys (Cordy 2002:20) did not occur until the 15th to 16th centuries. Residence in upper Lualualei occurred between the late 14th to mid-17th centuries (Dixon et al. 2008). The rich fishing grounds along the Wai‘anae coast provided marine protein, salt, and seaweed, while *kalo* and *‘uala* were starch staples in irrigated and dryland fields, respectively.

With respect to chiefly lineages and genealogies, the Kumuhonua line from Wai‘anae retained seniority over other Nana‘ulu descendants from approximately the early-15th to early/mid-16th centuries (Cordy 1996). During this period, three polities were present on O‘ahu—‘Ewa, Kona, and Ko‘olaupoko—with the ‘Ewa polity subsuming the ‘Ewa, Wai‘anae, and Waialua Districts (Cordy 2002). La‘akona (ruling approximately AD 1420-1440 based on genealogical reckoning) of the Kumuhonua line ruled the ‘Ewa polity and was recognized as the overall ruler for O‘ahu (Cordy 2002:24). This lineage fell from dominance with the killing of Haka (ruling approximately AD 1520-1540), an unpopular chief. The Wai‘anae District again came to prominence a century later when the heirs of the overall chief of O‘ahu, Kalaimanuia, fought over control of the island. Kalaimanuia’s younger son, Ha‘o, was killed by order of his brother Ka‘ihikapu,

prompting Ha‘o’s son, Nāpūlānahumahiki, to flee to Wai‘anae (Cordy 2002:31). In Wai‘anae, he briefly formed an independent kingdom until his line reunified with the O‘ahu kingdom through marriage in the mid-17th century (Fornander 1880:272-273). However, later periods of struggle between district-level chiefs and the overall chief of O‘ahu occurred periodically until Kahekili, the high chief of Maui, conquered O‘ahu in AD 1783.

Kahekili was followed by Kamehameha as an external ruler of O‘ahu. This occurred during the period of initial trade and contact between Western ships and the Hawaiian people. Kamehameha appointed the chief Boki as governor of O‘ahu and chief of Wai‘anae District in 1816. In this position, Boki demanded that Wai‘anae *maka‘āinana* harvest sandalwood in order that he might make payments on his debts to Honolulu merchants and continue his purchase of foreign goods (Sahlins 1992). Spending time harvesting timbers impinged on growing food, and it is presumed that many *maka‘āinana* left Wai‘anae at this time to become laborers in Honolulu (Dixon et al. 2003). The movement of people to town, combined with increased mortality from introduced diseases, led to a significantly decreased population for Lualualei and Wai‘anae District as a whole.

THE MAHELE AND CHANGES IN LAND TENURE

Traditional land tenure at the time of Western contact had *ali‘i* and *konohiki* controlling land units, with the disenfranchisement of *maka‘āinana* from land ownership. The chiefly claims to land were dynamic, with their control dependent upon the fortunes of warfare and the political success of higher-ranking *ali‘i*.

The Mahele of the mid-19th century marked a profound change in land tenure, creating a system of private land ownership as a replacement for the traditional structure. In 1845 and 1846, legislation was enacted to establish the Board of Commissioners to Quiet Land Titles. The Land Commission determined an individual’s right to land, issuing an award if the claim was successful, which was authorized by a Royal Patent from the minister of the interior upon payment of a fee. Claims had to be received by the board between 1846 and 1848, a survey of the property had to be completed, and claimants needed to testify before the commission between 1850 and 1855 (Moffat and Fitzpatrick 1995:50).

A key phase of the Mahele involved the division of lands between Kamehameha III (Kauikeaouli) and the major *ali‘i* and *konohiki*; Kauikeaouli subsequently gave a portion of his lands to the government. Although the “Principles Adopted by the Board of Commissioners to Quiet Land Titles in Their Adjudication of Claims Presented to Them” reserved one-third of the kingdom’s land for the *maka‘āinana*, this principle was never executed (Moffat and Fitzpatrick 1995:49). Instead, *kuleana* awards and government land-grant sales were aimed at providing the *maka‘āinana* with fee simple private ownership of land. *Kuleana* awards required that the claimant prove he or she had cultivated the land for two or more years. For those *maka‘āinana* who did not receive *kuleana* awards, government land grants were available. This fee simple sale of land, however, was also open to non-Hawaiian residents.

Through the Mahele, Kamehameha III claimed the *ahupua‘a* of Lualualei along with Wai‘anae and Nānākuli. Only six Land Commission Awards (LCA) were given in Lualualei Valley, all in the *‘ili ‘aina* of Pūhāwai. These six awards, and two other rejected land claims, indicate that at least eight families resided in Lualualei during the mid-19th century. The LCA for Lualualei document 163 *lo‘i*, multiple *kula* plots possibly used for dryland agriculture as well as *pili* harvesting, and plots of land planted in *wauke* used for *kapa* production. The project area was not claimed as an LCA.

NINETEENTH AND TWENTIETH-CENTURY LAND OWNERSHIP AND AGRICULTURE

With changes in land tenure, population, and economics in Lualualei during the 19th century, two agricultural industries began to dominate the valley: cattle ranching and sugarcane production. Later, the U.S. military became, and remains, a significant presence in the district.

Land Ownership

The project area and larger DHHL VOA property are within Grant 4751. The approximately 3,000-acre parcel (described among various sources as between 2,600 acres and 3,600 acres) that became Grant 4751 was first offered for sale by the Commissioner of Public Lands, E. S. Boyd, in 1902. The parcel was described as “pasture and arable land, and some is partially covered with algaroba forests,” and was initially expected to be sold in separate lots of about 500-600 acres each (*The Independent* August 8, 1902:4). J. M. Dowsett, a major shareholder in the Waianae Sugar Company, attempted to purchase the entire parcel in 1903 at four to five times the valued price ($32,000), but the sale was denied due to questions raised by Territorial Senator Lincoln Loy McCandless about Dowsett’s United States citizenship (*Evening Bulletin* May 20, 1903:1; *The Hawaiian Star* May 21, 1903:8; *The Independent* June 12, 1903:3). Approximately one month after the aborted sale, Heinrich (Henry) Martens von Holt (H.M. von Holt) purchased the parcel for almost an identical price ($32,100), prompting a letter from the Dowsett Company, Limited, to the Superintendent of Public Works challenging the legality of the sale (*The Independent* June 12, 1903:3; Dowsett Company, Limited 1903). Ownership of Grant 4751 passed to the George Holt Trust Estate by the 1930s, and a roughly 93-acre portion was transferred to the United States Government for the Voice of America radio transmitter station by 1948 or 1949, as recorded on tax maps of the area (Figure 4).

Cattle Ranching

Cattle ranching began in Lualualei in 1851 when William H. Jarrett leased nearly 17,000 acres of Crown Land from Kamehameha III (Kelly 1991). Lualualei Ranch, as it was named, changed hands, with partnerships variously between Jarrett, his son Paul Jarrett, and Paul Manini; Jarrett and George Galbraith; and Galbraith and James Dowsett (Kelly 1991:326-327). The lease on the Lualualei Ranch eventually held by Galbraith and Dowsett expired in 1901 and was not renewed. Soon after annexation by the United States in 1898, the Territorial Government initiated the division and auction of the Crown Lands in Lualualei Valley for homesteads primarily associated with ranching (Kelly 1991:328). Between 1909 and 1915, L.L. McCandless purchased more than half of the homestead lots in Lualualei and used the majority of this land for cattle ranching. The U.S. military condemned and acquired most of McCandless’s land in 1929, although grazing leases continued for several decades.

Sugarcane: The Waianae Sugar Company

The Waianae Company sugar plantation was formed in 1879 and the company had 300 acres of sugarcane planted in Lualualei Valley by 1892. The amount of land in Lualualei under cultivation varied during the next half century. The company leased 3,332 acres in Lualualei from the Territorial Government in 1901; however, in 1910 only 1,600 acres were planted in sugarcane in Wai‘anae and Lualualei Valleys. By 1913, much of the DHHL VOA parcel was planted in sugarcane (United States Army Corps of Engineers 1913). In 1931, cane land in Wai‘anae, Mākaha, and Lualualei went from 3,000 acres to 1,200 acres in order to concentrate irrigation and increase yields (Kelly 1991:337). A private narrow-gauge railroad transported the sugarcane from the fields to the mill, while the Oahu Railway and Land Company (OR&L) moved the sugar to Honolulu. After the OR&L discontinued service to Wai‘anae in 1946, the Waianae Company closed.

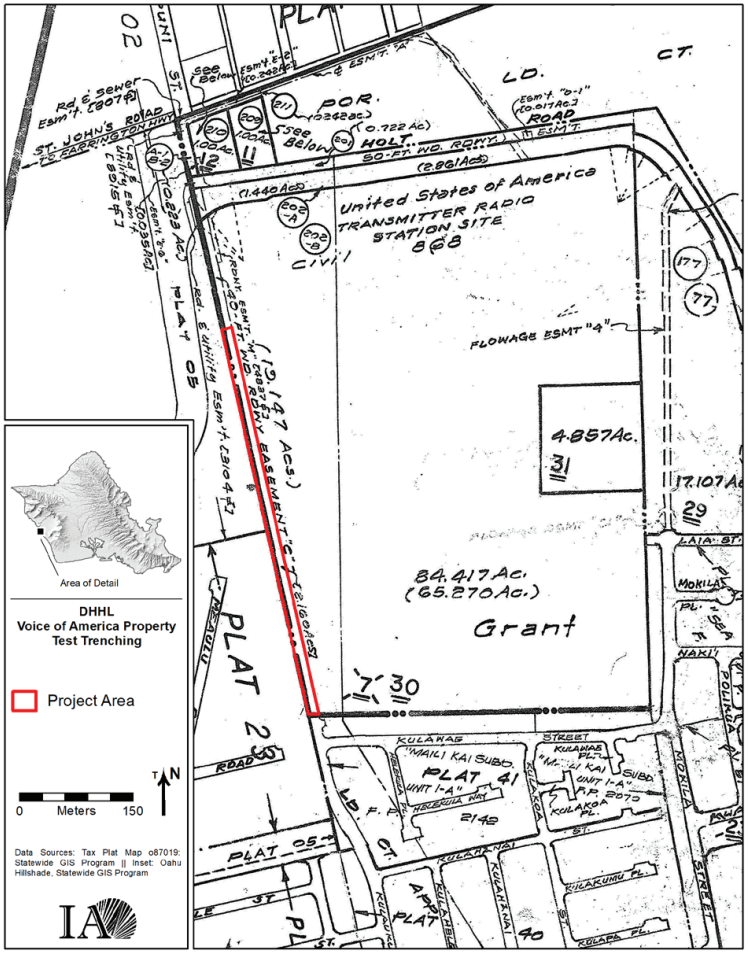

Figure 4. The Kulaaupuni Street Road Extension Corridor project area with TMK boundaries.

U.S. Military

The presence of the U.S. military in Lualualei and adjacent areas of leeward O‘ahu began incrementally in 1917 but greatly expanded to become the major landholder in 1929. Camp Andrew, a 31-acre military recreation area, was created along the Nānākuli coast in 1917 (Nakamura and Pantaleo 1994). In 1918, the U.S. Army established an amphibious training camp at Pōka‘i Bay as part of the Wai‘anae Military Reservation (Flood et al. 1994), and Kolekole Road was improved to provide access to the bay in 1923 (Kelly 1991). Between 1929 and 1933, the U.S. Navy obtained approximately 8,000 acres at the head of Lualualei Valley to establish the Naval Ammunition Depot and Naval radio transmission station. Infrastructure at the Ammunition Depot was expanded during World War II (WWII) with the construction of additional magazines, storage buildings, and houses (Landrum et al. 1997). During this time, the OR&L laid railroad tracks into the valley so that the military could transport munitions to the storage areas (Kelly 1991:340). After the end of WWII, the Lualualei Branch experienced renewed activity during the Korean War. Between the late 1980s and late 1990s, it was downsized significantly and now functions primarily as an ammunition depot.

In 1944, the Voice of America radio transmitter station was constructed in Mā‘ili. The station operated until at least 1964, and in 1971 the property was transferred to the U.S. Coast Guard for use as a transmitting station. The VOA antenna and transmission buildings were razed in the 1980s with remediation of hazardous materials beginning in 2018.

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

A substantial portion of Lualualei Valley has been subject to archaeological research, including an AIS of the entire DHHL VOA property by Rieth (2009) and Dagher and Spear (2013) (Table 1-Table 2;Figure 5-Figure 6).

Archaeology Investigations Outside of the Project Area

Several studies are relevant to the current project: archaeological investigations within the Mā‘ili Kai Property to the east and south of the project area (Barrera 1975; Cordy 1976; Jimenez 1994; Mayberry and Rosendahl 1994) and an archaeological assessment for the transitional housing at the northwestern corner of the project area (Tulchin and Hammatt 2007, 2008).

Barrera (1975) surveyed approximately 80 acres within the Mā‘ili Kai parcel and documented six sites (Sites 50-80-07-5309 through 5314). These sites are a possible religious structure, C-shape, two house site features, one possible site, and a subsurface midden scatter (Barrera 1975). Cordy (1975) conducted archaeological excavations at Site 50-80-07-5309 and determined that there was no evidence to support Barrera’s interpretation it was a religious structure; the site was determined to be a historical structure built no earlier than 1930-1940. Cordy (1976) also conducted an additional survey of 130 acres within Mā‘ili Kai (parcel previously referred to as the Kaiser Pacific Properties Land in Mā‘ili) which resulted in the identification of 19 sites, most of which are rock walls.

Mayberry and Rosendahl (1994) conducted a reconnaissance survey of the approximately 415-acre Mā‘ili Kai Property. Twenty-six sites were documented, 12 of which were newly identified (Sites 50-80-07-3333 to 3344), and 14 were re-located from previous survey work. Eleven previously recorded sites were not re-located and were determined to have been destroyed by land modification related to large-scale ranching, land clearing, and quarrying. Twenty-four of the 26 sites date to the 20th century. Jimenez (1994) completed an additional inventory survey at four archaeological sites (Sites 50-80-07-3339, 3344, 3750, and 3755)

previously recommended for further data collection by Mayberry and Rosendahl (1994). The findings of the additional work confirmed the initial site interpretations presented by Mayberry and Rosendahl (1994), with the exception of Site 50-80-07-3750. Excavations at Site 50-80-07-3750 resulted in the documentation of a cultural deposit containing small amounts of marine shell, charred *kukui* (*Aleurites molucanna*) endocarp, and charcoal. A single radiocarbon date (Beta-69585) indicates occupation may have begun sometime between the 15th to 17th centuries.

Tulchin and Hammatt (2007, 2008) surveyed a 6-acre parcel at the northern end of the VOA corridor and documented a single VOA antenna pedestal foundation (recorded as Site 50-80-07-7081 Feature 1 by Rieth 2009). No traditional Hawaiian features were documented.

Archaeological work along the shoreline to the west has documented intact pre-Contact cultural deposits (McDermott and Hammatt 2000) and burials (Hammatt and Shideler 1991). McDermott and Hammatt's (2000) inventory survey of 'Ulehawa Beach Park documented two subsurface cultural strata approximately 1 m below the surface (Sites 50-80-07-5762 and 5763) that contained vertebrate and invertebrate midden, and traditional and historical artifacts. The deposits are interpreted as being intermittent or temporary habitation locales that likely date to the late pre-Contact or very early post-Contact periods.

Seven burials (Site 50-80-07-4224) were encountered during the installation of a Board of Water Supply water main on Liopolo Street (Hammatt and Shideler 1991). The relatively high density of the burials suggests this area was a specific pre-Contact burial site for one or more Hawaiian families (Hammatt and Shideler 1991).

ARCHAEOLOGICAL INVESTIGATION WITHIN THE PROJECT AREA

Rieth (2009) and Dagher and Spear (2013) completed archaeological inventory surveys of the DHHL VOA parcel, including the road extension corridor. Three sites were recorded, none of which are within the current project area. Sites 50-80-07-7081 and 7082 are remnants of the VOA facility. Site 50-80-07-7081 consists of 18 concrete pedestal foundations for the former VOA antenna array and a historical trash dump. Rieth (2009) originally documented the site as including 16 pedestals, with Dagher and Spear (2013) recording two additional pedestals and the trash dump. The pedestal foundations are configured in three nearly linear parallel arrangements oriented northeast-southwest and extending across the length of the parcel. Site 50-80-07-7082 included four features that are the remnants of the VOA transmitter buildings and associated structures. All of these features were destroyed or razed to the post-hazardous material removal surface in 2018.

Site 50-80-07-7083 is a drylaid masonry structure Rieth (2009) interprets as a Waianae Company elevated railroad bed and Dagher and Spear (2013) interpret as a plantation cart path. The originally continuous structure is divided into three segments by breaches created during the construction of the VOA facility. It is constructed with dry laid angular and tabular basalt and coral boulders and cobbles. The faces of the structure have a slight batter angle. Basalt boulders are often present as the lower courses, with the majority of the structure constructed with limestone boulders and slabs.

Table 1. Archaeological Projects within 1.0 km of the Project Area; Listed Chronologically.

Author(s)	Description	Location
Barrera (1975)	Reconnaissance survey; 6 sites (religious structure, C-shape, two house site features, a possible site, and a subsurface midden scatter)	Mā'ili Kai Property (previously Kaiser Pacific Properties Corp. land)
Cordy (1975)	Excavation of Site 5309 (Ch-Oa-1) (possible religious structure first recorded by Barrera [1975])	Mā'ili Kai Property (previously Kaiser Pacific Properties Corp. land)
Cordy (1976)	Reconnaissance survey; 19 sites (walls, highly disturbed sites, or seemingly recent)	Mā'ili Kai Property
Hammatt and Shideler (1991)	Burial recovery of inadvertent finds during archaeological monitoring for Board of Water Supply water main; Site 50-80-07-4224	Liopolo Street
Mayberry and Rosendahl (1994)	Reconnaissance survey within Mā'ili Kai Property (TMK 8-7-10: 2, 14); 26 sites were found (14 previously recorded [Cordy 1976])	Mā'ili Kai Property (TMK 8-7-10:2, 14)
Jimenez (1994)	Additional AIS within Mā'ili Kai property; Sites 50-80-07-3339, 3344, 3750, 3755 (previously identified)	Mā'ili Kai Property
McDermott and Hammatt (2000)	Inventory survey; Site 50-80-12-9714 (previously recorded) and Sites 50-80-07-5761, 5762, 5763	'Ulehawa Beach Park Parcel (TMK 8-7-05:01, 03; 8-7-06:01; 8-7-07:01; 8-7-08:26)
Tulchin and Hammatt (2007, 2008)	Inventory survey; no sites	Northwest corner of VOA property
Rieth (2009)	Inventory survey; Sites 50-80-07-7081, 7082, 7083	DHHL VOA property
Dagher and Spear (2013)	Inventory survey; Sites 50-80-07-7081, 7082, 7083 (previously identified)	DHHL VOA property

Table 2. Summary of Sites within 1.0 km of the Project Area.

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3333	Complex; one standing structure, two collapsed structures, and associated post-WWII trash; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3334	Complex; cement and rock charcoal kiln, two collapsed wood and tin structures, small rock cairn; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3335	Sinkhole/well and wall; destroyed between 1987 and 1993; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994) , Jimenez (1994)
3336	Complex; two modified natural sinkholes, stone wall, two channeled concrete slabs; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3337	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3338	Complex; two small rock mounds; (not depicted in Figure 6)	Unknown	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3339	Two stone enclosures and a wall; (not depicted in Figure 6)	Unknown	Mā‘ili Kai Property	Mayberry and Rosendahl (1994), Jimenez (1994)
3340	C-shaped enclosure; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3341	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3342	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3343	Stone wall enclosure and associated C- shape; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3344	Platform; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994), Jimenez (1994)
3345	Rock mound and wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3346	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3347	Rock wall associated with Sites 3345 and 3346	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3348	Two circular mounds	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3349	C-shaped stone wall enclosure (or semi-enclosure) and a smaller wall	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3750	C-shape stone wall enclosure	15th to 17th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994) , Jimenez (1994)
3751	Rock mound	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3752	Two small low rock mounds	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3753	Rock mound	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3754	Stone bridge and shallow trench	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3755	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994) , Jimenez (1994)
3756	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3757	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3758	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
4224	Burial area (seven localized burials)	Pre-Contact	Liopolo Street, Mā‘ili	Hammatt and Shideler (1991)
5309	Possible religious structure; destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975), Cordy (1975)
5310	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5311	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5312	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5313	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5314	Subsurface midden scatter	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
5761	Three concrete bunkers and two foundations (not depicted in Figure 6)	WWII era	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
5762	Subsurface cultural layer (not depicted in Figure 6)	Pre-Contact or early post-Contact	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
5763	Subsurface cultural layer (not depicted in Figure 6)	Pre-Contact or early post-Contact	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
7081	VOA Antenna Foundations	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
7082	VOA Building Foundations and Support Structures	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
7083	Probable Sugarcane Railroad Bed	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
9714	Tracks of O.R.&L. Railroad line (not depicted in Figure 6)	Late 19th century	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
Ch-Oa-11	Stone wall; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-17	Central enclosure of two stone alignments; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-18	Stone enclosure; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-25	Rectangular stone platform; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-27	Trail (300 m long); destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)

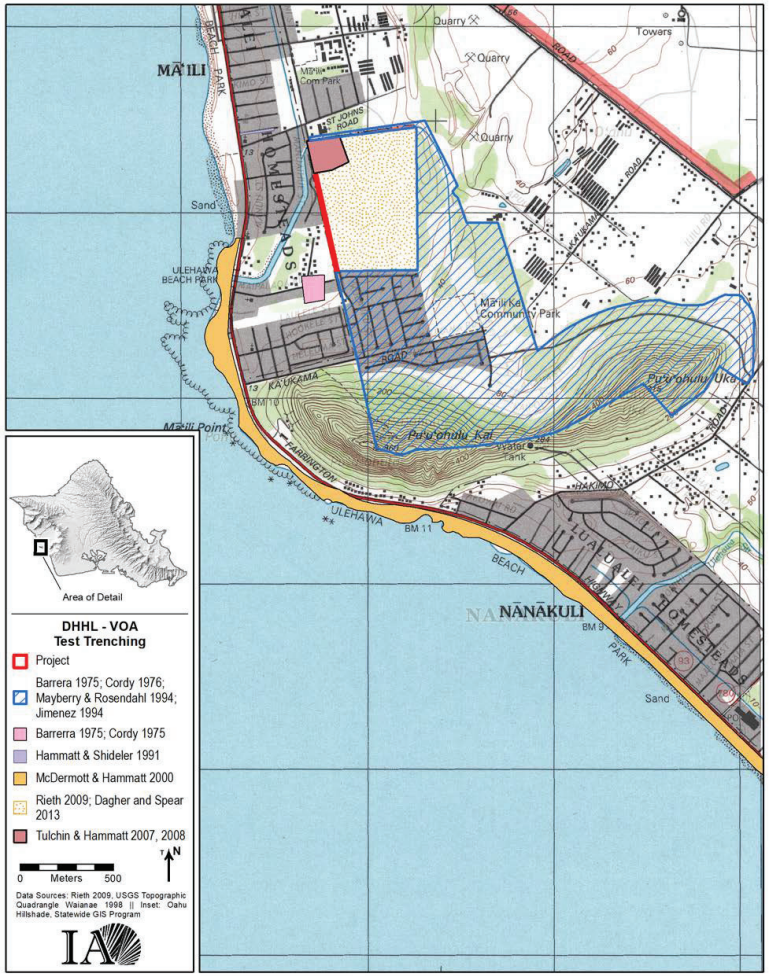

Figure 5. Previous archaeological investigations within 1 km of the project area.

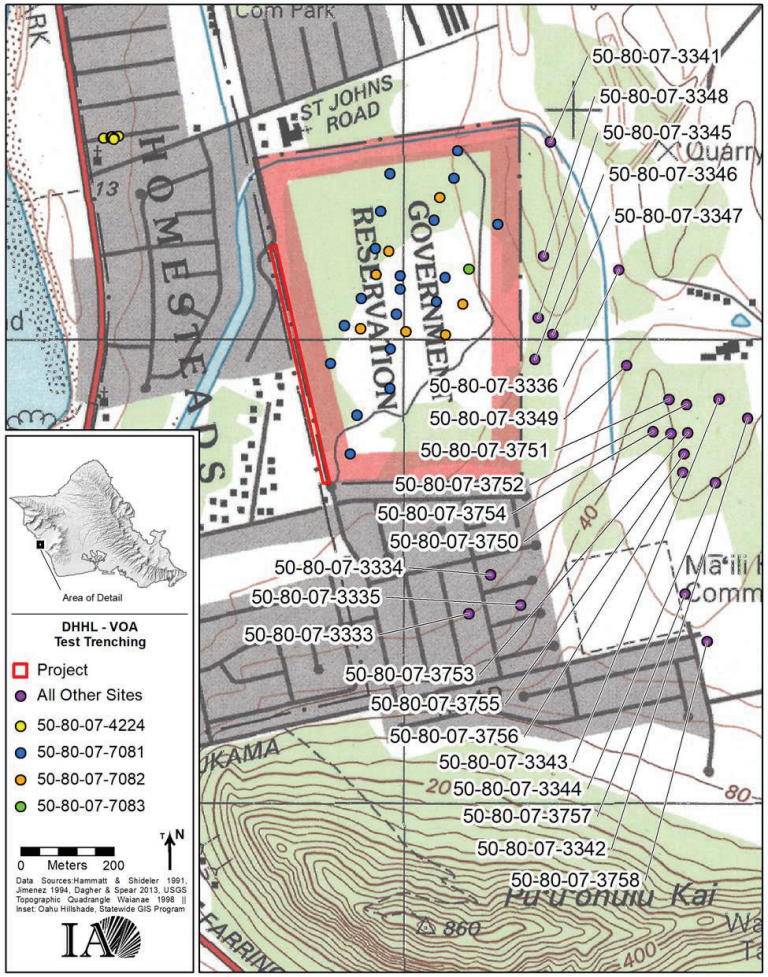

Figure 6. Previously identified archaeological sites near the project area.

III. RESEARCH METHODS

This section presents the project's research questions and fieldwork procedures.

RESEARCH QUESTIONS

Four research questions guided the survey and data analyses.

1) What is the depositional and soil forming sequence for the project area? Both natural and cultural deposits were assessed as to the depositional agent(s) and mode(s) that created them, what soils are present and how they formed, and the condition of the deposits.

2) Are pre-Contact cultural deposits present? If so, what activities are represented? As noted, legendary and historical evidence suggest the project area and surrounding areas were locations used for pre-Contact habitation.

3) Are historical period cultural deposits present? If so, what activities are represented? Sugarcane production was present in Lualualei during the late 19th and early 20th century, and it is possible that other agricultural activities took place in this area. These historical activities may have created archaeological deposits.

4) Are burials or isolated human skeletal remains present? Previous archaeological investigations along the coastline to the west have documented burials and isolated human skeletal remains.

FIELDWORK METHODS

The project area was systematically surveyed with transect lines spaced a few meters apart. Following the survey, four test trenches were mechanically excavated at locations distributed across the project area. Trenches ranged from 4.8-10.4 m long, and all trenches were 0.65 m wide and were excavated to an average depth of 1.0 m bs. All trenches were excavated with a mini excavator under the supervision of the Project Director and Field Technician. Exposed sediments and soils were examined for cultural material. Soils were documented following U.S. Soil Survey and Soil Conservation Service nomenclature (Soil Science Division Staff 2017) for texture; structural grade, size, and form (or absence of structure); dry or moist consistence; wet consistence (stickiness, plasticity); root frequency and size; presence of charcoal or other cultural materials; and lower boundary distinctness and topography. Color was recorded using the Munsell color system (Munsell 2000). Each deposit was also examined for signs of sedimentary structures such as bedding, and for any other additional information (e.g., evidence for basaltic or coralline origin) that can help clarify depositional and soil forming history. Scaled stratigraphic profiles were drawn for at least one long sidewall of each trench. Each profiled trench exposure was photographed using a Samsung Galaxy Tab S3 tablet, and the photographs were curated with the other archaeological project records. All trenches were backfilled at the end of the work day.

The locations of the trenches were recorded with a Trimble Geo 7X Global Positioning System (GPS) unit using the North American Datum of 1983 in Universal Transverse Mercator Zone 4 North (NAD 83 UTM 4N). GPS data were differentially corrected to produce data with submeter accuracy.

IV. RESULTS

This section presents the fieldwork results and is organized as follows.

RESULTS OF SUBSURFACE TESTING AND STRATIGRAPHIC INTERPRETATIONS

The four trenches were spaced at about 70 m intervals along the proposed full road extension corridor (Figure 7). Strata were correlated between the trenches with six primary layers (Layers I-VI) documented. Table 3 presents the descriptions of these layers and interpretations about their deposition. General consistencies in stratigraphy were documented across the project area. Appendix B presents individual soil and sediment descriptions for each trench.

TRENCH 1

Trench 1 was the northernmost excavation and was closest to the intersection of Kulaaupuni Street and Holt Road. The trench was behind 87-87122 Mamoalii Place. Trench 1 was 4.8 m long, 0.65 m wide, and 1.0 m deep (Photo 2; Figure 8). A buried fiber optic line conduit was exposed at 90 cm bs. Rainwater collecting within the conduit flooded the base of the trench and prohibited further excavation (Photo 3). No archaeological deposits were present. Recent fills atop alluvium were recorded.

TRENCH 2

Trench 2 was approximately 70 m southeast of Trench 1 along the road corridor. The trench was behind 226 Mamoalii Place. Trench 2 was 7.3 m long, 0.65 m wide, and 1.1 m deep (Photo 4; Figure 9). The water table was present around 1.0 m below surface. A modern *imu* originating from a fill (Layer Ia) was documented on the west wall of the trench. The *imu* extended to 78 cm bs. A modern concrete slab was encountered at 20 cm bs in the west and north walls, which prohibited further excavation in this portion of the trench. No archaeological deposits were present and recent fills capping several alluvial strata were recorded.

TRENCH 3

Trench 3 was approximately 90 m south-southeast of Trench 2, behind 87-702 Mealu Road. It was 10.4 m long, 0.65 m wide, and 1.35 m deep, ending at limestone bedrock (Photo 5; Figure 10). No archaeological deposits were present and recent fill capping two alluvial strata were recorded.

TRENCH 4

Trench 4 was the southernmost excavation, just west of the Kamehameha Schools' Community Learning Center and behind 87-722 Meaulu Road. It was 10 m long, 0.65 m wide, and 1.1 m deep, ending at limestone bedrock (Photo 6; Figure 11). Mottling of the upper fills and the presence of large concrete fragments, sawn tree roots and branches, and modern rubbish attest to recent mechanical ground disturbance. No archaeological deposits were present and recent fill capping two alluvial strata were recorded.

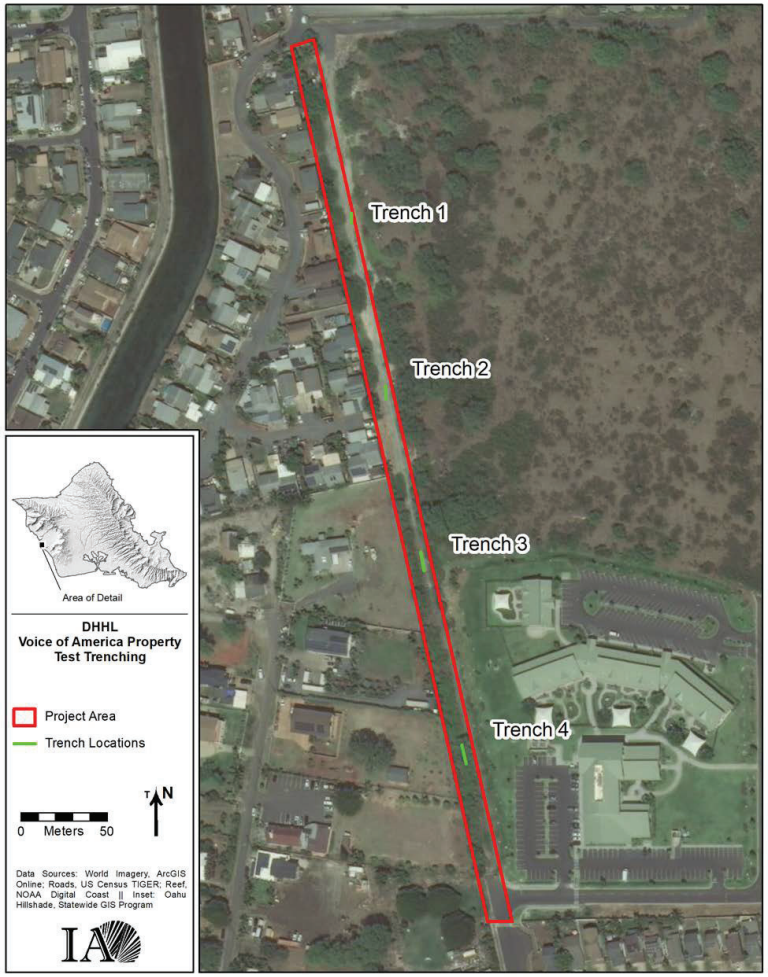

Figure 7. The locations of the trenches excavated within the project area.

Table 3. Soils and Sediments Documented Across the Project Area.

Layer	Interpretation	Description	Trenches
Ia	Fill	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	1, 2, 3, 4
Ib	Fill	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	1, 2
Ic	Fill	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	1, 2
Id	Fill	Very dark grayish brown (10YR 3/2) silt loam; moderate, coarse or thick, granular structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 10% subangular pebbles to cobbles; abrupt, wavy boundary	3
Ie	Fill	Very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; common, coarse roots; 15% subangular pebbles to cobbles; clear, wavy boundary	4
II	Alluvium	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic	1, 2, 3
IIIa	Alluvium	Light gray (10YR 7/2) clay; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; clear, wavy boundary	2
IIIb	Alluvium	Very dark grayish brown (10YR 3/2) clay loam; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; abrupt, wavy boundary	2

Layer	Interpretation	Description	Trenches
IV	Alluvium	Greenish gray (GLEY 1 6/5GY) sandy clay; weak structure; moist consistency: very friable; wet consistence: slightly sticky, slightly plastic; base of excavation	2
V	Alluvium	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; base of excavation	3, 4
VI	Alluvium	Very dark gray (10YR 3/1) sandy clay; weak structure; moist consistency: very friable; wet consistency: slightly sticky, plastic; base of excavation	4

Photo 2. West sidewall of Trench 1.

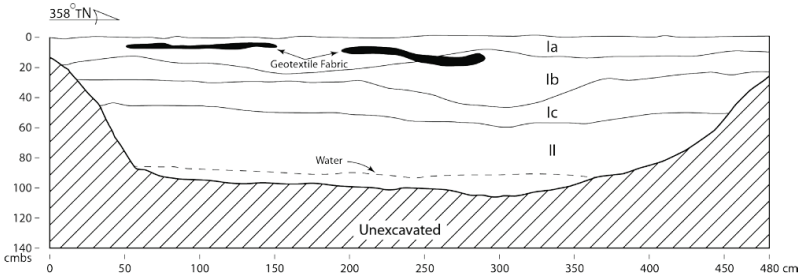

Figure 8. West sidewall of Trench 1.

Photo 4. West sidewall of Trench 2.

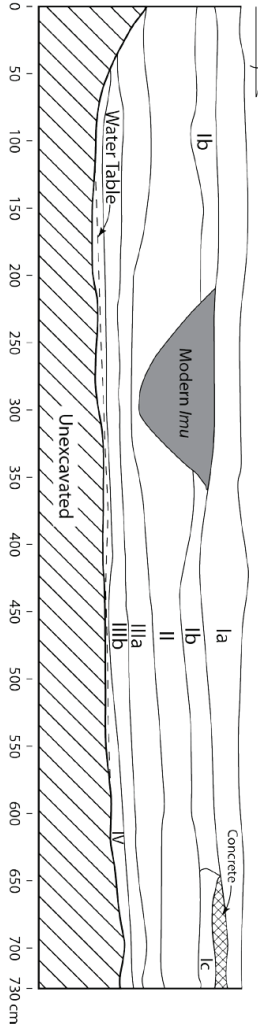

Figure 9. West sidewall of Trench 2.

Photo 3. Overview of Trench 1 after excavation; view to the north.

Photo 6. West sidewall of Trench 4.

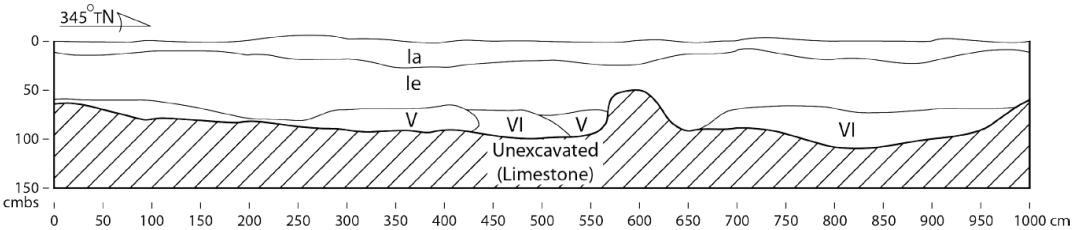

Figure 11. West sidewall of Trench 4.

Photo 5. West sidewall of Trench 3.

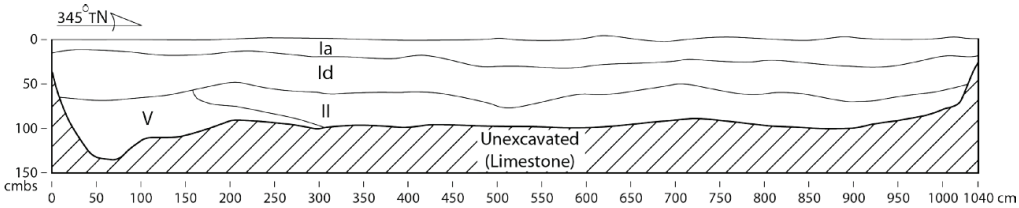

Figure 10. West sidewall of Trench 3.

V. DISCUSSION

The research questions outlined in Section III guided the analyses. These are addressed using data generated by the project along with results from other projects in the area.

1) What is the depositional and soil forming sequence for the project area?

The depositional sequence within the project area consists of three primary events. Basal reef-derived limestone bedrock formed during the last interglacial sea level highstand ca. 134-113,000 ka, associated with the Waimānalo reef formation (Fletcher et al. 2008:458). Multiple alluvial deposits accumulated atop the bedrock and formed soils (Layers II-VI). The alluvium is capped by multiple modern fills (Layers Ia-Ie) deposited by 20th century construction.

2) Are pre-Contact cultural deposits present? If so, what activities are represented?

No pre-Contact cultural deposits were observed.

3) Are historical period cultural deposits present? If so, what activities are represented?

No historical period cultural features or deposits were present in the project area.

4) Are burials or isolated human skeletal remains present?

No burials or human skeletal remains were encountered during excavations.

VI. CONCLUSION

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands, International Archaeology, LLC completed an archaeological inventory survey of the proposed Kulaaupni Street extension corridor. No archaeological sites were documented by the pedestrian survey and subsurface testing. No further work is recommended for the project area. However, if finds are encountered during construction, the State Historic Preservation Division should be contacted immediately.

REFERENCES

Allen, M.S.
2004 Bet-hedging Strategies, Agricultural Change, and Unpredictable Environments: Historical Development of Dryland Agriculture in Kona, Hawaii. *Journal of Anthropological Archaeology*, 23(2), pp.196-224.

Allen, Melinda S., and Jennifer M. Huebert
2014 Short-Lived Plant Materials, Long-Lived Trees, and Polynesian ^{14}C Dating: Considerations for ^{14}C Sample Selection and Documentation. *Radiocarbon* 56:257-276.

Barrera, William
1975 *Archaeological Site Survey at Mā'ili, O'ahu.* Prepared for Kaiser Pacific Properties Corporation. Chiniago, Inc., Kaneohe.

Cordy, Ross
1975 *Archaeological Excavation at CH-Oa-1 (Mā'ili, Oahu)*. Prepared for Kaiser Pacific Properties Corporation. Manuscript on file, State Historic Preservation Division, Department of Land and Natural Resources, Kapolei.

1976 *An Archaeological Survey of Kaiser Pacific Properties' Land, Mā'ili Kai, O'ahu.* Manuscript on file, Department of Land and Natural Resources-Historic Sites Section.

1996 The Rise and Fall of the O'ahu Kingdom: A Brief Overview of O'ahu's History. In *Oceanic Culture History: Essays in Honour of Roger Green* by Janet Davidson, Geoff Irwin, B. Leach, Andrew Pawley, and D. Brown (eds.), pp. 591-613. New Zealand Journal of Archaeology Special Publication.

2002 *The Rise and Fall of the O'ahu Kingdom*. Mutual Publishing, Honolulu.

Dagher, Cathleen A., and Robert L. Spear
2013 *An Archaeological Inventory Survey for the Kamehameha Schools Community Learning Center at Mā'ili, Lualualei Ahupua'a, Wai'anae District, Island of O'ahu, Hawai'i [TMK: (1) 8-7-010:007 (POR.)]* (Draft Report). Prepared for PBR Hawaii and Associates, Inc. Scientific Consultant Services, Honolulu.

Dixon, Boyd, Dennis Gosser, and Scott Williams
2008 Traditional Hawaiian Men's Houses and Their Socio-political Context in Lualualei, Leeward West O'ahu, Hawai'i. *Journal of the Polynesian Society* 117:267-295.

Dixon, Boyd, Dennis Gosser, Scott Williams, Jennifer Robins, Constance O'Hare, Laura Gilda, and Stephan Clark
2003 *Cultural Resources Survey of Selected Lands Naval Magazine Pearl Harbor, Lualualei Branch, Island of O'ahu, Hawai'i*. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. AMEC Earth and Environmental, Honolulu.

Dowsett Company, Limited
1903 Letter to the Superintendent of Public Works, Commissioner of Public Lands, and H. M. von Holt, Esq. 23 June 1903. Hawaii State Archives, Box 65.

Evening Bulletin
1903 "Senator McCandless Protests Against Lualualei Exchange." *Evening Bulletin* May 20, 1903. http://chroniclingamerica.loc.gov/lccn/sn82016413/1903-05-20/ed-1/seq-1/ (retrieved May 5, 2014).

Fletcher, Charles H., Chris Bochicchio, Chris L. Conger, Mary S. Engels, Eden J. Feirstein, Neil Frazer, Craig R. Glenn, Richard W. Grigg, Eric E. Grossman, Jodi N. Harney, Ebitari Isoun, Colin V. Murray-Wallace, John J. Rooney, Ken H. Rubin, Clark E. Sherman, and Sean Vitousek
2008 Geology of Hawai'i 'Reefs. In *Coral Reefs of the World*, Volume 1, edited by B.M. Riegl and R.E. Dodge, pp. 435-487, Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-6847-8_11

Flood, Krista, Paul Christiaan Kieger, Susan A. Lebo, Boyd Dixon, Stephan Clark, and Scot Parry
1994 *An Archaeological Inventory Survey and Mitigation Plan of a Seven Acre Parcel (TMK: 8-5-28: Por. 42) in Wai'anae Kai Ahupua'a, Wai'anae District, O'ahu Island, Hawai'i*. Prepared for Franklin Wong and Associates Limited. Bishop Museum Anthropology Department, Honolulu.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. United States Department of Agriculture Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station.

Fornander, Abraham
1880 *An Account of the Polynesian Race: Its Origin and Migrations and the Ancient History of the Hawaiian People to the Times of Kamehameha I; Volume II*. Trubner, London.

Giambelluca, Thomas W., Michael A. Nullet, and Thomas A. Schroeder
1986 *Rainfall Atlas of Hawai'i*. Department of Land and Natural Resources, Honolulu.

Green, Roger
1980 *Makaha Before 1880 A.D., Makaha Valley Historical Project-Summary; Report 5*. Pacific Anthropological Records 31. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Hammatt, Hallett H., and David W. Shideler
1991 *Archaeological Monitoring at Liopolo Street, Mā'ili 8" Water System, Part III, Mā'ili, Wai'anae, O'ahu, With a Discussion of Burial State Site No. 50-80-07-4244*. Cultural Surveys Hawai'i, Inc., Kailua.

Hawaiian Star
1903 "News in a Nutshell: Paragraphs That Give Condensed News of the Day." *The Hawaiian Star* May 21, 1903. http://chroniclingamerica.loc.gov/lccn/sn82015415/1903-05-21/ed-1/seq-8/, retrieved May 6, 2014.

Independent
1902 "Want Public Lands?" *The Independent* August 8, 1902. http://chroniclingamerica.loc.gov/lccn/sn85047097/1902-08-08/ed-1/seq-4/ (retrieved May 5, 2014).

1903 "Local and General News." *The Independent* June 12, 1903. http://chroniclingamerica.loc.gov /lccn/sn85047097/1903-06-12/ed-1/seq-3/ (retrieved May 5, 2014).

Jimenez, Joseph
1994 *Additional Archaeological Inventory Survey Mā'ili Kai Project Area, Land of Lualualei, Waianae District, Island of O'ahu*. Prepared for PBR Hawai'i. Paul H. Rosendahl, Ph.D., Inc., Hilo.

Kelly, Marion
1991 Notes on the History of Lualualei. In *An Archaeological Survey of the Naval Magazine and Naval Communications Area Transmission Facility Lualualei, O'ahu, Hawai'i* by Alan Haun. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Applied Research Group, Bishop Museum, Honolulu.

Landrum, James, Robert Drolet, and Katherine Bouthillier
1997 *Cultural Resources Overview Survey Naval Magazine Lualualei, Island of O'ahu, Hawai'i; In Conjunction with Department of Defense Legacy Resource Management Program: Demonstration Project #70.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Ogden Environmental and Energy Services Co., Inc., Honolulu.

MacDonald, Gordon A., Agatin T. Abbott, and Frank L. Peterson
1983 *Volcanoes in the Sea: The Geology of Hawaii*. University of Hawaii Press, Honolulu.

Mayberry, James, and Paul H. Rosendahl
1994 *Archaeological Reconnaissance Survey for Environmental Impact Statement (EIS) Maili Kai Property, Land of Lualualei,* Wai'anae District*, Island of O'ahu (TMK:8-7-10:2, 14)*. Prepared for PBR Hawai'i. Paul H. Rosendahl, Ph.D., Inc., Hilo.

McDermott, Matt. and Hallett H. Hammatt
2000 *Archaeological Inventory Survey of the 57.65 Acre 'Ulehawa Beach Park Parcel, Ahupua'a of Lualualei, Wai'anae District, Island of O'ahu (TMK:8-7-05:01, 03 and 05; 8-7-06:03; 8- 7-08:01; 8-7-08:26; 8-7-08:26)*. Cultural Surveys Hawai'i, Inc., Kailua.

Moffat, Riley M., and Gary L. Fitzpatrick
1995 *Surveying the Mahele*. Editions Limited, Honolulu.

Munsell (Color)
2000 *Munsell Soil Color Charts*. Revised washable edition. GretagMacbeth, New Windsor, New York.

Nakamura, Barry S., and Jeffrey Pantaleo
1994 *Aspects of the History of Lualualei and Nanakuli, Wai'anae District, O'ahu*. Prepared for DHM, Inc. Aki Sinoto Consulting, Honolulu.

Price, Saul
1973 Climate. In *Atlas of Hawaii* edited by R. Warwick Armstrong, pp. 53-60. University of Hawai'i Press, Honolulu.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
1974 *Place Names of Hawai'i*. University of Hawai'i Press, Honolulu.

Rieth, Timothy M.
2009 *An Archaeological Inventory Survey of the Former Voice of America Site, Mā'ili, Lualualei Ahupua'a, Wai'anae District, O'ahu; TMK: (1) 8-7-010:007*. Prepared for Element Environmental, LLC. International Archaeological Research Institute, Inc., Honolulu.

Rieth, Timothy M., and J. Stephen Athens
2013 Suggested Best Practices for the Application of Radiocarbon Dating to Hawaiian Archaeology. *Hawaiian Archaeology* 13:3-29.

Sahlins, Marshall
1992 Historical Ethnography. Volume I. In *Anahulu: The Anthropology of History in the Kingdom of Hawai'i* by Patrick V. Kirch and Marshall Sahlins (eds.). University of Chicago Press, Chicago.

Soehren, Lloyd J.
2002-2004 Ulukau: The Electronic Hawaiian Dictionary; Hawaiian Place Names. http://ulukau.org/cgi-bin/hpn?l=en.

Soil Science Division Staff
2017 *Soil Survey Manual*. United States Department of Agriculture Handbook No. 18. Government Printing Office, Washington, D.C.

Sterling, Elspeth, and Catherine Summers
1978 *Sites of Oahu*. Bernice Pauahi Bishop Museum Press, Honolulu.

Tulchin, Jon, and Hallett H. Hammatt
2007 *Archaeological Assessment for the Leeward Coast Emergency Homeless Shelter Project, Lualualei Ahupua 'a, Wai'anae District, Island of O'ahu (TMK: [1] 8-7-010:007)*. Prepared for Stanford Carr Development, LLC. Cultural Surveys Hawai'i, Inc., Kailua.

2008 *Addendum to an Archaeological Assessment for the Leeward Coast Emergency Homeless Shelter Project, Lualualei Ahupua'a, Wai'anae District, Island of O'ahu (TMK: [1] 8-7- 010:por. 007)*. Prepared for Stanford Carr Development, LLC. Cultural Surveys Hawai'i, Inc., Kailua.

United States Army Corps of Engineers
1913 Island of Oahu, Territory of Hawai'i Sheet IX [map]. (1:18000).

GLOSSARY OF HAWAIIAN WORDS

Hawaiian Spelling	Definition
ahupuaʻa	land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (ahu) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief
akua	god, goddess, spirit, ghost, devil, image, idol, corpse
aliʻi	chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander
ʻili ʻāina	an ʻili land division whose chief pays tribute to the chief of the ahupuaʻa of which it is a part, rather than directly to the king
imu	underground oven
kalo	taro, *Colocasia esculenta*
kapa	paperbark cloth; as made from *wauke* or *māmaki* bark; formerly clothes of any kind or bedclothes
kiawe	introduced leguminous tree (first planted in Hawaiʻi in 1828), *Prosopis pallida*
koa haole	introduced leguminous tree, *Leucaena leucocephala*
konohiki	head man of an ahupuaʻa land division under the chief
kula	plain, field, open country, pasture; "an act of 1884 distinguished dry or kula land from wet or taro land" (Pukui and Elbert 1986:178)
kuleana	small piece of property, as within an ahupuaʻa; right, privilege, concern, title, property, estate, portion, interest, claim, ownership
loʻi	irrigated terrace, especially for taro (*loʻi kalo*)
makaʻāinana	commoner
moku	district; island
pili	grass used for construction material, *Heteropogon contortus*
ʻuala	sweet potato, *Ipomoea batatas*
wauke	paper mulberry, *Broussonetia papyrifera*

* Adapted from Mary K. Pukui and Samuel H. Elbert, 1986, *Hawaiian Dictionary*, University of Hawaii Press, Honolulu, unless otherwise noted.

APPENDIX A: SHPD REVIEW LETTERS

INTERNATIONAL ARCHAEOLOGY, LLC

November 2, 2020

Dr. Alan Downer
SHPD Administrator
Kakuhihewa Building
601 Kamokila Blvd., Suite 555
Kapolei, Hawai‘i 96707

SUBJECT: Proposed Archaeological Inventory Survey Subsurface Testing Plan for the Department of Hawaiian Homelands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā‘ili, Lualualei Ahupua‘a, Wai‘anae District, Island of O‘ahu TMK: (1) 8-7-010:007 (portion). [IA201947]

Dear Mr. Downer;

Based on a November 6, 2019, meeting with Susan Lebo, Andrew McCallister, and Samantha Cragen to discuss the Department of Hawaiian Homelands (DHHL) planned development of the Voice of America (VOA) (also referred to as the "Coast Guard site") property, we are submitting an archaeological inventory survey (AIS) subsurface testing plan (see Log. 2017.00028, Doc. 1709SH05 for earlier correspondence about this project). As part of the residential development at the former VOA site, DHHL is proposing a road extension from the intersection of Kulaaupuni Street and Holt Road to the Kulawae and Kulauku Streets intersection 525 m to the south (Figure 1-Figure 3). We are proposing the systematic pedestrian survey of the road extension corridor and the mechanical excavation of four trenches. These trenches will allow for the opportunity to document sedimentary and soil stratification within the corridor and test for buried archaeological deposits. Figure 4 presents the proposed locations of the trenches. These locations have not been ground-truthed and it is possible that substitutions or adjustments in placement may be required; any changes would be coordinated with the SHPD.

The AIS will be completed independently of the to-be-determined mitigation measures for Sites 50-80-08-7081 (former VOA antenna foundations), 7082 (VOA transmitter building remnants), and 7083 (masonry railroad berm), which are located outside of the road extension corridor but within the larger development area.

Subsurface Testing Methods

Trenches will be mechanically excavated with a backhoe under the direct supervision of the Project Director. They will range from 8-10 m long by 0.8 m wide, with depths dictated by findings (based on previous trenching in the former VOA site, most are expected to be dug to less than 1 m bs). Soil will be removed in roughly 10-15 cm lifts. If a possible archaeological deposit is encountered, the archaeologist will halt the mechanical excavation and will manually inspect the soil. This may entail the excavation of a shovel probe and screening of the soil to determine the presence/absence of archaeological material. If an archaeological deposit or feature is confirmed, the SHPD will be consulted on additional actions.

PREHISTORIC & HISTORIC INVESTIGATIONS • CULTURAL RESOURCES ASSESSMENTS & PLANNING • PALEOENVIRONMENTAL STUDIES

HAWAI‘I: 2081 Young Street, Honolulu, Hawai‘i 96826-2231 - Tel: (808) 946-2548 - Fax: (808) 943-0716 - E-mail: HonoluluOffice@internationalarchaeologyllc.com
GUAM: P.O. Box 22621, GMF, Guam 96921 - Tel/Fax: (671) 646-7552 - E-mail: GuamOffice@internationalarchaeologyllc.com

Scaled profile drawings will be completed for at least one of the long sidewalls in each trench. Soils will be described and trench sidewalls and locations will be photographed. Stratigraphic profiles and soil descriptions will be described using a fresh vertical face. The following soil characteristics will be recorded, at a minimum: color, including moisture condition (wet, moist, dry) when color read; texture; structural grade, size, and form (or absence of structure); dry or moist consistence; wet consistence (stickiness, plasticity); root frequency and size; presence of charcoal or other cultural materials; and lower boundary distinctness and topography (Munsell Color 2000; Soil Science Division Staff 2017). Each deposit will be examined for signs of sedimentary structures such as bedding, and for any other information (e.g., evidence for basaltic or coralline origin) that can help to clarify depositional and soil forming history.

The locations of all trenches will be recorded using a professional-grade Trimble GPS unit using the North American Datum of 1983 (NAD 83) in Universal Transverse Mercator Zone 4 North (UTM 4N). Data will be differentially corrected.

Laboratory Analyses

Artifacts and faunal remains recovered from the trenches will be cleaned, sorted, and analyzed. Artifacts will be classified by material and form, and metric and nonmetric characteristics will be recorded. Faunal remains will be sorted to the lowest taxonomic categories possible using standard reference guides and collections.

Reporting

The survey, trenching, and laboratory results will be presented in an archaeological inventory survey report that conforms to HAR §13-276-5.

* * * * * *

Please do not hesitate to contact me if you should have any questions or concerns. I can be reached at (808) 946-2548, ext. 115 or at dfilimoehala@iarii.org.

Thank you,

Darby Filimoehala

Darby Filimoehala
Project Director

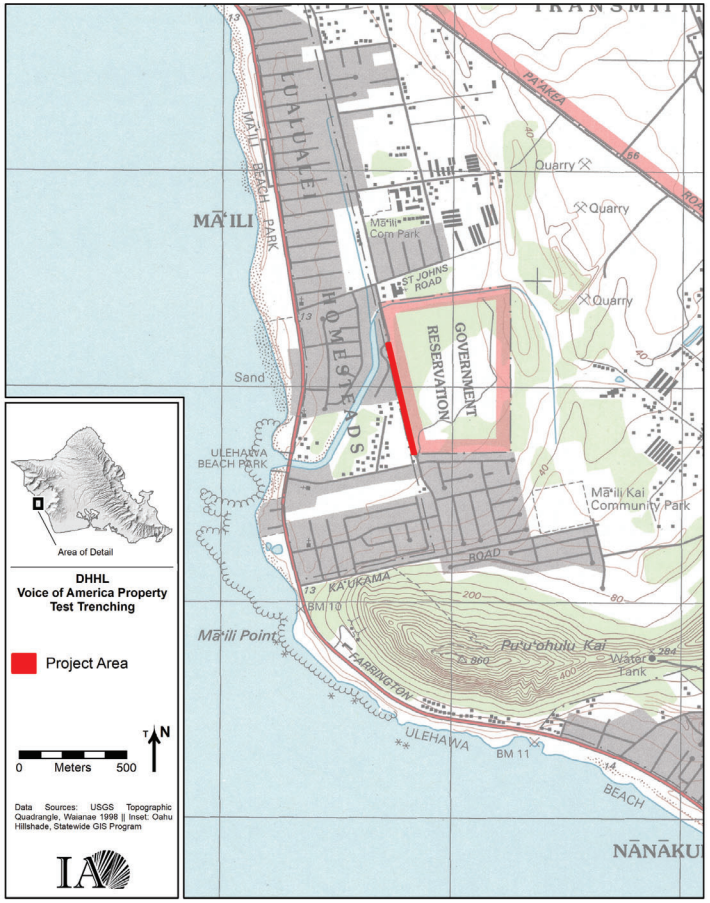

Figure 1. Location of the Kulaaupuni Street Road Extension Corridor project area, shown in red (base map is 1998 Wai'anae Quadrangle).

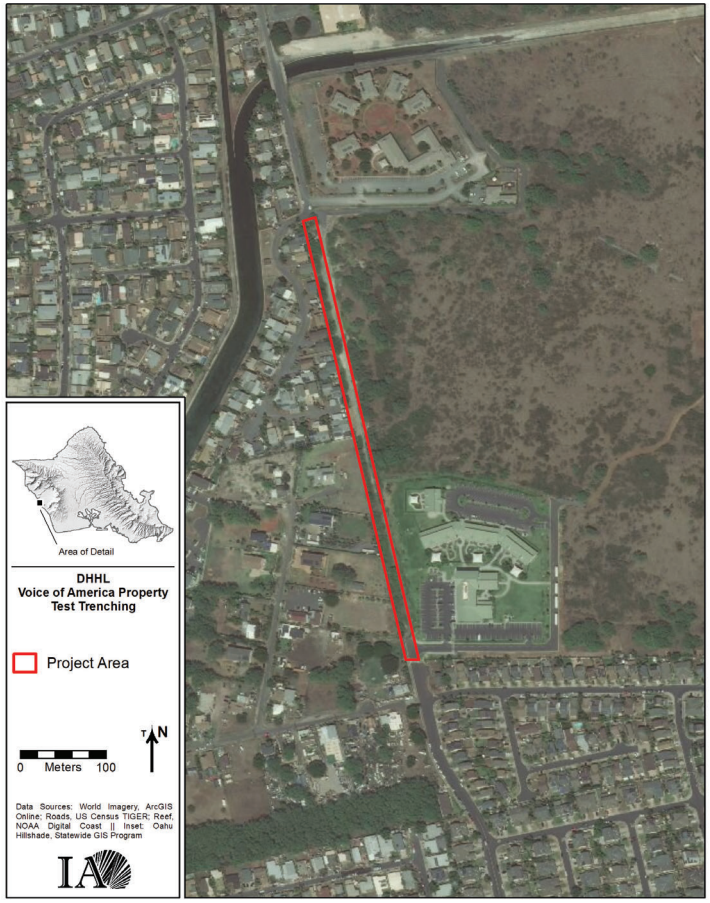

Figure 2. Detail of the Kulaaupuni Street Road Extension Corridor on World Imagery Aerial.

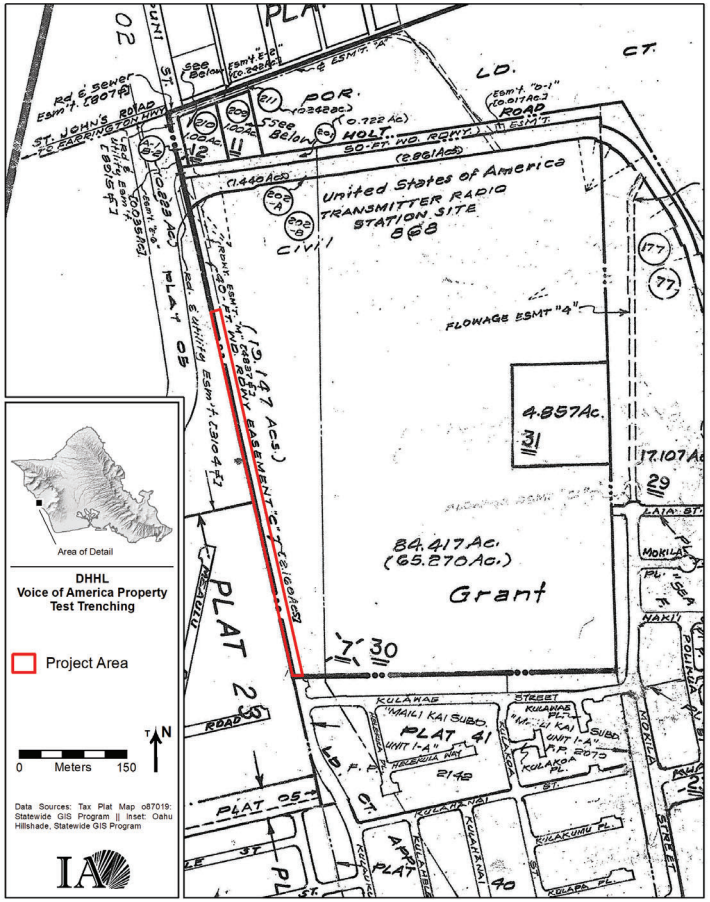

Figure 3. The Kulaaupuni Street Road Extension Corridor project area with TMK boundaries.

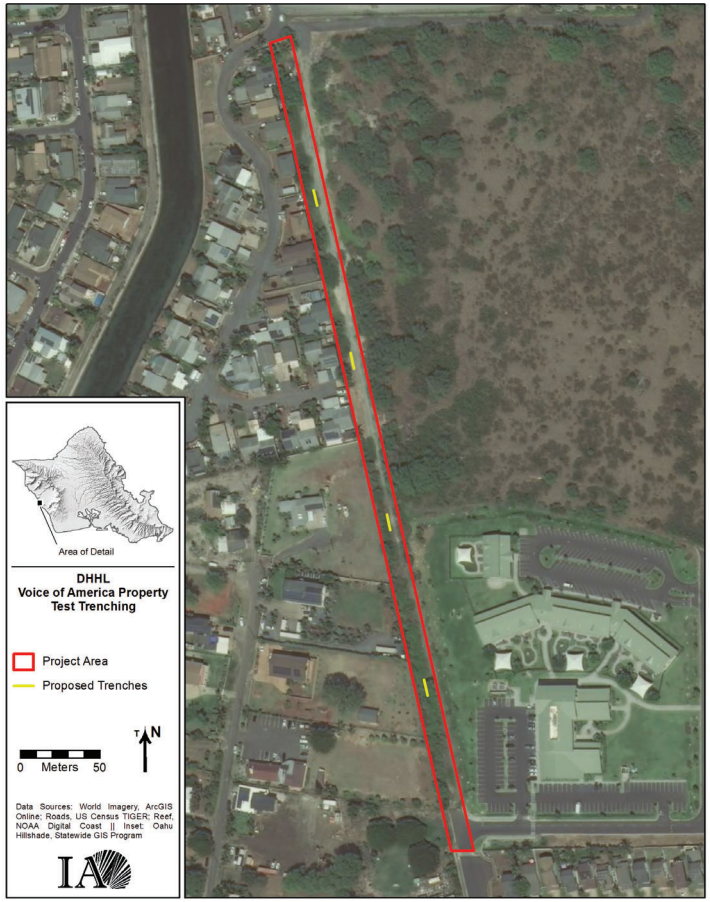

Figure 4. Proposed trench locations.

Darby Filimoehala <dbrown@iarii.org>

RE: [EXTERNAL] DHHL VOA, Kulaaupuni Street Road Corridor Extension, Proposed AIS Testing Plan

1 message

Hemenway, Samantha <samantha.hemenway@hawaii.gov> Thu, Nov 19, 2020 at 3:55 PM
To: Darby Filimoehala <DFilimoehala@iarii.org>, "Lebo, Susan A" <susan.a.lebo@hawaii.gov>
Cc: Timothy Rieth <TRieth@internationalarchaeologyllc.com>, Toby Hanzawa <thanzawa@grayhongnojima.com>, Sheryl Nojima <snojima@grayhongnojima.com>

Hello,

SHPD approves this AIS testing plan.

Please coordinate with SHPD if any adjustments to the trenches are needed.

Thank you,

Samantha C. Hemenway

O'ahu Island Archaeologist

State Historic Preservation Division

Department of Land and Natural Resources

Kakuhihewa Building

601 Kamakila Blvd., Suite 555

Kapolei, HI 96707

(808) 692-8011

From: Darby Filimoehala <DFilimoehala@iarii.org>
Sent: Monday, November 2, 2020 9:39 AM
To: Lebo, Susan A <susan.a.lebo@hawaii.gov>; Hemenway, Samantha <samantha.hemenway@hawaii.gov>
Cc: Timothy Rieth <TRieth@internationalarchaeologyllc.com>; Toby Hanzawa <thanzawa@grayhongnojima.com>; Sheryl Nojima <snojima@grayhongnojima.com>
Subject: [EXTERNAL] DHHL VOA, Kulaaupuni Street Road Corridor Extension, Proposed AIS Testing Plan

Good morning Susan and Samantha,

Based on a November 6, 2019, meeting with the SHPD to discuss the Department of Hawaiian Homelands (DHHL) planned development of the Voice of America (VOA) (also referred to as the "Coast Guard site") property, we are submitting the attached archaeological inventory survey (AIS) subsurface testing plan.

Please do not hesitate to contact me if you should have any questions or concerns.

Darby

--

Darby Filimoehala, M.A.
Project Director and Laboratory Manager

International Archaeological Research Institute Inc.
2081 Young Street
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APPENDIX B: TEST TRENCH SOIL AND SEDIMENT DESCRIPTIONS AND INTERPRETATIONS

Trench	Layer	Layer Depths	Description	Interpretation
1	Ia	0-25 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
1	Ib	10-45 cm bs	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	Fill
1	Ic	22-60 cm bs	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	Fill
1	II	45-100 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; base of excavation	Alluvial deposit
2	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
2	Ib	15-45 cm bs	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	Fill
2	Ic	15-30 cm bs	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	Fill

Trench	Layer	Layer Depths	Description	Interpretation
2	II	42-80 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; abrupt, wavy boundary	Alluvial deposit
2	IIIa	60-90 cm bs	Light gray (10YR 7/2) clay; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; clear, wavy boundary	Alluvial deposit
2	IIIb	70-100 cm bs	Very dark grayish brown (10YR 3/2) clay loam; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; abrupt, wavy boundary	Alluvial deposit
2	IV	80-110 cm bs	Greenish gray (GLEY 1 6/5GY) sandy clay; weak structure; moist consistency: very friable; wet consistence: slightly sticky, slightly plastic; base of excavation	Alluvial deposit
3	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
3	Id	10-75 cm bs	Very dark grayish brown (10YR 3/2) silt loam; moderate, coarse or thick, granular structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 10% subangular pebbles to cobbles; abrupt, wavy boundary	Fill
3	II	50-100 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; abrupt, wavy boundary	Alluvial deposit
3	V	58-135 cm bs	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; base of excavation	Alluvial deposit

Trench	Layer	Layer Depths	Description	Interpretation
4	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
4	Ie	10-90 cm bs	Very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; common, coarse roots; 15% subangular pebbles to cobbles; clear, wavy boundary	Fill
4	V	60-98 cm bs	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; clear, wavy boundary	Alluvial deposit
4	VI	64-110 cm bs	Very dark gray (10YR 3/1) sandy clay; weak structure; moist consistency: very friable; wet consistency: slightly sticky, plastic; base of excavation	Alluvial deposit

APPENDIX D

REPORT ON UAV-BASED MAGNETIC SURVEY, AUGUST 2020

DUDEK
970 NORTH KALAHEO AVENUE
KAILUA, HAWAII 96734
T 808.202.0022 F 808.892.2001

August 5, 2020

Arlene Campbell, LG
Element Environmental LLC
98-030 Hekaha Street, Unit 9
Aiea, Hawaii 96701

Subject: Report on UAV-Based Magnetic survey for the purpose of UXO and other ferrous material detection in the Ma'ili site.

Aloha Arlene:

This report describes a UAV-Based UXO and infrastructure detection survey carried out by DUDEK at the project site located in Ma'ili, HI, (21.414079°, -158.169512°) over approximately 50 acres.

The principal geophysical sensors included a Geometrics MFAM magnetometer system mounted on a UAV platform and a Gem Systems GSM-19 Overhauser Proton Procession magnetometer used as a base station.

The total survey distance for the Ma'ili site was ~55 line k/m (4m line spacing). The survey work described in this report took place July 6th to July 8th, 2020. The data was examined for highly susceptible ferro-metallic object magnetic anomalies, which display the potential to be buried waste or Unexploded Ordinance (UXO). A discussion of the results is presented in the Interpretation section of this report, along with an Analytic Signal Map and list of identified anomalies.

Sincerely,

Steven Hochart

Practice Director

Mapping and Surveying Division, Dudek

PROJECT SITE

The site is located near the town of Ma'ili, HI (21.414079°, -158.169512°) It is approximately 50 acres and is bound by extensive housing on the eastern and western boundaries and a concrete spillway/ flood channel on the northern boundary.

The site is mostly flat with terrain elevation changes approximately 2 meters in Northing and 9 meters Easting.

The site is mostly hard volcanic soil and rock sparsely treed with vegetation ranging from 1-meter grasses to 17 meter trees. There are several deposits of large rocks possibly related to previous excavations and construction on the site. The site is littered with various debris and trash related to vagrant activity.

The site was accessed by vehicle to a central site location where the UAV operations were conducted from.

Flight operations were conducted at a nominal line spacing of 4 meters at an altitude of approximately 15 meters AGL (sensor height). The altitude was selected based on highest tree height within the survey area plus a margin of safety.

Aerial data collection was conducted between July 6th and July 8th 2020. The weather during collection was mostly light winds between 5mph and 12mph with average temperatures around 85 degrees F. Aerial data collection was terminated if winds exceeded 14 mph.

FLIGHT OPERATIONS

The daily survey procedure consisted of an early morning safety and survey plan meeting. The GSM-19W Overhauser Base Station was set up, and the crew travelled to the designated takeoff and landing position. Access to the takeoff and landing zones was facilitated by on-site road access.

Prior to takeoff, pre-flight briefing and safety hazards were discussed. All flight equipment was assembled and pre-flight checked and prior to the flight logging was initiated on the MFAM sensor package. The UAV flight was initiated manually, and the ground crew monitored the ground control station, and maintained visual line of sight with the UAV during flight.

The position and altitude of the aircraft and magnetometer payload was achieved autonomously using a combination of Barometric Pressure Measurement, GPS, Compass, Inertial Measurement

Unit (IMU) and RADAR altimeter. Altitudes above ground level of the senor payload were 15 meters AGL. Above ground altitude was maintained using a combination of RADAR altitude measurement and barometric pressure readings.

Upon survey flight completion, the UAV returned to the predefined landing position, was taken over by manual flight control, and landed to ensure a safe position of the sensor payload. Between flights, the UAV was brought back to the staging area to swap batteries and check the sensor operation and data. The landing zone was marked with high visibility cones.

Raw survey data was downloaded at the completion of each flight and quality checked.

The magnetometer was suspended from the UAV in a fixed orientation by a vibration isolated mounting system at a sensor distance of approximately 1.3 meters to reduce UAV noise and magnetic interference. Nominal survey speed was maintained at 5 meters per second ground speed. Scan rates for data acquisition was 1000 hertz (Hz) for the magnetometer and 1 Hz for GPS positioning. Data was collected with a line spacing of 4m for Ma'ili site.

Navigation of the UAV was maintained by the onboard GPS-Compass system. Pre-programmed flight plans were uploaded to the UAV prior to takeoff, and the aircraft flew the flight lines autonomously, returning to its takeoff location, or a pre-programed landing location once the lines were completed. Landing and Takeoff were conducted manually by the UAV pilot and ground crew.

The operator was responsible for ensuring the MFAM magnetometer was properly warmed up and oriented prior to departure and that the instruments operated properly during flight.

The data was recorded for each flight and stored in real-time on-board the UAV with solid state memory. On return of the craft, the magnetometer was shut off and data were downloaded and checked for errors.

AIRCRAFT EQUIPMENT

The unmanned aircraft used was a Hexacopter. The platform has a maximum takeoff weight of 55lbs and contains various onboard systems specifically developed for use in geophysical surveys while providing the highest level of safety possible. Some of these features are: Triple redundant IMUs, Barometers, and Compass Systems. Dual GPS system, dual battery systems and redundant power management systems. The aircraft has 6 propulsion motors which can maintain flight in the event of a motor failure. The aircraft also has emergency features such as autonomous return to home, battery failsafe and Autoland.

AIRBORNE MAGNETOMETER SYSTEM:

The Magnetometer payload is centered around a Geometrics Micro Fabricated Atomic Magnetometer (MFAM) sensor package. It is a dual sensor 1000 hz logging rate device with onboard SD logging, GPS and Wi-Fi capabilities. Specifications listed below.

Operating Principle: Laser pumped cesium vapor (Cs133 non-radioactive) total field scalar magnetometer.

Operating Range: 20,000 to 100,000 nT.

Gradient Tolerance: 10,000nT/m.

Operating Zones: Configured for operation anywhere in the world without dead zones.

Dead Zone: None.

Noise/Sensitivity: 0.005nT/ Hzrms typical.

Sample Rate: 1000 Hz. synchronized to GPS 1PPS.

Bandwidth: 400Hz.

Heading Error: ± 5 nT over entire 360° equatorial and polar spins typical.

Output: WiFi data download over 2.4GHz WiFi access point.

GPS: Commercial grade with typical 1 m accuracy.

USB Port: Port for USB flash drive. Used for field upgrades.

Data Logger: Built in Data Logger.

Data Storage: 32 Gbyte Micro SD card, U3 speed class

MAGNETOMETER BASE STATION

A Gem Systems GSM-19W Overhauser base station magnetometer was set up each day at least 30 min prior to surveying to record the diurnal variations of the Earth's magnetic field. The base station was automatically time synchronized to UTC time using a GPS-integrated GSM-19 mobile magnetometer by Gem Systems. The base station collected data at a rate of one reading every 4 seconds.

DATA PROCESSING

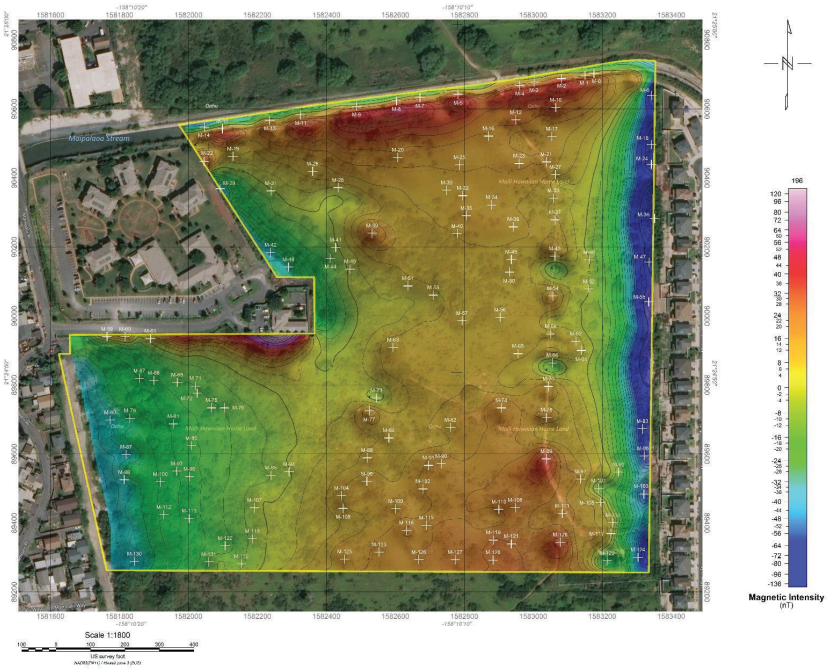
For each mission, raw data files were initially batch processed into a single comma-delimited file using custom software.

- The concatenated files from each mission were imported into Oasis Montaj for all remaining processing.
- Applied corrections:
  - Instrument Lag
  - Magnetic Heading
  - Major attitude noise due to wind
  - Diurnal variation
  - 1D filtering
  - Combining sorties into one dataset
  - Trend removal filter
  - Analytic signal grid filter
  - Other 2D smoothing filters
- Two maps for each site were published:
  - Magnetic intensity map
    - Best reflects the real-world magnetic field without major geologic trends.
    - Both negative and positive anomalies are visible
    - Units are nT (nanotesla)
  - Analytic Signal
    - Analytic Signal is a 2D grid filter applied to the gridded Total Magnetic Intensity data (measured by the sensor in nanoTeslas). The calculation is performed using this formula: Analytic Signal = sqrt (dx*dx + dy*dy + dz*dz) (2019 Geosoft Inc.). The output grid contains all positive values (in nanoTeslas per meter) and better resolves the source location of dipolar and monopolar anomalies, especially where the Earth's magnetic inclination is low and/or remanence of the anomaly source is unknown.
    - Used to pick magnetic anomaly peak locations with minimum thresholds determined based on the statistics of each data set.
    - The minimum selection threshold for Ma'ili site is 0.65 nT/m

  - Estimated positional error:
    - Approximately +/- 1m in the direction of flight (N-S)
  - Less than or equal to half the line spacing orthogonal to flight lines (E-W).
    - +/- 2m for the Ma'ili site.

Ma'ili Site: Analytic Signal Map

Ma'ili Site: Magnetic Intensity Map



LIST OF ANOMALIES

A total of 133 analytic signal anomalies for the Ma'ili site (denoted M-0 through M-132), as noted within this report on Table 1.

-Possible higher priority targets at Ma'ili: M-39, 63, 73, 74, 77, 87, 116

-Possible linear feature following dirt road starting with M-12 and ending around M-120

-Influence of cement river channel from M-0 to M-14

-Strong influence parallel to the east survey boundary, probably due to residential structures outside the survey area.

DISCLAIMER AND RELEASE OF LIABILITY

The enclosed report, data, results and interpretation were conducted as a wide area survey to aid in the identification of both buried infrastructure and potential UXO objects within the Ma'ili Site. The user of this data, results, report and provided interpretations, agrees to release DUDEK and its personnel of any and all liability related to the use and reliance upon the contained results. Furthermore, the users agree to release liabilities, perceived or otherwise, toward DUDEK, caused by actions or recommendations or lack thereof related to the discovery, deliberate or accidental of any UXO objects within the surveyed sites.

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-0	6.313515663	1583176.03	90703.21752	586200	2368448	-158.1682797	21.41627927
M-1	6.357232094	1583149.743	90698.13403	586192	2368446.4	-158.168357	21.4162652
M-2	6.936715126	1583081.415	90688.06746	586171.2	2368443.2	-158.1685578	21.41623729
M-3	5.680233479	1583002.586	90678.06781	586147.2	2368440	-158.1687895	21.41620953
M-4	5.593936443	1582960.513	90667.8339	586134.4	2368436.8	-158.1689132	21.41618123
M-5	7.525891304	1582781.818	90642.71764	586080	2368428.8	-158.1694384	21.41611156
M-6	10.99851227	1583343.655	90639.1369	586251.2	2368428.8	-158.1677867	21.41610336
M-7	7.228228569	1582671.484	90632.91878	586046.4	2368425.6	-158.1697628	21.41608426
M-8	8.441026688	1582603.156	90622.85219	586025.6	2368422.4	-158.1699636	21.41605634
M-9	8.103217125	1582487.538	90607.83598	585990.4	2368417.6	-158.1703035	21.41601466
M-10	2.316671848	1583065.127	90604.15485	586166.4	2368417.6	-158.1686054	21.41600624
M-11	5.620354652	1582324.595	90582.61931	585940.8	2368409.6	-158.1707824	21.41594475
M-12	1.81584239	1582949.375	90568.13538	586131.2	2368406.4	-158.1689456	21.41590674
M-13	5.294892311	1582235.231	90567.43576	585913.6	2368404.8	-158.1710451	21.41590269
M-14	9.845835686	1582046.068	90547.63722	585856	2368398.4	-158.1716011	21.41584762
M-15	8.623025894	1582098.542	90542.05176	585872	2368396.8	-158.1714468	21.4158324
M-16	1.035866737	1582870.312	90521.38003	586107.2	2368392	-158.1691779	21.4157778
M-17	0.998209298	1583054.09	90520.20878	586163.2	2368392	-158.1686376	21.41577512
M-18	8.669820786	1583342.751	90497.36499	586251.2	2368385.6	-158.1677889	21.41571308
M-19	1.451021194	1582129.545	90463.08872	585881.6	2368372.8	-158.1713554	21.41561512
M-20	1.070107579	1582607.37	90460.04348	586027.2	2368372.8	-158.1699507	21.41560816
M-21	1.559384108	1583037.869	90446.79779	586158.4	2368369.6	-158.1686851	21.41557298
M-22	5.138063431	1582045.432	90447.8717	585856	2368368	-158.1716027	21.41557297
M-23	1.13275671	1582959.074	90442.04894	586134.4	2368368	-158.1689167	21.41555967
M-24	8.271954536	1583342.383	90439.60606	586251.2	2368368	-158.1677898	21.41555408
M-25	0.886181474	1582785.763	90437.90244	586081.6	2368366.4	-158.1694262	21.41554774
M-26	0.975162745	1582360.314	90419.60977	585952	2368360	-158.1706769	21.41549612
M-27	1.497774601	1583063.889	90409.87478	586166.4	2368358.4	-158.1686084	21.41547141
M-28	1.374714375	1582433.524	90371.88394	585974.4	2368345.6	-158.1704615	21.41536496
M-29	5.786299706	1582092.187	90368.80827	585870.4	2368344	-158.171465	21.41535546
M-30	0.650867224	1582748.539	90364.6253	586070.4	2368344	-158.1695354	21.41534591
M-31	1.055828094	1582239.177	90362.62047	585915.2	2368342.4	-158.1710328	21.41533887
M-32	0.69180572	1582795.696	90348.57168	586084.8	2368339.2	-158.1693967	21.41530186
M-33	1.092463255	1583058.203	90341.64768	586164.8	2368337.6	-158.1686249	21.41528358
M-34	0.698772192	1582879.542	90321.78219	586110.4	2368331.2	-158.1691501	21.41522836
M-35	0.757671893	1582805.83	90290.7458	586088	2368321.6	-158.1693667	21.4151427
M-36	15.74589443	1583351.881	90282.01479	586254.4	2368320	-158.1677614	21.41512028
M-37	1.038030863	1583063.053	90278.60447	586166.4	2368318.4	-158.1686105	21.41511004
M-38	0.942944765	1582942.15	90258.37087	586129.6	2368312	-158.1689659	21.41505399
M-39	2.493532181	1582532.453	90239.97776	586004.8	2368305.6	-158.1701702	21.41500213
M-40	0.665885806	1582779.241	90238.40498	586080	2368305.6	-158.1694447	21.41499854
M-41	0.970149755	1582427.169	90198.6405	585972.8	2368292.8	-158.1704796	21.41488802
M-42	3.037794113	1582238.039	90184.09272	585915.2	2368288	-158.1710356	21.41484741
M-43	2.733634472	1583062.383	90173.58821	586166.4	2368286.4	-158.1686121	21.41482095
M-44	1.029805779	1582411.215	90167.236	585968	2368283.2	-158.1705264	21.41480152

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-45	0.708988845	1582936.297	90163.8897	586128	2368283.2	-158.1689828	21.41479388
M-46	1.533357501	1583162.082	90162.45079	586196.8	2368283.2	-158.168319	21.41479058
M-47	8.124481201	1583335.325	90156.0957	586249.6	2368281.6	-158.1678097	21.4147736
M-48	2.484975338	1582290.279	90141.75157	585931.2	2368275.2	-158.1708819	21.41473101
M-49	0.818558991	1582468.774	90135.36301	585985.6	2368273.6	-158.1703571	21.41471395
M-50	0.69824183	1582930.812	90127.16747	586126.4	2368272	-158.1689988	21.41469277
M-51	0.74475497	1582636.499	90087.03487	586036.8	2368259.2	-158.1698639	21.41458141
M-52	1.297810078	1583161.546	90078.43779	586196.8	2368257.6	-158.1683203	21.41455931
M-53	0.724699676	1582709.843	90060.31232	586059.2	2368251.2	-158.1696482	21.41450807
M-54	2.241557121	1583056.396	90058.1038	586164.8	2368251.2	-158.1686294	21.41450302
M-55	8.250247002	1583334.589	90040.57785	586249.6	2368246.4	-158.1678115	21.41445559
M-56	0.809754133	1582903.721	89996.06445	586118.4	2368232	-158.169078	21.41433178
M-57	0.690473199	1582793.387	89986.26553	586084.8	2368228.8	-158.1694023	21.41430448
M-58	1.699289799	1583050.443	89947.87019	586163.2	2368217.6	-158.1686465	21.41419954
M-59	3.143860817	1581763.893	89940.31596	585771.2	2368212.8	-158.1724287	21.4141749
M-60	3.838171005	1581816.401	89939.98133	585787.2	2368212.8	-158.1722743	21.41417414
M-61	1.895073056	1581889.879	89934.26205	585809.6	2368211.2	-158.1720583	21.41415861
M-62	1.546783328	1583123.82	89926.39847	586185.6	2368211.2	-158.1684307	21.41414065
M-63	1.10607934	1582593.354	89908.77488	586024	2368204.8	-158.1699901	21.41409056
M-64	1.526090264	1583139.405	89900.04403	586190.4	2368203.2	-158.1683848	21.41406815
M-65	0.846681952	1582955.56	89890.71357	586134.4	2368200	-158.1689253	21.41404192
M-66	2.945874214	1583055.158	89863.82373	586164.8	2368192	-158.1686324	21.41396819
M-67	1.034710407	1581857.638	89818.94483	585800	2368176	-158.1721527	21.41384107
M-68	0.939007103	1581899.611	89813.42632	585812.8	2368174.4	-158.1720293	21.413826
M-69	0.825450599	1581967.838	89807.74051	585833.6	2368172.8	-158.1718287	21.41381056
M-70	1.873985171	1583044.222	89795.63009	586161.6	2368171.2	-158.1686643	21.41378043
M-71	0.778621912	1582020.279	89796.90426	585849.6	2368169.6	-158.1716745	21.41378088
M-72	0.773337603	1582025.396	89775.86753	585851.2	2368163.2	-158.1716594	21.41372299
M-73	1.867669821	1582545.16	89762.05322	586009.6	2368160	-158.1701314	21.41368652
M-74	1.553893447	1582907.299	89733.49032	586120	2368152	-158.1690667	21.41360896
M-75	0.784622908	1582067.135	89733.5933	585864	2368150.4	-158.1715366	21.41360674
M-76	0.79090029	1582103.891	89733.35908	585875.2	2368150.4	-158.1714285	21.4136062
M-77	2.091414928	1582523.923	89725.43136	586003.2	2368148.8	-158.1701937	21.41358564
M-78	2.050991774	1583038.402	89706.39973	586160	2368144	-158.1686812	21.41353478
M-79	1.071354628	1581830.647	89703.59415	585792	2368140.8	-158.1722317	21.41352344
M-80	1.202615738	1581772.855	89698.71141	585774.4	2368139.2	-158.1724016	21.41350983
M-81	0.719525158	1581956.567	89687.03863	585830.4	2368136	-158.1718615	21.41347825
M-82	0.659242153	1582759.908	89676.66829	586075.2	2368134.4	-158.1694998	21.4134521
M-83	3.279120684	1583316.494	89673.12142	586244.8	2368134.4	-158.1678635	21.41344399
M-84	0.695989668	1582581.18	89646.30107	586020.8	2368124.8	-158.1700251	21.41336798
M-85	0.654823601	1582008.673	89623.69422	585846.4	2368116.8	-158.1717081	21.41330403
M-86	3.329485416	1583321.243	89594.32579	586246.4	2368110.4	-158.1678493	21.41322709
M-87	1.853775382	1581819.477	89598.64472	585788.8	2368108.8	-158.1722642	21.4132345
M-88	0.735354364	1582517.802	89588.94364	586001.6	2368107.2	-158.1702112	21.41320989
M-89	2.628010511	1583037.632	89585.63104	586160	2368107.2	-158.168683	21.41320232

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-90	0.966847777	1582732.985	89571.81931	586067.2	2368102.4	-158.1695786	21.41316339
M-91	0.893975616	1582696.196	89566.80272	586056	2368100.8	-158.1696867	21.41314947
M-92	2.132704258	1583247.431	89547.53693	586224	2368096	-158.1680661	21.41309807
M-93	0.684414089	1581966.198	89550.45047	585833.6	2368094.4	-158.1718327	21.41310227
M-94	0.680797637	1582291.749	89548.37592	585932.8	2368094.4	-158.1708757	21.41309754
M-95	0.695671916	1582239.174	89538.20889	585916.8	2368091.2	-158.1710302	21.41306939
M-96	0.706300855	1582002.854	89534.46379	585844.8	2368089.6	-158.1717249	21.41305837
M-97	1.773312211	1583137.03	89527.23635	586190.4	2368089.6	-158.1683906	21.41304186
M-98	1.516258359	1581813.757	89525.16673	585787.2	2368086.4	-158.1722808	21.41303221
M-99	0.851448119	1582517.367	89520.68304	586001.6	2368086.4	-158.1702123	21.41302198
M-100	0.731378853	1581918.74	89519.24671	585819.2	2368084.8	-158.1719721	21.41301623
M-101	1.767214537	1583189.371	89500.64769	586206.4	2368081.6	-158.1682367	21.41296882
M-102	0.773930311	1582680.008	89498.64252	586051.2	2368080	-158.1697341	21.41296179
M-103	3.712013006	1583320.54	89484.05874	586246.4	2368076.8	-158.167851	21.41292354
M-104	0.875454783	1582443.588	89479.14497	585979.2	2368073.6	-158.1704291	21.41290741
M-105	2.321354389	1583194.354	89458.60773	586208	2368068.8	-158.1682219	21.4128531
M-106	0.970717907	1582947.465	89444.42791	586132.8	2368064	-158.1689477	21.41281334
M-107	0.67249316	1582191.314	89443.99534	585902.4	2368062.4	-158.1711706	21.41280989
M-108	0.831118584	1582448.604	89442.3558	585980.8	2368062.4	-158.1704142	21.41280615
M-109	0.702700138	1582600.878	89441.38546	586027.2	2368062.4	-158.1699665	21.41280393
M-110	0.913122654	1582900.174	89439.47824	586118.4	2368062.4	-158.1690867	21.41279957
M-111	1.143409014	1583083.886	89427.80551	586174.4	2368059.2	-158.1685466	21.41276798
M-112	0.710143328	1581928.64	89424.66507	585822.4	2368056	-158.1719427	21.41275589
M-113	0.686349869	1582002.084	89413.695	585844.8	2368052.8	-158.1717268	21.41272591
M-114	2.715984583	1583230.741	89400.61458	586219.2	2368051.2	-158.1681147	21.41269356
M-115	0.720769405	1582689.841	89393.55931	586054.4	2368048	-158.1697049	21.41267254
M-116	1.169720292	1582631.981	89378.17493	586036.8	2368043.2	-158.1698749	21.41263002
M-117	2.817724705	1583225.29	89369.14316	586217.6	2368041.6	-158.1681307	21.41260691
M-118	0.655612648	1582185.495	89354.76493	585900.8	2368035.2	-158.1711874	21.41256424
M-119	0.933571517	1582883.853	89350.31479	586113.6	2368035.2	-158.1691344	21.41255407
M-120	2.441253424	1583078.1	89343.82597	586172.8	2368033.6	-158.1685633	21.41253678
M-121	0.837968528	1582936.294	89339.47857	586129.6	2368032	-158.1689802	21.41252439
M-122	0.955043614	1582106.599	89334.26355	585876.8	2368028.8	-158.1714193	21.41250756
M-123	0.664812684	1582552.818	89315.66705	586012.8	2368024	-158.1701074	21.4124577
M-124	4.655443668	1583303.617	89300.38072	586241.6	2368020.8	-158.1679002	21.41241785
M-125	0.953961611	1582452.918	89295.29952	585982.4	2368017.6	-158.170401	21.41240134
M-126	0.816744328	1582668.202	89293.92768	586048	2368017.6	-158.1697682	21.4123982
M-127	0.840810776	1582773.218	89293.25849	586080	2368017.6	-158.1694594	21.41239667
M-128	0.951334119	1582883.485	89292.55584	586113.6	2368017.6	-158.1691353	21.41239507
M-129	4.22790575	1583214.286	89290.4479	586214.4	2368017.6	-158.1681628	21.41239024
M-130	1.818381548	1581843.757	89288.67918	585796.8	2368014.4	-158.1721918	21.41238128
M-131	0.922531188	1582059.04	89287.30734	585862.4	2368014.4	-158.1715589	21.41237816
M-132	0.67103076	1582153.521	89281.45425	585891.2	2368012.8	-158.1712812	21.41236233

APPENDIX E

GEOPHYSICAL SURVEY ANOMALY VERIFICATION LETTER REPORT
AUGUST 31, 2021

element environmental llc
environmental · engineering · water resources

August 31, 2021

Ms. Sheryl E. Nojima, PhD, PE
Gray Hong Nojima & Associates, Inc.
201 Merchant St., Suite 1900
Honolulu HI 96813

Via e-mail: snojima@grayhongnojima.com

Subject: **Letter Report**
Geophysical Survey Anomaly Verification
87 576 Kulaaupuni Street
Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031
Maili, Oahu, Hawaii

Dear Ms. Nojima:

Element Environmental, LLC (E2) is pleased to submit this letter report to describe the Geophysical Survey Anomaly Verification activities and findings completed for the 38.817-acre portion of land designated as Tax Map Key: (1) 8-7-010: Parcel 030 (portion) and 031 (*the subject property or the site*), located in Maili, Oahu, Hawaii (Figure 1). The land is currently undeveloped and is owned by the State of Hawaii Department of Hawaiian Home Lands (DHHL).

Figure 1: Site Location Map

98-030 Hekaha Street Unit 9 Aiea Hawaii 96701 **tel:** (808) 488-1200 **fax:** (808) 488-1300
www.e2hi.com

GEOPHYSICAL SURVEY FINDINGS

On August 5, 2020, Dudek, a geophysical mapping consultant, completed an infrastructure detection survey of the subject property using an unmanned aerial vehicle (UAV) with a Geometrics Miniature Fabricated Atomic Magnetometer (MFAM) system mounted on a UAV platform and a Gem Systems GSM-19 Overhauser Proton Procession magnetometer used as a base station.

The total survey distance for the Maili site was approximately 55 line k/m (4-meter line spacing). The survey work took place July 6 to July 8, 2020. The west boundary of the subject property was not included in the magnetometer survey due to elevated power lines along the planned roadway area. The data was examined for highly susceptible ferro-metallic object magnetic anomalies, which display the potential to be buried waste (Figure 2). A discussion of the results is presented in the *Conclusions* section of this report, along with an Analytic Signal Map (Figure 3) and list of identified anomalies (attached).

A total of 133 analytic signal anomalies were identified for the Maili site (denoted M-0 through M-132), with seven (7) identified as possible higher priority targets located at M-39, -63, -73, -74, -77, -87, and -116 (circled in red in Figures 2 and 3).

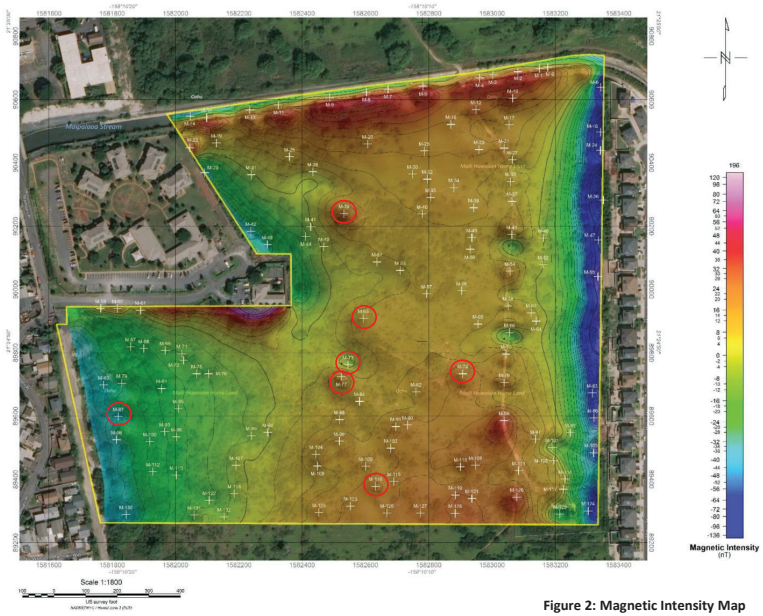


Figure 2: Magnetic Intensity Map

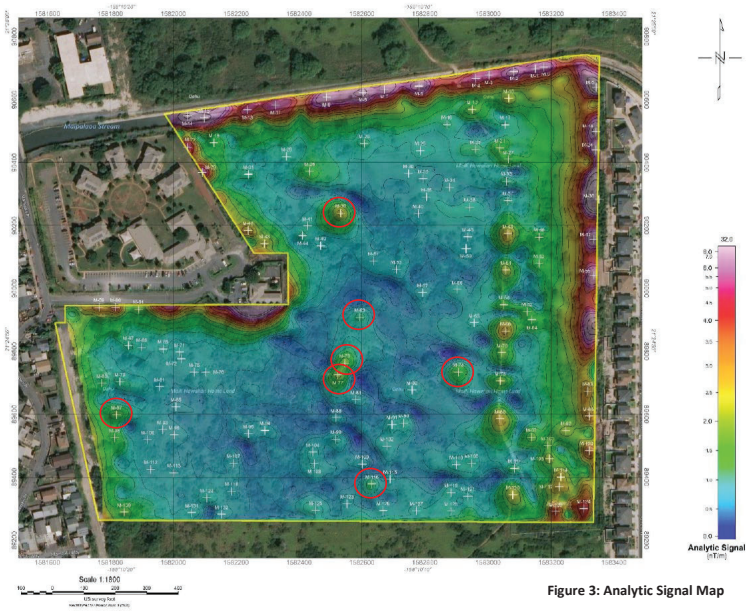


Figure 3: Analytic Signal Map

ANOMALY VERIFICATION INSPECTION

On July 12 to 15, 2021, Mr. John Ellis and Mr. Daniel Amato with E2 completed the anomaly verification inspection (AVI) of the subject property.

Using a Schonstedt GA-52CD Magnetic Locator, a SubSurface ML-1M Magnetic Locator, and a Leica Zeno GG04 global positioning system (GPS) antenna, E2 mobilized to 133 points of interest throughout the subject property as marked on the magnetic intensity report provided by Dudek. At each point of interest, if the magnetic anomaly was not apparent, E2 used the magnetic locators to attempt to identify the source of the anomaly within an approximate 15-foot diameter of the GPS point.

Magnetic identities within the 15-foot diameter of the GPS point were investigated using a pickaxe and shovel to dig to a maximum depth of 1 foot below ground surface (bgs) or until natural limestone bedrock was observed. Identified anomalies were documented and large anomalies or high-priority points of interest were photographed. Photographs are included in attachment.

Table 1 lists each anomaly that was identified during the AVI, briefly describes the anomaly, and lists the corresponding photo plate number when available, excluding:

- Anomalies associated with the Maipalaoa Stream concrete channel: M-0, -1, -2, -3, -4, -5, -7, -8, -9, -11, -13, -14, and -15;
- Anomalies associated with steel fencing along the northwest boundary of the subject property: M-22, -29, -42, -48, -59, -60, and -61;

- Anomalies associated with adjacent residential housing along the east boundary of the subject property: M-36, -47, -55, and -103; and
- Identified but unconfirmed anomalies likely associated with an underground utility adjacent to the east of an unimproved roadway bisecting the site from the north to the south: M-12, -21, -27, -33, -37, -43, -54, -58, -66, -70, -78, and -89.

Table 1: Identified Anomalies

Anomaly ID	Description	Photo Plate
M-06	Large metal pipe.	1
M-10	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-18	Buried scrap metal.	2
M-24	Rebar stake.	3
M-28	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	4, 5
M-34	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-39	Stockpile containing remnant guy-wire and/or metal scrap.	6
M-50	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-53	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-62	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-63	Metal pipe.	7
M-73	Remnant guy-wire associated with the former Coast Guard VOA antenna.	8
M-74	Remnant guy-wire associated with the former Coast Guard VOA antenna.	9
M-77	Remnant guy-wire associated with the former Coast Guard VOA antenna.	10
M-80	Abandoned washing machine and other metal waste.	11
M-83	North end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	No Photo
M-84	Remnant guy-wire associated with the former Coast Guard VOA antenna.	12
M-86	South end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	13
M-87	Abandoned vehicle frame and other metal waste.	14
M-88	Concrete block, creosote pole, metal fittings, and remnant guy-wire associated with the former Coast Guard VOA antenna.	15
M-92	Former fence post base and foundation.	No Photo
M-94	Metal scrap associated with the former Coast Guard VOA antenna.	16
M-95	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-97	Former fence post base and foundation.	No Photo
M-99	Metal scrap associated with the former Coast Guard VOA antenna.	17
M-101	Four metal bollards/fence poles.	18
M-104	Remnant guy-wire associated with the former Coast Guard VOA antenna.	19
M-105	Former fence post base and foundation.	No Photo
M-108	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-109	Metal scrap associated with the former Coast Guard VOA antenna.	20
M-111	Concrete pad with vertical metal beams.	21
M-114	Former fence post base and foundation.	No Photo
M-116	Rebar associated with former building foundation.	No Photo
M-117	Rebar associated with former building foundation.	No Photo
M-120	Remnant guy-wire associated with the former Coast Guard VOA antenna.	22
M-122	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-124	Rebar associated with former building foundation.	No Photo
M-129	Rebar associated with former building foundation.	No Photo

Anomalies that were not observed with the magnetic locaters within 15 feet of the GPS point were excluded from this report. Active trespassing, squatting, illegal dumping, and clean-up activities may have resulted in anomalies located on the ground surface being moved within or from the subject property in the time between the magnetometer survey and the AVI.

It is likely that remnant guy-wires associated with the former Coast Guard Voice of America (VOA) site antennas remain throughout the subject property and may have affected the magnetometer survey.

CONCLUSIONS

Based on the magnetometer survey and the anomaly verification inspection, E2 concludes the following:

- Antenna supports structures and guy-wire remnants associated with the former Coast Guard VOA station are located throughout the property.
- A suspect underground utility line is likely located immediately east of the unimproved dirt roadway that bisects the subject property from the north to the south along points M-12, -21, -27, -33, -37, -43, -54, -58, -66, -70, -78, and -89.
- The higher priority targets located at M-39, -63, -73, -74, -77, -87, and -116 were determined to be surface debris.
- With the exception of the suspected underground utility line, no magnetic sub-surface items or structures were observed during the magnetometer survey and subsequent anomaly verification inspection.
- The results of this survey and inspection apply only to magnetic items. Furthermore, certain metals such as aluminum, brass, copper, and lead have weak magnetic properties and the presence or absence of these materials cannot be confidently confirmed.

Should you have any questions, please call me on my mobile at 551-9552.

Sincerely,

Arlene H. Campbell

Arlene H. Campbell, L.G.
Senior Geologist

Enclosures:
Photo Plates
Table of GPS Coordinates

ATTACHMENTS

E2 Project No.: 190051	Description	M-06: Large metal pipe.	Photo 1
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-18: Buried scrap metal.	Photo 2
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-24: Rebar stake.	Photo 3
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-28: Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	Photo 4
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-28: Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	Photo 5
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-39: Stockpile containing remnant guy-wire and/or metal scrap.	Photo 6
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.:	Description	M-63: Metal pipe.	Photo 7
190051	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.:	Description	M-73: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 8
190051	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.:	Description	M-74: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 9
190051	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.:	Description	M-77: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 10
190051	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-80: Abandoned washing machine and other metal waste.	Photo 11
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-84: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 12
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-86: South end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	Photo 13
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-87: Abandoned vehicle frame and other metal waste.	Photo 14
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-88: Concrete block, creosote pole, metal fittings, and remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 15
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-94: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 16
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-99: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 17
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-101: Four metal bollards/fence poles.	Photo 18
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-104: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 19
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-109: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 20
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-111: Concrete pad with vertical metal beams.	Photo 21
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-120: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 22
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-0	6.313516	1583176	90703.22	586200	2368448	-158.168	21.41628
M-1	6.357232	1583150	90698.13	586192	2368446	-158.168	21.41627
M-2	6.936715	1583081	90688.07	586171.2	2368443	-158.169	21.41624
M-3	5.680233	1583003	90678.07	586147.2	2368440	-158.169	21.41621
M-4	5.593936	1582961	90667.83	586134.4	2368437	-158.169	21.41618
M-5	7.525891	1582782	90642.72	586080	2368429	-158.169	21.41611
M-6	10.99851	1583344	90639.14	586251.2	2368429	-158.168	21.4161
M-7	7.228229	1582671	90632.92	586046.4	2368426	-158.17	21.41608
M-8	8.441027	1582603	90622.85	586025.6	2368422	-158.17	21.41606
M-9	8.103217	1582488	90607.84	585990.4	2368418	-158.17	21.41601
M-10	2.316672	1583065	90604.15	586166.4	2368418	-158.169	21.41601
M-11	5.620355	1582325	90582.62	585940.8	2368410	-158.171	21.41594
M-12	1.815842	1582949	90568.14	586131.2	2368406	-158.169	21.41591
M-13	5.294892	1582235	90567.44	585913.6	2368405	-158.171	21.4159
M-14	9.845836	1582046	90547.64	585856	2368398	-158.172	21.41585
M-15	8.623026	1582099	90542.05	585872	2368397	-158.171	21.41583
M-16	1.035867	1582870	90521.38	586107.2	2368392	-158.169	21.41578
M-17	0.998209	1583054	90520.21	586163.2	2368392	-158.169	21.41578
M-18	8.669821	1583343	90497.36	586251.2	2368386	-158.168	21.41571
M-19	1.451021	1582130	90463.09	585881.6	2368373	-158.171	21.41562
M-20	1.070108	1582607	90460.04	586027.2	2368373	-158.17	21.41561
M-21	1.559384	1583038	90446.8	586158.4	2368370	-158.169	21.41557
M-22	5.138063	1582045	90447.87	585856	2368368	-158.172	21.41557
M-23	1.132757	1582959	90442.05	586134.4	2368368	-158.169	21.41556
M-24	8.271955	1583342	90439.61	586251.2	2368368	-158.168	21.41555
M-25	0.886181	1582786	90437.9	586081.6	2368366	-158.169	21.41555
M-26	0.975163	1582360	90419.61	585952	2368360	-158.171	21.4155
M-27	1.497775	1583064	90409.87	586166.4	2368358	-158.169	21.41547
M-28	1.374714	1582434	90371.88	585974.4	2368346	-158.17	21.41536
M-29	5.7863	1582092	90368.81	585870.4	2368344	-158.171	21.41536
M-30	0.650867	1582749	90364.63	586070.4	2368344	-158.17	21.41535
M-31	1.055828	1582239	90362.62	585915.2	2368342	-158.171	21.41534
M-32	0.691806	1582796	90348.57	586084.8	2368339	-158.169	21.4153
M-33	1.092463	1583058	90341.65	586164.8	2368338	-158.169	21.41528
M-34	0.698772	1582880	90321.78	586110.4	2368331	-158.169	21.41523
M-35	0.757672	1582806	90290.75	586088	2368322	-158.169	21.41514
M-36	15.74589	1583352	90282.01	586254.4	2368320	-158.168	21.41512
M-37	1.038031	1583063	90278.6	586166.4	2368318	-158.169	21.41511
M-38	0.942945	1582942	90258.37	586129.6	2368312	-158.169	21.41505
M-39	2.493532	1582532	90239.98	586004.8	2368306	-158.17	21.415
M-40	0.665886	1582779	90238.4	586080	2368306	-158.169	21.415
M-41	0.97015	1582427	90198.64	585972.8	2368293	-158.17	21.41489
M-42	3.037794	1582238	90184.09	585915.2	2368288	-158.171	21.41485
M-43	2.733634	1583062	90173.59	586166.4	2368286	-158.169	21.41482
M-44	1.029806	1582411	90167.24	585968	2368283	-158.171	21.4148
M-45	0.708989	1582936	90163.89	586128	2368283	-158.169	21.41479

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-46	1.533358	1583162	90162.45	586196.8	2368283	-158.168	21.41479
M-47	8.124481	1583335	90156.1	586249.6	2368282	-158.168	21.41477
M-48	2.484975	1582290	90141.75	585931.2	2368275	-158.171	21.41473
M-49	0.818559	1582469	90135.36	585985.6	2368274	-158.17	21.41471
M-50	0.698242	1582931	90127.17	586126.4	2368272	-158.169	21.41469
M-51	0.744755	1582636	90087.03	586036.8	2368259	-158.17	21.41458
M-52	1.29781	1583162	90078.44	586196.8	2368258	-158.168	21.41456
M-53	0.7247	1582710	90060.31	586059.2	2368251	-158.17	21.41451
M-54	2.241557	1583056	90058.1	586164.8	2368251	-158.169	21.4145
M-55	8.250247	1583335	90040.58	586249.6	2368246	-158.168	21.41446
M-56	0.809754	1582904	89996.06	586118.4	2368232	-158.169	21.41433
M-57	0.690473	1582793	89986.27	586084.8	2368229	-158.169	21.4143
M-58	1.69929	1583050	89947.87	586163.2	2368218	-158.169	21.4142
M-59	3.143861	1581764	89940.32	585771.2	2368213	-158.172	21.41417
M-60	3.838171	1581816	89939.98	585787.2	2368213	-158.172	21.41417
M-61	1.895073	1581890	89934.26	585809.6	2368211	-158.172	21.41416
M-62	1.546783	1583124	89926.4	586185.6	2368211	-158.168	21.41414
M-63	1.106079	1582593	89908.77	586024	2368205	-158.17	21.41409
M-64	1.52609	1583139	89900.04	586190.4	2368203	-158.168	21.41407
M-65	0.846682	1582956	89890.71	586134.4	2368200	-158.169	21.41404
M-66	2.945874	1583055	89863.82	586164.8	2368192	-158.169	21.41397
M-67	1.03471	1581858	89818.94	585800	2368176	-158.172	21.41384
M-68	0.939007	1581900	89813.43	585812.8	2368174	-158.172	21.41383
M-69	0.825451	1581968	89807.74	585833.6	2368173	-158.172	21.41381
M-70	1.873985	1583044	89795.63	586161.6	2368171	-158.169	21.41378
M-71	0.778622	1582020	89796.9	585849.6	2368170	-158.172	21.41378
M-72	0.773338	1582025	89775.87	585851.2	2368163	-158.172	21.41372
M-73	1.86767	1582545	89762.05	586009.6	2368160	-158.17	21.41369
M-74	1.553893	1582907	89733.49	586120	2368152	-158.169	21.41361
M-75	0.784623	1582067	89733.59	585864	2368150	-158.172	21.41361
M-76	0.7909	1582104	89733.36	585875.2	2368150	-158.171	21.41361
M-77	2.091415	1582524	89725.43	586003.2	2368149	-158.17	21.41359
M-78	2.050992	1583038	89706.4	586160	2368144	-158.169	21.41353
M-79	1.071355	1581831	89703.59	585792	2368141	-158.172	21.41352
M-80	1.202616	1581773	89698.71	585774.4	2368139	-158.172	21.41351
M-81	0.719525	1581957	89687.04	585830.4	2368136	-158.172	21.41348
M-82	0.659242	1582760	89676.67	586075.2	2368134	-158.169	21.41345
M-83	3.279121	1583316	89673.12	586244.8	2368134	-158.168	21.41344
M-84	0.69599	1582581	89646.3	586020.8	2368125	-158.17	21.41337
M-85	0.654824	1582009	89623.69	585846.4	2368117	-158.172	21.4133
M-86	3.329485	1583321	89594.33	586246.4	2368110	-158.168	21.41323
M-87	1.853775	1581819	89598.64	585788.8	2368109	-158.172	21.41323
M-88	0.735354	1582518	89588.94	586001.6	2368107	-158.17	21.41321
M-89	2.628011	1583038	89585.63	586160	2368107	-158.169	21.4132
M-90	0.966848	1582733	89571.82	586067.2	2368102	-158.17	21.41316
M-91	0.893976	1582696	89566.8	586056	2368101	-158.17	21.41315

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-92	2.132704	1583247	89547.54	586224	2368096	-158.168	21.4131
M-93	0.684414	1581966	89550.45	585833.6	2368094	-158.172	21.4131
M-94	0.680798	1582292	89548.38	585932.8	2368094	-158.171	21.4131
M-95	0.695672	1582239	89538.21	585916.8	2368091	-158.171	21.41307
M-96	0.706301	1582003	89534.46	585844.8	2368090	-158.172	21.41306
M-97	1.773312	1583137	89527.24	586190.4	2368090	-158.168	21.41304
M-98	1.516258	1581814	89525.17	585787.2	2368086	-158.172	21.41303
M-99	0.851448	1582517	89520.68	586001.6	2368086	-158.17	21.41302
M-100	0.731379	1581919	89519.25	585819.2	2368085	-158.172	21.41302
M-101	1.767215	1583189	89500.65	586206.4	2368082	-158.168	21.41297
M-102	0.77393	1582680	89498.64	586051.2	2368080	-158.17	21.41296
M-103	3.712013	1583321	89484.06	586246.4	2368077	-158.168	21.41292
M-104	0.875455	1582444	89479.14	585979.2	2368074	-158.17	21.41291
M-105	2.321354	1583194	89458.61	586208	2368069	-158.168	21.41285
M-106	0.970718	1582947	89444.43	586132.8	2368064	-158.169	21.41281
M-107	0.672493	1582191	89444	585902.4	2368062	-158.171	21.41281
M-108	0.831119	1582449	89442.36	585980.8	2368062	-158.17	21.41281
M-109	0.7027	1582601	89441.39	586027.2	2368062	-158.17	21.4128
M-110	0.913123	1582900	89439.48	586118.4	2368062	-158.169	21.4128
M-111	1.143409	1583084	89427.81	586174.4	2368059	-158.169	21.41277
M-112	0.710143	1581929	89424.67	585822.4	2368056	-158.172	21.41276
M-113	0.68635	1582002	89413.7	585844.8	2368053	-158.172	21.41273
M-114	2.715985	1583231	89400.61	586219.2	2368051	-158.168	21.41269
M-115	0.720769	1582690	89393.56	586054.4	2368048	-158.17	21.41267
M-116	1.16972	1582632	89378.17	586036.8	2368043	-158.17	21.41263
M-117	2.817725	1583225	89369.14	586217.6	2368042	-158.168	21.41261
M-118	0.655613	1582185	89354.76	585900.8	2368035	-158.171	21.41256
M-119	0.933572	1582884	89350.31	586113.6	2368035	-158.169	21.41255
M-120	2.441253	1583078	89343.83	586172.8	2368034	-158.169	21.41254
M-121	0.837969	1582936	89339.48	586129.6	2368032	-158.169	21.41252
M-122	0.955044	1582107	89334.26	585876.8	2368029	-158.171	21.41251
M-123	0.664813	1582553	89315.67	586012.8	2368024	-158.17	21.41246
M-124	4.655444	1583304	89300.38	586241.6	2368021	-158.168	21.41242
M-125	0.953962	1582453	89295.3	585982.4	2368018	-158.17	21.4124
M-126	0.816744	1582668	89293.93	586048	2368018	-158.17	21.4124
M-127	0.840811	1582773	89293.26	586080	2368018	-158.169	21.4124
M-128	0.951334	1582883	89292.56	586113.6	2368018	-158.169	21.4124
M-129	4.227906	1583214	89290.45	586214.4	2368018	-158.168	21.41239
M-130	1.818382	1581844	89288.68	585796.8	2368014	-158.172	21.41238
M-131	0.922531	1582059	89287.31	585862.4	2368014	-158.172	21.41238
M-132	0.671031	1582154	89281.45	585891.2	2368013	-158.171	21.41236

APPENDIX F

A NATURAL RESOURCES ASSESSMENT OF THE FORMER VOICE OF AMERICA SITE, MAY 27, 2021

AECOS No. 1628

A natural resources assessment of the former Voice of America Site (TMK: 8-7-010: 030 & 031) Lualualei, leeward O'ahu

AECOS Inc.
45-939 Kamehameha Highway
Suite 104
Kāne'ohe, Hawai'i 96744

May 27, 2021

A natural resources assessment of the former Voice of America Site (TMK: 8-7-010: 030 & 031) Lualualei, leeward O‘ahu

May 27, 2021 *AECOS* No. 1628

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Introduction

AECOS Inc. was contracted by Gray Hong Nojima & Associates, Inc. to conduct a natural resources survey of the State of Hawai‘i, Department of Hawaiian Home Lands (DHHL) former Voice of America Site in Lualualei, leeward O‘ahu and to assess whether the adjacent Mā‘ili Stream is considered jurisdictional under the Clean Water Act (CWA) and Rivers and Harbors Act (RHA), and/or a wetland protected under Executive Order 11990[1]. This 89.27-ac (36.13-ha) site (TMK: 8-7-010: 030 & 031) is accessed off Kula‘aupuni Street in Mā‘ili. Proposed is development of approximately 300 single-family residential lots and multi-family units for native Hawaiian beneficiaries on 40 ac (16 ha) of the land, a majority of which is vacant. Scant evidence by way of concrete support bases and some old paved roadway remains of the Voice of America radio station. However, occupying leased portions (total area of 5.6 ac or 2.27 ha) of TMK: 8-7-010: 030 are the Ulu Ke Kukui transitional housing and Ho‘omalu O Nā Kamali‘i, projects serviced by Holt Road off Kula‘aupuni Street. These two developments are fenced off and not included in our survey. Some 40 ac (16 ha) of TMK: 8-7-010: 030 is designated for Kamehameha Schools Community Learning Center at Mā‘ili (CLC-M). The margins of this fully landscaped complex were included in the survey, as was Kulauku Street up to the CLC-M entrance. In addition, the survey included a brief look at the entrance roads (St. Johns Road and Kula‘aupuni Street) and vicinity aquatic environments, specifically Mā‘ili Stream bordering the north property boundary of TMK: 8-7-010: 030, the

[1] This report is intended to become part of the public record and incorporated into an EA for the subject project.

estuary of Mā‘ili Stream out to the ocean mouth, and the nearshore of the Pacific Ocean in the vicinity of the Mā‘ili Stream discharge point.

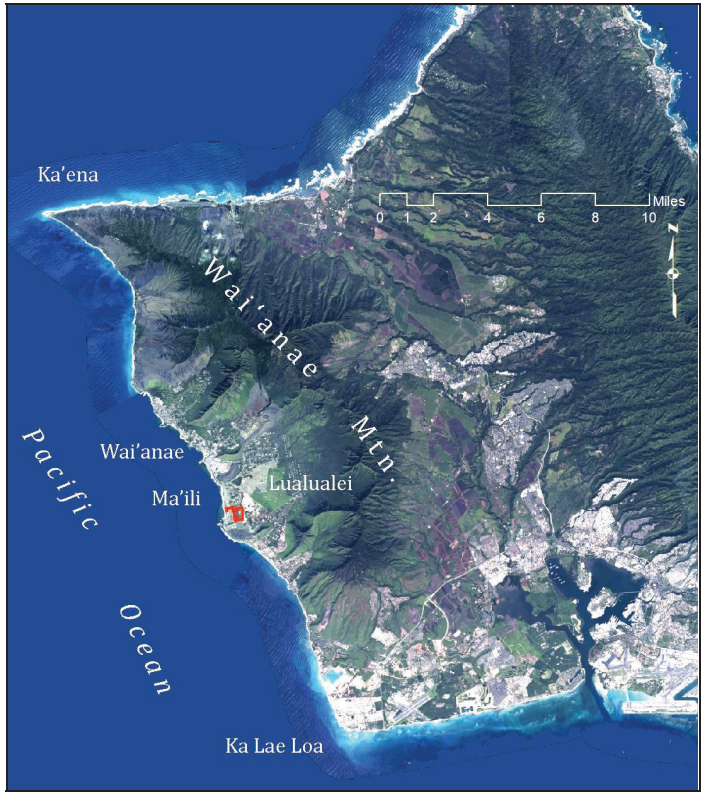

Figure 1. Project location (red) on leeward O‘ahu.

Figure 2. Survey area (terrestrial) outlined in red.

Site Description

The site is mostly level ground at around the 6-ft (2-m) elevation and surrounded on the west, south, and east by housing of suburban Mā'ili. Mā'ili Stream borders the north side and vacant land to the north of this concrete-lined drainage canal extends to St. John Road. All of the area is an ancient raised reef platform. Although appearing mostly flat, the ground does slope gradually to the west where, at times, runoff pools along an unimproved track (extension of Kula'aupuni Street). In this area, surface runoff is stopped by the adjacent built-up area of houses along Mamoali'i Place and the water infiltrates into the ground.

Mā'ili Stream

Mā'ili (or Maipalaoa Stream) and its watershed is sometimes considered a sub-watershed of the larger Mā'ili'ili Stream (State Watershed Code No. 35004), which originates in the Waianae Mountains (Parham et. al., 2008). Mā'ili Stream is an excavated, fully concrete-lined, trapezoidal channel that drains the coastal plain of Mā'ili and discharges into the Pacific Ocean at Ulehawa Beach Park (Figure 3). The total length of Mā'ili Stream is short, reaching less than one mile (1.6 km) inland.

Mā'ili Stream channel receives runoff from residential neighborhoods in Mā'ili, a portion of Lualualei Naval Reservation, and agricultural lots *mauka* (inland) of the residential area; this contribution is rain-dependent and largely seasonal. From approximately 200 m (656 ft) upstream of Kula'aupuni Street (just *mauka* of Ulu Ke Kukui, adjacent to the Project site), downstream to the stream mouth, the excavated channel intersects the brackish groundwater and is an estuary: the water in this segment of the channel is brackish, tidally influenced, and relatively permanent (Figure 4).

The estuary *makai* of Farrington Highway bridge is lined with limestone boulder berms and has a limestone solution bench across the outlet in the intertidal zone. During high tide or during large swells, seawater enters the estuary over the solution bench, providing some flushing of the channel waters. In fact, deposits of seaweed are present in the channel, up to 1,145 m (0.7 mi) inland from Farrington Highway (Figure 5). During low tide the stream does have visible outflow to the ocean (*AECOS*, 2019).

The subject watershed is relatively dry throughout the year. The nearest rain gage to the Project site, Lualualei, records an average annual rainfall of 31.9 in (810 mm), with rainfall typically highest in January and lowest in June (Giambelluca et. al, 2013; Figure 6).

Figure 3. Estuary of Mā'ili Stream showing water quality stations.

Figure 4. Shallow water of the estuary of Ma'ili Stream adjacent to the Project site, which is above left bank (on the left in this photograph).

Figure 5. High tides deposited seaweed in Ma'ili Stream far inland, here adjacent to the Project site (left bank on right in this photograph).

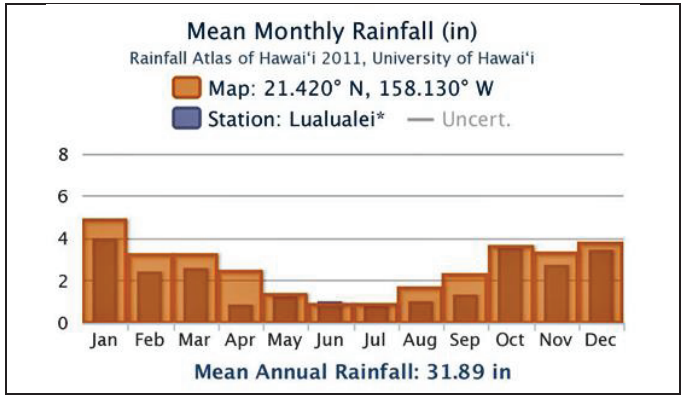

Figure 6. Mean monthly rainfall at Lualualei rain gage.

The entire Project area falls within the non-special flood hazard area, and consists of both zone "X" and "XS". Zone X are areas outside of the 0.2% annual chance flood. Zone XS are 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 (HDLNR, 2011).

USDA-NRCS mapped soils in the survey area are predominantly Mokuleia clay (Mtb) and Mamala cobbly silty clay loam, 0-12% slopes (MnC), with a small portion of Keaau stony clay, 2-6% slopes (KmaB) on the northwest of the Project site (USDA-NRCS, 2020a). KmaB is on the Hydric Soils List for O'ahu (USDA-NRCS, 2020b).

Jurisdictional Waters

Waters of the U.S. (also called "jurisdictional waters") are surface waters that come under federal jurisdiction as authorized by the CWA and the RHA. Authority over these waters is granted to various federal agencies, including the U.S. Environmental Protection Agency (USEPA), with the U.S. Army Corps of Engineers (USACE) having permit authority for actions that impact

jurisdictional waters. Jurisdictional waters include all tidal waters and a subset of streams (both perennial and intermittent), lakes, reservoirs, and wetlands.

On June 22, 2020, the Navigable Waters Protection Rule (NWPR) came into effect (USACE and USEPA, 2020), which redefined the scope of waters regulated under the CWA. As applicable to Mā'ili Stream channel and the Project site, the NWPR specifically identifies tidal waters and intermittent and perennial stream tributaries as jurisdictional waters but excludes ephemeral tributaries and wetlands without a direct hydrologic surface connection to an otherwise jurisdictional water body.

In the NWPR, a *tributary* is defined as an intermittent or perennial surface water channel (e.g., stream) that contributes surface flow to other waters of the U.S. (e.g., ocean) in a typical year. An *intermittent* stream is one that has surface water flowing continuously during certain times of the year and more than in direct response to precipitation and a *perennial* stream has surface water flowing continuously year-round. An *ephemeral* stream has surface water flowing or pooling only in direct response to precipitation. A tributary does not lose its jurisdictional status if it flows through a channelized non-jurisdictional surface water (such as a culvert) and a perennial or intermittent ditch is jurisdictional if it is a relocated tributary or is constructed in an adjacent wetland. The jurisdictional boundary of tidal waters is the mean high water (MHW, in RHA) and high tide line (HTL, in CWA), in non-tidal streams it is the ordinary high water mark (OHWM), and the jurisdictional boundary of adjacent wetlands is the wetland/upland boundary. *Wetlands* are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

If a wetland is present and adjacent to a jurisdictional water, CWA and RHA jurisdiction extends to the wetland/upland boundary. Adjacent wetlands means wetlands that (i) abut a jurisdictional waterbody, (ii) are inundated by flooding from a jurisdictional waterbody, (iii) are separated from a jurisdictional waterbody only by a natural berm, bank, dune, or similar natural feature; or (iv) are physically separated from a jurisdictional waterbody by an artificial dike, barrier, or similar artificial structure so long as that structure allows for a direct hydrologic connection in a typical year, such as via a culvert, flood or tide gate, pump, or similar artificial feature (USACE and USEPA, 2020).

Executive Order 11990 (The President, 1977) requires federal agencies to minimize the destruction, loss, or degradation of wetlands and to preserve and

enhance the values of wetlands. Wetlands protected by this Executive Order are defined similarly as they are in the NWPR (see above).

Methods

Aquatic Environments Surveys

Surveys were undertaken to cover aquatic environments in the Project vicinity, specifically of the concrete-lined channel of lower Mā'ili Stream estuary and the ocean nearshore near the mouth of the estuary. Our survey of the subject property included looking for any areas that might need further consideration as wetlands based upon dominant plant species present or primary indicators of wetland hydrology.

Water Quality Survey

The team collected water samples and measured *in situ* water quality at five stations in the vicinity of the Project (see Figure 3): "Station 1" located at the upper end of the Mā'ili Stream estuary off the northwest corner of the Project property; "Station 2" in Mā'ili Stream estuary 2360 feet (720 m) from the mouth; "Station 3" at the mouth of the Mā'ili Stream channel; "Station 4" off the beach at Ulehawa Beach Park just north of the stream mouth; and "Station 5" off the shore some 720 ft (220 m) south of the stream mouth.

Samples were collected on September 30, 2020 from just below the water surface, chilled in a cooler with ice, and returned to *AECOS* laboratory for water quality analyses (*AECOS* Log No. 40912). Water quality measurements made in the field included: temperature, salinity, conductivity, pH, and dissolved oxygen (DO); analyses conducted in the laboratory included: turbidity, total suspended solids (TSS), ammonia (NH_3) nitrate+nitrite (NO_3+NO_2), total nitrogen (TN), total phosphorus (TP), and chlorophyll α. Analytical methods are listed in Table 1.

Estuarine Biological Survey

Bryson Luke and Susan Burr undertook a survey for aquatic animals in the Mā'ili Stream estuary on September 30, 2020. The survey consisted of making visual observations while wading in the estuary channel and walking along the banks. The biologists noted relative abundances (e.g., rare, common, abundant) of each species encountered as the survey progressed. Nomenclature and identifications follow *Hawai'i's Native and Exotic Freshwater Animals*

(Yamamoto and Tagawa, 2000), *Hawai'i's Sea Creatures* (Hoover, 1999), *Shore Fishes of Hawai'i* (Randall, 2010), and *Hawaiian Reef Plants* (Huisman et al, 2007).

Table 1. Analytical methods used for water samples collected on September 30, 2020 from Mā'ili Stream and nearshore waters.

Analysis	Method	Reference	Instrument
Temperature	SM 2550B	SM (2017)	YSI Pro Plus DO meter thermistor
Salinity	SM 2550B	SM (2017)	YSI Pro Plus
pH	SM 4500H+	SM (2017)	pH pHep HANNA meter
Dissolved Oxygen	SM 4500-O G	SM (2017)	YSI Pro Plus
Turbidity	EPA 180.1 rev. 2.0	USEPA (1993b)	Hach 2100Q Turbidimeter
Ammonium	EPA 349	USEPA (1997a)	Lachat Quickchem 8500
Nitrate + Nitrite	EPA 353.2	USEPA (1993a)	Lachat Quickchem 8500
Total Nitrogen	ASTM D5176-08	ASTM (2015)	Shimadzu TNM-1
Ortho-Phosphate	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Total Phosphorus	EPA 365.5	USEPA (1997b)	Lachat Quickchem 8500
Chlorophyll α	SM10200H(M)	SM (1998)	Turner Fluorometer

Marine Biological Survey

Susan Burr conducted a reconnaissance survey of marine resources on the solution bench and in the nearshore waters in the vicinity of the Mā'ili Stream mouth. The snorkel survey extended approximately 120 m (400 ft) offshore, beginning at 09:55, 34 minutes after a predicted 0.33 ft low tide relative to mean lower low water (MLLW: Waianae ID 1612482: NOAA-NOS, 2020). Depths surveyed ranged from 1 to 3 m (3 to 10 ft); underwater visibility was poor—on the order of 2 m (6 ft). Marine algae, fishes, and macroinvertebrates were identified in the field and verified with various texts: *Hawai'i's Sea Creatures* (Hoover, 1999), *Shore Fishes of Hawai'i* (Randall, 2010), and *Hawaiian Reef Plants* (Huisman et al, 2007).

Preliminary Jurisdictional Waters Determination

In the field, we confirmed that Mā'ili Stream has a surface connection to the Pacific Ocean, and, therefore, considering flow regime, may considered to be a tidal waterbody or a jurisdictional tributary. We reviewed literature, maps, and GIS datasets prior to our field study; sources included: U.S. Fish and Wildlife Service, National Wetlands Inventory (NWI; USFWS, 2020); U.S. Dept. of Agriculture, Natural Resource Conservation Service (USDA-NRCS) web soil survey (USDA-NRCS; 2020a); U.S. Geological Survey (USGS) StreamStats (USGS, 2017); National Oceanic and Atmospheric Administration (NOAA) Climate Data Online (NOAA-NCEI, 2020); and State of Hawaii Dept. of Land and Natural Resources (HDLNR) Flood Hazard Assessment Tool (FHAT; HDLNR, 2011).

No open water bodies or streams of any kind are present within the Project site. However, we did assess the site for any areas with wetland hydrology indictors (i.e., areas with surface water, surface saturation) or dominated by wetland vegetation (plant hydrophytes) indicating presence of wetlands where further delineation might be required.

Terrestrial Botanical Survey

The natural resources survey of flora in the Project area was undertaken by Eric Guinther on September 30, 2020. The wandering pedestrian transect was recorded on a Trimble 6000 Series GNSS unit (Trimble GeoXH), providing guidance in real time on location and adequacy of coverage and position locations of any plants encountered of particular interest or concern.

Plant species were identified as they were encountered. Plant species names follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2019).

Terrestrial Vertebrates Survey

Avian Survey

Reginald David conducted the terrestrial vertebrates survey on September 30, 2020. Seven avian count-stations were sited roughly equidistant from each other within the Project site. A single eight-minute avian point count was made at each of the count stations. The avian counts were conducted in the early morning hours with the aid of Leica 8 X 42 binoculars and by listening for

vocalizations. Additionally, two 30-minute time-dependent waterbird counts were completed, one from the bridge on Kula'aupuni Street over Mā'ili Stream and the other from the Farrington Highway bridge over the estuary. Time not spent counting birds at point-count stations was used to search the Project area for species and habitats not detected during the point-counts. Weather conditions were ideal, with unlimited visibility, no precipitation, and winds between 1 and 15 kph.

The avian phylogenetic order and nomenclature used in this report follow the AOU *Check-List of North and Middle American Birds* 2019, and the Sixtieth Supplement to the American Ornithological Society's *Check-List of North American Birds* (Chesser et al., 2019, 2020).

Mammalian Survey

The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial mammalian species detected within the survey area. Mammal scientific names follow Wilson and Reeder (2005).

Results

Water Quality

Water quality results are presented in Table 2. Considering that the stations cover the estuarine portion of Ma'ili Stream from near the upper end to the mouth and include two nearby shore stations, the wide range in values for every measured parameter is as expected. Salinity shows the very different waters present: 11 psu (about 1/3 the salinity of ocean water) at the upper end of the estuary and 26 psu midway towards the mouth. At the ocean away from the estuary mouth, salinity was a typical oceanic value of 36 psu. Temperature varied from 26.8 °C to a somewhat surprising 29.7°C at one of the ocean shore stations (Sta, 5).

pH increased as expected from a low of 6.98 at Sta. 1 to typical oceanic values of 8.3 at Stations 4 and 5. DO saturation values were high at all stations (range: 87 to 104%), except at Station 2. Turbidity and TSS values were high: in the range of 0.64-1.40 ntu and 4.1-6.9 mg/l at stations 2 through 5, but excessive at Station 1 (60.4 ntu and 139 mg/L). The high Chl. α value at Sta. 1 establishes that a phytoplankton bloom was occurring in the stagnant water at the upper end of the estuary. Much of the turbidity at this station is a result of this

Table 2. Water quality measurements for Ma'ili Stream estuary and nearshore waters at mouth for September 30, 2020.

Station	Temp. (°C)	Salinity (PSU)	pH	DO (mg/L)	DO Sat. (%)	Turbidity† (NTU)
Sta. 1	26.8	11.0	6.98	7.17	97	60.4
Sta. 2	28.3	25.9	7.24	3.53	52	1.34
Sta. 3	28.6	31.1	7.70	5.67	87	1.40
Sta. 4	28.4	35.9	8.28	6.64	104	0.64
Sta. 5	29.7	35.8	8.28	6.07	97	1.20
Station	**TSS (mg/L)**	**NH_4 (µgN/L)**	**NO_3+NO_2 (µgN/L)**	**Total N (µgN/L)**	**Total P (µgP/L)**	**Chl. α (µg/L)**
Sta. 1	139	17	8840	10,400	17	26.6
Sta. 2	4.1	93	3010	4080	32	1.44
Sta. 3	4.6	52	1290	1870	<3	0.73
Sta. 4	4.4	86	21	288	6	1.71
Sta. 5	6.9	22	<1	76	10	0.77

productivity and photosynthesis there was contributing to both the high DO and low ammonium values. Chlorophyll α was typical at all other stations.

All nitrogen moieties (NH_4, NO_3+NO_2, TN) were high in the estuary and at the mouth, being much lower at the two ocean shore stations. Most of the nitrogen measured in the TN values at the estuary stations is inorganic (NH_4 and NO_3+NO_2). TP values were on the low side at all but Sta. 2.

Preliminary Jurisdictional Waters Determination

Mā'ili Stream is identified (as Maipalaoa Stream) on the USFWS National Wetlands Inventory (NWI) (USFWS, 2020). Despite the name, the NWI identifies both surface waters and wetlands. The lower segment of Mā'ili Stream is characterized in the NWI as an excavated, subtidal estuarine channel with an unconsolidated bottom (E1UBLx)—an excavated estuary. The upper segment is characterized as an excavated, seasonally flooded, intermittent stream (R4SBCx)—an excavated intermittent stream. Our field observations on September 30, 2020 generally support these characterizations and also confirm the concrete-lined channel is not a wetland. The channel has neither wetland

vegetation nor hydric soil (see Figs. 4 and 5), so it does not meet two of the three required criteria. We did not prepare wetland data determination sheets for this concrete-lined channel.

Water quality parameters (described above) measured in the channel near and downstream of Ulu Ke Kukui confirm the water is tidally-influenced, and, as described below, marine and estuarine fishes inhabit the channel. Inland of this point, the channel was dry and flow in the channel is either ephemeral or intermittent. Because the channel is a single, connected basin, for jurisdictional purposes, it should be considered as a single waterbody. Thus, under the NWPR, the line of federal jurisdiction in Mā'ili Stream channel can be drawn on the channel walls, at a minimum of the MHW[2]. The assertion that jurisdictional limits are at the top-of-bank of the channel wall is a conservative assumption, but appropriate for this Project. All potential jurisdictional limits are contained within the channel: HTL, MHW, MHHW, and OHWM.

No other streams were found to be present within the Project vicinity. No land adjacent to Mā'ili Stream displayed wetland hydrology or was found to have vegetation dominated by wetland plants. Our survey revealed only one area on the Project site that might require further assessment of federal jurisdiction where water forms ephemeral pools after heavy rains along the west margin of the site and pickleweed (*Batis maritima*) is locally abundant.

Vegetation

Vegetation across the site varies from open grassland (dominated by buffelgrass, *Cenchrus ciliaris*) to shrubland, dominated by Indian fleabane (*Pluchea indica*) and *koa haole* (*Leucaena leucocephala*; Figures 8a and 8b). Trees (*kiawe* or *Prosopis pallida*) are scattered around the area, but form more or less open forested areas along the western and southeastern sides of the property.

Flora

Table A1 (see Attachment A) is a listing of flowering plants (angiosperms) observed during the survey with 72 taxa identified from the survey area. The vast majority (86%) are naturalized or ornamental, non-native species. Ten indigenous natives are present: *naupaka kahakai* (*Scaevola taccada*), *kou* (*Cordia subcordata*), *kīpūkai* (*Heliotropum curassavicum*), *koali'awa* (*Ipomoea*

[2] Tidal datum from the nearest NOAA tidal gage (1612366, Fort Kamehameha, Bishop Point, Pearl Hbr, HI) indicates Mean Higher Water (MHW) is +0.19 m (+0.62 ft) above the Mean Sea Level (MSL), and Mean Higher High Water (MHHW) is+0.33 m (+1.08 ft) above MSL (NOAA, 2021).

Figure 8a (upper). A majority of the site is grassland/shrubland. Figure 8b (lower). In many areas, shrubland predominates with scattered *kiawe* trees.

indica), *pāʻūohiʻiaka* (*Jacquemontia ovalifolia*), *koʻoloa keokeo* (*Abutilon incanum*), *ʻilima* (*Sida fallax*), *ʻuhaloa* (*Waltheria indica*), a small sedge (*Cyperus polystachyos*), and *pili* grass (*Heteropogon contortus*). *Koʻoloa keokeo, ʻuhaloa, ʻilima*, and *pili* are common across the site. The others are mostly uncommon or rare here, and the percent of natives (14%) is typical for a lowland location on Oʻahu. A single Polynesian introduction (*kukui* or *Aleurites moluccana*) and 10 ornamentals were recorded. The ornamentals were found mostly along the borders of adjacent developed projects and house lots. Many of the natives are plantings made at CLC-M.

Aquatic Biota

Māʻili Stream estuary extends inland confined to a concrete channel (Figs. 4 and 5. above), the upper extent of the estuary near the northwest corner of the Project area. Farther upstream, flow in Māʻili Stream is ephemeral, but the size of the concrete channel suggests a large volume of water is anticipated during infrequent freshets. Table A2 (Attachment A) lists aquatic species observed by *AECOS* on September 30, 2020, as well as reported in Māʻili Stream near the Project area from previous biological surveys (*AECOS*, 2010; 2019). Relative abundances in the table are provided only for species observed during the September 2020 survey.

Clumps of marine algae (*Acanthophora spicifera* and *Gracilaria salicornia*) are the most conspicuous feature in the channel near the Project site. Schools of finger-sized striped mullet or *pua ʻama* (*Mugil cephalus*) inhabit this very upper end of the estuary. Blackchin tilapia (*Sarotheron melanotheron*) and liberty/Mexican molly (*Poecilia* sp. hybrid complex [*salvatoris/mexicana* group) are also conspicuous and the nearly transparent, glass shrimp or *ʻōpae huna* (*Palaemon debilis*) can be seen along the edge of the water in the channel.

Although the water is brackish downstream of Kulaʻaupuni Street bridge, the inhabitants of the estuary are decidedly more marine in character here than upstream of the bridge. Blackchin tilapia remain dominant, but large adult striped mullet or *ʻamaʻama* are common in the channel and conspicuous marine fishes, such as racoon butterflyfish (*Chaetodon lunulatus*), *puhi kāpā* or snowflake moray (*Echidna nebulosa*), *toʻau* (*Lutjanus fulvus*), and *ʻoama* (*Mulloidichthys flavolineatus*) are present.

Marine Biota[3]

The littoral limestone bench at Ulehawa Beach Park hosts Hawaiian mussel (*Brachidontes crebristriatus*). The splash pools on the limestone bench host a few juvenile fishes (*āholehole* or *Kuhlia xenura*, *Plectroglyphidodon impairipennis*, and *Bathygobius* spp.) and invertebrates, including: *pipipi* (*Nerita picea*), false limpet (*Siphonaria normalis*), helmet urchin (*Colobocentrotus atratus*), and periwinkle (*Littorina pintado*). A diverse assemblage of algae and invertebrates occur in tidal pools on the bench: *Padina* spp., *Laurencia* spp., *Sargassum echinocarpum*, *Microdictyon setchellianum*, and *Neomeris* sp. are the most commonly observed species. Less commonly seen algae include: *Tricleocarpa fragilis*, *Turbinaria ornata*, *S. obtusifolium*, *S. polyphyllum*, *Spatoglossum macrodontum*, *Cladophora* sp., *Dictyosphaeria cavernosa* and *D. verslyuii*. Urchins (*Echinometra mathaei*, *E. oblonga,* and *Heterocentrotus mammillatus*) and snakehead cowry (*Cypraea caputserpentis*) are found in crevices on the bench. Other invertebrates observed include variable worm snail (*Serpulorbis variabilis*), *'a'ama* (*Grapsus tenuicrustatus*), hermit crab (Family Diogenidae), ashy sea cucumber (*Holothuria cinerascens*), and teated sea cucumber (*H. whitmaei*).

A submerged (sublittoral) limestone shelf lies offshore of the estuary mouth. Urchins are ubiquitous on this shelf, their scouring activity visible in the surface. Blue soft coral (*Sarcothelia edmondsoni*) is common on the limestone, whereas hermatypic corals are sparse. Off the seaward face of the shelf (at approximately the 12-ft or 4-m depth), the bottom is low-relief limestone, with low-growing and turf-forming algae and some corals (*Porites lobata*, *Porites* spp., and *Pocillopora meandrina*). Several large outcrops with large (80-cm or 30-in) *Porites* spp. colonies occur (Figure 9). Some colonies of *Pocillopora meandrina* were bleached in 2020, but fewer than were noticed in the 2019 survey (*AECOS*, 2019).

Common fishes observed off the stream mouth are surgeonfishes, damselfish, goatfishes, triggerfish, butterflyfishes, wrasses, and Moorish idol. A few green sea turtle or *honu* (*Chelonia mydas*) were seen in both 2019 and in the current survey. Relative abundances of marine organisms encountered during the survey are listed in Table A3 (Attachment A).

[3] The marine community observed in the September 2020 marine survey is nearly identical to the community observed in July 2019 (*AECOS*, 2019), with respect to diversity and abundances; therefore, the description below is nearly identical to that in our 2019 report.

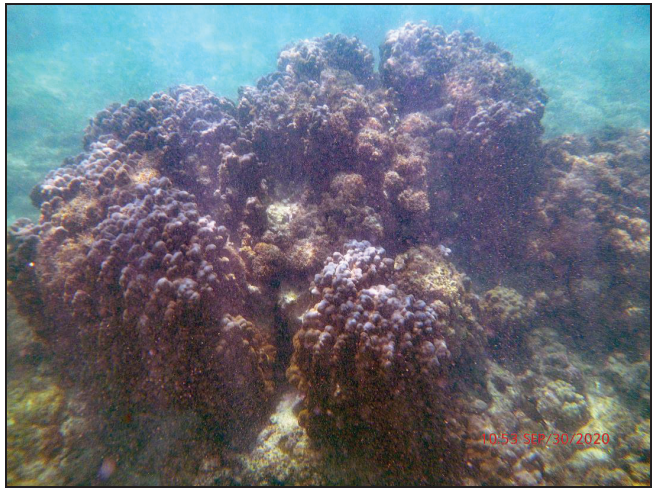

Figure 9. Large outcrop with coral colonies offshore of the mouth of Mā'ili Stream.

Avian Fauna

A total of 310 individual birds of 18 species and representing 13 separate families, was recorded during station counts (Table A4; see Attachment A). Three species recorded: Pacific Golden-Plover (*Pluvialis fulva*), Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*), and Short-eared Owl (*Asio flammeus sandwichensis*) are native species. The plover is an indigenous, migratory shorebird species, the Black-crowned Night-Heron is a resident indigenous, water obligate species and the Short-eared Owl, or *pueo* as it known locally, is an endangered endemic subspecies of the near cosmopolitan Short-eared Owl (DLNR, 1998; USFWS, 2015, n.d.). The remaining 15 species recorded during the course of this survey are alien to the Hawaiian Islands.

Avian diversity and densities are in keeping with the lowland grass and shrub environments present within the site. Four species—Rock Pigeon (*Columba livia*), Red-vented Bulbul (*Pycnonotus cafer*), Zebra Dove (*Geopelia* striata) and

Common Myna (*Acridotheres tristis*)—accounted for 52% of all birds recorded during station counts. The most frequently recorded species was Rock Pigeon, which accounted for 17% of the total number of individual birds recorded during station point-counts.

No waterbirds were recorded at either of the 30-minute time dependent waterbird count at the Mā'ili estuary locations.

Mammals

Three terrestrial mammalian species were detected on site during the course of this survey. We saw a number of small Indian mongooses (*Herpestes javanicus auropunctatus*) within the site and along roadways. Cat (*Felis catus*) tracks and scat were seen at numerous locations within the site. Numerous dogs (*Canis lupus familiaris*) were heard barking from locations outside of the survey area. Tracks and scat of dogs, cats and mongooses were encountered on the various trails and unimproved roads we walked.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, nd). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to listed species to the maximum extent practicable.

Water Quality

Estuarine waters are typically highly variable in water quality, representing a place of mixing of stream and seawater. In this case, the lack of flow in Ma'ili Stream at the time of the survey suggests somewhat stagnant conditions would be present. Salinity well below that of seawater at the upper end indicates perhaps a recent injection of fresh water or groundwater seepage into the system. The comparative low temperature at Sta. 1 (26.8 °C), some 3C° below that of the nearby nearshore ocean waters is suggestive of groundwater influence. However, the nearshore temperature of 29.7 °C at Station 5 is high; average seawater temperature off O'ahu in September is 27.2 °C (September and October are the warmest months of seawater of O'ahu; NOAA-NCEI, 2020).

As noted, the high chlorophyll α value at the upper end of the estuary is an indication of a phytoplankton bloom in that location, probably being fed by

nutrients in groundwater seepage. Values measured elsewhere in the estuary and the ocean are more typical for natural waters. Dense phytoplankton in active photosynthesis (eutrophication) will raise the DO, raise the pH, and represent a significant contribution to turbidity. Uptake of ammonium is occurring as indicated by the low value at Station 1. The fact that pH is not particularly high at Station 1 (at 6.98) is somewhat unusual although DO saturation is at 97% (and DO highest of any of the stations at 7.17 mg/L), and not supersaturation (above 100%).

An indication of poor water quality in this sampling event is the high nitrogen concentrations at all three stations within the estuary (though much diluted at the mouth). Outflow from the system is impacting on Station 4 as indicated by all the nitrogen moieties comparing Stations 4 and 5.

Preliminary Jurisdictional Waters Determination

The results of the jurisdictional waters survey of Mā'ili Stream are intended for planning and environmental permitting purposes. The jurisdictional limits of Mā'ili Stream may be conservatively drawn at the top-of-bank of the Mā'ili Stream channel. The channel does not contain a wetland and, therefore, is not subject to Executive Order 11990. Acceptance of our preliminary delineation by the USACE may require a field visit to make a jurisdictional determination and confirm the boundary. Our delineation is not official until accepted in writing by the USACE.

The area along the west margin of the site (described above on page 14) might require further assessment of federal jurisdiction. Water forms ephemeral pools after heavy rains here, pickleweed is locally abundant, and the mapped soil type of or near the area is a hydric soil.

- Prior to construction, a wetland survey should be conducted to determine if this area is within the Project area, and, if so, delineate the boundaries and obtain a jurisdictional determination from the USACE. Jurisdictional determinations are valid for a period of five years, so the survey should be timed accordingly.

Floral Resources

No plants of conservation interest or statutory concern (HDLNR, 1998; USFWS, nd-a) were encountered during our survey of the Project area.

Estuarine Biota

Flow in Mā'ili Stream upstream of the estuary is likely ephemeral, resulting in a depauperate freshwater fauna. While not observed during this survey, native gobies that reside in estuaries—for example, *'o'opu 'akupa* (*Eleotris sandwicensis*) and *'o'opu naniha* (*Stengobius hawiiensis*)—have been observed near the mouth Mā'ili Stream (*AECOS*, 2010). Native gobies are amphidromous: eggs are laid in the stream and the larvae that hatch from these eggs move down stream and out into the ocean where they develop for a time before migrating back into fresh water to grow to maturity (Ford and Kinzie, 1982; Kinzie, 1988). These fishes may occur in the concrete channel adjacent to the Project area, but the habitat is not ideal for them and no habitat is available for them farther upstream. In addition to the poor physical environment, predatory blackchin tilapia make survival here difficult for these animals.

Discharge of storm water from the DHHL development will not have adverse impacts on estuarine biota, assuming the system is built in compliance with the Storm Water Management Program (SWMP) developed to comply with requirements in National Pollutant Discharge Elimination System (NPDES) permit for the O'ahu municipal separate storm sewer system (MS4).

Marine Biota

Invertebrates

Coral species are protected by Hawai'i State regulations that prohibit damage to "any stony coral by any intentional or negligent activity causing the introduction of sediment, biological contaminants, or pollution into state waters" (HDLNR, 2014). On September 20, 2018, NOAA issued a proposed rule for listing the cauliflower coral (*Pocillopora meandrina*) as an endangered or threated species under ESA (NOAA-NMFS, 2018). A global status review has been initiated by NOAA to determine whether listing it throughout its range is warranted.

Hawai'i Department of Land and Natural Resources (HDLNR) regulates shellfishes such as pearl oysters (HDLNR, 1987) and *'opihi* (HDLNR, 1989). One *'opihi* species (*C. exarata*) was observed in our survey. Fishing regulations are in place for certain fishes (HDLNR, 2014); however, because fishing activity is not expected to be influenced or impacted by the Project, these catch-regulated species are not discussed further.

Sea turtles

The distinct population segment (DPS) of green sea turtle that occurs in Hawai'i is federally-listed as a threatened species (USFWS and NOAA-NMFS, 2016; USFWS, 2018) and as a threatened subspecies (*Chelonia mydas agassizi*) under State of Hawai'i regulations (HDLNR, 2014).

Threats to the green sea turtle in Hawai'i include: disease and parasites, accidental fishing take, boat collisions, entanglement in marine debris, loss of foraging habitat to development, and ingestion of marine debris. Throughout the global range of green sea turtle, nesting and foraging habitats are being altered and destroyed by coastal development, beach armoring, beachfront lighting, vehicular/pedestrian traffic, invasive species, and pollution from discharges and runoff (NOAA & USFWS, 2007a, 2007b). Adult green sea turtles forage in shallow nearshore areas and coral reefs. Contamination from effluent discharges and runoff has degraded these environments, and invasive species may reduce native algae species preferred by green sea turtles or could exacerbate susceptibility to, or development of disease (NOAA-NMFS and USFWS, 2007a). Fibropapillomatosis, a disease characterized by the presence of internal and/or external tumors that may grow large enough to hamper swimming, vision, feeding, and potential escape from predators continues to be a major threat to green sea turtles. Extremely high incidence has been reported in Hawai'i, where affliction rates peaked at 47-69% in some foraging areas (Murakawa et al., 2000).

Hawksbill sea turtle is distributed across the Pacific, Indian, and Atlantic oceans. Hawksbill sea turtle is much less common in the Hawaiian Islands than green sea turtle and is known to nest only in the southern reaches of the state (NOAA-PIFSC, 2010). Hawksbill sea turtle is federally-listed as endangered (USFWS, nd) and is listed as an endangered subspecies (*Eretmochelys imbricata bissa*) under Hawai'i state regulations (HDLNR, 2014). Hawksbill sea turtle faces many of the same threats affecting green sea turtle (see above section; NOAA-NMFS, 2007b).

Monk Seal — The endangered Hawaiian monk seal (*Monachus schauinslandi*) is known to occur in the Project vicinity. The Hawaiian monk seal was listed as an endangered species pursuant to the ESA on November 23, 1976 (41 FR 51612) and remains listed as endangered. In that same year, the Hawaiian monk seal population was designated as "depleted" under the Marine Mammal Protection Act (MMPA). The majority of Hawaiian monk seal sighting information collected in the main Hawaiian Islands is reported by the general public and, therefore, highly biased by location and reporting effort. The only truly systematic monk seal count data available for the main Hawaiian Islands are

from aerial surveys conducted by the Pacific Islands Fisheries Science Center (PIFSC) in 2000, 2001, and 2008 (Baker and Johanos, 2004; PIFSC unpublished data). No seals were sighted in Mā‘ili during these three complete surveys of O‘ahu.

Reports by the general public, which are non-systematic and not representative of overall seal use of main Hawaiian Island shorelines, have been collected in the main Hawaiian Islands since the early 1980s. For the purposes of this report, a sighting is defined as a calendar day during which an individual seal is documented as present at a specific location. There have been 2732 reported sightings of monk seals in Mā‘ili (between Mā‘ili Point and Maili'ili Stream mouth) from 2009 to 2018 (Table 3). Sightings were divided into six areas based on reported location and include Mā‘ili Beach Park, Mā‘ili Point, Mā‘ili Stream, Mā‘ili‘ili Stream, Maipaloa Beach, and Nani Kai Beach Park. The vast majority (81%) of the sightings were reported at Mā‘ili Point. Of the total sightings, 2629 reports can be attributed to 36 uniquely identifiable seals (Table 4). No monk seal births have been documented in Mā‘ili.

Table 3. Number of reported Hawaiian monk seal sightings in Mā‘ili, between Mā‘ili Point and Mā‘ili‘ili i Stream, on the island of Oahu (2009 to 2018).

Location	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	**Total**
Mā‘ili Beach Park	5	6	9	22	11	40	12	13	100	9	**227**
Mā‘ili Point	23	43	125	216	165	143	209	296	484	514	**2218**
Mā‘ili Stream	0	0	0	0	0	1	53	0	0	0	**54**
Mā‘ili‘ili i Stream	0	0	0	0	0	0	7	0	0	0	**7**
Maipaloa Beach	0	0	1	0	7	9	18	0	0	0	**35**
Nani Kai Beach Park	0	3	0	8	4	7	13	6	137	13	**191**
Total	**28**	**52**	**135**	**246**	**187**	**200**	**312**	**315**	**721**	**536**	**2732**

Table 4. Number of sightings of uniquely identified Hawaiian monk seals reported in Mā‘ili, between Mā‘ili Point and Mā‘ili‘ili i Stream, on the island of Oahu (2009 to 2018).

Seal ID	**Sex**	**Sightings**
R010	Female	5
R012	Male	21
R018	Male	26
R020	Female	42
R2AU	Male	3
R303	Female	9
R3CU	Male	7
R4DF	Female	4
R6FI	Male	105
R912	Female	111
RA20	Female	1
R6FI	Male	105
R912	Female	111
RA20	Female	1
RB00	Female	1
RB24	Female	47
RE74	Male	158
RG32	Male	2
RH32	Male	122
RH36	Female	12
RH48	Female	101
RH92	Female	8
RI37	Female	8
RK36	Male	77
RK72	Male	414
RL12	Female	1
RL42	Female	3
RN14	Male	178
RO28	Female	181
RN36	Female	13
RR70	Male	308
RS00	Female	2
RT12	Male	73

Table 4 (continued).

Seal ID	Sex	Sightings
RW02	Male	137
RW08	Male	198
RW22	Male	231
RV08	Male	5
T21M	Male	2
T34M	Male	13
Total		**2629**

Invertebrates

Yellow-faced bee are listed as endangered in the Hawaiian Islands (USFWS, 2016), and six of seven species of yellow-faced bee are known to occur on Oʻahu island (*Hylaeus anthracinus*, *H. assimulans*, *H. facilis*, *H. kuakea, H. longiceps,* and *H. mana*) in montane and coastal habitat. Coastal habitat for yellow-faced bee is restricted to a narrow zone, 30 to 65 ft (10-20 m) wide along the coastline (USFWS-PIFWO, nd). No yellow-faced bee species was observed during our survey and the Project area is beyond 65 ft (20 m) from the ocean shore. However, the Project site could be considered adjacent to yellow-faced bee habitat, and woody *kiawe* debris favored by some yellow-faced bee species is especially abundant in some areas. Food resources for this insect are most likely to be present in the plantings of native flowers at CLC-M.

Blackburn's sphinx moth (*Manduca blackburnii*), an insect federally listed as endangered in Hawaiʻi (USFWS, 2000), is not presently known to occur on Oʻahu. The caterpillar of this moth feeds exclusively on plants in the Family Solanaceae (USFWS 2003; HDLNR, 2005), particularly tree tobacco. No plants in this family were noted in our survey.

Avian Resources

The findings of the avian survey are consistent with the location of the property and habitats present there. As previously mentioned, three of the species detected are native species. Pacific Golden-Plover is an indigenous migratory shorebird species which nest in the high Arctic during the late spring and summer months, returning to Hawaiʻi and the tropical Pacific to spend the fall and winter months each year. They usually leave Hawaiʻi and return to the Arctic in late April or the very early part of May. Pacific Golden-Plover are

commonly countered shorebirds throughout the Hawaiian Islands during late summer through mid-spring months. Black-crowned Night-Heron is a resident indigenous, water obligate species commonly found close to just about any water feature in the Hawaiian Islands.

Short-eared owl

The Hawaiian sub-species of the Short-eared Owl is an endangered endemic subspecies of the near cosmopolitan Short-eared Owl. The Oʻahu population of this species listed as an endangered species under State of Hawaiʻi, endangered species statutes (DLNR, 1998). The species is not listed under federal endangered species statutes.

The species is known to nest within the Lualualei Naval Magazine. A buffelgrass grassland present on a good portion of the DHHL site (Figure 3) is typical of the habitat that this species nests in on the Island of Oʻahu. This owl is a ground nesting species. This species is not habitat restricted on Oʻahu, though there certainly is less suitable nesting habitat than there once was, this species faces daunting odds on an Island as heavily populated as Oʻahu – they are a ground nesting diurnal species, the sheer number and densities of mammalian predator on the Island make it very difficult for this species to successful nest except within protected areas that have a strong mammalian predator control program in place.

- To avoid disturbance of any nesting Short-eared Owls, it is recommended that a nesting survey be conducted by a qualified biologist immediately prior to clearing and grubbing activities.

Waterbirds

As previously mentioned, we did not record any waterbirds within the concrete-lined channel of Māʻili Stream. The habitat is not particularly conducive for waterbirds, being shallow and brackish. It is possible that Black-necked Stilt (*Himantopus mexicanus knudseni*) use resources in the canal or on the beach on a temporary basis. The Hawaiian endemic subspecies of the Black-necked Stilt is listed as an endangered species under both federal and state endangered species statutes (DLNR, 2015; USFWS, nd-a)

Seabirds

It is possible that Hawaiian Petrel (*Puffinus sandwichesis*), Band-rumped Storm-Petrel (*Hydrobates castro*), and Newell's Shearwater (*Puffinus newelli*) over-fly the Project area between April and the middle of December each year in very

small numbers. Newell's Shearwaters are not known to breed on Oʻahu, though recent acoustical surveys have recorded low numbers of this species calling over the higher reaches of the Island (Young, et al., 2019). These authors also recorded one Hawaiian Petrel over the Island. No suitable nesting habitat exists within or close to the Project area for any of these three seabird species.

The primary cause of mortality in Hawaiian Petrels and Newell's Shearwaters in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with man-made structures and, if not killed outright, become easy targets of opportunity for feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003).

The principal potential impact that the proposed project poses to protected seabirds is the threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main types of outdoor lighting are: 1) construction lighting for nighttime construction activities, and 2) street and/or security lighting at the completed Project. In either case, all associated lights should be shielded, and where large flood/work lights are used, these should be placed on poles that are high enough to allow the lights to be pointed directly at the ground (Reed et al., 1985; Teller et al., 1987). Deleterious impacts to transiting seabirds can be avoided if construction occurs during daylight hours and all outdoor lighting installed is fully "dark sky compliant" (HDLNR-DOFAW, 2016).

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the property and the habitats currently present on the site. Although no rodents were recorded on either survey it is likely that some, of the established alien *muridae* found on Oʻahu—roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*)—use various resources found within *the general project area on a seasonal basis. All of these introduced rodents are deleterious to native fauna.

Hawaiian hoary bats

Hawaiian hoary bats may overfly the Project area on a seasonal basis. The principal impact that the Project may pose to bats is during the clearing and grubbing phases as vegetation is removed. The removal of vegetation within the Project site may temporarily displace individual bats using the vegetation for roosting. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of a roost tree is likely to be minimal. However, during the pupping season, females carrying their pups and very small pups may be unable to rapidly vacate a roost site as it is felled.

- Potential adverse impacts from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 ms (15 ft) between June 1 and September 15, the period in which bats may have pups.

Protected and Listed Species

No species protected by State of Hawaiʻi Administrative Rules (DLNR, 1998, 2015), nor federally endangered or threatened species (USFWS, nd-a), were observed in Māʻili Stream or vicinity. One federally protected species was observed in our survey: green sea turtle. Other state- and/or federally-listed marine species—hawksbill sea turtle and monk seal—may occur in the general vicinity of the Project considering the distribution of these species and occurrences throughout the Islands (HDLNR, 2015; USFWS, nd-a).

Critical Habitat

No federally designated Critical Habitat for any species occurs within the Project site (USFWS, nd-b). No equivalent designation exists under State of Hawaiʻi endangered species statutes.

Critical habitat for Hawaiian monk seals has been designated (NOAA-NMFS, 2015) and includes the seafloor and marine habitat to 10 m above the seafloor from the 200 m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points. These terrestrial boundary points define preferred pupping areas and significant haul-out areas (NOAA-NMFS, 2015). The ocean shoreline off Māʻili falls within assigned boundary points OA21 and OA22—Maiʻli Beach through Kalaeloa Barbers Point Harbor—and therefore is designated monk seal terrestrial critical habitat. The waters offshore of the Project area are designated monk seal marine critical habitat.

Essential Fish Habitat in the Project Vicinity

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The Magnuson-Stevens Act (MSA) provisions at 50 CFR 600.10 provide further definition for the purpose of interpreting EFH as follows:

> *"Waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle*

The Project vicinity is located within the boundaries of the Hawai'i Archipelago Fishery Ecosystem Plan (FEP; WPRFMC, 2009a). This place-based FEP uses an ecosystem-based approach with "geographically defined ecosystem plans containing identical fishery regulations." The FEP identifies and categorizes Management Unit Species (MUS) based on the managed fisheries and incorporates all of the management provisions of the former Fishery Management Plans, with updates. MUS known to be present in waters around the Hawai'i Archipelago include Bottomfish and Seamount Groundfish MUS (BMUS), Crustaceans MUS (CMUS), Precious Corals MUS (PCMUS), and Coral Reef Ecosystems MUS (CREMUS). Pelagic MUS (PMUS) are managed separately through the Pacific Pelagic FEP. According to the Hawai'i Archipelago and Pacific Pelagic FEPs, the following MUS and life history stages are identified as likely present at, near, or dependent on the Project area:

- BMUS: all life stages for shallow complex, eggs and post-hatch pelagic for intermediate and deep complexes.
- CMUS: all life stages.
- CREMUS: all life stages
- PMUS: all life stages.

Waters and substrate in the Project vicinity are designated as EFH for managed fishery species listed in Table 5.

The Project is located close to the estuarine reach of Mā'ili Stream. Nearby waters off the coast are designated as EFH (including water column and all bottom areas) for coral reef ecosystem, bottomfish, pelagic, and crustacean MUS. According to the EFH designations in the Hawai'i FEP, the area is absent of EFH for precious corals, deep-water shrimp, and seamount ground fish. No juveniles or adults for either BMUS or CMUS were recorded from our surveys in

the area.

The Hawai'i and Pelagic FEPs further identify ecologically valuable subsections of EFH for the above MUS as "habitat areas of particular concern" (HAPC). These HAPCs are based on the importance of the ecological functions provided, the sensitivity to human or development-induced environmental degradation or stress, and rarity. There are no HAPCs near the Project vicinity that might be affected by the Project.

Table 5. EFH designated in Project vicinity.

MUS	Species Complex	Designated EFH
CREMUS[+]	All currently and potentially harvested coral reef taxa	Water column and all benthic substrate to a depth of 50 fathoms (fm) from the shoreline to the Exclusive Economic Zone (EEZ).
BMUS (all stages)[++]	Bottomfish Shallow Complex	Eggs and post-hatch pelagic: Water column from the surface to 240-m depth from the shoreline to the EEZ. Post-settlement and Subadult/adult: Water column from the surface to 240-m depth from the shoreline to the EEZ.
	Bottomfish Intermediate and Deep complexes	Eggs and post-hatch pelagic: Water column from the surface to 400-m depth from the shoreline to the EEZ.
CMUS[+]	Spiny/Slipper Lobster and Kona Crab complexes (all stages)	Eggs and larvae: water column from the surface to 150-m depth, from the shoreline to the EEZ. Juveniles and adults: bottom habitat from the shoreline to 100-m depth.
PMUS[+++]	Temperate/Tropical Species, Sharks and Squid complexes	Eggs and larvae: water column from the surface to 200-m depth, from the shoreline to the EEZ. Juveniles and adults: water column from the surface to 1,000-m depth, from the shoreline to the EEZ.

[+]Western Pacific Regional Fishery Management Council, 2009a.
[++] Western Pacific Regional Fishery Management Council, 2016.
[+++] Western Pacific Regional Fishery Management Council, 2009b.

In February 2019, NMFS published a final rule to reclassify certain management

unit species in the Pacific Islands as ecosystem component species (ECS; NOAA-NMFS, 2019, 84 FR 2767). An ECS means a stock that a Council or the Secretary has determined does not require conservation and management but is identified in an FEP to achieve ecosystem management objectives. The intent is to focus management efforts on species that are in need of conservation and management and improve efficiency of fishery management in the region. The rule reduces the number of MUS from 173 species or families to 20 in the Hawai'i FEP. The rule also removes the definitions of "Currently Harvested Coral Reef Taxa (CHCRT)" and "Potentially Harvested Coral Reef Taxa (PHCRT)" and revises the definitions of "Ecosystem Component Species" and "Special Permit" throughout. In the current regulations, coral reef MUS are divided into two categories: CHCRT and PHCRT. CHCRT are those species that are harvested commercially in the EEZ, and PHCRT are those species that may be potentially harvested in the future. This final rule reclassifies all coral reef MUS as ECS, so the designations CHCRT and PHCRT are unnecessary (NOAA-NMFS, 2019).

The extent of impacts associated with the proposed Project with the potential to affect EFH is limited to the transport of sediment and/or pollutants in runoff that reaches Mā'ili estuary. Mā'ili Stream often exhibits high levels of turbidity under existing conditions and likely transports sediment loads in the drainage. Project BMPs are intended to reduce the extent to which sediment disturbed as a result of construction would be transferred to coastal waters, and with effective implementation they will contribute to minimal adverse impacts to EFH.

References Cited

AECOS, Inc. 2010. Biological reconnaissance and water quality survey of Mā'ili Stream for a bridge replacement project on the leeward coast of O'ahu. Prep. For SSFM. *AECOS* Report No. 1201: 21 pp.

_____. 2019. Biological and water quality surveys, Mā'ili Stream Flood Control Improvement Project, Mā'ili, O'ahu, Hawai'i. *AECOS* Report No. 1585B: 44 pp.

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, in: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna. Studies in Avian Biology No. 22*. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. Pp. 108-123.

ASTM. 2015. Standard Test Method for Total Chemically Bound Nitrogen in Water by Pyrolysis and Chemiluminescence Detection. ASTM D5176-08(2015).

Baker, J. D., and T. C. Johanos. 2004. Abundance of the Hawaiian monk seal in the main Hawaiian Islands. Biological Conservation 116:103-110.

Balazs, G. H., H. F. Hirth, P. Kawamoto, E. Nitta, L. Ogren, R. Wass and J. Wetherall. 1992. Recovery plan for Hawaiian sea turtles. *Nat Marine Fish. Ser., S. F. S. C.*, Honolulu, Adm. Rep. H-92-01: 76 pp.

Bonaccorso, F. J., C. M. Todd, A. C. Miles, and P. M. Gorresen. 2015. Foraging range movements of the endangered Hawaiian hoary bat, *Lasiurus cinereus semotus. J. of Mammology*, 96:64-71.

Brock, R. E. 1988a. Green sea turtle population monitoring during blasting work at West Beach, Oahu. Final Report. Prep. for Alfred A. Yee Division, Leo A. Daly. 15 pp.

_____. 1988b. Green turtles (*Chelonia mydas*) at Hawai'i Kai, Hawai'i: An analysis of the impacts with the development of a ferry system. Prep. for Sea Engineering, Inc. 26 pp.

Chesser, R. T., S. M. Billerman, K. J. Burns, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, N. A. Mason, P. C. Rassmusen, J. V. Remsen Jr., D. F. Stotz, and K. Winker. 2020. Sixty-first Supplement to the Check-list of North American Birds. American Ornithological Society. Available online at URL: http://checklist.aou.org/taxa; last retrieved July 31, 2020.

Chaloupka, M. and C. Limpus. 2001. Trends in the abundance of sea turtles resident in southern Great Barrier Reef waters. *Biological Conservation*, 102: 14 pp.

_____, T. M. Work, G. H., Balazs, S. K. K. Murakawa, and R. Morris. 2008. Cause-specific temporal and spatial trends in green sea turtle strandings in the Hawaiian Archipelago (1982–2003). *Mar Biol*., 154: 11 pp.

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. *Colonial Waterbirds*, 21 (1): 11-19.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. *The Auk,* 120: 669-679.

Ford, J. I. and R. A. Kinzie III. 1982. Life crawls upstream. *Nat. Hist.*, 91: 61-67.

Giambelluca, T. W., Q. Chen, A. G. Frazier, J. P. Price, Y. –L. Chen, P. –S. Chu, J. K. Eischeid, and D. M. Delparte. 2013: online Rainfall Atlas of Hawai'i. *Bull. Amer. Meteor. Soc.* 94: 313-316. doi. 10.1175/BAMS-D-11-00228.1. Available online at URL: http://rainfall.geography.hawaii.edu/interactivemap.html; last retrieved December 7, 2020.

Hadley, T. H. 1961. Shearwater calamity on Kauai. *Elepaio*, 21: 60.

Hawaii Cooperative Park Service Unit (HCPSU). 1990. Hawaii stream assessment. A preliminary appraisal of Hawaii's stream resources. Prep. for State of Hawaii, Commission on Water Resource Management. National Park Service, Hawaii Cooperative Park Service Unit, Rept. No. R84: 294 pp.

Hawaii Department of Land and Natural Resources (HDLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

_____. 2005. Terrestrial Invertebrates. Blackburn's Sphinx Moth, *Manduca blackburni*. Hawaii's Comprehensive Wildlife Conservation Strategy, October 1, 2005. Available online at URL: https://dlnr.hawaii.gov/wildlife/files/2013/09/Fact-Sheet-Blackburns-Sphinx-Moth.pdf; last retrieved March 5, 2020.

_____. 2009. Hawai'i Administrative Rules. Title 13. Department of Land and Natural Resources. Chapter 4. Protected Marine Fisheries. 15 pp.

_____. 2011. Flood Hazard Assessment Tool. Available online at: http://gis.hawaiinfip.org/ FHAT/; last retrieved January 11, 2021.

Hawaii Department of Land and Natural Resources (HDLNR). 2014. Hawai'i Administrative Rules, Title 13, Department of Land and Natural Resources, Chapter 95, Protected Marine Fisheries Resources, Rules Regulating the Taking and Selling of Certain Marine Resources. 14 pp.

_____. 2015. Hawai'i Administrative Rules, Title 13, Department of Land and Natural Resources, Subtitle 5 Forestry and Wildlife, Part 2 Wildlife, Chapter 124, Indigenous Wildlife, Endangered and Threatened Wildlife, Injurious Wildlife, Introduced Wild Birds, and Introduced Wildlife. February 27, 2015. 16 pp.

Hawai'i Department of Land and Natural Resources-Division of Forestry and Wildlife (HDLNR-DOFAW). 2016. Wildlife Lighting. PDF available at URL: http://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf; last retrieved February 21, 2020.

Hoover, J. P. 1999. *Hawai'i's Sea Creatures: A Guide to Hawai'i's Marine Invertebrates.* Revised Edition. Mutual Publishing. 366 pp.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawai'i. Pp. 234-242, *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas.

Huisman J. M., I. A. Abbott, and C. M. Smith. 2007. *Hawaiian Reef Plants*. University of Hawaii Sea Grant College Program Publication. Report No. UNIHI-SEAGRANT-BA-03-02. 234 pp.

Imada, C. T. 2019. Hawaiian Naturalized Vascular Plants Checklist (February 2019 update). *Bishop Museum Tech. Rept. 69*. 209 pp.

Johanos, T. C. 2019a. Hawaiian Monk Seal Research Program Hawaiian monk seal survey data collected in the main Hawaiian Islands, 2008-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/5676; last retrieved May 25, 2021.

Johanos, T. C. 2019b. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (annual) collected in the Hawaiian Archipelago, 1962-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/12939; last retrieved May 25, 2021.

_____. 2019c. Hawaiian Monk Seal Research Program Hawaiian monk seal master identification records (seal) collected in the Hawaiian Archipelago, 1962-2018. US National Oceanographic Data Center. Available online at: https://inport.nmfs.noaa.gov/inport/item/5677; last retrieved May 25, 2021.

Kinzie, R. A. III. 1988. Habitat utilization by Hawaiian stream fishes with reference to community structure in oceanic stream islands. *Environ. Biol. of Fishes*, 22: 179-192.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). 1996. MSFCMA as amended through October 11, 1996. 16 U.S.C. §1801-1883. Available online at URL: https://www.fisheries.noaa.gov/resource/document/magnuson-stevens-fishery-conservation-and-management-act; last retrieved May 25, 2021.

Murakawa, S. K. K., G. H. Balazs, D. M. Ellis, S. Hau & S. M. Eames. 2000. Trends in Fibropapillomatosis among Green Turtles Stranded in the Hawaiian Islands, 1982–98. Pp. 239-241 *in*: Kalb, H. & T. Wibbels (Compilers). Proceedings of the *(PDF) Presence of fibropapillomatosis in green turtles Chelonia mydas at Príncipe Island in the Gulf of Guinea*. Available online at: https://www.researchgate.net/publication/235746310_Presence_of_fibropapillomatosis_in_green_turtles_Chelonia_mydas_at_Principe_Island_in_the_Gulf_of_Guinea; last retrieved May 25, 2021.

National Oceanic and Atmospheric Administration – National Weather Service Forecast Office, Honolulu, HI (NOAA-NWS). 2020. Hydrology in Hawaii. Available online at URL: https://www.weather.gov/hfo/hydro_summary; last retrieved January 11, 2021.

National Oceanic and Atmospheric Administration–National Centers for Environmental Information (NOAA-NCEI). 2020. Climate Data Online. Available online at URL: https://www.ncdc.noaa.gov/cdo-web/; last retrieved on November 19, 2020.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2014. Department of Commerce. Endangered and Threatened Wildlife and Plants: Final Listing Determination on Proposal to List 66 Reef-building Coral Species and to Reclassify Elkhorn and Staghorn Corals. Available online at URL: https://www.fisheries.noaa.gov/protected-resource-regulations; last retrieved May 25, 2021.

_____. 2015a. Endangered and Threatened Species: Final Rulemaking To Revise Critical Habitat for Hawaiian Monk Seals. *Federal Register*, *80* (162; August 21, 2015): 50925-50988.

_____. 2015b. Endangered and Threatened Species: Final Rulemaking To Revise Critical Habitat for Hawaiian Monk Seals. *Federal Register*, 80 (162; August 21, 2015): 50925-50988.

National Oceanic and Atmospheric Administration–National Marine Fisheries Service (NOAA-NMFS). 2016. Endangered and Threatened Species; Identification of 14 Distinct Population Segments of the Humpback Whale (*Megaptera novaeangliae*) and Revision of Species-Wide Listing; Final Rule. *Federal. Register*, 81(174; September 8, 2016): 62260-62320.

_____. 2018. Endangered and Threatened Wildlife; Positive 90-Day Finding on a Petition to List the Cauliflower Coral, *Pocillopora meandrina*. Proposed Rule. *Federal Register*, 83 (September 8, 2018): 47592-47598.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 1998. Recovery Plan for U.S. Pacific Populations of the Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD. 97 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/15970; last retrieved May 25, 2021.

_____. 2019. Department of Commerce. Final Rule, Pacific Island Fisheries; Reclassifying Management Unit Species to Ecosystem Component Species. *Federal Register*, 84 (February 8, 2019): 2767-2775.

National Oceanic and Atmospheric Administration–National Ocean Service (NOAA-NOS). 2020. Tide Predictions at Sta. 1612482 Waianae, HI.

Subordinate Station. Reference Sta. Honolulu 1612340. Available online at URL: https://tidesandcurrents.noaa.gov/noaatidepredictions.html?id=1612482&units=standard&bdate=20200930&edate=20200930&timezone=LST&clock=12hour&datum=MLLW&interval=hilo&action=dailychart; last retrieved October 5, 2020.

_____. 2021. Datums for 1612366, Fort Kamehameha, Bishop Point, Pearl Hbr HI. Available online at URL: https://tidesandcurrents.noaa.gov/datums.html?datum=MSL&units=0&epoch=0&id=1612366&name=FORT+KAMEHAMEHA%2C+BISHOP+POINT%2C+PEARL+HBR&state=HI; last retrieved on January 27, 2021.

National Oceanic and Atmospheric Administration–National Centers for Environmental Information (NOAA-NCEI). 2020. Water Temperature Table of All Coastal Regions. Available online at https://www.ncei.noaa.gov/access/data/coastal-water-temperature-guide/all_meanT.html; last retrieved on December 16, 2020.

National Oceanic and Atmospheric Administration and U.S. Fish and Wildlife Service (NOAA & USFWS). 2007a. Green Sea Turtle (*Chelonia mydas*). 5-Year Review: Summary and Evaluation. 105 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/17044; last retrieved May 25, 2021.

_____. 2007b. Hawksbill Sea Turtle (*Eretmochelys imbricata*). 5-Year Review. 93 pp. Available online at URL: https://repository.library.noaa.gov/view/noaa/17041; last retrieved May 25, 2021.

Pacific Islands Fishery Science Center (PIFSC). Internal report IR 19-008. Issued August 15, 2019.

Parham, J. E., G. R. Higashi, E. K. Lapp, D. G. K. Kuamoʻo, R. T. Nishimoto, S. Hau, J. M. Fitzsimmons, D. A. Polhemus and W. S. Devick. 2008. Atlas of Hawaiian Watersheds and their Aquatic Resources. Island of Oʻahu. Bishop Museum and Division of Aquatic Resources. 614 pp.

Podolsky, R., D. G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kauaʻi. *Colonial Waterbirds*, 21: 20-34.

Randall, J.E. 2010. *Shore Fishes of Hawaiʻi*. Revised edition. University of Honolulu Press. 234 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. *The Auk*, 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In:* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell's Shearwater. Pp. 76-78 *in*: Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Standard Methods (SM). 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. 1998. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1220 pp.

_____. 2017. Standard Methods for the Examination of Water and Wastewater, 23rd Edition. American Public Health Association, American Water Works Association, Water Environment Federation.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places.* Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. *ʻElepaio,* 39: 71.

_____, J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. *Wildlife Soc. Bull*., 15: 406-413.

The President. 1977. Protection of Wetlands. Executive Order 11990. *Federal Register*, 42 (101; May 25, 1977): 26961.

U.S. Army Corps of Engineers and U.S. Environmental Protection Agency (USACE and USEPA). 2020. Department of Defense, Department of the Army, Corps of Engineers, 33 CFR Part 328, Environmental Protection Agency, 40 CFR Parts 110, 112, 116, 117, 122, 230, 232, 300, 302, and 401, The Navigable Waters Protection Rule: Definition of "Waters of the United States". *Federal Register*, 85 (77; Tuesday, April 21, 2020): 22250-22342.

U.S. Department of Agriculture–Natural Resources Conservation Service (USDA-NRCS). 2020a. Web Soil Survey, Soil Map—Island Of Oʻahu Area, Hawaiʻi. Available online at URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx; last retrieved January 25, 2021.

_____. 2020b. National Hydric Soils List by State. Available online at URL: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/?cid=nrcs142p2_053957; last retrieved January 25, 2021.

U.S. Environmental Protection Agency (USEPA). 1993a. Methods for the determination of inorganic substances in environmental samples. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH. EPA/600/R-93/100.

_____. 1993b. Method 353.2, Revision 2.0: determination of nitrate-nitrite nitrogen by automated colorimetry. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

U.S. Environmental Protection Agency (USEPA). 1997a. Method 349.0. Determination of ammonia in estuarine and coastal waters by gas segmented continuous flow colorimetric analysis; version 1.0. US EPA, Office of Research and Development, Environmental Monitoring Systems Laboratory, Cincinnati, OH.

_____. 1997b. Methods for determination of chemical substances in marine and estuarine matrices – 2nd edition. USEPA, Washington, DC. EPA /600/R-97/072.

_____. 2019. National Hydrography Dataset Plus. Available online at URL: https://www.epa.gov/waterdata/get-nhdplus-national-hydrography-dataset-plus-data; last retrieved on November 19, 2020.

U.S. Fish & Wildlife Service (USFWS). 1983. Hawaiian Dark-Rumped Petrel & Newell's Manx Shearwater Recovery Plan. USFWS, Portland, Oregon. February 1983.

U.S. Fish & Wildlife Service (USFWS). 2016. 50 CFR 17. Final Rule: Endangered and Threatened Wildlife and Plants; Endangered Status for 49 Species from the Hawaiian Islands. *Federal Register*, 81 (190; Friday, September 30, 2016): 67786-67860.

_____. 2000. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for Blackburn's Sphinx Moth from the Hawaiian Islands, *Federal Register*, 65: (21; February 1, 2000): 4770-4779.

_____. 2003. Draft recovery plan for the Blackburn's Sphinx Moth (*Manduca blackburni*). USFWS, Portland, Oregon. September 2005.

_____. undated (nd-a). USFWS Endangered Species. Available online at URL: https://www.fws.gov/endangered/; Last retrieved September 4, 2019. Also: Environmental Conservation Online System (ECOS), at URL: https://ecos.fws.gov/ecp/species-reports; last retrieved September 4, 2019.

_____. undated website (nd-b). Critical Habitat Portal. Available online at URL: https://ecos.fws.gov/ecp/report/table/critical-habitat.html; last retrieved May 20, 2020.

_____. 2020. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Data layers are from 2005. Available online at URL: https://www.fws.gov/wetlands/Data/Mapper.html; last retrieved January 27, 2021.

U.S. Fish & Wildlife Service-Pacific Islands Fish and Wildlife Office (USFWS-PIFWO). No date (nd). Avoidance and Minimization Measures. Available online at URL: https://www.fws.gov/pacificislands/articles.cfm? id=149489720; last retrieved July 31, 2020.

U.S. Geological Survey (USGS). 2017. StreamStats. Available online at URL: http://streamstatus.usgs.gov; last retrieved December 11, 2020.

Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. *Manual of the Flowering Plants of Hawaiʻi: Volume I and II*. Bishop Museum Special Publication 83. University of Hawaiʻi Press. 1853 pp.

_____ and _____. 1999. *Supplement to the Manual of the flowering plants of Hawaiʻi*, pp. 1855-1918. *In:* Wagner, W. L., D. R. Herbst, and S. H. Sohmer, Manual of the flowering plants of Hawaiʻi. Revised edition. 2 vols. University of Hawaii Press and B.P. Bishop Museum.

Western Pacific Regional Fishery Management Council (WPRFMC). 2001. Final Coral Reef Ecosystem Fishery Management Plan. Available online at URL: https://www.wpcouncil.org/former-fishery-management-plans/coral-reef-ecosystem-fishery-management-plan/; last retrieved May 25, 2021.

_____. 2009a. Fishery Ecosystem Plan for the Hawaii Archipelago. Honolulu, HI: N.P., 2009. Available online at URL: https://www.wpcouncil.org/fishery-ecosystem-plans-amendments/hawaii-fishery-ecosystem-plan/; last retrieved May 25, 2021.

_____. 2009b. Fishery Ecosystem Plan for the Pacific Pelagic Fisheries of the Pacific Region. Available online at URL: https://www.wpcouncil.org/fishery-ecosystem-plans-amendments/pelagics-fishery-ecosystem-%20plan/; last retrieved May 25, 2021.

_____. 2016. Amendment 4 to the Fishery Ecosystem Plan for the Hawaii Archipelago. Revised Descriptions and Identification of Essential Fish Habitat and Habitat Areas of Particular Concern for Bottomfish and Seamount Groundfish of the Hawaiian Archipelago. Available online at URL: https://www.wpcouncil.org/wp-content/uploads/2013/03/2016-01-28-FINAL-Hawaii-FEP-Amd-4-Bottomfish-EFH-RIN-0648-XD907-All-Pages-with-Appendices.pdf; last retrieved May 25, 2021.

Wilson, D. E. and D. M. Reeder (eds.). 2005. Wilson & Reeder's Mammal Species of the World (Third Edition). Available online at URL: http://www.departments.bucknell.edu/biology/resources/msw3/browse.asp; last retrieved December 9, 2019.

Wurth. T. 2019. NOAA-Pacific Island Fisheries Science Center-Protected Species Division. Hawaiian Monk Seal Research Program. Personal communication. Email dated July 29, 2019.

Yamamoto, M. N. and A. W. Tagawa. 2000. *Hawai'i's Native and Exotic Freshwater Animals*. Mutual Publishing, Honolulu. 200 pp.

Young, L. C., E. A. VanderWerf, M. McKown, P. Roberts, J. Schueter, and A. Vorsino. 2019. Evidence of Newell's Shearwaters and Hawaiian Petrels on Oahu, Hawaii. *The Condor, Ornithological Applications 2019,* 121: 1-7.

Attachment A

Species Lists

Table A1. Plant species listing for DHHL Lualualei VOA site.

Species listed by family	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
? *Barleria repens*		Nat	R	<2>
Ruellia prostrata Poir.	prostrate wild petunia	Nat	R	<2>
AIZOACEAE				
Trianthema tetragonioides (Pall.) Kuntze	---	Nat	O	<1>
AMARANTHACEAE				
Alternanthera pungens Kunth	khaki weed	Nat	U	<1>
Amaranthus spinosus L.	spiny amaranth	Nat	R	<1>
Amaranthus viridus L.	slender amaranth	Nat	R	<1,2>
ANACARDIACEAE				
Mangifera indica L.	mango	Nat	R	<2>
Schinus terebinthefolius Raddi	Christmas berry	Nat	C	
ASTERACEAE (COMPOSITAE)				
Pluchia carolinensis (Jacq.) G. Don	sourbush	Nat	U	
Pluchia indica (L.) Less.	Indian fleabane	Nat	A	
Pluchea x *fosbergii*	---	Nat	O	
Spagneticola trilobata (L.) Pruski	wedelia	Nat	U	<2>
Tridax procumbens L.	coat buttons	Nat	U	<2>
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	U	
BATACEAE				
Batis maritima L.	pickleweed	Nat	CL	<3>
BIGNONIACEAE				
Tecoma cf. *castaneifolia* (D. Don) Melch.	---	Orn	U	<4>
BORAGINACEAE				
Cordia subcordata Lam.	*kou*	**Ind**	R	<2>
Heliotropium curassavicum L.	*kīpūkai*	**Ind**	U	<1,3>

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
CACTACEAE				
Hylocereus undatus (Haw.) Britrton & Rose	night-blooming cereus	Orn	U	<2>
CARICACEAE				
Carica papaya L.	papaya	Nat	R	<2>
CHENOPODIACEAE				
Atriplex suberecta Verd.	---	Nat	U	
Salsola tragus L.	Russian thistle	Nat	O	
CONVOLVULACEAE				
Ipomoea indica (J. Burm.) Merr.	*koali'awa*	**Ind**	OL	
Ipomoea obscura (L.) Ker-Gawl	---	Nat	O	<1>
Ipomoea triloba L.	little bell	Nat	U	<2>
Jacquemontia ovalifolia (Choisy) H. Hallier	*pā'ūohi'iaka*	**Ind**	U	
Merremia aegyptica (L.) Urb.	hairy merremia	Nat	R	
CUCURBITACEAE				
Momordica charantia L.	wild bitter melon	Nat	U	<2>
CRASSULACEAE				
Bryophyllum daigremontianum (Raymond-Hamer & H. Perrier) A. Berger	---	Orn	R	<4>
EUPHORBIACEAE				
Aleurites moluccana (L.) Willd.	*kukui*	**Pol**	R	<2>
Euphorbia heterophylla L.	*kaliko*	Nat		
Euphorbia hypericifolia L.	graceful spurge	Nat		
Euphorbia hirta L.	garden spurge	Nat	R	<2>
Albizia saman (Jacq.) F. Muell.	monkeypod (juv.)	Nat	R	<2>
Cassia sp.	shower tree	Orn	R	<2>
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	O	
Indigofera hendicaphyla Jacq.	creeping indigo	Nat	O	<2>
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	AA	
Macroptilium atropurpureum (DC.) Urb.	---	Nat	R	
Prosopis juliflora (Sw.) DC.	long-spine *kiawe*	Nat	R	<2,3>
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	*kiawe*	Nat	C	
Vachellia farnesiana (L.) Willd.	*klu*	Nat	C	

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
GOODENACEAE				
Scaevola taccada (Gaertn.) Roxb.	*naupaka kahakai*	**Ind**	R	<2>
LAMIACEAE				
Leonotis nepetifolia (L.) R. Br.	lion's ear	Nat	R	
Ocimum cf. *gratissimum* L.	---	Nat	R	<4>
MALVACEAE				
Abutilon grandifolium (Wild.) Sweet	hairy abutilon	Nat	R	<2>
Abutilon incanum (Link) Sweet	*koʻoloa keokeo*	**Ind**	CL	
Gossypium cf. *barbadense* L.	sea island cotton	Nat	R	
Hibiscus rosa-sinensis L.	Chinese hibiscus cult.	Orn	R	<2>
Malvastrum coromandelianum (L.) Garcke	false mallow	Nat	R	
Sida ciliaris L.	---	Nat	A	<1>
Sida fallax Walp.	*ʻilima*	**Ind**	OL	
Sida spinosa L.	prickly sida	Nat	U	<1>
Waltheria indica L.	*ʻuhaloa*	**Ind**	C	
MELIACEAE				
Azadirachta indica Adr. Juss.	neem	Nat	R	<2>
MORINGACEAE				
Moringa oleifera Lam.	horseradish tree	Nat	R	<1>
NYCTAGINACEAE				
Boerhavia coccinea Mill.	false *alena*	Nat	O	<1>
Bougainvillea cf. *spectabilis* Wild.	bougainvillea	Orn	R	<2>
PORTULACEAE				
Portulaca oleracea L.	pigweed	Nat	R	<1>
RUTACEAE				
Murraya paniculata (L.) W. Jack	mock orange	Nat	U	<2>
FLOWERING PLANTS				
MONOCOTYLEDONES				
ALOEACEAE				
Aloë vera (L.) N.L. Burman	aloe vera	Orn	R	
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki,* ti	Nat	U	<2>
Furcraea foetida (L.) Haw.	Mauritius hemp	Nat	R	
ARECACEAE				
Cocos nucifera L.	coconut palm	Nat	R	<2>

Table A-1 (continued).

Species listed by family	Common name	Status	Abundance	Notes
ARECACEAE (cont.)				
Dypsis lutescens (H. Wendl.) Beentje & J. Dransfield	areca palm	Orn	U	<2>
Wodyetia bifurcata A. K. Irvine	foxtail palm	Orn	U	<2>
CYPERACEAE				
Cyperus polystachyos Rottb.	---	**Ind**	U	<2>
POACEAE				
Cenchrus ciliaris L.	buffelgrass	Nat	AA	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	A	
Chloris virgata Sw.	feather fingergass	Nat		
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	AA	
Eleusine indica (L.) Gaertn.	wiregrass	Nat		
Heteropogon contortus (L.) P. Beauv. ex Roem. & Schult.	*pili*	**Ind**	CL	<2>
Megathyrsus maximus (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat	AA	
Melinus repens (Willd.) Zizka	Natal redtop	Nat		
Setaria verticillata (L.) P. Beauv.	bristly foxtail	Nat	U	<1>
Sporobolus pyramidatus (Lam.) Hitch.	---	Nat	C	<1><3>

Legend to Table A1

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Orn = A cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawaiʻi.

Pol = An early Polynesian introduction. Introduced before 1778.

ABUNDANCE = occurrence ratings for plant species:

-- - Species not present in area.

R – Rare — seen in only one or perhaps two locations.

U - Uncommon — seen at most in several locations

O - Occasional — seen with some regularity

C - Common — observed numerous times during the survey

A - Abundant — found in large numbers; may be locally dominant.

AA - Very abundant — abundant and dominant; defining vegetation type.

NOTES:

<1> – Mostly limited to disturbed areas (roads).

<2> - Plantings on adjacent projects areas (Ulu ke Kukui; Kam schools Learning center

<3> – Indicative or found in areas of ephemeral wetlands.

<4> - Plant lacking key diagnostic characteristics (flower, fruit) or in poor condition; identification, therefore, uncertain.

Table A2 List of aquatic species observed in Mā'ili Stream estuary. Abundance codes are only provided for species observed in the vicinity of the Project site during the September 2020 survey.

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
	ALGAE			
CYANOPHYTA	GREEN ALGAE			
OSCILLATORIACAE				
Lyngbya majuscula (Dilwyn) Harvey ex Gomont		--	**Ind**	2, 3
Lyngbya semiplena (C.Agardh) J. Agardh		--	**Ind**	2, 3
RHODOPHYTA	RED ALGAE			
GRACILARIACAE				
Gracilaria salicornia (C.Agardh) Dawson		C	**Ind**	1a, 1b, 2, 3
RHODOMELACAE				
Acanthophora spicifera (Vahl) Borgesen		A	Nat	1a, 1b, 2, 3
PHAEOPHYTA	BROWN ALGAE			
SARGASSACEAE				
Sargassum echinocarpum J.Ag		--	**Ind**	2, 3
	INVERTEBRATES			
CNIDARIA, ANTHOZOA, SCLERACTINIA				
PORITIDAE				
Porites cf. *lobata* Dana	lobe coral	--	**Ind**	2, 3
POCILLOPORIDAE				
Pocillopora meandrina Dana	cauliflower coral	--	**Ind**	2, 3
MOLLUSCA,GASTROPODA NEOTAENIOGLOSSA				
THIARIDAE				
Tarebia granifera Lamarck	quilted melania	--	Nat	2
MOLLUSCA,BIVALVIA OSTREOIDA				
OSTREIDAE				
unid.	indet. oyster	--	--	2
ECHINODERMATA ECHINOIDEA				
ECHONMETRIDAE				
Echinometra mathei Blainville	*'ina kea*; rock boring urchin	--	**Ind**	2, 3
Echinometra oblonga Blainville	*'ina*; oblong urchin	--	**Ind**	2, 3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
ARTHROPODA,INSECTA ODONATA				
AESHNIDAE				
Anax junius Drury	*pinao*; green darner	--	Nat	3
COENAGRIONIDAE				
Enallagma civile Hagen	familiar bluet	--	Nat	1b, 2
LIBELLULIDAE				
Crocothemis servilia (Drury, 1773)	scarlet skimmer	--	Nat	1b, 2, 3
Pantala flavescens (Fabricius, 1798)	wandering glider	U	Nat	1a, 1b, 3
Tramea lacerata Hagen	black saddlebags	--	Nat	3
ARTHROPODA, MAXILIPODA SESSILIA				
BALANIDAE				
Amphibalanus eburneus Gould	white rock barnacle	--	Nat	3
ARTHROPODA, MALACOSTRACA, DECOPODA				
GRAPSIDAE				
Grapsus tenuicrustatus	*'a'ama*; thin-shelled rock crab;	--	**Ind**	2, 3
Metopograpsus thukuhar Owen	*'alamihi, kūkūau*; purple-clawed shore crab	--	Nat	3
CAMBARIDAE				
Procambarus clarkii (Girard, 1852)	crayfish	R	Nat	1a
PALAEMONIDAE				
Palaemon debilis Dana	*'ōpae huna* glass shrimp	C	**Ind**	1a, 3
PORTUNIDAE				
Scylla serrata Forskal	Samoan crab	R	Nat	1a, 2
Thalamita crenata (H. Milne Edwards, 1834)	blue-pincer swimming crab	--	**Ind**	1b, 2
	FISHES			
CHORDATA, ACTINOPTERYGII, ANGUILLIFORMES				
MURAENIDAE				
Echidna nebulosa (Ahl, 1789)	*puhi kāpā*; snowflake moray	--	**Ind**	1b
CHORDATA, ACTINOPTERYGII, BELONIFORMES				
BELONIDAE				
Platybelone argus (Lesuer, 1821)	keeltail needlefish	--	**Ind**	3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
CHORDATA, ACTINOPTERYGII, CLUPEIFORMES				
ENGRAULIDAE				
Encrasicholina purpurea (Fowler, 1900)	*nehu;* Hawaiian anchovy	--	**End**	2, 3
CHORDATA, ACTINOPTERYGII, CYPRINODONTIFORMES				
POECILIIDAE				
Poecilia sp.	indet. molly	C	Nat	1a, 2, 3
Poecilia sp. hybrid complex (*salvatoris/mexicana* group)	liberty/Mexican molly	C	Nat	1a, 1b, 3
CHORDATA, ACTINOPTERYGII, MUGILIFORMES				
MUGILIDAE				
Mugil cephalus Linnaeus, 1758	*pua ʻama*; striped mullet (finger size)	A	**Ind**	1a, 2, 3
Mugil cephalus Linnaeus, 1758	*ʻamaʻama*; striped mullet (adult)	--	**Ind**	1b
CHORDATA, ACTINOPTERYGII, PERCIFORMES				
ACANTHURIDAE				
Acanthurus blochii Valenciennes in Cuvier and Valenciennes, 1835	*pualu*; ringtail surgeonfish	--	**Ind**	1b
Acanthurus triostegus sandvicensis Streets	*manini*; convict tang	--	**End**	1b, 2, 3
BLENNIDAE				
Istiblennius zebra (Vailant & Sauvage, 1875)	zebra rockskipper	--	**Ind**	1b, 2, 3
CARANGIDAE				
indet.	unid. jack	--	**Ind**	3
Scomberoides lysan (Forsskål, 1775)	*lai*	--	**Ind**	2
CHAETODONTIDAE				
Chaetodon lunulatus Quoy and Gairmard, 1824	racoon butterflyfish	--	**Ind**	1b
CICHLIDAE				
Archocentrus nigrofasciatus (Günther, 1867)	convict cichlid	--	Nat	3
Sarotheron melanotheron (Rüppell, 1852)	blackchin tilapia	C	Nat	1a, 1b, 2, 3
GOBIIDAE				
Awaous stamineus (Eydoux and Souleyet, 1850)	*ʻoʻopu nākea*	--	**Ind**	3

Table A2 (continued).

PHYLUM, CLASS, ORDER FAMILY *Species*	Common name	Abundance*	Status	ID Code
GOBIIDAE (cont.)				
Bathygobius cocosensis (Bleeker, 1854)	*ʻoʻopu ōhune;* Cocos frillgoby	--	**Ind**	2
Stenogobius hawaiiensis Watson, 1991	*ʻoʻopu naniha*	--	**Ind**	3
ELEOTRIDAE				
Eleotris sandwicensis (*Vaillant and Sauvage*, 1875)	*ʻoʻopu akupa*	--	**End**	3
KUHLIIDAE				
Kuhlia sandvicensis (Steindachner, 1876)	*ʻāholehole;* zebra head flagtail	--	**Ind**	2, 3
Kuhlia xenura (Jordan and Gilbert, 1882)	*ʻāholehole*; Hawaiian flagtail	--	**End**	2, 3
LABRIDAE				
Thalassoma duperrey (Quoy and Gairmard, 1824)	saddle wrasse; *hinalea lauwili*	--	**End**	2, 3
LUTJANIDAE				
Lutjanus fulvus (Forster in Bloch and Schneider, 1801)	*toʻau*; blacktail snapper	--	Nat	1b
MULLIDAE				
Mulloidichthys flavolineatus (Lacepède, 1801)	*ʻoama*; yellowstripe goatfish	--	**Ind**	1b
POMACENTRIDAE				
Abudefduf abdominalis (Quoy & Gaimard, 1825)	*mamo*; Hwn. sergeant	--	**End**	2, 3
Abudefduf sordidius (Forskål, 1775)	*kūpīpī;* blackspot sergeant	--	**End**	2, 3
SCARIIDAE				
Scarus psittacus (Forskål, 1775)	*uhu; palenose parrotfish*	--	**Ind**	2, 3
SPHYRAENIDAE				
Sphyraena barracuda (Edwards in Catesby, 1771)	*kākū*; great barracuda	--	**Ind**	2, 3
ZANCLIDAE				
Zanclus cornutus (Linnaeus, 1758)	Moorish idol	--	**Ind**	2, 3
CHORDATA, ACTINOPTERYGII, TELEOSTEI				
SYNODONTOIDEI				
unid. Synodontoidei	lizardfishes	--	**Ind**	1b

* Abundance codes given only for species observed in the vicinity of the Project site during the September 2020 survey.

Table A2 (continued)

LEGEND TO TABLE A2

Abundance categories:

R – Rare – only one or two individuals observed.
U – Uncommon – several to a dozen individuals observed.
O – Occasional – seen irregularly in small numbers
C – Common -observed everywhere, although generally not in large numbers.
A – Abundant – observed in large numbers and widely distributed.

Status categories:

End – Endemic – species found only in Hawai'i
Ind – Indigenous – species found in Hawai'i and elsewhere
Nat – Naturalized – species were introduced to Hawai'i intentionally, or accidentally.

Location codes:

1a – observed in present survey in project area
1b – observed in present survey downstream of project area
2 – observed by *AECOS* in Mā'ili Stream Channel on July 5, 2019
3 – observed by *AECOS* in Mā'ili Stream Channel on March 23, 2009

Table A3. List of marine biota observed on the limestone bench and marine waters offshore of Mā'ili Stream during the July 2019 and September 2020 surveys.

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
	ALGAE		
CHLOROPHYTA	GREEN ALGAE		
Caulerpa racemosa (Forkssal) J. Agardh		**Ind**	O
Codium edule Silva		**Ind**	R
Dictyosphaeria versluyii Weber-van Bosse		**Ind**	R
Halimeda discoidea Decaisne		**Ind**	O
Neomeris sp.		**Ind**	C
Ulva expansa (Setchell) Setchell & N.L.Gardner	large sea lettuce	**Ind**	U
RHODOPHYTA	RED ALGAE		
Acanthophora pacifica (Setchell) Kraft		**Ind**	C
Acanthophora spicifera(Vahl) Borgesen		Nat	R
Asparagopsis taxiformis (Delile) Trevisan	*limu kohu*	**Ind**	A
Haliptilon subulatum (Ellis&Solander) Johansen		**Ind**	O
Hydrolithon gardineri (Foslie) Verheij & Prud'homme		**Ind**	O
Hydrolithon onkodes (Heydrich) Penrose & Chamberlain		**Ind**	O
Hydrolithon reinboldii (Weber-van Bosse) Foslie		**Ind**	O
Hypnea chordacea Kutzing		**Ind**	O
Laurencia mcdermidiae Abbott		**End**	R
Laurencia nidifica J. Agardh		**Ind**	R
Sporolithon erythraeum (Rothpletz) Kylin		**Ind**	U
Tricleocarpa cylindrical (Ellis & Solander) Huisman & Townsend		**Ind**	R
Tricleocarpa fragilis (Linnaeus) Huisman & Townsend		**Ind**	R

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
PHAEOPHYTA	BROWN ALGAE		
Asteronema breviarticulatum (J. Agardh) Ouriques & Bouzon		**Ind**	O
Dictyota ceylanica Kutzing		**Ind**	C
Dictyota friabilis Setchell		**Ind**	O
Dictyota sandvicensis Sonder	Hawaiian dictyota	**End**	U
Padina spp.		**Ind**	A
Padina sanctae-crucis Borgesen		**Ind**	R
Sargassum echinocarpum J Agardh		**End**	C
Sargassum obtusifolium J Agardh		**End**	O
Turbinaria ornata (Turner) J. Agardh		**Ind**	U
	INVERTEBRATES		
CNIDARIA, ANTHOZOA, ALCYONACEA			
XENIIDAE			
Sarcothelia edmondsoni Verrill	blue soft coral	**End**	C
ZOANTHINARIA	ZOANTHIDS		
Palythoa caesia Dana	blue-gray zoanthid	**Ind**	O
CNIDARIA, ANTHOZOA, SCLERACTINIA	HARD CORALS		
POCILLOPORIDAE			
Pocillopora damicornis Linnaeus	lace coral	**Ind**	O
Pocillopora meandrina Dana	cauliflower coral	**Ind**	C
PORITIDAE			
Porites sp.		**Ind**	C
Porites compressa Dana	finger coral	**Ind**	O
Porites lobata Dana	lobe coral, *pohaku puna*	**Ind**	O
MOLLUSCA, GASTROPODA	SNAILS and SLUGS		
PATELLIDAE			
Cellana sandwicensis Pease	yellow-foot *'opihi*	**End**	O
Siphonaria normaliis Gould	false limpet	**Ind**	O
NERITIDAE			
Nerita picea Recluz	black nerite; *pipipi*	**End**	C
LITTORINIDAE			
Littorina pintado Wood	periwinkle; *pipipi kōlea*	**Ind**	C

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
THAIDIDAE			
Morula granulata Duclos	granular drupe; *maka'awa*	**Ind**	O
Morula uva Roding	grape drupe	**Ind**	O
MOLLUSCA, BIVALVIA	BIVALVES		
MYTILIDAE			
Brachidontes crebristriatus Conrad	Hawaiian mussel	**End**	O
ARTHROPODA, CRUSTACEA, DECAPODA			
GRAPSIDAE			
Grapsus tenuicrustatus Herbst	thin shelled rock crab; *'a'ama*	**Ind**	O
ECHINODERMATA, ECHNOIDEA, ECHINOMETRIDAE	SEA URCHINS		
Echinometra mathaei Blainville	rock boring urchin; *'ina kea*	**Ind**	A
Echinometra oblonga Blainville	oblong boring urchin; *'ina*	**Ind**	A
Heterocentrotus mammillatus Linnaeus	red pencil urchin; *hā'uke'uke'ula'ula*	**Ind**	O
DIADEMATIDAE			
Diadema paucispinum Agassiz	long-spined urchin; *wana hālula*	**Ind**	O
Echinothrix calamaris Pallas	banded urchin	**Ind**	O
TOXOPNEUSTIDAE			
Tripneustes gratilla Linnaeus	collector urchin; *hāwa'e maoli*	**Ind**	C
CHORDATA, ACTINOPTERYGII	BONY FISHES		
ACANTHURIDAE	SURGEONFISHES and UNICORNFISH		
Acanthurus achilles Shaw	Achilles tang; *pāku'iku'i*	**Ind**	O
Acanthurus nigrofuscus Forsskal	brown tang, *mā'i'i'i*	**Ind**	C
Acanthurus olivaceus Bloch & Schneider	orangeband surgeonfish, *na'ena'e*	**Ind**	C
Acanthurus triostegus Linnaeus	convict tang; *manini*	**Ind**	C
Naso lituratus Forestner	orangespine unicornfish; *umaumalei*	**Ind**	O
Naso unicornis Forkssal	bluespine unicornfish; *kala*	**Ind**	O
BALISTIDAE	TRIGGERFISH		
Rhinecanthus rectangulus Block & Schneider	*humuhumu nukunuku apua'a*	**Ind**	O

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
BELONIDAE	NEEDLEFISH		
Platybelone argalus Leseur	keeltail needlefish	**Ind**	O
CHAETODONTIDAE	BUTTERFLYFISH		
Chaetodon lunula Lacepede	raccoon butterflyfish; *kīkākapu*	**Ind**	U
Chaetodon miliaris Quoy & Gaimard	milletseed butterflyfish; *lauwiliwili*	**End**	O
Chaetodon multicinctus Garrett	multiband butterflyfish; *kīkākapu*	**End**	R
Chaetodon quadrimaculatus Gray	fourspot butterflyfish, *lauhau*	**Ind**	O
Forcipiger flavissimus Jordan & McGregor	common longnose butterflyfish; *lauwiliwili nukunuku ʻoiʻoi*	**Ind**	U
LABRIDAE	WRASSES		
Gomphosus varius Lacepede	bird wrasse; *hīnālea ʻiʻiwi*	**Ind**	U
Thalassoma duperrey Quoy & Gaimard	saddle wrasse; *hinalea lauwili*	**End**	C
Thalassoma trilobatum Lacepede	Christmas wrasse; *ʻawela*	**Ind**	O
MULLIDAE	GOATFISH		
Mulloidichthys vanicolensis Valenciennes	yellow fin goatfish, *weke ʻula*	**Ind**	O
Parupeneus multifasciatus Quoy & Gaimard	manybar goatfish, *moana*	**Ind**	O
OSTRACIIDAE			
Ostracion meleagris Shaw	spotted boxfish; *moa*	**Ind**	R
POMACENTRIDAE	DAMSELFISH		
Abudefduf abdominalis Quoy & Gaimard	Hawaiian sergeant; *mamo*	**End**	C
Abudefduf vaigiensis Quoy & Gaimard	Indo-Pacific sergeant	**Ind**	C
Abudefduf sordidus Forsskal	blackspot sergeant; *kūpīpī*	**Ind**	O
Plectroglyphidodon imparipennis Vailiant & Sauvage	bright-eye damselfish	**Ind**	O
Stegastes marginatus Jenkins	Hawaiian gregory	**End**	U
ZANCLIDAE			
Zanclus cornutus Linnaeus	moorish idol; *kihikihi*	**Ind**	U

Table A3 (continued).

PHYLUM, CLASS, ORDER, FAMILY *Species*	Common name	Status	Abundance
	REPTILES		
CHORDATA, REPTILIA			
CHELONIIDAE			
Chelonia mydas Linnaeus	green sea turtle, *honu*	**Ind**	R

Key to Table A3

Abundance categories:
- R – Rare – only one or two individuals observed.
- O – Occasional – seen irregularly in small numbers
- C – Common –observed everywhere, although generally not in large numbers.
- A – Abundant – observed in large numbers and widely distributed.

Status categories:
- **End** – Endemic – species found only in Hawaiʻi.
- **Ind** – Indigenous – species found in Hawaiʻi and elsewhere.
- Nat – Naturalized – species introduced to Hawaiʻi intentionally, or accidentally.

Table A4. Avian species detected at the former Voice of America site in Lualualei, September 2020.

Common Name	Scientific Name	Status	*RA*
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	A	0.29
Domestic Chicken	*Gallus gallus*	A	1.14
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Rock Pigeon	*Columba livia*	A	7.57
Spotted Dove	*Streptopelia chinensis*	A	1.57
Zebra Dove	*Geopelia striata*	A	6.57
	CHARADRIIFORMES		
	CHARADRIIDAE - Lapwings & Plovers		
	Charadriinae - Plovers		
Pacific Golden-Plover	*Pluvialis fulva*	**IM**	0.19
	PELECANIFORMES		
	ARDEIDAE - Herons, Bitterns & Allies		
Black-crowned Night-Heron	*Nycticorax nycticorax hoactli*	**I**	0.14
	STRIGIFORMES		
	STRIGIDAE - Typical Owls		
Short-eared Owl	*Asio flammeus sandwichensis*	**Es**	0.29
	PASSERIFORMES		
	PYCNONOTIDAE - Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	A	6.71
Red-whiskered Bulbul	*Pycnonotus jocosus*	A	0.57
	ZOSTEROPIDAE - White-eyes		
Warbling White-eye	*Zosterops japonicus*	A	2.14
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	3.71
	ESTRILDIDAE – Estrildid Finches		
Common Waxbill	*Estrilda astrild*	A	2.86
Java Sparrow	*Lonchura punctulata*	A	3.57

Table A4 (continued).

Common Name	Scientific Name	Status	*RA*
	PASSERIDAE – Old World Sparrows		
House Sparrow	*Passer domesticus*	A	0.86
	FRINGILLIDAE – Fringilline and Carduline Finches & Allies Carduelinae – Carduline Finches& Hawaiian Honeycreepers		
House Finch	*Haemorhous mexicanus*	A	3.43
	CARDINALIDAE – Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	2.14
	THRAUPIDAE – Tanagers		
Red-crested Cardinal	*Paroaria coronata*	A	0.43

Key to Table A4.

Status:

Es = Endemic to the Hawaiian Islands; state listed as endangered.
I = Indigenous to the Hawaiian Islands.
IM = Indigenous, migratory species.
A = Alien; naturalized, non-native species (introduced).

Relative Abundance (***RA***): Species count / number of point-count stations (n=7).

APPENDIX G

MOBILITY ANALYSIS REPORT (MAR) FOR THE VOICE OF AMERICA SITE IN MĀ'ILI
OCTOBER 29, 2021

Mobility Analysis Report (MAR)

for the

Voice of America Site in Maili

Prepared for:
Gray, Hong, Nojima & Associates, Inc.
on behalf of
Department of Hawaiian Homelands (DHHL)

October 29, 2021

SD20-0360

FEHR PEERS

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1. Executive Summary

This report documents the assessment of mobility and access associated with the proposed development on the Department of Hawaiian Home Lands (DHHL) site located in the community of Maili on the island of Oahu. The project site is located mauka and south of the existing Ulu Ke Kui apartment development on Kulaaupuni Street. The project involves construction of 136 multi-family dwelling units and 145 single-family dwelling units, and it is anticipated to be built and fully occupied by 2028. Access to the site for all modes is proposed via one street connecting to Kulaaupuni Street south of Holt Road.

The impacts of the proposed project to mobility and access surrounding the project site were evaluated following guidelines and standards of the affected government agencies. A multimodal evaluation of mobility effects from the project was conducted to determine potential impacts to walking, biking, transit, and traffic operations. Four study intersections in the vicinity of the project were evaluated during the weekday morning (AM) and evening (PM) peak hours for Existing (2020) conditions, Baseline (2028) conditions with and without the project, and Baseline (2028) with Kulaaupuni Street extended to Kulauku Street without and with the project.

Trip generation for the facility was determined based on standard trip rates published in the *Trip Generation Manual* (10th Edition, 2017) by the Institute of Transportation Engineers (ITE), as well as appropriate reductions to account for the mix of uses and the travel characteristics of other uses in this area. The proposed project is expected to generate 2,382 net new daily vehicle trips, including 170 net new vehicle trips during the AM peak hour (42 inbound/128 outbound) and 218 net new vehicle trips during the PM peak hour (81 inbound/218 outbound).

Key findings of the mobility analysis are summarized below:

- The project will have a significant impact at the Kulaaupuni Street/St John's Road intersection, where operations for side street traffic are expected to be LOS F during the AM peak hour. All-way stop control will need to be implemented at this intersection to reduce delays and improve operations to desirable levels (i.e., LOS D or better).
- Westbound queue lengths and westbound delays at the Farrington Highway/St John's Road intersection will be excessive under no project conditions and will worsen under with project conditions. Additional capacity on this approach is not considered feasible based on available right of way. While the overall intersection is projected to operate at a desirable level, the project sponsor will need to work with HDOT to ensure that signal timing is adjusted by the time of project occupancy in 2028 to reduce projected vehicle queues. Additional green time for the westbound phase should be provided to reduce delays and queues. It is feasible to move green time from the northbound and southbound phases to the eastbound and westbound phases to reduce westbound queues while maintaining acceptable LOS at the intersection. This would involve completion of a signal timing study to justify modification of timings subject to approval by DOT.

- The project will construct an extension of Kulaaupuni Street (including a sidewalk on along the mauka side of the street) along its entire frontage. Extending Kulaaupuni Street from south of the project site to Kulauku Street was identified as a neighborhood improvement in the traffic study for the Community Learning Center development project to the south, but is not required to serve the DHHL project or to mitigate any potential impacts. An operations analysis assuming the full extension in place shows that it will reduce the average amount of delay at most intersections by one or two seconds except at one location (Farrington Highway/Kaukama Street) where it increases delay by the same amount. The full extension would benefit the westbound St. John's Road approach at Farrington Highway by reducing the AM peak hour vehicle queue and delays and would improve overall community connectivity
- Two active transportation opportunities were identified that could enhance bicycle, pedestrian and/or transit access and safety in the vicinity of the site:
    - Installation of a formal walking path for the mauka side of Kulaaupuni Street from the Maili Channel bridge to St John's Road. This connection would improve access to Maili Elementary School and Community Park, the Leeward Community College Waianae Moku campus, and bus stops on Farrington Highway. The path should be designed as an accessible facility and ideally would physically separate pedestrians and vehicles (e.g., via installation of a raised asphalt curb).
    - A bicycle/pedestrian connection from the southeast corner of the project site to Laia Street to improve neighborhood connectivity and access to local parks and shops. The project sponsor would have to obtain an easement from or agreement with the adjacent property since this connection would traverse land outside of the current site plan.

2. Introduction

This mobility analysis report (MAR) presents the study conducted by Fehr & Peers for the proposed development on the Department of Hawaiian Home Lands (DHHL) Voice of America (VOA) site located in the community of Maili on the island of Oahu. This MAR was conducted in accordance with the guidelines and standards of the affected government agencies, and it addresses the potential impact of the project on all modes of travel.

The project site encompasses roughly 40 acres located on tax map parcels 8-7-010:030 and 031, and it is under the jurisdiction of the Department of Hawaiian Home Lands (DHHL). The project site is bounded by Kulaaupuni Street on the makai side, Kamehameha Schools Community Learning Center and vacant DHHL land to the south, the Maili Channel to the north, and the Sea Country residential development on the mauka side, as shown on **Figure 1**.

2.1 Project Description

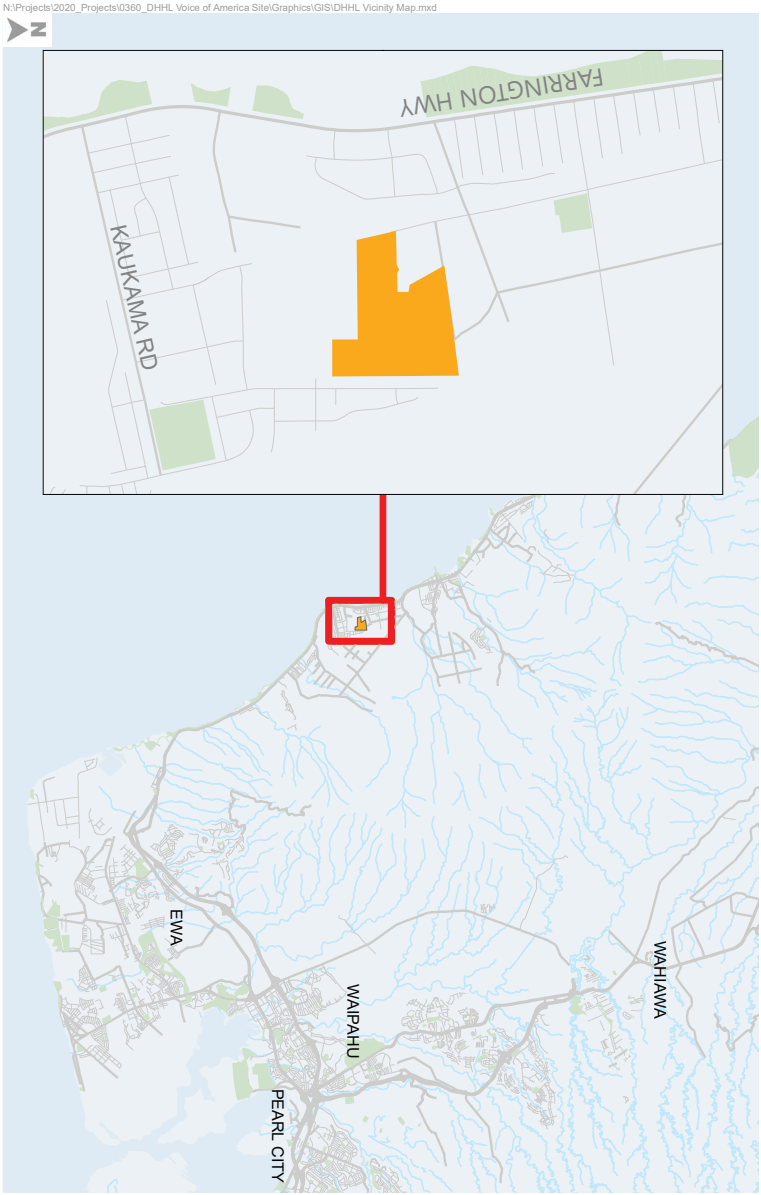
The project involves construction of 281 residential dwelling units, consisting of 145 single family units and 136 multi-family units. Vehicular access to the site is proposed via a project driveway on Kulaaupuni Street approximately 400 feet south of Holt Road. The project site plan is shown on **Figure 2**.

2.2 Study Area

The transportation analysis focused on evaluating the potential project-related transportation impacts at four existing intersections in the vicinity of the proposed project. The analyzed intersections are listed below and are shown on **Figure 3**:

1. Farrington Highway/St John's Road
2. Kulaaupuni Street/St John's Road
3. Farrington Highway/Kaukama Road
4. Kulauku Street/Kaukama Road

The intersection of Farrington Highway/Hookele Street was also included in the network analysis to account for coordinated corridor operations along Farrington Highway. This study analyzes the potential project-related traffic impacts under typical weekday AM and PM peak hour traffic conditions. The AM and PM peak hour for each intersection are identified as the highest one-hour totals of traffic at the intersection between 6:00 AM and 9:00 AM and 3:00 and 6:00 PM on a weekday.



Legend

Project Site

Figure 1

Vicinity Map and Project Site

Voice of America Site in Maili - Mobility Analysis Report

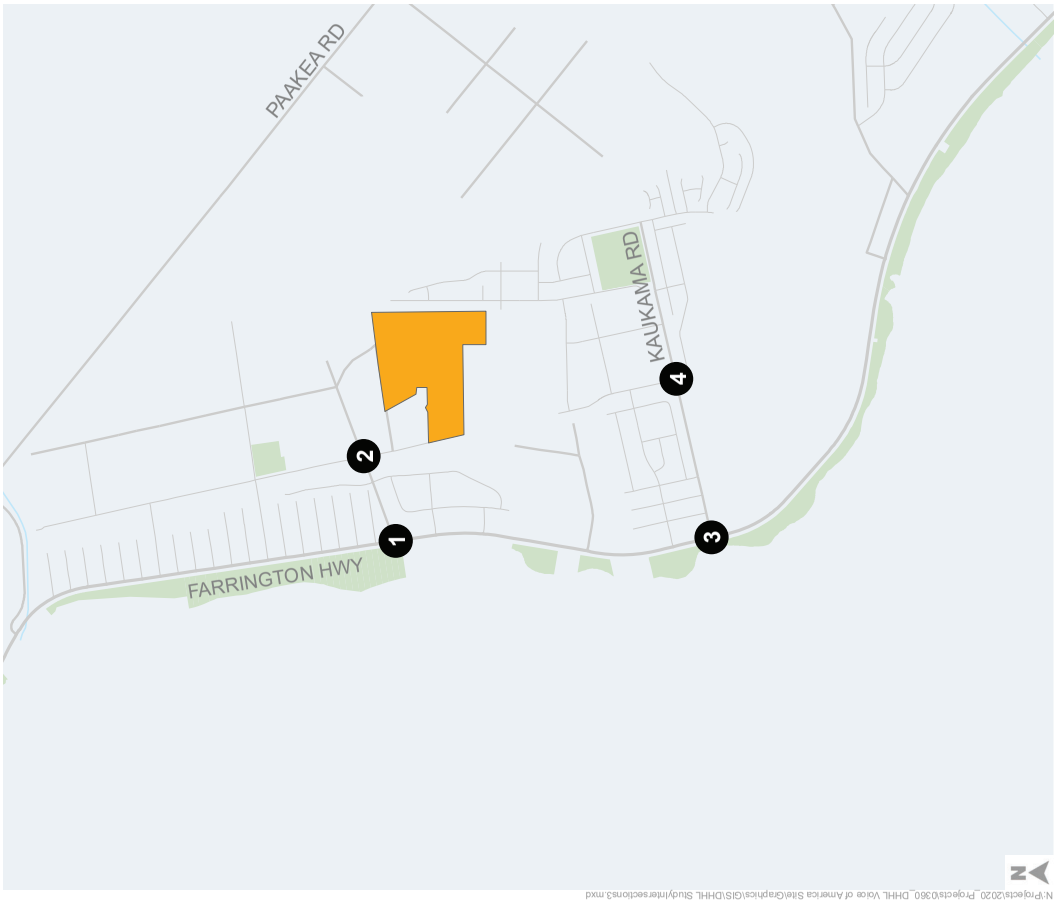


Figure 3

Project Site & Study Intersections

Voice of America Site in Maili - Mobility Analysis Report

Legend

Project Site

Study Intersections

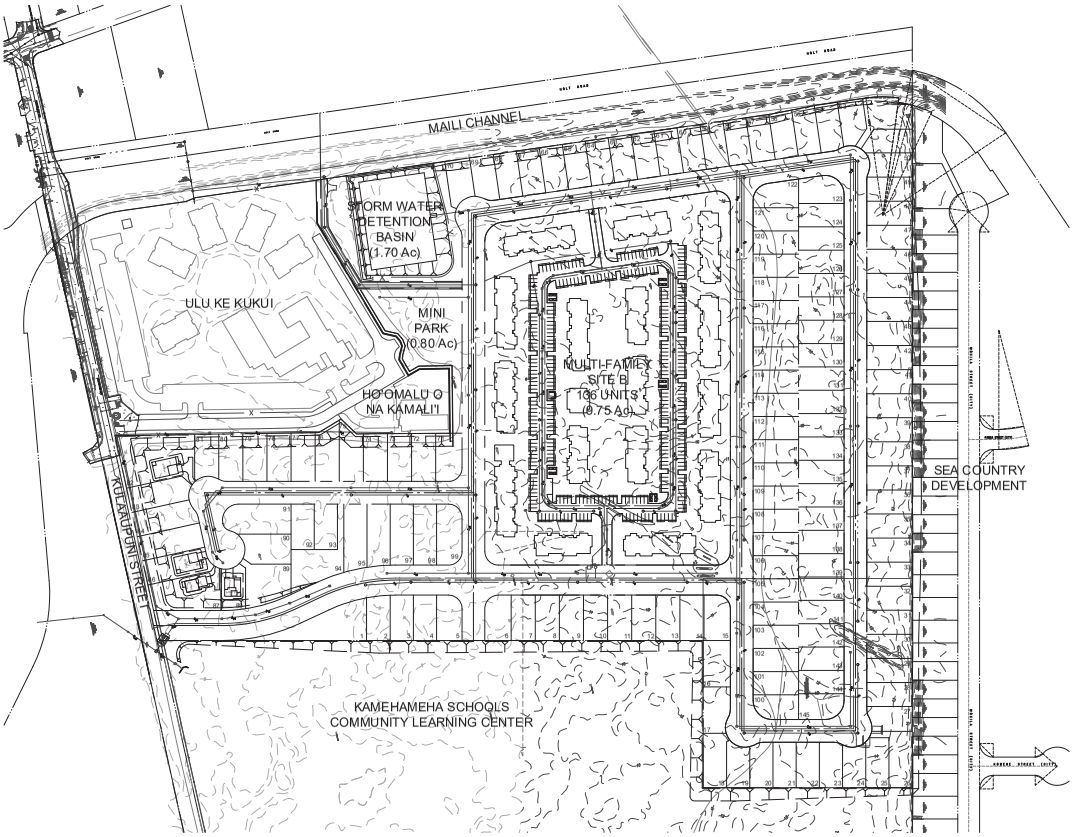


Figure 2

Site Plan

DHHL Voice of America Site

UNIT TABULATION

SINGLE FAMILY LOTS - 145 LOTS
MULTI-FAMILY UNITS - 136 UNITS
TOTAL UNITS - 281 UNITS

SITEPLAN OPTION 3
SF & MF HYBRID

FEET 1"=200'
0 100 200 400

Conceptual Design
June 22, 2021

Developed for Department of Hawaiian Home Lands

DHHL VOICE OF AMERICA SITE
Maili, Oahu, Hawaii

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A-8

2.3 Study Scenarios

The operations of the study intersections were evaluated during the weekday AM and PM peak hours for the following scenarios:

- **Existing Conditions** – Given the ongoing COVID-19 pandemic, traffic counts collected in early December 2020 do not reflect typical levels of peak hour volumes. Accordingly, the observed volumes were adjusted using the comparison of 2020 vs. 2019 volumes reported by the State of Hawaii Department of Transportation – Highways Division – Planning Branch (HDOT). Additional adjustments were made to reflect typical neighborhood traffic volumes not captured in the 2020 counts based on counts from 2012, in particular resulting from Ma'ili Elementary, Ma'ili Preschool, and Leeward Communitiy College Wai'anae Moku. This scenario represents an existing conditions scenario if the COVID-19 pandemic had not occurred. The analysis of traffic operations under this scenario was conducted for the peak hours and existing intersection lane configurations. The existing conditions analysis also includes a description of key area roadways and a review of existing transit facilities and services near the site.
- **Baseline (2028) No Project Conditions** – Existing peak-hour volumes increased to account for forecasted growth in the area at the opening year of the project in 2028. Traffic growth was estimated based on an annual growth factor to account for ambient traffic growth within the study area.
- **Baseline (2028) Plus Project Conditions** – This traffic scenario includes traffic volumes under Baseline (2028) No Project conditions plus the addition of forecasted project-generated traffic.
- **Baseline (2028) No Project Conditions with Kulaaupuni Extension** – This traffic scenario assumes the extension of Kulaaupuni Street south of the Project site to Kulauku Street and reassigns Baseline (2028) No Project traffic volumes accordingly. This scenario is provided for informational purposes only.
- **Baseline (2028) Plus Project Conditions** – This traffic scenario includes traffic volumes under Baseline (2028) No Project Conditions with Kulaaupuni Extension plus the addition of forecasted project-generated traffic. This scenario is provided for informational purposes only.

2.4 Traffic Analysis Methods

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6), published by the Transportation Research Board in 2016. The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels are defined, from LOS A, with the least congested operating conditions, to LOS F, with the most congested operating conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions.

2.4.1 Signalized Intersections

The method described in "Chapter 19: Signalized Intersections" of the *HCM 6* was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay alone is used to characterize LOS for the entire intersection or for an approach. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections is calculated using Synchro 10.0 analysis software and is correlated to a LOS designation, as shown in **Table 1**.

Table 1: Signalized Intersection LOS Definitions

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of desirable delay. These high-delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered undesirable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

2.4.2 Unsignalized Intersections

The operations of the unsignalized intersections were evaluated using the method contained in "Chapter 20: Two-Way Stop-Controlled Intersections" of the *HCM 6*. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At this two-way- or side-street-stop-controlled (SSSC) intersection, the average control delay is calculated for the minor-street stopped movement and the major-street left turns, not for the overall intersection. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented for SSSC. As shown in **Table 2**, LOS F is assigned to the

movement if the volume-to-capacity (V/C) ratio for the movement exceed 1.0, regardless of control delay. The average control delay for unsignalized intersections is calculated using Synchro 10.0 analysis software and is correlated to a LOS designation, as shown in **Table 2**.

Table 2: Unsignalized Intersection LOS Definition

Level of Service (V/C ≤ 1.0)	Level of Service (V/C > 1.0)[1]	Description	Delay in Seconds
A	F	Little or no delay	≤ 10.0
B	F	Short traffic delay	> 10.0 to 15.0
C	F	Average traffic delays	> 15.0 to 25.0
D	F	Long traffic delays	> 25.0 to 35.0
E	F	Very long traffic delays	> 35.0 to 50.0
F	F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.
Notes:
[1] For approach-based and intersection-wide assessments, such as that used for all-way stop controlled intersections, LOS is defined solely by control delay.

2.4.3 Significant Impact Criteria

The analysis of Baseline (2028) conditions compares no-project operations with conditions when the project is fully built out to determine whether project implementation is expected to result in a significant impact on the surrounding roadways. Based on previous studies conducted for the City & County of Honolulu Department of Planning and Permitting (DPP) Traffic Review Branch (TRB), the minimum desired operating standard for a signalized intersection is typically LOS D. Additionally, HDOT strives to maintain LOS D intersection operations for state facilities, but both agencies acknowledge that some facilities may operate at worse levels during peak hours. Both agencies usually define a significant intersection impact as when the operation of a signalized intersection changes from LOS D or better to LOS E or F. Impacts are also defined to occur when the addition of project traffic exacerbates locations already operating at or projected to operate at LOS E or F. When evaluating intersection operations at any location, other factors are considered in the analysis, such as traffic volumes and potential secondary impacts to pedestrian, bicycle, and transit travel.

Significant impacts are categorized as either a project-specific or cumulative impact. An impact is considered project-specific at a signalized intersection if the addition of project traffic is expected to degrade LOS D or better operations to LOS E or F operations. An impact is considered a cumulative impact at a signalized intersection if the addition of project trips exacerbates LOS E or F operations and increases the intersection delay by more than five (5) seconds.

For unsignalized intersections, the criterion for a project-specific impact is the same as for signalized intersections, as described above (i.e., LOS D or better to E or F). However, the project is determined to have a potentially significant cumulative impact when it adds traffic to a study location that includes a controlled approach operating at an undesirable level (i.e., LOS E or F) *and* one or more volume-based signal warrants are met. The signal warrants used for this evaluation are those described in Chapter 4C of the *Manual of Uniform Control Devices* (MUTCD, 2009), published by the US Department of Transportation Federal Highways Administration (FHWA).

The City & County of Honolulu Department of Planning & Permitting (DPP) Traffic Review Branch (TRB) and HDOT have not approved detailed criteria for significant pedestrian, bicycle, and transit impacts. However, these impacts are generally evaluated based on whether a proposed project would: 1) conflict with existing or planned pedestrian, bicycle, or transit facilities and services, or 2) create substantive walking, bicycling, or transit use demand without providing adequate and appropriate facilities for non-motorized mobility. Existing facilities for pedestrians, bicycles, and transit users were inventoried to evaluate the quality and scope of facilities/services currently in place. The assessments of planned pedestrian, bicycle, and transit facilities were conducted using information in planning documents, such as the *2019 Oahu Bike Plan Update* and the *Primary Urban Center Development Plan (2004)*. For these modes, if the proposed project is expected to conflict with existing or planned improvements to pedestrian and bicycle facilities, or if the project is expected to generate a substantial demand that could warrant additional transit service, then the project would be determined to have a project-specific impact to non-motorized modes of transportation.

It should be noted that the City & County Department of Transportation Services (DTS) has developed an analysis methodology for evaluating multimodal operations for vehicular, bicycle, pedestrian and transit modes. However, this methodology is only currently required for City & County-sponsored projects and will only be completed if required to address comments provided by DTS through DPP TRB.

3. Existing Conditions

This chapter describes the existing pedestrian, bicycle, and transit facilities, as well as the roadway network located within the project study area. A discussion of the existing intersection LOS operation results is also included in this chapter.

3.1 Existing Site and Transportation Facilities

The existing Voice of America site contains the Ulu Ke Kukui transitional housing project, Hoomalu O Na Kamalii, and the Kamehameha Schools Community Learning Center at Maili. All these existing uses will remain, and the proposed project will be developed on vacant land within the overall Voice of America site. A focused data collection effort was undertaken to identify existing transportation conditions in the vicinity of the proposed site. The assessment of existing conditions relevant to this study includes existing public transit, bicycle, and pedestrian facilities, as well as an inventory of the street system, traffic volumes on these facilities, and operating conditions at key intersections.

3.1.1 Existing Transit Facilities and Services

TheBus is the main public transportation service on the Island of Oahu, where it served over 60 million riders in the fiscal year of 2019 on its fixed-route service. Within the greater project study area, Routes 40, 93, C, and PH1 provide service along Farrington Highway. Route 403 also operates in the Maili area on Paakea Road, but there is no direct pedestrian access between the site and stops on that route.

Routes 93, C, and PH1 are express routes, while Route 40 is a regular service bus route. The existing transit schedules are summarized in **Table 3**.

Table 3: Existing Transit Services

Route	From	To	Weekdays			Weekends	
			Operating Hours	Headway (minutes)		Operating Hours	Headway (minutes)
				Peak	Midday		
40	Honolulu	Makaha	12:00 am – 12:00 am	30 min	30 min	12:00 am – 12:00 am	30 min
93	Downtown Honolulu	Makaha	Eastbound: 3:45 am – 8:16 am; Westbound: 3:23 pm – 7:34 pm	27 min	-	-	-
C	Honolulu	Makaha	3:03 am – 11:02 pm	30 min	30 min	3:04 am – 11:09 pm	30 min
PH1	Pearl Harbor	Makaha	Eastbound: one departure from Makaha at 4:25 am; Westbound: one departure from Pearl Harbor at 3:10 pm	-	-	-	-

Source: Fehr & Peers, 2021; TheBus.org.

All routes serve the bus stops located at Farrington Highway/St John's Road, located approximately a 2/3-mile walk from the middle of the proposed project site. The northbound bus stop is provided with a bench, and the southbound bus stop is provided with a shelter and a bench. Both bus stops also have a painted shoulder to allow for bus pull-outs, so buses stopping to pick up or drop off passengers will not block vehicles traveling on Farrington Highway.

3.1.2 Existing Bicycle Activity

The roadways in the study area do not provide separate bicycle facilities and have a minimal amount of bicycle activity. Based on the peak period traffic counts which included bicycle counts, no more than three (3) bicyclists were observed at any of the study intersections in the AM peak hour. In the PM peak hour, 14 bicycles were observed at the Kulaaupuni Street/St John's Road intersection, and 11 were observed at Farrington Highway/St John's Road. No more than five (5) bicyclists were observed at Farrington Highway/Kaukama Road and Kulauku Street/Kaukama Road in the PM peak hour.

3.1.3 Existing Pedestrian Activity

Most of the study area intersections have a minimal amount of pedestrian activity, with counts between five (5) and 15 pedestrians passing through each intersection during the peak hours. The exception is the Kulauku Street/Kaukama Road intersection, which had 28 pedestrians observed in the AM peak hour and 63 pedestrians observed in the PM peak hour.

3.1.4 Collision History

Collision data was reviewed to identify the occurrence of collisions by mode in the study area. According to the Hawaii State Office of Planning data, 11 collisions occurred at the study intersections from 2016 through June 2018. A screenshot of the data is shown on the next page. Table 4 below details the locations, dates, and types of crashes. As shown, most incidents were vehicle collisions. Two (2) pedestrian-related collisions were recorded at Farrington Highway/St John's Road during this period, and no bicycle-related collisions were reported.

Table 4: Collision History 2016 Through June 2018

Crash Type	Crash Type	Year	Number of Crashes
Farrington Hwy/St John's Rd	Motorcycle/ Moped	2016	1
Farrington Hwy/St John's Rd	Pedestrian	2016	1
Farrington Hwy/St John's Rd	Car/Truck	2016	1
Farrington Hwy/St John's Rd	Pedestrian	2017	1
Farrington Hwy/St John's Rd	Car/Truck	2017	1
Farrington Hwy/Kaukama Rd	Car/Truck	2016	3
Farrington Hwy/Kaukama Rd	Car/Truck	2017	2
Kulauku St/Kaukama Rd	Car/Truck	2018	1

Source: Fehr & Peers, 2021; Hawaii State Office of Planning.

Source: https://histategis.maps.arcgis.com/apps/webappviewer/index.html?id=2ad9abc4cf064a9dabbf46763eddf8b5

3.1.5 Existing Roadway System

The key roadways providing access to or in the vicinity of the project site are described below. As noted in **Section 2**, the site is located east of Kulaaupuni Street and south of the Maili Channel.

Farrington Highway (Route 93) is a principal arterial that largely is under the jurisdiction of HDOT. It extends as a four-lane facility from H-1/Queen Liliuokalani Freeway to Makaha Valley Road, where it becomes a two-lane facility to its northern terminus at Kaena Point State Park. From 0.22 miles north of the Na Ohi Kilolo Stream bridge, Farrington Highway is under the jurisdiction of the City & County of Honolulu. Adjacent to the project, the posted speed limit is 35 miles per hour (mph). A continuous sidewalk is provided on the mauka side of the roadway, and a painted shoulder is provided on the makai side of the roadway. Farrington Highway is also a designated bike route, and on-street parking is prohibited primarily in the four-lane section of roadway.

St John's Road is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Kaukamana Road and includes approximately 22 feet of pavement width makai of Kulaaupuni Street with unpaved shoulders. The posted speed limit is 15 mph makai of Kulaaupuni Street and 25 mph mauka of Kulaaupuni Street. A narrow asphalt path is only provided on the north side of the street between Kulaaupuni Street and Manuaihue Street. On-street parking was observed on the unpaved shoulder areas.

Kaukama Road (Route 8750) is a two-lane minor collector that is under the jurisdiction of the City & County of Honolulu. It extends from Farrington Highway to Pakeke Street. The posted speed limit is 25 mph. Sidewalks are provided on both sides of the roadway, and on-street parking is permitted on both sides as well.

Kulaaupuni Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Mamoalii Place (adjacent to the project site) to a terminus at the Mailiilii Stream. The posted speed limit is 25 mph. A sidewalk is provided on the makai side of the road between Mamoalii Place and the Maili Channel, and a raised curb designates a street-level walking path on the mauka side of the road for the same segment, with sidewalk provided on the Maili Channel bridge. A sidewalk is also provided on the makai side of the road between St John's Road and approximately 200 feet south of Maliona Street. No sidewalk or formal path is provided on the other segments of Kulaaupuni Street, including the segment between the Maili Channel and St John's Road. On-street parking is provided adjacent to the sidewalk, and parking was observed in the unpaved shoulder immediately adjacent to the roadway. No parking is permitted on the mauka side of the roadway between Mamoalii Place and the Maili Channel as designated by red curb.

Kulauku Street is a two-lane local roadway under the jurisdiction of the City & County of Honolulu. It extends from Kaukama Road to Kulawae Street. Kulauku Street has the potential to be extended to the north along the makai edge of the project site and the Community Learning Center at Maili to connect with Kulaaupuni Street, but there are no plans to make that connection at this time. The posted speed limit is 25 mph. A sidewalk is provided on both sides of the roadway, and on-street parking is permitted on both sides as well.

3.2 Existing Traffic Volumes/Lane Configurations

Given the ongoing COVID-19 pandemic and the resulting change in temporal and behavioral travel patterns, it was not possible to conduct traffic counts that reflect typical peak hour volume levels. Accordingly, the analysis of existing traffic conditions is based on counts collected in early December 2020, which were adjusted to account for demand prior to the COVID-19 pandemic.

The adjustment factor was based on Year 2019 to 2020 traffic volume comparisons reported by HDOT for a location on H-1 at mile marker 3.43 at the Kualakai Parkway interchange. This location was the nearest reported volume comparison to the project and is the only access between the Leeward coast regions and the central and eastern Oahu regions. According to HDOT reports, traffic volumes on December 2 were 10% lower than 2019 annual average daily traffic, volumes for all of December were 7% lower, and

volumes for all of November were 11% lower. Based on this data, an adjustment factor of 10% was applied to increase observed traffic volumes from December 1, 2020, to volumes representative of an existing condition scenario for 2020 if the COVID-19 pandemic had not occurred.

Additional adjustments were made for turning movement volumes determined to be significant deviations from normal resulting from pandemic conditions. Existing condition volumes were compared to counts taken for the Ka Pua Community Learning Center traffic study in November 2012, which were grown by 1% per year for 8 years to represent 2020 volumes. If the grown 2012 volume from the Ka Pua Community Learning Center traffic study was higher than the adjusted 2020 count taken for this study, the grown 2012 volumes was used as the final existing conditions volume to provide a more conservative analysis. This was done to ensure that volumes used in the Existing Conditions analysis accurately captured expected travel patterns resulting from unique land-uses in the area adversely affected by the pandemic, notably the nearby schools and educational facilities.

Signal timing data for the study intersections was obtained from field observations. Traffic volumes at the intersection of Farrington Highway/Hookele Street were estimated based on study intersection count data. **Figure 4** presents the analyzed peak hour turning movement volumes, corresponding lane configurations, and traffic control devices under Existing conditions. **Appendix A** provides traffic count data sheets.

3.3 Existing Intersection Operations

Peak hour intersection capacity analysis was performed for the study intersections using the methodology described in **Section 2.4** and the Existing Conditions peak hour traffic volumes. Due to *HCM 6* limitations for analyzing signalized intersections, St John's Road has been analyzed as having a speed limit of 25 mph at the intersection with Farrington Highway. **Table 5** summarizes the results of the intersection operations analysis for Existing conditions. Detailed LOS worksheets are provided in **Appendix B**. As shown in **Table 5**, all intersections operate at LOS C or better in both peak hours. Note that the calculated LOS generally represents operations in the field. Some intersection approaches, notably the westbound approach at Farrington Highway/St John's Road, experience long delays and lengthy queues intermittently during the AM peak hour.

Figure 4
Traffic Volumes, Lane Configurations, and Level of Service
Existing Conditions

Table 5: Existing Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for Side Street Stop)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	17.7	B	
		PM	13.9	B	
2. Kulaaupuni St/St John's Rd	Side Street Stop	AM	21.2	C	NBL/T/R
		PM	11.8	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.5	A	
		PM	8	A	
4. Kulauku St/Kaukama Rd	Side Street Stop	AM	11.8	B	SBL
		PM	13.4	B	SBL

Source: Fehr & Peers, 2020.
Notes:
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.

4. Baseline (2028) No Project Conditions

To evaluate the potential impacts of traffic generated by the proposed project on the surrounding street system, it was necessary to first develop estimates of future traffic conditions in the area without the project. Future traffic conditions without the project reflect traffic increases due to regional growth and development near the study site at the time the project is expected to be fully built and occupied. This scenario is referred to as baseline or "no project" conditions. The forecasted future traffic volumes were then used as a baseline to identify impacts from the project on the roadway system. This chapter describes the development of this future traffic scenario.

4.1 Baseline (2028) No Project Traffic Estimates

The following section summarizes the growth assumptions used to estimate the amount of traffic that would be added to existing intersection volumes to develop volume estimates for Baseline (2028) No Project conditions.

A growth factor is typically applied to the baseline traffic volumes to account for future regional growth. For this study, the growth factor was derived from forecasts developed as part of the Farrington Highway Corridor Study. Growth within the study area was estimated to be approximately 0.90% per year. To provide a worst-case forecast, a 1.0% annual growth factor was assumed for all turning movements in the study area, compounded over the eight-year timeframe (2020 to 2028).

Figure 5 illustrates the forecasted peak hour traffic volumes and lane configurations for Baseline (2028) No Project conditions.

4.2 Baseline (2028) No Project Intersection Levels of Service

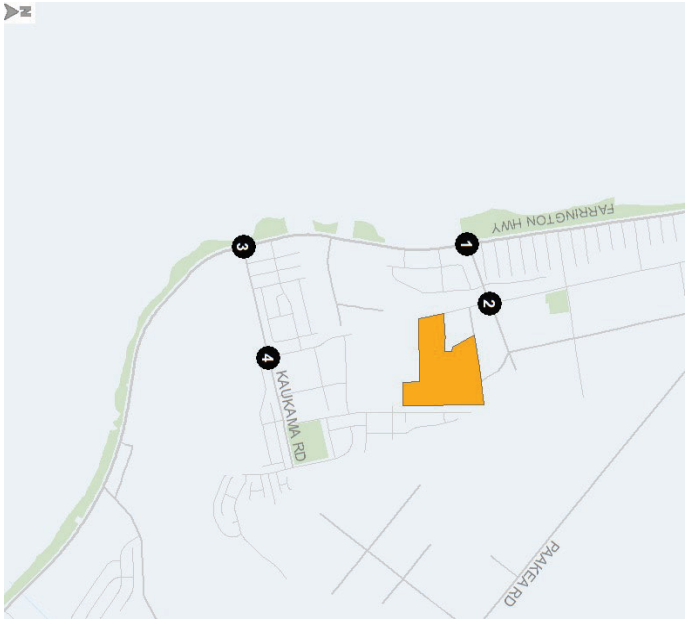
Levels of service (LOS) calculations were conducted to evaluate the operating levels of the study intersections under Baseline (2028) No Project conditions with the forecasted growth in traffic. The results of the LOS analysis for the study intersections are presented in **Table 6.** The corresponding LOS calculation sheets are included in **Appendix B**.

The changes in operations from Existing conditions are the result of the addition of ambient traffic growth. The analysis results indicate that all intersections will operate at desirable levels of service. While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS D), where the 95th percentile queue is projected to exceed 500 feet. This is caused by the limited approach capacity (i.e., a shared lane for turning and through vehicles, as well as by the lengthy amount of green time for through traffic on Farrington Highway.

Table 6: Baseline (2028) No Project Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for Side Street Stop)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	20.4	C	
		PM	18.5	B	
2. Kulaaupuni St/St John's Rd	Side Street Stop	AM	29.5	D	NBL/T/R
		PM	13.5	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.9	A	
		PM	9.3	A	
4. Kulauku St/Kaukama Rd	Side Street Stop	AM	15.7	C	SBL
		PM	21.2	C	SBL

Source: Fehr & Peers, 2020.
Notes:
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.



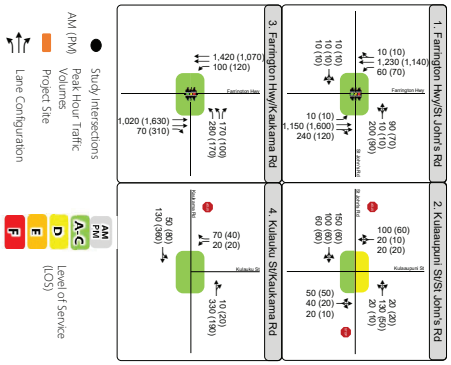


Figure 5
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Conditions

5. Project Traffic Estimates

This section describes the anticipated number of vehicle trips and the directionality of those trips that would result from implementation of the proposed project. Future traffic added to the roadway system by the project is estimated using a three-step process: (1) project trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic that would be added to the roadway network. The second step estimates the direction of travel to and from the project site. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

5.1 Project Trip Generation Estimates

The vehicle trip generation for the proposed project was estimated using standard trip rates published in the *Trip Generation Manual* (10th Edition, 2017) by the Institute of Transportation Engineers (ITE).

The project trip totals were then adjusted using the Mixed-Use (MXD) Trip Generation Model developed by Fehr & Peers and the Environmental Protection Agency (EPA), which is based on statistically superior data compared to the mixed-use methodology used by ITE alone. This model accounts for the local site context and other factors to estimate potential internalization and multimodal trip reductions using published travel survey data.

As shown in **Table 7**, the proposed project is expected to generate a total of 2,378 net new daily vehicle trips, including 151 net new vehicle trips during the AM peak hour (99 inbound/88 outbound) and 223 net new vehicle trips during the PM peak hour (104 inbound/118 outbound).

Table 7: Project Vehicle Trip Generation Estimates

Land Use	Quantity	Vehicle Trips						
		Daily[1]	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single-Family Housing	145 dwelling units	1,464	27	81	108	91	54	145
Multi-Family Housing	136 dwelling units	987	15	49	64	49	29	78
Gross New Trips		**2,451**	**42**	**130**	**172**	**140**	**83**	**223**
Internal Capture Reduction		(10)	0	0	0	0	0	0
Walk and Bike Reduction		(59)	0	(2)	(2)	(3)	(2)	(5)
Total Reductions		**(69)**	**0**	**(2)**	**(2)**	**(3)**	**(2)**	**(5)**
NET NEW VEHICLE TRIPS		**2,378**	**73**	**78**	**151**	**104**	**118**	**223**

Source: Fehr & Peers, 2020 using Institute of Transportation Engineers *Trip Generation Manual* (10th Edition, 2017) trip rates and Mixed-Use (MXD) Trip Generation Model developed by Fehr & Peers and the Environmental Protection Agency.

Project Trip Distribution and Assignment

The geographic distribution of trips generated by the proposed project is dependent on characteristics of the street system serving the project site, the level of accessibility of routes to and from the project site, and primary land uses to which project tenants would be drawn (e.g., job centers, residential areas, shopping destinations, services, and schools).

The project's trip distribution pattern was primarily developed by using model data and existing turning movement counts to determine the likely geographic distribution of project trips. The more localized distribution was based on available travel paths and Google Maps typical travel times. The resulting overall trip distribution pattern estimates for the peak hour project-generated traffic are as follows:

- 25% to/from North along Farrington Highway
- 70% to/from South along Farrington Highway
- 4% local to/from Hookele Street and Kaukama Road
- 1% local to/from St. John's Road, Kulaaupuni Street and the surrounding neighborhood

Using the estimated trip generation and the distribution patterns discussed above, the traffic generated by the proposed project was assigned to the individual turning movements at intersections within the street network. **Figure 6** details the project's trip distribution and trip assignment at each study intersection.

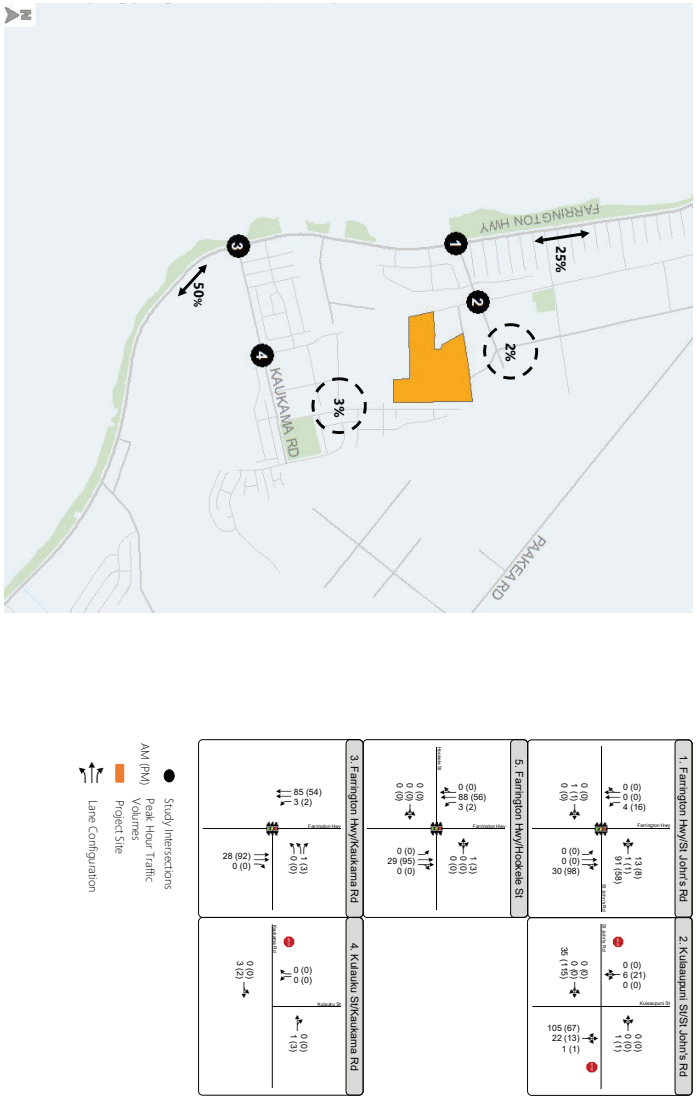


Figure 6
Traffic Volumes and Lane Configurations
Trip Distribution and Assignment

6. Baseline (2028) Plus Project Conditions

This section describes the analysis of potential impacts on the roadway system due to projected future increases in traffic, including traffic generated by the project in 2028. The Baseline (2028) Plus Project roadway network is the same network assumed under the Baseline No Project scenario. The analysis compares the project levels of service (LOS) at each study intersection with and without the addition of project-generated trips to determine potential impacts to the transportation network.

6.1 Baseline (2028) Plus Project Intersection Levels of Service

To forecast the peak hour operating conditions at each study intersection, the project trip assignment was superimposed on Baseline (2028) No Project traffic volumes to yield Baseline (2028) Plus Project volumes.

Figure 7 presents the forecasted Baseline (2028) Plus Project AM and PM peak hour volumes. The peak hour volumes were used to analyze operations using the LOS methodology described in **Section 2.4**. The comparative LOS analysis results for the study intersections under Baseline (2028) Without and With Project conditions are presented in **Table 8**. Detailed LOS results are included in **Appendix B**.

The results presented in **Table 8** indicate that under Baseline (2028) Plus Project conditions, operations at the signalized intersections are largely unchanged with the addition of project-generated traffic, with less than 10 seconds of increased delay at each location and in each peak hour. At the unsignalized intersections, LOS D conditions in the AM peak hour at Kulaaupuni Street/St John's Road would be exacerbated by project traffic with operations for the northbound approach projected to worsen to LOS F.

While the Farrington Highwayy/St John's Road intersection is projected to operate at or above the minimum desired level in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS F), where the 95th percentile queue is expected to extend back to Manuaihue Street. On Farrington Highway, the 95th percentile southbound left-turn queue length is projected to be 100 feet during the PM peak hour, which is the total available turn pocket storage.

6.2 Collision Assessment

The proposed project is not changing the transportation network in the vicinity where crashes occur as discussed in **Section 3.1.4**. While the project will add a small amount of traffic to these facilities where these crashes occurred, the project is not anticipated to change the crash rate. Given that it is not possible to perfectly predict human behavior and random fluctuations in crash locations or frequency, additional factors and influences may obfuscate the effects of the proposed project. This does not constitute, and is not meant to be, a comprehensive review of safety in the study or surrounding area, which could be much broader in scope (e.g., including a review of individual collision records, human factors considerations, and comparisons of the collision rates and frequencies with similar localities).

Table 8: Baseline (2028) Without and With Project Intersection Levels of Service

			Future No Project Conditions			Future Plus Project Conditions			
			Overall Intersection or Worst Movement			Overall Intersection or Worst Movement			
Intersection	Traffic Control	Peak Hour	Delay (sec/veh)[1]	LOS	Worst Movement (for SSSC)	Delay (sec/veh)[1]	LOS	Worst Movement (for SSSC)	Change in Delay (sec/veh)[1]
1. Farrington Hwy/St John's Rd	Signalized	AM	20.4	C		29.6	C		9.2
		PM	18.5	B		24	C		5.5
2. Kulaaupuni St/St John's Rd	SSSC	AM	29.5	D	NBL/T/R	**>120**	**F**	NBL/T/R	**>60**
		PM	13.5	B	NBL/T/R	19.8	C	NBL/T/R	6.3
3. Farrington Hwy/Kaukama Rd	Signalized	AM	9.9	A		9.7	A		-0.2
		PM	9.3	A		9.7	A		0.4
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL	15.8	C	SBL	0.1
		PM	21.2	C	SBL	21.4	C	SBL	0.2

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for the signalized intersection. The vehicular delay for the worst movement is reported for the side-street stop-controlled intersection.

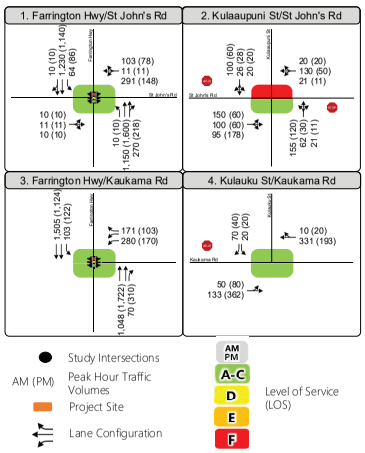


Figure 7
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Plus Project Conditions

6.3 Needed Traffic Improvements

6.3.1 Kulaaupuni St/St John's Road

A multi-way stop will improve operations at Kulaaupuni Street/St John's Road under Baseline (2028) Plus Project conditions. Implementation of this control would result in average vehicle delays of 14.7 seconds in the AM peak hour. While AWSC would add delay to the eastbound and westbound approaches, which currently are uncontrolled movements, this control is not expected to substantially affect operations at adjacent intersections. In addition, the installation of stop signs on all approaches would enhance safety for pedestrians in that all vehicles would be required to stop at this location. Pedestrians crossing St. John's Road trying to get to and from existing neighborhoods and the project site south of this roadway would benefit from all vehicles being controlled at the Kulaaupuni Street intersection.

6.3.2 Farrington Highway/St John's Road

Signal timing modifications at this intersection will improve westbound and southbound left-turn queueing at Farrington Highway/St John's Road. Because signals are likely to be retimed between current conditions and 2028, updated signal timing should consider future increases in traffic to/from St John's Road in the future such that side street queues be reduced without substantially impacting throughput on the highway. The project sponsor should work with HDOT to ensure that updated timing improves westbound operations. For example, reallocating up to 20 seconds of green time from the northbound and southbound through phase to the eastbound and westbound through phase would reduce westbound queues by 100 feet, while still maintaining LOS C overall operations at the intersection. The project sponsor would be responsible for conducting a signal timing study to justify any signal timing modifications and subject to approval by DOT. Unfortunately, adequate right of way on St. John's Road is not available to allow the addition of a second westbound left-turn lane to reduce queues and delays on this approach.

7. Baseline (2028) No Project Conditions with Kulaaupuni Extension

In the future, Kulaaupuni Street is expected to be extended south of the project site, past the Community Learning Center at Maili property, to connect with Kulauku Street. This extension was studied as part of the Community Learning Center development project and is likely to be constructed as part of future development within the overall Voice of America site. Analysis of this scenario with the extension was incorporated in this study to assess operations of study facilities with and without the project for informational purposes only and to be consistent with previous studies.

The following section summarizes the assumptions used to estimate the how traffic patterns will change with the extension and summarizes the operations under Baseline (2028) No Project with Kulaaupuni Extension conditions.

7.1.1 Redistribution of Vehicle Trips

Connecting Kulaaupuni Street to Kulauka Street would provide enhanced neighborhood connectivity by increasing the number of available travel paths and minimizing the need to use Farrington Highway for local trips between adjacent neighborhoods. While some neighborhood trips going north or south on Farrington Highway may use the extension, many of the trips expected to use the facility are to/from the educational facilities, public parks, shops, and other trip generators within the neighborhoods.

Trips were reassigned to the roadway network based on existing peak hour turning movement volumes, existing travel patterns, and available travel paths.

Figure 8 illustrates the forecasted peak hour traffic volumes and lane configurations for Baseline (2028) No Project with Kulaaupuni Extension conditions.

7.2 Baseline (2028) No Project with Kulaaupuni Extension Intersection Levels of Service

Levels of service (LOS) calculations were conducted to evaluate the operating levels of the study intersections under Baseline (2028) No Project conditions with the forecasted growth in traffic. The results of the LOS analysis for the study intersections are presented in **Table 9.** The corresponding LOS calculation sheets are included in **Appendix B**.

The changes in operations from Existing conditions are the result of the addition of ambient traffic growth and the assumed Kulaaupuni Street connection. The analysis results indicate that all intersections will operate at or above the minimum desired overall levels of service. The change in average delay is projected to decrease by approximately one or two seconds from "no extension" conditions at most study

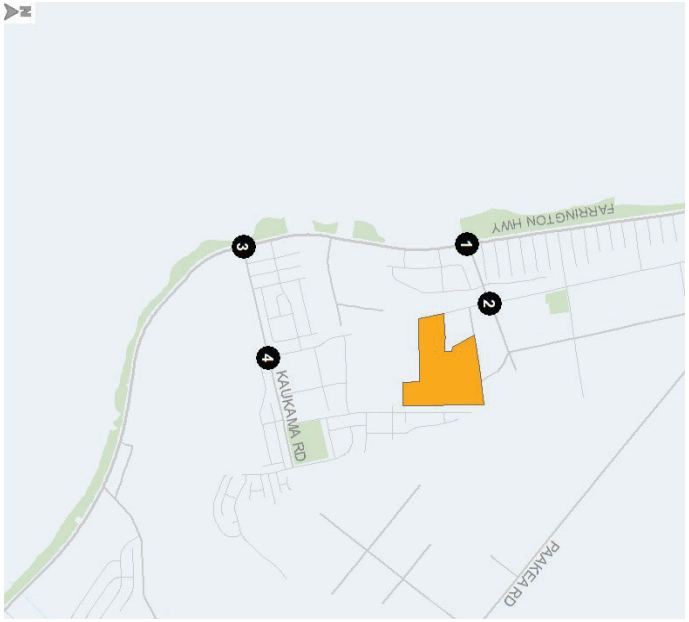
locations. A slight increase in delay is expected at the Farrington Highway/Kaukama Road intersection where some vehicles are expected to divert from the St. John's Road approach.

While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour would continue to be highest on the westbound approach. With the extension, the 95th percentile queue is expected to be reduced to 440 feet, or roughly 80 feet less than under "no extension" conditions.

Table 9: Baseline (2028) with Kulaaupuni Extension Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Intersection or Worst Movement		Worst Movement (for SSSC)
			Delay (sec/veh)[1]	LOS	
1. Farrington Hwy/St John's Rd	Signalized	AM	19.0	B	
		PM	16.6	B	
2. Kulaaupuni St/St John's Rd	SSSC	AM	27.8	D	NBL/T/R
		PM	13.1	B	NBL/T/R
3. Farrington Hwy/Kaukama Rd	Signalized	AM	10.3	B	
		PM	9.5	A	
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL
		PM	17.2	C	SBL

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.



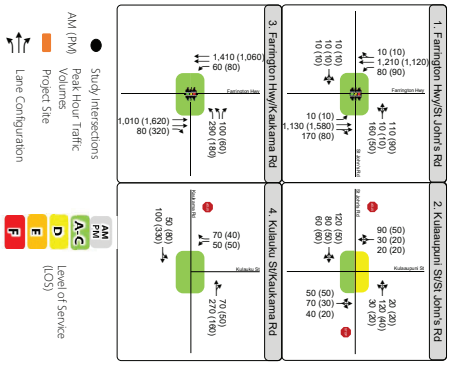


Figure 8
Traffic Volumes, Lane Configurations, and Level of Service
Baseline (2028) Conditions with Kulaaupuni Extension

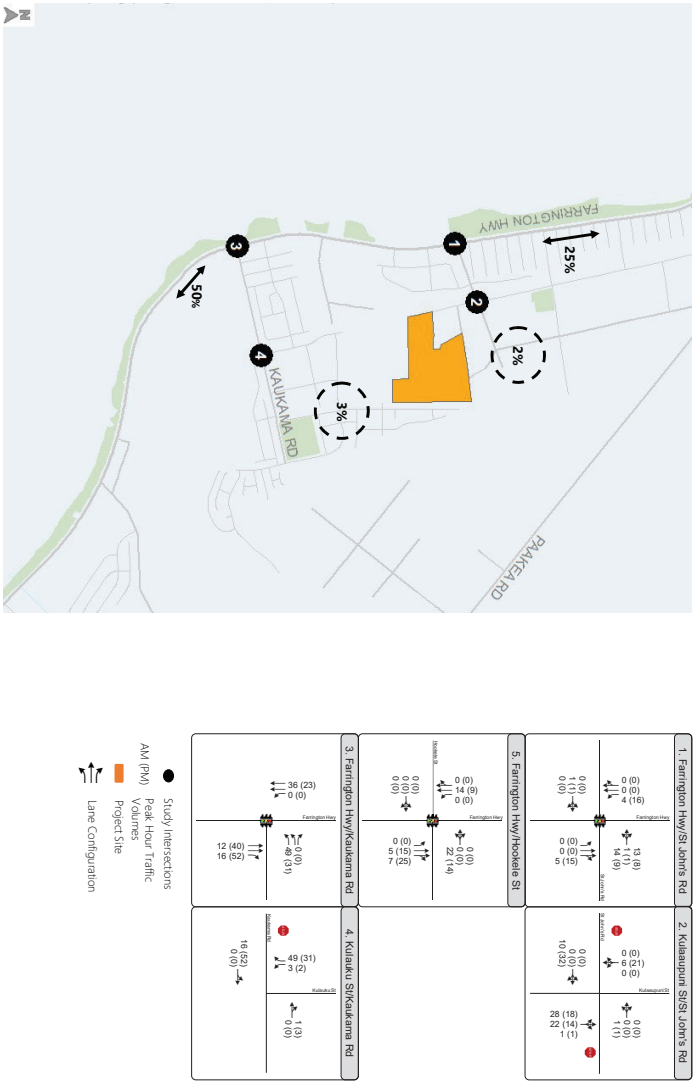
8. Project Traffic Estimates with Kulaaupuni Extension

This section describes the anticipated assignment of project-generated vehicle trips that would result from extension of Kulaaupuni Street.

Project Trip Assignment with Kulaaupuni Street Extension

The extension of Kulaaupuni Street allows for an alternate route to access the project from the south. Therefore, a majority of project trips to/from the south along Farrington Highway were assigned to use the Kulaaupuni Street extension via Kaukama Road and Hookele Street to access the site.

Figure 9 details the project's trip distribution and trip assignment at each study intersection with the Kulaaupuni Street extension in place.



Study Intersections

AM (PM) Peak Hour Traffic Volumes

Project Site

Lane Configuration

Figure 9

Traffic Volumes and Lane Configurations
Trip Distribution and Assignment with Kulaaupuni Extension

9. Baseline (2028) Plus Project Conditions with Kulaaupuni Extension

This section describes the analysis of potential impacts to the roadway system from the addition of project-generated traffic in 2028 with the proposed Kulaaupuni Road extension in place. The Baseline (2028) Plus Project with Kulaaupuni Extension roadway network is the same network assumed under the Baseline (2028) No Project with Kulaaupuni Extension scenario. The analysis compares the project levels of service (LOS) at each study intersection with and without the addition of project-generated trips to determine potential impacts to the transportation network.

9.1 Baseline (2028) Plus Project with Kulaaupuni Extension Intersection Levels of Service

To forecast the peak hour operating conditions at each study intersection, the project trip assignment was superimposed on Baseline (2028) No Project with Kulaaupuni Extension traffic volumes to yield Baseline (2028) Plus Project with Kulaaupuni Extension volumes.

Figure 10 presents the forecasted Baseline (2028) Plus Project with Kulaaupuni Extension AM and PM peak hour volumes. The peak hour volumes were used to analyze operations using the LOS methodology described in **Section 2.4**. The comparative LOS analysis results for the study intersections under Baseline (2028) No Project and With Project with Kulaaupuni Extension conditions are presented in **Table 10**. Detailed LOS results are included in **Appendix B**.

The results presented in **Table 10** indicate that under Baseline (2028) Plus Project with the Kulaaupuni Extension in place, operations at the signalized intersections are largely unchanged with the addition of project-generated traffic with less than two seconds of increased delay at each location and in each peak hour. Baseline LOS D conditions in the AM peak hour at the Kulaaupuni Street/St John's Road intersection with the extension would be exacerbated by project traffic with operations degrading to LOS E.

While Farrington Highway/St John's Road operates with desirable delays in both peak hours, delays during the AM peak hour are highest on the westbound approach (LOS D), where the 95th percentile queue is 490 feet.

Figure 10
Traffic Volumes, Lane Configurations, and Level of Service
Baseline Plus Project Conditions with Kulaaupuni Extension

Table 10: Baseline (2028) Without and With Project with Kulaaupuni Extension Intersection Levels of Service

Intersection	Traffic Control	Peak Hour	Future No Project w/ Kulaaupuni			Future Plus Project w/ Kulaaupuni			Change in Delay (sec/veh)[1]
			Intersection or Worst Movement		Worst Movement (for SSSC)	Intersection or Worst Movement		Worst Movement (for SSSC)	
			Delay (sec/veh)[1]	LOS		Delay (sec/veh)[1]	LOS		
1. Farrington Hwy/St John's Rd	Signalized	AM	19	B		20	C		1
		PM	16.6	B		17.6	B		1
2. Kulaaupuni St/St John's Rd	SSSC	AM	27.8	D	NBL/T/R	48	E	NBL/T/R	20.2
		PM	13.1	B	NBL/T/R	15	C	NBL/T/R	1.9
3. Farrington Hwy/Kaukama Rd	Signalized	AM	10.3	B		11.7	B		1.4
		PM	9.5	A		10.6	B		1.1
4. Kulauku St/Kaukama Rd	SSSC	AM	15.7	C	SBL	16.8	C	SBL	1.1
		PM	17.2	C	SBL	30.1	D	SBL	12.9

Source: Fehr & Peers, 2020.
Notes:
SSSC=Side-Street Stop Controlled
[1] Whole intersection weighted average stopped delay expressed in seconds per vehicle for the signalized intersection. The vehicular delay for the worst movement is reported for the side-street stop-controlled intersection.

9.2 Needed Traffic Improvements

9.2.1 Kulaaupuni Street/St John's Road

A multi-way stop would improve operations at Kulaaupuni Street/St. John's Road under Baseline (2028) Plus Project conditions. Implementation of this control would result in average vehicle delays of 12 seconds in the AM peak hour. While AWSC would add delay to the eastbound and westbound approaches, which currently are uncontrolled movements, this control is not expected to substantially affect operations at adjacent intersections. In addition, the installation of stop signs on all approaches would enhance safety for pedestrians in that all vehicles would be required to stop at this location. Pedestrians crossing St. John's Road trying to get to and from existing neighborhoods and the project site south of this roadway would benefit from all vehicles being controlled at the Kulaaupuni Street intersection.

9.2.2 Farrington Highway/St John's Road

Signal timing modifications at this intersection should be made to improve westbound and southbound left-turn queueing at Farrington Highway/St John's Road. Because signals are likely to be retimed between current conditions and 2028, updated signal timing should consider increases in traffic to/from St John's Road in the future such that side street queues can be reduced without substantially impacting throughput on the highway. The project sponsor should work with HDOT to ensure that updated timing improves westbound operations. The project sponsor would be responsible for conducting a signal timing study to justify any signal timing modifications and subject to approval by DOT. Unfortunately, adequate right of way on St. John's Road is not available to allow the addition of a second westbound left-turn lane to reduce queuing and delays on this approach.

10. Site Access, Circulation, and Parking

This chapter includes a review of the site access and on-site circulation for vehicles, bicyclists, and pedestrians, which would also include most transit users. An evaluation of off-site active and transit travel modes is presented in **Section 11**.

10.1 Site Access

As shown in the site plan (**Figure 2)**, vehicle access to the site will be provided via Kulaaupuni Street, which would be extended by approximately 400 feet south of its current terminus with Mamoalii Place. The primary mauka-makai on-site roadway intersecting Kulaaupuni Street would be designed as a full-access roadway to accommodate the future extension of Kulaaupuni Street. Turn volumes at this intersection are projected to be low enough such that no dedicated turn pockets are necessary. It is recommended that the westbound approach of the primary on-site roadway will include a stop sign and associated pavement striping at Kulaaupuni Street.

Overall, on-site access is considered to be adequate with the proposed and recommended improvements.

10.2 On-Site Circulation & Parking

On-site vehicular circulation will be provided via a network of residential streets that provide continuous circulation plus one cul-de-sac street on the makai side of the property. In general, the street segments are short enough and through traffic is not an issue such that speed control devices would not be needed. To clearly establish vehicular right of way and to enhance safety, all on-site T-intersections are recommended to include a stop sign and striping on the single approach roadway. Several surrounding neighborhood streets are marked with 15 mph speed limit signs, and this approach could be utilized within the project to encourage drivers to maintain slow speeds within the site.

A parking lot with approximately 300 parking spaces will be provided for the 136 multi-family units. The required parking supply per unit per the Revised Ordinances of Honolulu Section 21-6.30 is two parking spaces per unit, so the proposed supply will exceed the Code's minimum requirement for the multi-family housing buildings.

The 145 single-family lots will have dedicated parking within each parcel, and it is anticipated that on-street parking will be permitted on all internal streets where feasible. Parking should be expressly prohibited near each intersection to provide adequate sight distance of pedestrians and cyclists at these locations.

No substantial circulation or parking issues are anticipated with construction of the proposed project.

11. Multimodal Assessment

This chapter includes a review of multimodal access to the site and circulation for buses, other vehicles, pedestrians, and bicyclists surrounding the site.

11.1 Transit Facilities and Services

As noted in Section 3, transit service is currently provided along Farrington Highway by TheBus. Within the project study area, Routes 40, 93, C, and PH1 provide service along the highway, which will be able to serve project residents, commuters, and visitors of the project site. Some increase in demand to transit is anticipated with implementation of the proposed project, which can be accommodated based on existing service and frequency. Within the project study area, implementation of the proposed project is not expected to conflict with any existing or planned transit service included in the planning documents listed in **Section 2.4.3.** No significant impacts to transit are anticipated to occur with buildout of the proposed project. However, a formal walking path from the site to access transit on the highway is discontinuous.

11.2 Bicycle Facilities

Bicyclists will access the site via the existing roadway network. While these roadways in the study area do not provide separate bicycle facilities, they serve a minimal amount of existing bicycle activity. The project is expected to generate additional bicycle trip demand, but the existing facilities can accommodate these trips from a capacity perspective. Lower speed and lower volume residential streets typically do not have separate bicycle facilities, the final Bike Plan does not include any new bicycle facilities on the roadways immediately adjacent to the project site.

Implementation of the proposed project is not expected to conflict with any existing bikeways or planned bicycle facilities included in the planning documents listed in **Section 2.4.3**. Accordingly, no significant impacts to bicyclists are expected to occur with buildout of the proposed project.

11.3 Pedestrian Facilities

Pedestrians will access the site via existing sidewalks along Kulaaupuni Street, as well as via new sidewalks that the project will install as part of frontage improvements. Roadways internal to the project site are all expected to have sidewalks or formal paths on at least one side of the street.

However, several gaps exist in pedestrian facilities between the site and nearby key intersections and destinations. Specifically, project-generated pedestrians do not have a formal path between the Maili Channel bridge and the St. John's Road intersection to accommodate travel between the site and key destinations such as Maili Elementary School and Community Park, the Leeward Community College Waianae Moku campus, and bus stops on Farrington Highway. An improvement opportunity that could be considered is the development of a formal walking path on the mauka side of Kulaaupuni Street between the bridge and St John's Road. This could be accomplished through installation of a raised curb

along the pavement edge and an asphalt or decomposed granite path to provide an accessible facility (i.e., compliant with the Americans with Disabilities Act (ADA)).

Without the completion of the full Kulaaupuni Street extension, the project site will be isolated from the adjacent neighborhoods located south and mauka of the site including Mokila Street and Kaukama Road. These areas include the Maili Kai Community Park and the Sea Country General Store. To provide access to this area, an improvement opportunity that could be considered is a pedestrian and bicycle connection (i.e., a shared use path) from the southeast corner of the project site to the makai terminus of Laia Street. The path could be located between Lots 24 and 25, for example, and then extend alongside the Sea Country development. This would provide greater connectivity between neighborhoods to the north and south, facilitate bicycle and pedestrian trips, and reduce overall vehicle miles of travel.

Appendix A: Traffic Count Data

FEHR PEERS

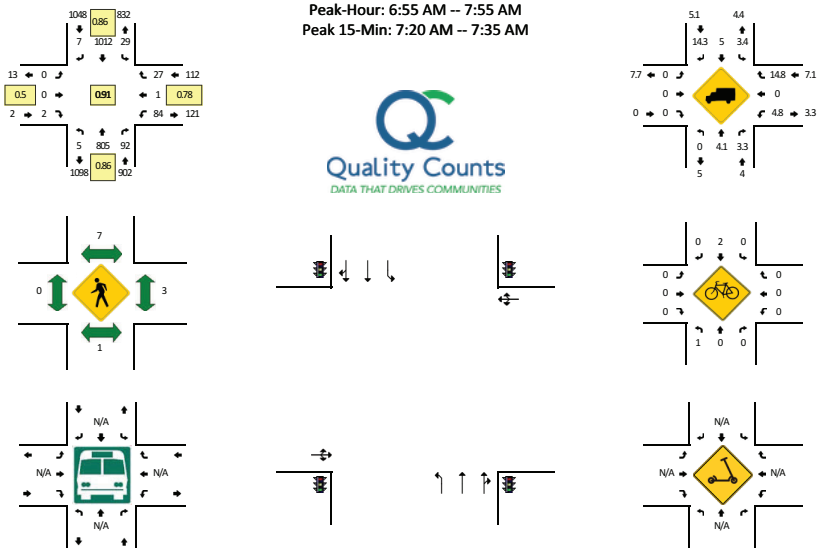
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Farrington Hwy -- Saint Johns Rd
CITY/STATE: Maili, HI

QC JOB #: 15306601
DATE: Tue, Dec 1 2020

Peak-Hour: 6:55 AM -- 7:55 AM
Peak 15-Min: 7:20 AM -- 7:35 AM



5-Min Count Period Beginning At	Farrington Hwy (Northbound)				Farrington Hwy (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	31	3	0	3	91	1	0	0	0	0	0	8	0	0	0	137	
6:05 AM	0	32	2	0	1	129	1	0	0	0	0	0	10	0	2	0	177	
6:10 AM	1	33	5	0	1	88	1	0	1	0	0	0	7	1	1	0	139	
6:15 AM	0	33	1	0	0	99	0	0	0	0	1	0	6	0	4	0	144	
6:20 AM	0	30	1	0	0	97	2	0	0	0	1	0	5	0	1	0	137	
6:25 AM	1	57	2	0	3	78	0	0	0	0	1	0	5	0	4	0	151	
6:30 AM	0	39	2	0	4	92	1	0	1	0	0	0	10	0	0	0	149	
6:35 AM	0	62	3	0	1	109	0	0	1	0	1	0	4	0	1	0	182	
6:40 AM	0	44	5	0	1	83	0	0	0	0	0	0	9	0	5	0	147	
6:45 AM	0	52	7	0	1	92	0	0	0	0	1	0	11	0	2	0	166	
6:50 AM	0	60	4	0	2	70	0	0	0	0	0	0	13	0	6	0	155	
6:55 AM	0	64	5	0	2	89	0	0	0	0	0	0	4	0	0	0	164	1848
7:00 AM	0	57	6	0	3	106	1	0	0	0	0	0	7	0	0	0	180	1891
7:05 AM	0	71	8	0	2	86	0	0	0	0	0	0	9	1	4	0	181	1895
7:10 AM	1	43	2	0	1	105	1	0	0	0	1	0	5	0	2	0	161	1917
7:15 AM	0	57	10	0	0	57	1	0	0	0	0	0	6	0	2	0	133	1906
7:20 AM	0	64	6	0	6	105	1	0	0	0	0	0	8	0	3	0	193	1962
7:25 AM	0	79	6	0	4	84	0	0	0	0	0	0	14	0	2	0	189	2000
7:30 AM	2	85	8	0	1	81	1	0	0	0	0	0	4	0	5	0	187	2038
7:35 AM	0	58	9	0	4	88	0	0	0	0	0	0	4	0	1	0	164	2020
7:40 AM	1	64	12	0	0	65	0	0	0	0	0	0	8	0	4	0	154	2027
7:45 AM	1	81	13	0	3	69	1	0	0	0	1	0	11	0	2	0	182	2043
7:50 AM	0	82	7	0	3	77	1	0	0	0	0	0	4	0	2	0	176	2064
7:55 AM	0	58	8	0	7	77	0	0	0	0	2	0	7	1	3	0	163	2063
8:00 AM	0	43	4	0	2	58	0	0	2	0	1	0	11	0	3	0	124	2007
8:05 AM	0	77	2	0	4	76	0	0	0	0	0	0	4	0	4	0	167	1993
8:10 AM	1	50	4	0	2	74	1	0	0	1	1	0	12	1	4	0	151	1983
8:15 AM	0	57	8	0	3	69	1	0	2	1	0	0	4	0	4	0	149	1999
8:20 AM	0	42	9	0	1	79	0	0	0	0	0	0	6	0	5	0	142	1948
8:25 AM	0	59	3	0	2	89	0	0	0	0	0	0	4	0	6	0	163	1922
8:30 AM	0	55	6	0	2	65	0	0	1	0	1	0	10	0	1	0	141	1876
8:35 AM	0	49	2	0	5	55	0	0	0	0	0	0	7	0	4	0	122	1834
8:40 AM	0	53	8	0	1	69	0	0	3	0	1	0	7	0	4	0	146	1826
8:45 AM	0	62	4	0	3	60	1	0	0	0	0	0	5	0	1	0	136	1780
8:50 AM	0	52	4	0	2	56	0	0	0	0	0	0	5	0	3	0	122	1726
8:55 AM	0	67	2	0	1	78	1	0	0	0	0	0	4	0	3	0	156	1719

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	8	912	80	0	44	1080	8	0	0	0	0	0	104	0	40	0	2276
Heavy Trucks	0	32	4		4	84	0		0	0	0		0	0	12		136
Buses																	
Pedestrians		0				0				0				8			8
Bicycles	4	0	0		0	0	0		0	0	0		0	0	0		4
Scooters																	

Comments:

Report generated on 12/7/2020 9:53 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

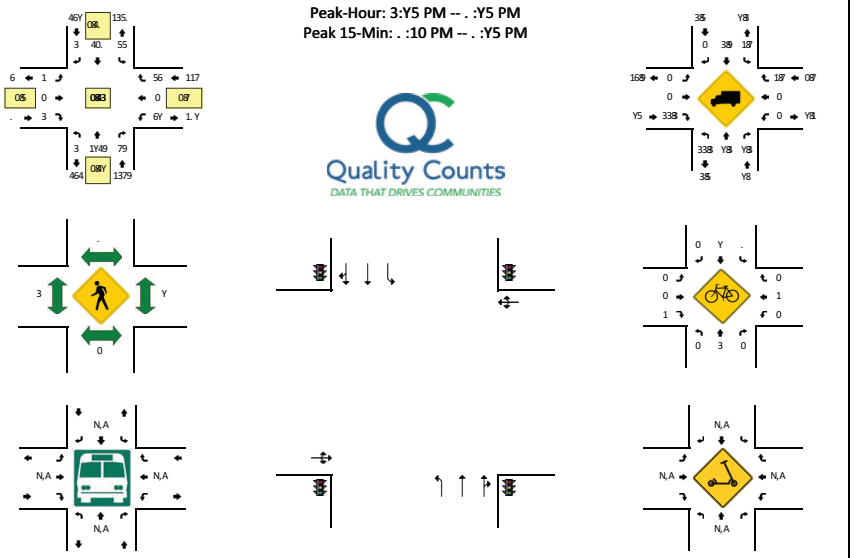
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Farrington Hwy -- Saint Johns Rd
CIT/, STATE: MailiDHI

QC JOB #: 1530660Y
2 ATE: TueD2 ec 1 Y0Y0

Peak-Hour: 3:Y5 PM -- . :Y5 PM
Peak 15-Min: . :10 PM -- . :Y5 PM



5-Min Count Period Beginning At	Farrington Hwy (Northbound)				Farrington Hwy (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	45	16	0	.	93	0	0	0	0	0	0	5	0	Y	0	145	
3:05 PM	0	76	11	0	Y	43	1	0	1	0	0	0	10	0	9	0	Y11	
3:10 PM	0	130	5	0	.	10Y	0	0	0	0	0	0	11	0	.	0	Y56	
3:15 PM	0	4.	1Y	0	9	96	0	0	0	0	0	0	.	0	.	0	149	
3:Y0 PM	0	91	3	0	3	6.	1	0	0	0	0	0	6	0	3	0	151	
3:Y5 PM	0	113	3	0	3	7.	0	0	0	0	0	0	9	0	Y	0	Y1Y	
3:30 PM	0	103	7	0	.	97	0	0	0	0	0	0	7	0	7	0	Y04	
3:35 PM	0	1YY	5	0	.	70	0	0	1	0	1	0	5	0	9	0	YY5	
3:. 0 PM	0	107	7	0	5	99	0	0	0	0	0	0	.	0	Y	0	Y0.	
3:. 5 PM	0	104	11	0	.	90	0	0	0	0	0	0	Y	0	3	0	144	
3:50 PM	0	49	1.	0	3	67	0	0	0	0	0	0	4	0	.	0	145	
3:55 PM	0	104	5	0	.	93	1	0	0	0	0	0	.	0	5	0	Y01	Y. 55
. :00 PM	0	100	9	0	3	63	0	0	0	0	0	0	3	0	6	0	17Y	Y. . Y
. :05 PM	1	70	7	0	5	97	1	0	0	0	0	0	3	0	6	0	17Y	Y. 13
. :10 PM	1	1Y5	9	0	13	7.	1	0	0	0	Y	0	5	0	Y	0	Y. 0	Y349
. :15 PM	1	1Y7	4	0	.	64	0	0	0	0	0	0	5	0	9	0	YY3	Y. Y3
. :Y0 PM	0	103	Y	0	3	70	0	0	0	0	0	0	9	0	.	0	144	Y. 91
. :Y5 PM	0	79	6	0	5	50	0	0	0	0	0	0	3	0	1	0	15Y	Y. 11
. :30 PM	1	105	9	0	6	7Y	Y	0	0	0	0	0	3	0	Y	0	Y07	Y. 10
. :35 PM	0	11Y	6	0	5	74	1	0	0	1	0	0	.	0	1	0	Y14	Y. 0.
. :. 0 PM	0	107	10	0	3	69	1	0	1	0	0	0	10	0	.	0	Y0.	Y. 0.
. :. 5 PM	0	114	1.	0	Y	56	1	0	0	0	1	0	9	0	3	0	Y03	Y. 07
. :50 PM	1	79	1.	0	5	69	0	0	1	0	1	0	9	1	3	0	179	Y. 00
. :55 PM	0	77	9	0	1	69	0	0	0	0	0	0	7	0	9	0	197	Y399
5:00 PM	0	110	9	0	Y	56	0	0	0	0	0	0	4	1	.	0	174	Y37.
5:05 PM	Y	47	1Y	0	5	75	0	0	0	0	0	0	5	0	3	0	Y10	Y. 1Y
5:10 PM	3	44	11	0	3	67	1	0	1	0	1	0	11	1	3	0	Y0Y	Y39.
5:15 PM	0	109	.	0	Y	93	0	0	1	1	1	0	9	0	5	0	Y01	Y35Y
5:Y0 PM	0	4Y	7	0	Y	59	0	0	0	0	1	0	15	0	5	0	170	Y333
5:Y5 PM	0	1. 6	4	0	1	56	1	0	0	0	0	0	9	1	3	0	YY.	Y. 05
5:30 PM	1	77	9	0	Y	55	0	0	1	1	1	0	.	0	9	0	169	Y36.
5:35 PM	Y	44	6	0	6	6Y	1	0	0	0	0	0	7	0	9	0	141	Y336
5:. 0 PM	0	107	11	0	.	6Y	0	0	1	0	0	0	.	0	5	0	145	Y3Y9
5:. 5 PM	0	131	3	0	.	53	0	0	0	0	0	0	0	0	Y	0	143	Y319
5:50 PM	1	79	11	0	4	59	1	0	0	0	0	0	.	0	1	0	191	Y301
5:55 PM	0	100	9	0	5	. 0	0	0	0	0	0	0	5	0	3	0	160	YY73

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	7	1. Y.	9Y	0	70	43Y	.	0	0	0	7	0	67	0	5Y	0	Y6. 7
Heavy Trucks	.	Y0	0		.	. 0	0		0	0	.		0	0	0		9Y
Buses																	
Pedestrians		0				.				.				0			7
Bicycles	0	1Y	0		0	.	0		0	0	0		0	0	0		16
Scooters																	

Comments:

Report generated on 1Y, 9, Y0Y0 4:53 AM

SOURCE: Quality CountsDLLC (http:, , www8qualitycounts8net) 1-799-570-YY1Y

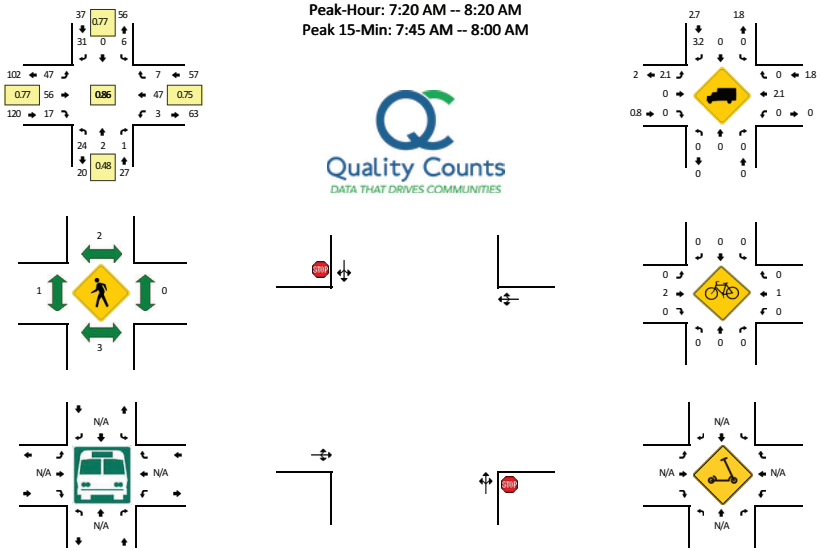
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulaaupuni St -- Saint Johns Rd
CITY/STATE: Maili, HI

QC JOB #: 15306603
DATE: Tue, Dec 1 2020

Peak-Hour: 7:20 AM -- 8:20 AM
Peak 15-Min: 7:45 AM -- 8:00 AM



5-Min Count Period Beginning At	Kulaaupuni St (Northbound)				Kulaaupuni St (Southbound)				Saint Johns Rd (Eastbound)				Saint Johns Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	1	0	0	0	0	0	1	0	0	0	0	0	0	3	0	0	5	
6:05 AM	6	0	0	0	0	0	4	0	2	3	1	0	0	3	0	0	19	
6:10 AM	2	0	0	0	0	1	1	0	2	0	0	0	0	1	0	0	7	
6:15 AM	4	0	0	0	0	0	0	0	4	1	0	0	0	2	0	0	11	
6:20 AM	1	0	0	0	0	0	4	0	1	0	0	0	0	2	0	0	8	
6:25 AM	1	0	0	0	0	0	1	0	1	1	0	0	0	3	0	0	7	
6:30 AM	0	0	0	0	0	0	3	0	1	1	3	0	0	1	0	0	9	
6:35 AM	2	1	0	0	0	0	4	0	2	0	0	0	0	3	0	0	12	
6:40 AM	5	0	0	0	0	0	0	0	4	2	1	0	0	2	0	0	14	
6:45 AM	3	0	0	0	0	1	2	0	4	2	0	0	0	4	0	0	16	
6:50 AM	3	0	0	0	1	0	5	0	4	0	2	0	0	6	0	0	21	
6:55 AM	2	1	0	0	0	0	2	0	4	2	0	0	0	2	0	0	13	142
7:00 AM	0	0	0	0	0	1	4	0	1	5	2	0	0	2	0	0	15	152
7:05 AM	3	2	0	0	1	1	1	0	6	6	0	0	0	4	0	0	24	157
7:10 AM	1	0	0	0	0	0	2	0	8	2	1	0	0	4	0	0	18	168
7:15 AM	0	0	0	0	0	0	2	0	1	2	0	0	0	0	1	0	6	163
7:20 AM	3	0	0	0	0	0	1	0	4	4	1	0	0	5	0	0	18	173
7:25 AM	8	1	0	0	1	0	3	0	2	4	1	0	0	6	0	0	26	192
7:30 AM	1	0	1	0	1	0	1	0	7	7	2	0	0	2	0	0	22	205
7:35 AM	2	0	0	0	0	0	1	0	5	5	1	0	0	2	2	0	18	211
7:40 AM	0	0	0	0	0	0	4	0	6	3	0	0	0	3	0	0	16	213
7:45 AM	1	1	0	0	1	0	4	0	6	7	3	0	2	2	1	0	28	225
7:50 AM	2	0	0	0	0	0	3	0	6	6	0	0	1	3	0	0	21	225
7:55 AM	2	0	0	0	1	0	2	0	5	4	2	0	0	5	0	0	21	233
8:00 AM	0	0	0	0	0	0	2	0	2	7	2	0	0	2	2	0	17	235
8:05 AM	0	0	0	0	1	0	6	0	0	4	1	0	0	7	1	0	20	231
8:10 AM	3	0	0	0	1	0	2	0	1	2	2	0	0	7	0	0	18	231
8:15 AM	2	0	0	0	0	0	2	0	3	3	2	0	0	3	1	0	16	241
8:20 AM	4	0	0	0	0	0	1	0	4	4	2	0	0	1	2	0	18	241
8:25 AM	3	0	0	0	0	0	0	0	3	4	2	0	0	4	0	0	16	231
8:30 AM	2	1	1	0	0	0	4	0	0	3	1	0	0	7	0	0	19	228
8:35 AM	1	0	0	0	1	0	0	0	2	4	1	0	1	5	0	0	15	225
8:40 AM	4	0	0	0	0	3	2	0	1	3	2	0	0	4	0	0	19	228
8:45 AM	3	1	0	0	0	0	1	0	4	2	1	0	0	0	1	0	13	213
8:50 AM	3	1	0	0	0	1	3	0	0	4	0	0	0	2	0	0	14	206
8:55 AM	1	0	0	0	0	0	0	0	2	4	1	0	0	1	0	0	9	194

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	20	4	0	0	8	0	36	0	68	68	20	0	12	40	4	0	280
Heavy Trucks	0	0	0		0	0	0		4	0	0		0	4	0		8
Buses																	
Pedestrians		0				8				4				0			12
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 12/7/2020 9:53 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

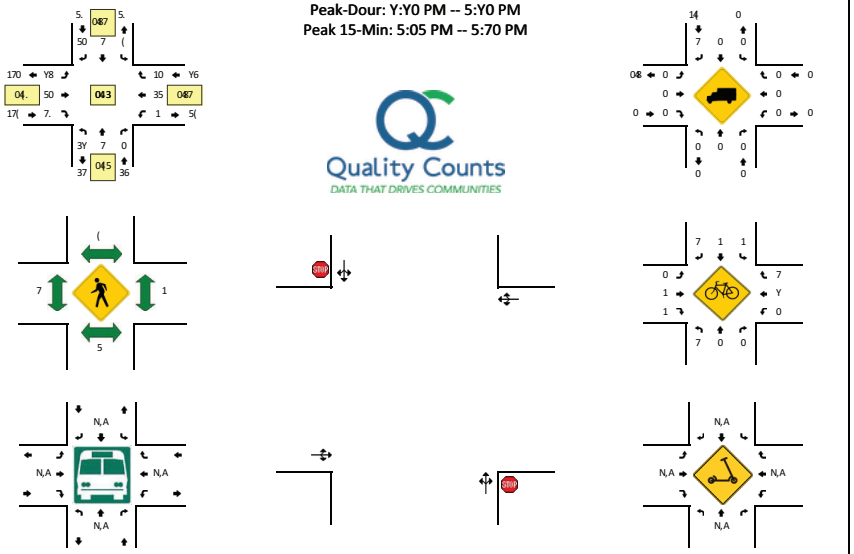
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulaaupuni St -- Saint Johns Rd
CIT/, STATE: MailiHDI

QC JOB #: 1530660Y
2ATE: TueH2 ec 1 7070

Peak-Dour: Y:Y0 PM -- 5:Y0 PM
Peak 15-Min: 5:05 PM -- 5:70 PM



5-Min Count Period Beginning At	Kulaaupuni St)NorthboundW				Kulaaupuni St)SouthboundW				Saint Johns Rd)EastboundW				Saint Johns Rd)U estboundW				Total	Dourly Totals
	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9		
3:00 PM	3	0	0	0	0	0	7	0	Y	6	7	0	0	0	0	0	1(	
3:05 PM	7	0	0	0	1	0	7	0	6	Y	7	0	0	8	1	0	76	
3:10 PM	Y	1	0	0	0	1	5	0	3	7	7	0	0	5	1	0	7Y	
3:15 PM	3	0	0	0	0	0	Y	0	3	7	7	0	0	7	1	0	1(	
3:70 PM	7	0	0	0	0	0	Y	0	8	5	Y	0	0	3	0	0	76	
3:75 PM	1	0	0	0	0	0	6	0	1	Y	1	0	1	1	1	0	16	
3:30 PM	5	0	0	0	0	0	5	0	1	1	7	0	0	Y	1	0	1.	
3:35 PM	7	7	0	0	1	1	1	0	1	3	1	0	0	7	0	0	1Y	
3:Y0 PM	7	1	0	0	0	0	7	0	1	Y	5	0	0	1	7	0	18	
3:Y5 PM	7	1	0	0	0	7	1	0	7	3	7	0	0	7	1	0	16	
3:50 PM	1	1	0	0	0	0	5	0	5	(	6	0	0	3	0	0	78	
3:55 PM	1	3	0	0	1	0	1	0	1	8	7	0	0	Y	7	0	73	7YY
Y:00 PM	7	1	0	0	0	0	7	0	3	7	7	0	0	6	1	0	1.	7Y6
Y:05 PM	1	7	0	0	0	0	5	0	1	5	7	0	0	7	0	0	18	738
Y:10 PM	0	1	0	0	1	0	3	0	3	7	7	0	0	Y	0	0	16	730
Y:15 PM	1	0	0	0	0	0	Y	0	7	(	Y	0	0	1	1	0	70	733
Y:70 PM	0	0	0	0	0	0	1	0	5	7	7	0	0	7	1	0	13	770
Y:75 PM	7	1	0	0	0	1	1	0	0	3	7	0	0	5	0	0	15	71.
Y:30 PM	0	1	0	0	0	1	7	0	3	3	3	0	0	1	0	0	1Y	71Y
Y:35 PM	0	0	0	0	0	1	7	0	Y	7	Y	0	0	7	1	0	16	716
Y:Y0 PM	5	1	0	0	1	0	8	0	1	7	7	0	0	Y	0	0	7Y	777
Y:Y5 PM	Y	0	0	0	0	0	7	0	3	5	Y	1	0	3	0	0	77	778
Y:50 PM	7	0	0	0	0	0	3	0	6	5	1	0	0	3	1	0	71	771
Y:55 PM	7	0	0	0	0	0	Y	0	5	8	1	0	0	0	1	0	71	71.
5:00 PM	1	0	0	0	0	0	3	0	Y	3	3	0	0	6	0	0	70	770
5:05 PM	3	0	0	0	1	0	(	0	7	3	7	0	0	7	7	0	77	77Y
5:10 PM	3	0	0	0	1	0	7	0	(	(	6	0	0	1	0	0	7(	735
5:15 PM	3	0	0	0	0	0	7	0	5	Y	Y	0	0	5	0	0	73	738
5:70 PM	Y	1	0	0	1	0	6	0	1	Y	1	0	0	3	1	0	77	7Y(
5:75 PM	Y	0	0	0	0	0	(	0	5	1	3	0	1	1	0	0	77	75Y
5:30 PM	1	0	0	0	1	0	3	0	Y	Y	0	0	0	1	5	0	1.	75.
5:35 PM	7	0	0	0	7	7	3	0	Y	Y	7	0	0	6	0	0	75	768
5:Y0 PM	7	0	0	0	0	0	7	0	Y	6	3	1	0	7	1	0	71	765
5:Y5 PM	1	1	0	0	1	0	7	0	7	Y	3	0	0	3	0	0	1(	760
5:50 PM	Y	0	0	0	1	0	3	0	5	0	7	0	0	1	1	0	1(	756
5:55 PM	7	0	0	0	0	0	0	0	(	6	5	0	0	7	0	0	77	75(

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	Left	Thru	Right	9	
All Vehicles	36	0	0	0	8	0	YY	0	56	56	Y8	0	0	37	8	0	788
Deavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Buses																	
Pedestrians		Y				70				8				0			37
Bicycles	0	0	0		0	0	0		0	0	Y		0	0	0		Y
Scooters																	

Comments:

Report generated on 17, (, 7070 . :53 AM

SO9 RCE: Quality CountsHLLC)http:, , www4qualitycounts4netW1-8((-580-7717

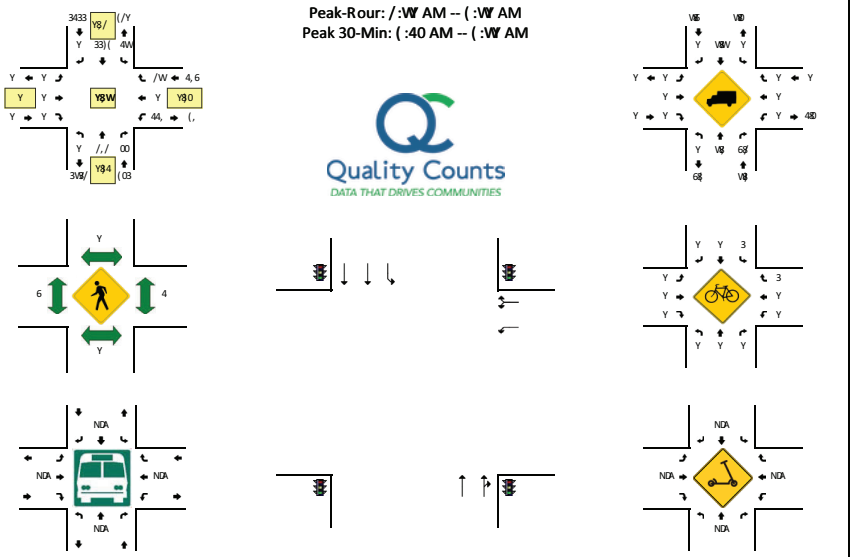
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kaukama Sd -- Jarrington RQy
CITHD2TATE: Maili7RI

BC #O1 5: 306Y//Y,
. ATE: Tue7. ec 3 4Y4Y

Peak-Rour: /:WY AM -- (:WY AM
Peak 30-Min: (:40 AM -- (:WY AM



0-Min Count Period 1eginning At	Kaukama Sd UNorthbound9				Kaukama Sd U2outhbound9				Jarrington RQy UEastbound9				Jarrington RQy UF estbound9				Total	Rourly Totals
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w		
/:YY AM	Y	66	W	Y	3	, 4	Y	Y	Y	Y	Y	Y	3(	Y	3	Y	3W	
/:Y0 AM	Y	40	4	Y	4	330	Y	Y	Y	Y	Y	Y	3/	Y	W	Y	3/W	
/:3Y AM	Y	66	4	Y	4	36(	Y	Y	Y	Y	Y	Y	6Y	Y	Y	Y	4YW	
/:30 AM	Y	6Y	6	Y	3	33/	Y	Y	Y	Y	Y	Y	4/	Y	3	Y	3((	
/:4Y AM	Y	WY	6	Y	W	, 4	Y	Y	Y	Y	Y	Y	40	Y	6	Y	3/(	
/:40 AM	Y	/Y	/	Y	Y	344	Y	Y	Y	Y	Y	Y	30	Y	W	Y	4Y(	
/:6Y AM	Y	6/	4	Y	Y	3Y3	Y	Y	Y	Y	Y	Y	30	Y	W	Y	30)	
/:60 AM	Y	04	0	Y	4	, ,	Y	Y	Y	Y	Y	Y	43	Y	W	Y	3) 6	
/:WY AM	Y	W	W	Y	6	34Y	Y	Y	Y	Y	Y	Y	3)	Y	4	Y	3, 6	
/:W0 AM	Y	W6	W	Y	3	, W	Y	Y	Y	Y	Y	Y	3W	Y	4	Y	30)	
/:0Y AM	Y	W8	4	Y	Y	,)	Y	Y	Y	Y	Y	Y	4W	Y	0	Y	3(Y	
/:00 AM	Y	(0	/	Y	3	, 6	Y	Y	Y	Y	Y	Y	46	Y	6	Y	4Y3	436Y
(:YY AM	Y	/,	/	Y	4	3YY	Y	Y	Y	Y	Y	Y	4)	Y	6	Y	4Y)	43, Y
(:Y0 AM	Y	06	6	Y	4	3YY	Y	Y	Y	Y	Y	Y	4Y	Y	6	Y	3) 3	44Y(
(:3Y AM	Y	64	Y	Y	4	3YW	Y	Y	Y	Y	Y	Y	33	Y	0	Y	30W	430(
(:30 AM	Y	0,	/	Y	W	3Y6	Y	Y	Y	Y	Y	Y	4Y	Y	0	Y	3, (	43((
(:4Y AM	Y	(3	/	Y	3	, W	Y	Y	Y	Y	Y	Y	30	Y	(	Y	3, W	44YW
(:40 AM	Y	/(	(	Y	4	) 0	Y	Y	Y	Y	Y	Y	4Y	Y	36	Y	3, W	43, 3
(:6Y AM	Y	(0	W	Y	6	3Y6	Y	Y	Y	Y	Y	Y	3/	Y	,	Y	43Y	44W6
(:60 AM	Y	/0	(	Y	6	, 6	Y	Y	Y	Y	Y	Y	4Y	Y	(	Y	3, 0	4400
(:WY AM	Y	/0	W	Y	Y	) 6	Y	Y	Y	Y	Y	Y	34	Y	(	Y	3(3	4466
(:W0 AM	Y	) 4	(	Y	4	WY	Y	Y	Y	Y	Y	Y	44	Y	(	Y	3/ (	44W4
(:0Y AM	Y	0Y	(	Y	W	, Y	Y	Y	Y	Y	Y	Y	3/	Y	6	Y	3(Y	44W4
(:00 AM	Y	00	36	Y	4	( )	Y	Y	Y	Y	Y	Y	,	Y	W	Y	3/ 3	44Y4
) :YY AM	Y	WW	33	Y	0	/)	Y	Y	Y	Y	Y	Y	4/	Y	0	Y	30,	4306
) :Y0 AM	Y	//	(	Y	(	(/	Y	Y	Y	Y	Y	Y	3(	Y	)	Y	3) 3	4306
) :3Y AM	Y	04	33	Y	(	(6	Y	Y	Y	Y	Y	Y	4W	Y	W	Y	3(3	43(Y
) :30 AM	Y	//	(	Y	0	(6	Y	Y	Y	Y	Y	Y	3)	Y	0	Y	3(W	43WY
) :4Y AM	Y	0(	/	Y	0	) (	Y	Y	Y	Y	Y	Y	44	Y	W	Y	3) 3	436W
) :40 AM	Y	W6	0	Y	0	, /	Y	Y	Y	Y	Y	Y	36	Y	6	Y	3/0	43Y0
) :6Y AM	Y	0W	3	Y	W	(Y	Y	Y	Y	Y	Y	Y	3(	Y	4	Y	3WY	4YW6
) :60 AM	Y	0W	0	Y	0	/ 3	Y	Y	Y	Y	Y	Y	3)	Y	)	Y	303	3, , ,
) :WY AM	Y	WY	W	Y	0	) 3	Y	Y	Y	Y	Y	Y	)	Y	)	Y	30W	3,) 4
) :W0 AM	Y	0)	33	Y	6	) 4	Y	Y	Y	Y	Y	Y	34	Y	W	Y	3(Y	3,) 0
) :0Y AM	Y	W	W	Y	/	06	Y	Y	Y	Y	Y	Y	)	Y	W	Y	34W	3, 6,
) :00 AM	Y	/4	(	Y	4	/)	Y	Y	Y	Y	Y	Y	3Y	Y	,	Y	30)	3, 6/

Peak 30-Min J loQrates	Northbound				2outhbound				Eastbound				F estbound				Total
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	
All Vehicles	Y	) 4)	(4	Y	64	334W	Y	Y	Y	Y	Y	Y	44W	Y	33/	Y	46, /
Reavy Trucks	Y	4W	Y		Y	/Y	Y		Y	Y	Y		Y	Y	Y		) W
1uses																	
Pedestrians		Y				Y				Y				Y			Y
1icycles	Y	Y	Y		Y	Y	Y		Y	Y	Y		Y	Y	Y		Y
2cooters																	

Comments:

Seport generated on 34D(D4Y4Y , :06 AM

2OwSCE: B uality Counts7LLC Uhttp:DDQQQ8qualitycounts8net93-) ((-0) Y-4434

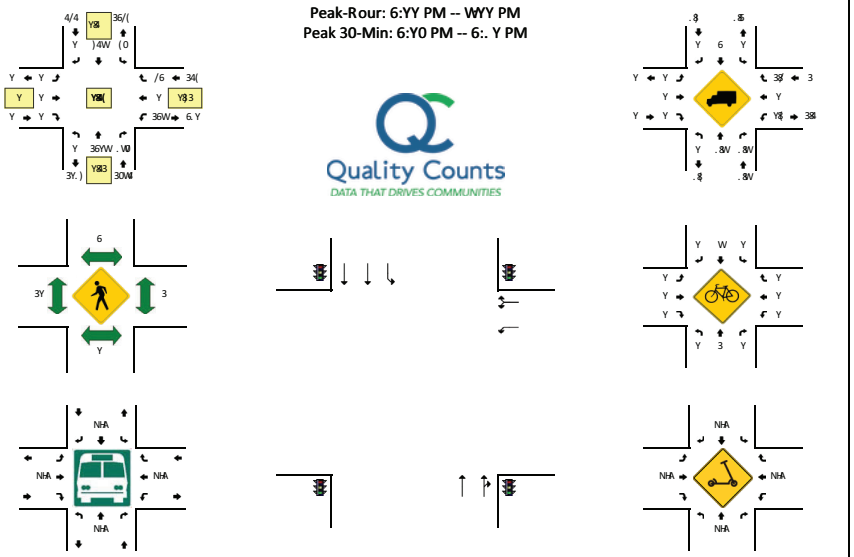
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kaukama Sd -- Jarrington RQy
CIT, HDTATE: Maili2RI

BC #O1 5: 306Y//3Y
7ATE: Tue27ec 3 . Y. Y

Peak-Rour: 6:YY PM -- WYY PM
Peak 30-Min: 6:Y0 PM -- 6:. Y PM



0-Min Count Period 1eginning At	Kaukama Sd UNorthbound9				Kaukama Sd UDouthbound9				Jarrington RQy UEastbound9				Jarrington RQy UF estbound9				Total	Rourly Totals
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w		
6:YY PM	Y	4/	3W	Y	3Y	/(	Y	Y	Y	Y	Y	Y	3.	Y	(	Y	. Y/	
6:Y0 PM	Y	33W	. W	Y	6	))	Y	Y	Y	Y	Y	Y	)	Y	0	Y	. W	
6:3Y PM	Y	3YW	33	Y	0	).	Y	Y	Y	Y	Y	Y	36	Y	(	Y	. . .	
6:30 PM	Y	33Y	. 3	Y	6	) 0	Y	Y	Y	Y	Y	Y	36	Y	W	Y	. 6/	
6:. Y PM	Y	44	. .	Y	(	)/	Y	Y	Y	Y	Y	Y	. Y	Y	W	Y	. 6)	
6:. 0 PM	Y	3YW	3)	Y	6	) Y	Y	Y	Y	Y	Y	Y	3.	Y	0	Y	. . .	
6:6Y PM	Y	3Y/	. .	Y	/	( )	Y	Y	Y	Y	Y	Y	)	Y	/	Y	. . /	
6:60 PM	Y	333	. 3	Y	4	(6	Y	Y	Y	Y	Y	Y	3.	Y	/	Y	. 6.	
6:W PM	Y	3Y)	3(	Y	4	(0	Y	Y	Y	Y	Y	Y	/	Y	W	Y	. 34	
6:W0 PM	Y	3. .	. /	Y	6	0(	Y	Y	Y	Y	Y	Y	3.	Y	W	Y	. . W	
6:0Y PM	Y	3Y)	63	Y	)	/3	Y	Y	Y	Y	Y	Y	33	Y	)	Y	. . (	
6:00 PM	Y	3. .	3)	Y	4	/.	Y	Y	Y	Y	Y	Y	(	Y	6	Y	. . 3	. (30
WYY PM	Y	40	. (	Y	0	/.	Y	Y	Y	Y	Y	Y	(	Y	/	Y	. Y.	. (33
WY0 PM	Y	(4	. 4	Y	6	06	Y	Y	Y	Y	Y	Y	3(	Y	W	Y	3) 0	. / 0W
W3Y PM	Y	3Y4	. 0	Y	/	(6	Y	Y	Y	Y	Y	Y	36	Y	6	Y	. . 4	. / / 3
W30 PM	Y	36/	34	Y	0	/Y	Y	Y	Y	Y	Y	Y	3Y	Y	0	Y	. 60	. / / Y
W. Y PM	Y	33(	. 3	Y	0	(6	Y	Y	Y	Y	Y	Y	0	Y	/	Y	. . (	. / W4
W. 0 PM	Y	3Y3	. (	Y	0	(.	Y	Y	Y	Y	Y	Y	4	Y	0	Y	. 34	. / W
W6Y PM	Y	3Y/	34	Y	(	0Y	Y	Y	Y	Y	Y	Y	/	Y	36	Y	. Y3	. / . 3
W60 PM	Y	3YW	36	Y	W	) 6	Y	Y	Y	Y	Y	Y	(	Y	(	Y	. 3)	. / Y(
WWW PM	Y	33W	. .	Y	.	) (	Y	Y	Y	Y	Y	Y	36	Y	W	Y	. W	. / 6Y
WW0 PM	Y	33/	6Y	Y	W	W	Y	Y	Y	Y	Y	Y	/	Y	.	Y	. YW	. / 3Y
W0Y PM	Y	4(	. 3	Y	3	(3	Y	Y	Y	Y	Y	Y	/	Y	(	Y	. Y6	. 0) /
W00 PM	Y	33.	. (	Y	W	W	Y	Y	Y	Y	Y	Y	/	Y	W	Y	. Y3	. 0 / /
0:YY PM	Y	3Y4	. /	Y	0	(Y	Y	Y	Y	Y	Y	Y	/	Y	0	Y	. . 3	. 0) 0
0:Y0 PM	Y	33.	. 3	Y	W	04	Y	Y	Y	Y	Y	Y	/	Y	/	Y	. Y)	. / Y)
0:3Y PM	Y	3YW	3/	Y	3Y	(.	Y	Y	Y	Y	Y	Y	6	Y	4	Y	. 3W	. 046
0:30 PM	Y	3Y.	6W	Y	3.	/ /	Y	Y	Y	Y	Y	Y	3.	Y	33	Y	. 6(	. 040
0:. Y PM	Y	3Y6	63	Y	4	/6	Y	Y	Y	Y	Y	Y	3W	Y	)	Y	. .)	. 04/
0:. 0 PM	Y	3. .	. .	Y	(	0/	Y	Y	Y	Y	Y	Y	33	Y	)	Y	. . /	. / Y6
0:6Y PM	Y	3Y)	34	Y	0	/.	Y	Y	Y	Y	Y	Y	4	Y	)	Y	. 33	. / 36
0:60 PM	Y	334	34	Y	0	0/	Y	Y	Y	Y	Y	Y	/	Y	6	Y	. Y)	. / Y6
0:W PM	Y	3. 4	. .	Y	(	W4	Y	Y	Y	Y	Y	Y	)	Y	6	Y	. 3)	. 0(4
0:W0 PM	Y	36Y	66	Y	6	06	Y	Y	Y	Y	Y	Y	W	Y	(	Y	. 6Y	. / Y0
0:0Y PM	Y	4(	. 0	Y	/	0.	Y	Y	Y	Y	Y	Y	0	Y	)	Y	346	. 040
0:00 PM	Y	4/	. W	Y	0	W	Y	Y	Y	Y	Y	Y	3Y	Y	/	Y	3) 6	. 0((

Peak 30-Min J loQrates	Northbound				Douthbound				Eastbound				F estbound				Total
	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	Left	Thru	Sight	w	
All Vehicles	Y	363.	. . W	Y	WW	3Y. Y	Y	Y	Y	Y	Y	Y	36/	Y	/ W	Y	.) YY
Reavy Trucks	Y	6.	Y		Y	6/	Y		Y	Y	Y		Y	Y	Y		/)
1uses																	
Pedestrians		Y				W				W				W			3.
1icycles	Y	Y	Y		Y	Y	Y		Y	Y	Y		Y	Y	Y		Y
Dcooters																	

Comments:

Seport generated on 3. H(H Y. Y 4:06 AM

DOwSCE: Buality Counts2LLC Uhttp:HQ.QQ8quality counts8net93-) ((-0) Y-. . 3.

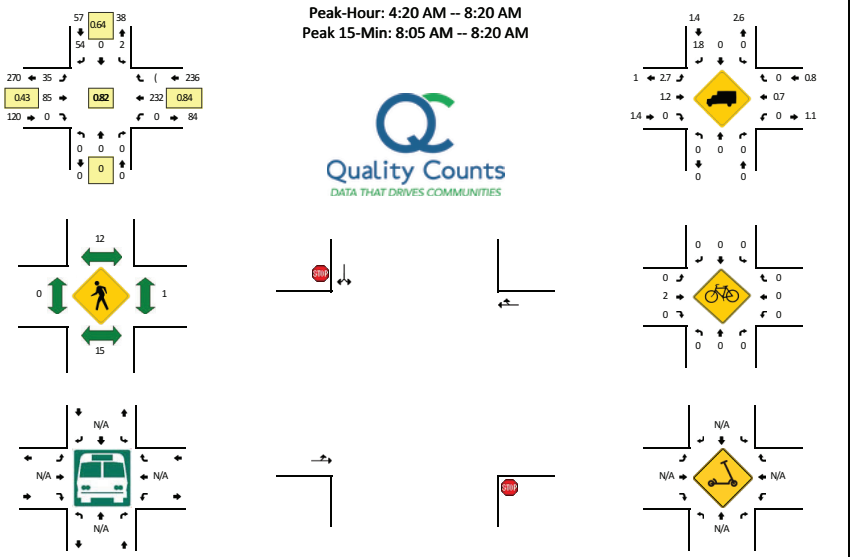
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulauku St -- Kaukama J d
CITY/STATE: Maili, HI

R C QDB #: 15306611
DATE: Tue, Dec 1 2020

Peak-Hour: 4:20 AM -- 8:20 AM
Peak 15-Min: 8:05 AM -- 8:20 AM



5-Min Count Period Beginning At	Kulauku St)NorthboundW				Kulauku St)SouthboundW				Kaukama J d)EastboundW				Kaukama J d)U estboundW				Total	Hourly Totals
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9		
6:00 AM	0	0	0	0	0	0	1	0	0	3	0	0	0	1(	0	0	18	
6:05 AM	0	0	0	0	0	0	5	0	1	3	0	0	0	18	0	0	24	
6:10 AM	0	0	0	0	1	0	(	0	0	3	0	0	0	31	1	0	(0	
6:15 AM	0	0	0	0	0	0	(	0	1	2	0	0	0	13	0	0	20	
6:20 AM	0	0	0	0	0	0	2	0	1	4	0	0	0	20	0	0	30	
6:25 AM	0	0	0	0	0	0	5	0	1	(	0	0	0	20	1	0	31	
6:30 AM	0	0	0	0	0	0	(	0	1	1	0	0	0	16	0	0	22	
6:35 AM	0	0	0	0	1	0	6	0	1	3	0	0	0	17	0	0	30	
6:(0 AM	0	0	0	0	0	0	(	0	1	8	0	0	0	1(	0	0	24	
6:(5 AM	0	0	0	0	0	0	(	0	0	3	0	0	0	14	1	0	25	
6:50 AM	0	0	0	0	0	0	(	0	0	2	0	0	0	18	0	0	2(	
6:55 AM	0	0	0	0	0	0	(	0	2	5	0	0	0	17	0	0	30	32(
4:00 AM	0	0	0	0	1	0	6	0	1	5	0	0	0	26	0	0	37	3(5
4:05 AM	0	0	0	0	0	0	2	0	0	3	0	0	0	15	0	0	20	338
4:10 AM	0	0	0	0	0	0	(	0	1	1	0	0	0	20	0	0	26	32(
4:15 AM	0	0	0	0	0	0	2	0	0	8	0	0	0	22	0	0	32	336
4:20 AM	0	0	0	0	0	0	2	0	3	5	0	0	0	20	0	0	30	336
4:25 AM	0	0	0	0	0	0	(	0	3	(	0	0	0	21	0	0	32	334
4:30 AM	0	0	0	0	0	0	5	0	0	6	0	0	0	23	0	0	3(	3(7
4:35 AM	0	0	0	0	0	0	4	0	2	10	0	0	0	2(	0	0	(3	362
4:(0 AM	0	0	0	0	0	0	(	0	1	2	0	0	0	20	0	0	24	362
4:(5 AM	0	0	0	0	0	0	8	0	(	5	0	1	0	14	1	0	36	343
4:50 AM	0	0	0	0	0	0	1	0	(	4	0	0	0	11	0	0	23	342
4:55 AM	0	0	0	0	1	0	2	0	4	5	0	0	0	16	0	0	31	343
8:00 AM	0	0	0	0	0	0	3	0	(	7	0	0	0	15	1	0	32	366
8:05 AM	0	0	0	0	0	0	7	0	2	10	0	0	0	25	2	0	(8	37(
8:10 AM	0	0	0	0	0	0	6	0	3	13	0	0	0	21	0	0	(3	(11
8:15 AM	0	0	0	0	1	0	6	0	1	7	0	0	0	17	0	0	36	(15
8:20 AM	0	0	0	0	0	0	1	0	(	7	0	0	0	16	0	0	30	(15
8:25 AM	0	0	0	0	0	0	6	0	3	8	0	0	0	11	0	0	28	(11
8:30 AM	0	0	0	0	0	0	8	0	0	(	0	0	0	13	1	0	26	(03
8:35 AM	0	0	0	0	0	0	5	0	1	7	0	0	0	13	0	0	28	388
8:(0 AM	0	0	0	0	0	0	3	0	1	3	0	0	0	16	0	0	23	38(
8:(5 AM	0	0	0	0	1	0	(	0	2	11	0	1	0	7	0	0	28	346
8:50 AM	0	0	0	0	0	0	2	0	3	7	0	0	0	12	0	0	26	347
8:55 AM	0	0	0	0	0	0	6	0	2	6	0	0	0	16	0	0	30	348

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	
All Vehicles	0	0	0	0	(	0	8(	0	2(	128	0	0	0	260	8	0	508
Heavy Trucks	0	0	0		0	0	(		0	(	0		0	(	0		12
Buses																	
Pedestrians		8				12				0				0			20
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

J eport generated on 12/4/2020 7:53 AM

SO9 J CE: R uality Counts, LLC)http://www.qualitycounts.netW1-844-580-2212

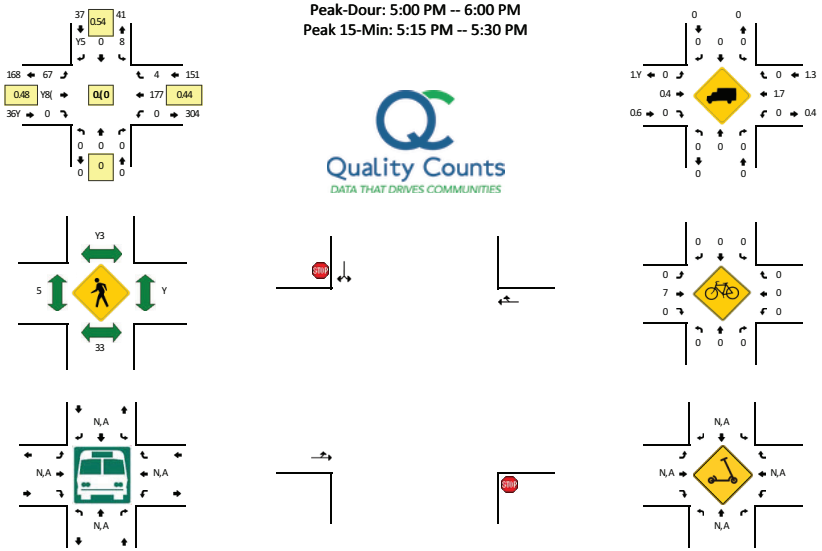
Type of peak hour being reported: Intersection Peak

Method for determining peak hour: Total Entering Volume

LOCATION: Kulauku St -- Kaukama J d
CIT/, STATE: MailiHDI

R C QDB #: 1530661Y
2 ATE: TueH2 ec 1 Y0Y0

Peak-Dour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:15 PM -- 5:30 PM



5-Min Count Period Beginning At	Kulauku St)NorthboundW				Kulauku St)SouthboundW				Kaukama J d)EastboundW				Kaukama J d)U estboundW				Total	Dourly Totals
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9		
3:00 PM	0	0	0	0	1	0	0	0	7	18	0	0	0	8	0	0	33	
3:05 PM	0	0	0	0	1	0	5	0	5	Y6	0	0	0	11	0	0	7(	
3:10 PM	0	0	0	0	0	0	5	0	5	13	0	0	0	13	0	0	36	
3:15 PM	0	0	0	0	Y	0	7	0	7	17	0	0	0	13	1	0	3(	
3:Y0 PM	0	0	0	0	1	0	3	0	7	Y1	0	0	0	18	0	0	7(	
3:Y5 PM	0	0	0	0	1	0	1	0	5	13	0	0	0	15	1	0	36	
3:30 PM	0	0	0	0	0	0	5	0	10	Y1	0	0	0	8	0	0	75	
3:35 PM	0	0	0	0	1	0	7	0	5	Y7	0	0	0	6	0	0	70	
3:70 PM	0	0	0	0	0	0	1	0	Y	Y1	0	0	0	8	1	0	37	
3:75 PM	0	0	0	0	1	0	7	0	6	Y7	0	0	0	15	0	0	50	
3:50 PM	0	0	0	0	1	0	7	0	1Y	Y7	0	0	0	10	Y	0	53	
3:55 PM	0	0	0	0	1	0	3	0	(	Y0	0	0	0	4	0	0	38	500
7:00 PM	0	0	0	0	0	0	7	0	7	30	0	0	0	13	0	0	51	51(
7:05 PM	0	0	0	0	0	0	1	0	3	Y7	0	0	0	16	1	0	75	515
7:10 PM	0	0	0	0	Y	0	1	0	3	Y6	0	0	0	15	0	0	74	5Y6
7:15 PM	0	0	0	0	1	0	7	0	3	Y1	0	0	0	(	Y	0	38	5Y4
7:Y0 PM	0	0	0	0	Y	0	Y	0	3	Y1	0	0	0	6	0	0	37	513
7:Y5 PM	0	0	0	0	Y	0	1	0	(	Y6	0	1	0	13	1	0	5Y	5Y8
7:30 PM	0	0	0	0	1	0	3	0	(	16	0	0	0	16	1	0	75	5Y8
7:35 PM	0	0	0	0	1	0	0	0	7	17	0	0	0	13	0	0	3Y	5Y1
7:70 PM	0	0	0	0	1	0	1	0	5	16	0	0	0	11	1	0	35	5YY
7:75 PM	0	0	0	0	Y	0	3	0	1Y	18	0	0	0	(	0	0	77	516
7:50 PM	0	0	0	0	0	0	3	0	5	Y0	0	0	0	(	Y	0	3(	501
7:55 PM	0	0	0	0	1	0	3	0	5	18	0	0	0	10	1	0	38	501
5:00 PM	0	0	0	0	1	0	Y	0	5	YY	0	0	0	4	1	0	3(	7((
5:05 PM	0	0	0	0	1	0	Y	0	3	Y3	0	0	0	(	1	0	3(	7(1
5:10 PM	0	0	0	0	0	0	0	0	3	Y0	0	0	0	14	0	0	70	747
5:15 PM	0	0	0	0	0	0	Y	0	8	31	0	0	0	16	0	0	5(	783
5:Y0 PM	0	0	0	0	0	0	5	0	6	35	0	0	0	16	0	0	6Y	5Y1
5:Y5 PM	0	0	0	0	0	0	3	0	4	Y6	0	0	0	13	1	0	50	518
5:30 PM	0	0	0	0	Y	0	5	0	5	14	0	0	0	16	1	0	76	5Y0
5:35 PM	0	0	0	0	1	0	Y	0	0	14	0	0	0	8	1	0	30	51(
5:70 PM	0	0	0	0	1	0	Y	0	10	Y7	0	0	0	6	0	0	73	5Y6
5:75 PM	0	0	0	0	0	0	0	0	(	Y6	0	0	0	17	1	0	78	531
5:50 PM	0	0	0	0	1	0	1	0	6	30	0	0	0	1Y	0	0	50	573
5:55 PM	0	0	0	0	Y	0	1	0	Y	Y4	0	0	0	10	1	0	73	574

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				U estbound				Total
	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	Left	Thru	J ight	9	
All Vehicles	0	0	0	0	0	0	70	0	((	36(	0	0	0	1(0	7	0	6(0
Deavy Trucks	0	0	0		0	0	0		0	(	0		0	0	0		(
Buses																	
Pedestrians		Y0				1Y				7				0			36
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

J eport generated on 1Y, 4, Y0Y0 8:53 AM

SO9 J CE: R uality CountsHLLC)http:, , www.qualitycounts.netW1-(44-5(0-YY1Y

Appendix B: LOS Worksheets

FEHR PEERS

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	3	182	2	75	6	1057	213	48	1133	8
Future Volume (veh/h)	0	0	3	182	2	75	6	1057	213	48	1133	8
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	0	0	1	200	2	73	7	1162	219	53	1245	9
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	0	0	381	327	5	93	233	1505	282	233	1933	14
Arrive On Green	0.00	0.00	0.25	0.25	0.25	0.25	0.01	0.51	0.51	0.04	0.55	0.55
Sat Flow, veh/h	0	0	1529	1017	20	375	1767	2925	547	1767	3530	26
Grp Volume(v), veh/h	0	0	1	275	0	0	7	692	689	53	612	642
Grp Sat Flow(s),veh/h/ln	0	0	1529	1411	0	0	1767	1749	1723	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	15.3	0.0	0.0	0.2	27.0	27.5	1.2	21.0	21.0
Cycle Q Clear(g_c), s	0.0	0.0	0.0	15.4	0.0	0.0	0.2	27.0	27.5	1.2	21.0	21.0
Prop In Lane	0.00		1.00	0.73		0.27	1.00		0.32	1.00		0.01
Lane Grp Cap(c), veh/h	0	0	381	425	0	0	233	900	887	233	950	997
V/C Ratio(X)	0.00	0.00	0.00	0.65	0.00	0.00	0.03	0.77	0.78	0.23	0.64	0.64
Avail Cap(c_a), veh/h	0	0	449	488	0	0	435	1912	1885	377	1897	1991
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	24.0	29.7	0.0	0.0	11.7	16.6	16.7	13.7	13.4	13.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	2.4	0.0	0.0	0.1	1.4	1.5	0.5	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	5.4	0.0	0.0	0.1	9.9	10.0	0.4	7.3	7.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	0.0	0.0	24.0	32.2	0.0	0.0	11.7	18.0	18.2	14.2	14.2	14.1
LnGrp LOS	A	A	C	C	A	A	B	B	B	B	B	B
Approach Vol, veh/h		1			275			1388			1307	
Approach Delay, s/veh		24.0			32.2			18.1			14.2	
Approach LOS		C			C			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.1	49.8		27.2	5.3	52.6		27.2
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.2	29.5		2.0	2.2	23.0		17.4
Green Ext Time (p_c), s	0.0	14.3		0.0	0.0	11.6		1.0

Intersection Summary		
HCM 6th Ctrl Delay		17.7
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Existing (2020) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	6.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	136	88	55	11	116	18	40	29	10	12	15	89
Future Vol, veh/h	136	88	55	11	116	18	40	29	10	12	15	89
Conflicting Peds, #/hr	6	0	8	8	0	6	14	0	16	16	0	14
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	158	102	64	13	135	21	47	34	12	14	17	103

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	162	0	0	174	0	0	704	646	158	667	668	166
Stage 1	-	-	-	-	-	-	458	458	-	178	178	-
Stage 2	-	-	-	-	-	-	246	188	-	489	490	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1411	-	-	1397	-	-	350	389	885	371	378	876
Stage 1	-	-	-	-	-	-	581	565	-	821	750	-
Stage 2	-	-	-	-	-	-	756	743	-	559	547	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1403	-	-	1386	-	-	260	332	865	297	323	859
Mov Cap-2 Maneuver	-	-	-	-	-	-	260	332	-	297	323	-
Stage 1	-	-	-	-	-	-	504	490	-	714	738	-
Stage 2	-	-	-	-	-	-	634	731	-	442	475	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.8	0.6	21.2	12.6
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	1403	-	-	1386	-	-	609
HCM Lane V/C Ratio	0.293	0.113	-	-	0.009	-	-	0.221
HCM Control Delay (s)	21.2	7.9	0	-	7.6	0	-	12.6
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.2	0.4	-	-	0	-	-	0.8

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Existing (2020) Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	252	152	933	61	88	1306	
Future Volume (veh/h)	252	152	933	61	88	1306	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	268	0	993	0	94	1389	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	329		2569		471	2862	
Arrive On Green	0.10	0.00	0.74	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	268	0	993	0	94	1389	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	10.7	0.0	14.6	0.0	1.7	0.0	
Cycle Q Clear(g_c), s	10.7	0.0	14.6	0.0	1.7	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	329		2569		471	2862	
V/C Ratio(X)	0.81		0.39		0.20	0.49	
Avail Cap(c_a), veh/h	588		2569		586	2862	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.88	0.88	
Uniform Delay (d), s/veh	62.1	0.0	6.6	0.0	4.3	0.0	
Incr Delay (d2), s/veh	4.9	0.0	0.4	0.0	0.2	0.5	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	4.9	0.0	5.0	0.0	0.5	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	67.0	0.0	7.0	0.0	4.5	0.5	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	268	A	993	A		1483	
Approach Delay, s/veh	67.0		7.0			0.8	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	109.7				120.6	19.4
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.7	16.6				2.0	12.7
Green Ext Time (p_c), s	0.1	9.0				16.3	0.7

Intersection Summary	
HCM 6th Ctrl Delay	9.5
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Existing (2020) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	39	115	301	6	12	63
Future Vol, veh/h	39	115	301	6	12	63
Conflicting Peds, #/hr	12	0	0	13	13	12
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	48	140	367	7	15	77

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	387	0	-	0	633	396
Stage 1	-	-	-	-	384	-
Stage 2	-	-	-	-	249	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1166	-	-	-	442	651
Stage 1	-	-	-	-	686	-
Stage 2	-	-	-	-	790	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1152	-	-	-	412	636
Mov Cap-2 Maneuver	-	-	-	-	412	-
Stage 1	-	-	-	-	648	-
Stage 2	-	-	-	-	781	-

Approach	EB	WB	SB
HCM Control Delay, s	2.1	0	11.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1152	-	-	-	412	636
HCM Lane V/C Ratio	0.041	-	-	-	0.036	0.121
HCM Control Delay (s)	8.3	0	-	-	14.1	11.4
HCM Lane LOS	A	A	-	-	B	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	0.4

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Existing (2020) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	2	2	126	2	36	3	803	31	14	1205	2
Future Volume (veh/h)	3	2	2	126	2	36	3	803	31	14	1205	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	3	2	0	134	2	29	3	854	32	15	1282	2
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	7	5	0	163	2	35	316	2539	95	481	2689	4
Arrive On Green	0.01	0.01	0.00	0.12	0.12	0.12	0.00	0.73	0.73	0.02	0.74	0.74
Sat Flow, veh/h	1081	721	0	1400	21	303	1767	3465	130	1767	3611	6
Grp Volume(v), veh/h	5	0	0	165	0	0	3	434	452	15	626	658
Grp Sat Flow(s),veh/h/ln	1801	0	0	1724	0	0	1767	1763	1832	1767	1763	1854
Q Serve(g_s), s	0.4	0.0	0.0	13.1	0.0	0.0	0.1	12.2	12.2	0.3	19.7	19.7
Cycle Q Clear(g_c), s	0.4	0.0	0.0	13.1	0.0	0.0	0.1	12.2	12.2	0.3	19.7	19.7
Prop In Lane	0.60		0.00	0.81		0.18	1.00		0.07	1.00		0.00
Lane Grp Cap(c), veh/h	11	0	0	201	0	0	316	1292	1342	481	1312	1381
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.01	0.34	0.34	0.03	0.48	0.48
Avail Cap(c_a), veh/h	64	0	0	486	0	0	372	1292	1342	516	1312	1381
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.90	0.90	0.90	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.3	0.0	0.0	60.4	0.0	0.0	6.0	6.6	6.6	5.0	7.1	7.1
Incr Delay (d2), s/veh	24.5	0.0	0.0	8.1	0.0	0.0	0.0	0.6	0.6	0.0	1.2	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	6.2	0.0	0.0	0.0	4.4	4.6	0.1	7.1	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	93.8	0.0	0.0	68.5	0.0	0.0	6.0	7.3	7.2	5.0	8.3	8.3
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	A	A
Approach Vol, veh/h		5			165			889			1299	
Approach Delay, s/veh		93.8			68.5			7.3			8.3	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.7	107.1		5.4	5.1	108.7		20.8
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.3	14.2		2.4	2.1	21.7		15.1
Green Ext Time (p_c), s	0.0	6.6		0.0	0.0	11.7		1.0

Intersection Summary			
HCM 6th Ctrl Delay			12.3
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	4	75	0	62	4	1475	102	61	1049	4
Future Volume (veh/h)	2	0	4	75	0	62	4	1475	102	61	1049	4
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		1.00	0.95		0.94	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1411	1856	1856	1856	1411	1856	1856	1856	1841	1856
Adj Flow Rate, veh/h	2	0	0	81	0	18	4	1586	107	66	1128	4
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	3	3	33	3	3	3	33	3	3	3	4	3
Cap, veh/h	331	0	0	266	7	45	260	2014	135	220	2288	8
Arrive On Green	0.18	0.00	0.00	0.18	0.00	0.18	0.01	0.60	0.60	0.04	0.64	0.64
Sat Flow, veh/h	1404	0	0	1084	37	249	1344	3346	224	1767	3574	13
Grp Volume(v), veh/h	2	0	0	99	0	0	4	830	863	66	552	580
Grp Sat Flow(s),veh/h/ln	1404	0	0	1371	0	0	1344	1763	1807	1767	1749	1838
Q Serve(g_s), s	0.0	0.0	0.0	5.5	0.0	0.0	0.1	33.8	34.8	1.3	15.9	15.9
Cycle Q Clear(g_c), s	0.1	0.0	0.0	6.0	0.0	0.0	0.1	33.8	34.8	1.3	15.9	15.9
Prop In Lane	1.00		0.00	0.82		0.18	1.00		0.12	1.00		0.01
Lane Grp Cap(c), veh/h	331	0	0	318	0	0	260	1061	1088	220	1119	1176
V/C Ratio(X)	0.01	0.00	0.00	0.31	0.00	0.00	0.02	0.78	0.79	0.30	0.49	0.49
Avail Cap(c_a), veh/h	437	0	0	426	0	0	401	1716	1759	338	1702	1789
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.0	0.0	0.0	34.4	0.0	0.0	8.2	14.3	14.5	14.6	9.0	9.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	0.0	0.0	1.3	1.4	0.8	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.0	0.0	2.1	0.0	0.0	0.0	12.1	12.8	0.6	5.3	5.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.0	0.0	0.0	34.9	0.0	0.0	8.2	15.6	15.8	15.3	9.4	9.4
LnGrp LOS	C	A	A	C	A	A	A	B	B	B	A	A
Approach Vol, veh/h		2			99			1697			1198	
Approach Delay, s/veh		32.0			34.9			15.7			9.7	
Approach LOS		C			C			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	63.5		23.4	5.0	67.1		23.4
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.3	36.8		2.1	2.1	17.9		8.0
Green Ext Time (p_c), s	0.1	20.7		0.0	0.0	9.7		0.4

Intersection Summary		
HCM 6th Ctrl Delay		13.9
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	5.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	53	55	51	2	39	11	38	14	1	11	5	55
Future Vol, veh/h	53	55	51	2	39	11	38	14	1	11	5	55
Conflicting Peds, #/hr	9	0	7	7	0	8	7	0	6	8	0	9
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	93	93	93	93	93	93	93	93	93
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	57	59	55	2	42	12	41	15	1	12	5	59

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	63	0	0	121	0	0	301	275	102	278	296	66
Stage 1	-	-	-	-	-	-	208	208	-	61	61	-
Stage 2	-	-	-	-	-	-	93	67	-	217	235	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1533	-	-	1460	-	-	649	631	950	672	614	995
Stage 1	-	-	-	-	-	-	792	728	-	948	842	-
Stage 2	-	-	-	-	-	-	912	837	-	783	709	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1520	-	-	1450	-	-	578	596	936	628	580	978
Mov Cap-2 Maneuver	-	-	-	-	-	-	578	596	-	628	580	-
Stage 1	-	-	-	-	-	-	756	694	-	902	834	-
Stage 2	-	-	-	-	-	-	843	829	-	729	676	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.5	0.3	11.8	9.6
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	587	1520	-	-	1450	-	-	862
HCM Lane V/C Ratio	0.097	0.037	-	-	0.001	-	-	0.089
HCM Control Delay (s)	11.8	7.5	0	-	7.5	0	-	9.6
HCM Lane LOS	B	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Existing (2020) Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	148	91	1498	286	103	984	
Future Volume (veh/h)	148	91	1498	286	103	984	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	
Adj Flow Rate, veh/h	153	0	1544	0	106	1014	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	
Percent Heavy Veh, %	3	3	3	3	3	3	
Cap, veh/h	209		2734		313	3008	
Arrive On Green	0.06	0.00	0.78	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3618	1572	1767	3618	
Grp Volume(v), veh/h	153	0	1544	0	106	1014	
Grp Sat Flow(s),veh/h/ln	1714	1572	1763	1572	1767	1763	
Q Serve(g_s), s	6.1	0.0	24.5	0.0	1.6	0.0	
Cycle Q Clear(g_c), s	6.1	0.0	24.5	0.0	1.6	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	209		2734		313	3008	
V/C Ratio(X)	0.73		0.56		0.34	0.34	
Avail Cap(c_a), veh/h	588		2734		428	3008	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.94	0.94	
Uniform Delay (d), s/veh	64.6	0.0	6.3	0.0	5.7	0.0	
Incr Delay (d2), s/veh	4.9	0.0	0.9	0.0	0.6	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	2.9	0.0	8.1	0.0	0.7	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	69.5	0.0	7.1	0.0	6.3	0.3	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	153	A	1544	A		1120	
Approach Delay, s/veh	69.5		7.1			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	114.5				125.5	14.5
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.6	26.5				2.0	8.1
Green Ext Time (p_c), s	0.2	18.7				9.3	0.4

Intersection Summary		
HCM 6th Ctrl Delay		8.0
HCM 6th LOS		A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Existing (2020) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	71	328	171	13	16	28
Future Vol, veh/h	71	328	171	13	16	28
Conflicting Peds, #/hr	28	0	0	25	25	28
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	80	80	80	80	80	80
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	89	410	214	16	20	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	258	0	-	0	863	278
Stage 1	-	-	-	-	250	-
Stage 2	-	-	-	-	613	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1301	-	-	-	324	758
Stage 1	-	-	-	-	789	-
Stage 2	-	-	-	-	539	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1266	-	-	-	279	718
Mov Cap-2 Maneuver	-	-	-	-	279	-
Stage 1	-	-	-	-	697	-
Stage 2	-	-	-	-	524	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	13.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1266	-	-	-	279	718
HCM Lane V/C Ratio	0.07	-	-	-	0.072	0.049
HCM Control Delay (s)	8.1	0	-	-	18.9	10.3
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Existing (2020) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	2	2	74	2	35	3	1367	135	42	991	2
Future Volume (veh/h)	3	2	2	74	2	35	3	1367	135	42	991	2
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	3	2	0	79	2	24	3	1454	140	45	1054	2
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	7	5	0	103	3	31	424	2456	235	280	2820	5
Arrive On Green	0.01	0.01	0.00	0.08	0.08	0.08	0.00	0.76	0.76	0.03	0.78	0.78
Sat Flow, veh/h	1081	721	0	1289	33	392	1767	3251	311	1767	3610	7
Grp Volume(v), veh/h	5	0	0	105	0	0	3	784	810	45	515	541
Grp Sat Flow(s),veh/h/ln	1801	0	0	1714	0	0	1767	1763	1799	1767	1763	1854
Q Serve(g_s), s	0.4	0.0	0.0	8.4	0.0	0.0	0.1	27.4	28.0	0.8	12.6	12.6
Cycle Q Clear(g_c), s	0.4	0.0	0.0	8.4	0.0	0.0	0.1	27.4	28.0	0.8	12.6	12.6
Prop In Lane	0.60		0.00	0.75		0.23	1.00		0.17	1.00		0.00
Lane Grp Cap(c), veh/h	11	0	0	137	0	0	424	1332	1359	280	1377	1448
V/C Ratio(X)	0.44	0.00	0.00	0.76	0.00	0.00	0.01	0.59	0.60	0.16	0.37	0.37
Avail Cap(c_a), veh/h	64	0	0	312	0	0	481	1332	1359	291	1377	1448
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.77	0.77	0.77	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.3	0.0	0.0	63.1	0.0	0.0	4.4	7.5	7.6	6.6	4.7	4.7
Incr Delay (d2), s/veh	24.5	0.0	0.0	8.5	0.0	0.0	0.0	1.5	1.5	0.3	0.8	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	4.0	0.0	0.0	0.0	9.6	10.0	0.3	4.2	4.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	93.8	0.0	0.0	71.6	0.0	0.0	4.4	9.0	9.1	6.9	5.5	5.5
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	A	A
Approach Vol, veh/h		5			105			1597			1101	
Approach Delay, s/veh		93.8			71.6			9.1			5.6	
Approach LOS		F			E			A			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	110.3		5.4	5.1	113.9		15.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	2.8	30.0		2.4	2.1	14.6		10.4
Green Ext Time (p_c), s	0.0	18.3		0.0	0.0	8.6		0.4

Intersection Summary		
HCM 6th Ctrl Delay		10.2
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	200	10	90	10	1150	240	60	1230	10
Future Volume (veh/h)	10	10	10	200	10	90	10	1150	240	60	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	3	220	11	89	11	1264	249	66	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	201	189	46	302	12	97	219	1585	308	211	2027	16
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.55	0.55	0.04	0.58	0.58
Sat Flow, veh/h	604	769	187	977	49	395	1767	2903	565	1767	3526	29
Grp Volume(v), veh/h	25	0	0	320	0	0	11	755	758	66	665	698
Grp Sat Flow(s),veh/h/ln	1561	0	0	1422	0	0	1767	1749	1719	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	20.7	0.0	0.0	0.3	34.4	35.7	1.6	26.3	26.3
Cycle Q Clear(g_c), s	1.1	0.0	0.0	21.8	0.0	0.0	0.3	34.4	35.7	1.6	26.3	26.3
Prop In Lane	0.44		0.12	0.69		0.28	1.00		0.33	1.00		0.02
Lane Grp Cap(c), veh/h	436	0	0	411	0	0	219	955	939	211	998	1046
V/C Ratio(X)	0.06	0.00	0.00	0.78	0.00	0.00	0.05	0.79	0.81	0.31	0.67	0.67
Avail Cap(c_a), veh/h	443	0	0	418	0	0	382	1632	1605	323	1619	1699
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	28.7	0.0	0.0	36.4	0.0	0.0	12.6	18.1	18.4	16.7	14.6	14.6
Incr Delay (d2), s/veh	0.1	0.0	0.0	9.0	0.0	0.0	0.1	1.5	1.7	0.8	0.8	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	8.5	0.0	0.0	0.1	13.0	13.3	0.6	9.5	10.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	28.8	0.0	0.0	45.4	0.0	0.0	12.7	19.6	20.1	17.5	15.4	15.3
LnGrp LOS	C	A	A	D	A	A	B	B	C	B	B	B
Approach Vol, veh/h		25			320			1524			1429	
Approach Delay, s/veh		28.8			45.4			19.8			15.4	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.7	60.4		30.5	5.8	63.3		30.5
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.6	37.7		3.1	2.3	28.3		23.8
Green Ext Time (p_c), s	0.1	16.8		0.1	0.0	13.5		0.3

Intersection Summary		
HCM 6th Ctrl Delay		20.4
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	9.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	60	20	130	20	50	40	20	20	20	100
Future Vol, veh/h	150	100	60	20	130	20	50	40	20	20	20	100
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	70	23	151	23	58	47	23	23	23	116

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	181	0	0	195	0	0	802	735	178	768	759	186
Stage 1	-	-	-	-	-	-	508	508	-	216	216	-
Stage 2	-	-	-	-	-	-	294	227	-	552	543	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1388	-	-	1372	-	-	301	346	862	317	335	854
Stage 1	-	-	-	-	-	-	546	537	-	784	722	-
Stage 2	-	-	-	-	-	-	712	714	-	516	518	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1379	-	-	1360	-	-	208	286	840	232	277	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	208	286	-	232	277	-
Stage 1	-	-	-	-	-	-	465	456	-	668	703	-
Stage 2	-	-	-	-	-	-	572	695	-	380	440	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.9	0.9	29.5	15.5
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	272	1379	-	-	1360	-	-	503
HCM Lane V/C Ratio	0.47	0.126	-	-	0.017	-	-	0.324
HCM Control Delay (s)	29.5	8	0	-	7.7	0	-	15.5
HCM Lane LOS	D	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	2.4	0.4	-	-	0.1	-	-	1.4

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	280	170	1020	70	100	1420	
Future Volume (veh/h)	280	170	1020	70	100	1420	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	298	0	1085	0	106	1511	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	360		2537		428	2831	
Arrive On Green	0.10	0.00	0.73	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	298	0	1085	0	106	1511	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	11.9	0.0	17.1	0.0	2.0	0.0	
Cycle Q Clear(g_c), s	11.9	0.0	17.1	0.0	2.0	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	360		2537		428	2831	
V/C Ratio(X)	0.83		0.43		0.25	0.53	
Avail Cap(c_a), veh/h	588		2537		542	2831	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.80	0.80	
Uniform Delay (d), s/veh	61.4	0.0	7.3	0.0	5.0	0.0	
Incr Delay (d2), s/veh	5.1	0.0	0.5	0.0	0.2	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	5.5	0.0	6.0	0.0	0.6	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	66.6	0.0	7.9	0.0	5.3	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	298	A	1085	A		1617	
Approach Delay, s/veh	66.6		7.9			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	108.4				119.3	20.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.0	19.1				2.0	13.9
Green Ext Time (p_c), s	0.2	10.3				19.4	0.8

Intersection Summary	
HCM 6th Ctrl Delay	9.9
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	130	330	10	20	70
Future Vol, veh/h	50	130	330	10	20	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	159	402	12	24	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	429	0	-	0	719	436
Stage 1	-	-	-	-	423	-
Stage 2	-	-	-	-	296	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1125	-	-	-	394	618
Stage 1	-	-	-	-	659	-
Stage 2	-	-	-	-	752	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1109	-	-	-	360	602
Mov Cap-2 Maneuver	-	-	-	-	360	-
Stage 1	-	-	-	-	611	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1109	-	-	-	360	602
HCM Lane V/C Ratio	0.055	-	-	-	0.068	0.142
HCM Control Delay (s)	8.4	0	-	-	15.7	12
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	40	10	870	40	20	1310	10
Future Volume (veh/h)	10	10	10	140	10	40	10	870	40	20	1310	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	34	11	926	41	21	1394	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	40	271	2403	106	426	2532	20
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.70	0.70	0.02	0.71	0.71
Sat Flow, veh/h	905	905	0	1327	98	303	1767	3438	152	1767	3584	28
Grp Volume(v), veh/h	22	0	0	194	0	0	11	475	492	21	685	720
Grp Sat Flow(s),veh/h/ln	1810	0	0	1728	0	0	1767	1763	1828	1767	1763	1850
Q Serve(g_s), s	1.7	0.0	0.0	15.4	0.0	0.0	0.3	15.5	15.5	0.5	26.2	26.2
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.4	0.0	0.0	0.3	15.5	15.5	0.5	26.2	26.2
Prop In Lane	0.50		0.00	0.77		0.18	1.00		0.08	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	228	0	0	271	1232	1277	426	1245	1306
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.39	0.39	0.05	0.55	0.55
Avail Cap(c_a), veh/h	65	0	0	488	0	0	312	1232	1277	453	1245	1306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.87	0.87	0.87	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.4	0.0	0.0	8.2	8.7	8.7	6.5	9.9	9.9
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.1	0.8	0.8	0.0	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.3	0.0	0.0	0.1	5.9	6.1	0.2	9.9	10.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	8.2	9.5	9.5	6.5	11.6	11.6
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			194			978			1426	
Approach Delay, s/veh		82.1			67.9			9.5			11.5	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.3	102.3		7.4	6.2	103.4		23.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.5	17.5		3.7	2.3	28.2		17.4
Green Ext Time (p_c), s	0.0	7.5		0.0	0.0	13.4		1.1

Intersection Summary			
HCM 6th Ctrl Delay			15.5
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	70	10	1600	120	70	1140	10
Future Volume (veh/h)	10	10	10	90	10	70	10	1600	120	70	1140	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	2	99	11	59	11	1758	128	77	1253	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	156	145	23	190	29	92	290	2097	151	180	2331	20
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.01	0.64	0.64	0.04	0.66	0.66
Sat Flow, veh/h	601	782	126	764	156	494	1767	3300	237	1767	3523	31
Grp Volume(v), veh/h	24	0	0	169	0	0	11	920	966	77	617	647
Grp Sat Flow(s),veh/h/ln	1509	0	0	1414	0	0	1767	1749	1789	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	11.5	0.0	0.0	0.3	47.7	50.4	1.7	22.0	22.0
Cycle Q Clear(g_c), s	1.3	0.0	0.0	12.9	0.0	0.0	0.3	47.7	50.4	1.7	22.0	22.0
Prop In Lane	0.46		0.08	0.59		0.35	1.00		0.13	1.00		0.02
Lane Grp Cap(c), veh/h	324	0	0	311	0	0	290	1111	1137	180	1148	1204
V/C Ratio(X)	0.07	0.00	0.00	0.54	0.00	0.00	0.04	0.83	0.85	0.43	0.54	0.54
Avail Cap(c_a), veh/h	365	0	0	348	0	0	425	1381	1413	268	1370	1437
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	39.6	0.0	0.0	44.2	0.0	0.0	8.9	16.5	17.0	22.6	10.5	10.5
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.5	0.0	0.0	0.1	3.6	4.2	1.6	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	4.7	0.0	0.0	0.1	18.3	19.8	1.3	7.7	8.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.7	0.0	0.0	45.7	0.0	0.0	8.9	20.1	21.2	24.2	10.9	10.8
LnGrp LOS	D	A	A	D	A	A	A	C	C	C	B	B
Approach Vol, veh/h		24			169			1897			1341	
Approach Delay, s/veh		39.7			45.7			20.6			11.6	
Approach LOS		D			D			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.1	80.8		27.8	6.0	83.9		27.8
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.7	52.4		3.3	2.3	24.0		14.9
Green Ext Time (p_c), s	0.1	22.5		0.1	0.0	11.7		0.7

Intersection Summary		
HCM 6th Ctrl Delay		18.5
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	60	60	10	50	20	50	20	10	20	10	60
Future Vol, veh/h	60	60	60	10	50	20	50	20	10	20	10	60
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	70	70	70	12	58	23	58	23	12	23	12	70

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	148	0	0	398	368	122	376	392	90
Stage 1	-	-	-	-	-	-	253	253	-	104	104	-
Stage 2	-	-	-	-	-	-	145	115	-	272	288	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1498	-	-	1427	-	-	560	559	926	579	542	965
Stage 1	-	-	-	-	-	-	749	696	-	899	807	-
Stage 2	-	-	-	-	-	-	855	798	-	732	672	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1484	-	-	1416	-	-	478	516	911	517	500	947
Mov Cap-2 Maneuver	-	-	-	-	-	-	478	516	-	517	500	-
Stage 1	-	-	-	-	-	-	705	654	-	844	792	-
Stage 2	-	-	-	-	-	-	766	783	-	655	632	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.5	0.9	13.5	10.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	518	1484	-	-	1416	-	-	737
HCM Lane V/C Ratio	0.18	0.047	-	-	0.008	-	-	0.142
HCM Control Delay (s)	13.5	7.5	0	-	7.6	0	-	10.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0.1	-	-	0	-	-	0.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	170	100	1630	310	120	1070	
Future Volume (veh/h)	170	100	1630	310	120	1070	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	181	0	1734	0	128	1138	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	239		2659		262	2954	
Arrive On Green	0.07	0.00	0.77	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	181	0	1734	0	128	1138	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.3	0.0	32.7	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	7.3	0.0	32.7	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	239		2659		262	2954	
V/C Ratio(X)	0.76		0.65		0.49	0.39	
Avail Cap(c_a), veh/h	588		2659		376	2954	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.89	0.89	
Uniform Delay (d), s/veh	64.0	0.0	7.6	0.0	9.9	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.3	0.0	1.3	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.4	0.0	10.8	0.0	1.5	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.9	0.0	8.9	0.0	11.2	0.3	
LnGrp LOS	E		A		B	A	
Approach Vol, veh/h	181	A	1734	A		1266	
Approach Delay, s/veh	68.9		8.9			1.4	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	11.0	113.3				124.3	15.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	34.7				2.0	9.3
Green Ext Time (p_c), s	0.2	22.1				11.3	0.5

Intersection Summary	
HCM 6th Ctrl Delay	9.3
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	360	190	20	20	40
Future Vol, veh/h	80	360	190	20	20	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	439	232	24	24	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	287	0	-	0	938	306
Stage 1	-	-	-	-	275	-
Stage 2	-	-	-	-	663	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1269	-	-	-	292	732
Stage 1	-	-	-	-	769	-
Stage 2	-	-	-	-	511	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1232	-	-	-	246	689
Mov Cap-2 Maneuver	-	-	-	-	246	-
Stage 1	-	-	-	-	667	-
Stage 2	-	-	-	-	496	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1232	-	-	-	246	689
HCM Lane V/C Ratio	0.079	-	-	-	0.099	0.071
HCM Control Delay (s)	8.2	0	-	-	21.2	10.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.3	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	40	10	1490	150	50	1080	10
Future Volume (veh/h)	10	10	10	90	10	40	10	1490	150	50	1080	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	32	11	1585	156	53	1149	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	40	367	2330	227	228	2635	25
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1184	136	395	1767	3245	316	1767	3577	34
Grp Volume(v), veh/h	22	0	0	139	0	0	11	853	888	53	566	594
Grp Sat Flow(s),veh/h/ln	1810	0	0	1714	0	0	1767	1763	1798	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	37.0	38.5	1.1	17.4	17.4
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	37.0	38.5	1.1	17.4	17.4
Prop In Lane	0.50		0.00	0.69		0.23	1.00		0.18	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	174	0	0	367	1266	1291	228	1299	1362
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.67	0.69	0.23	0.44	0.44
Avail Cap(c_a), veh/h	65	0	0	312	0	0	409	1266	1291	236	1299	1362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.64	0.64	0.64	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.5	0.0	0.0	5.9	10.8	11.0	11.1	7.1	7.1
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.1	0.0	0.0	0.0	1.9	1.9	0.5	1.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	13.6	14.5	0.5	6.3	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	5.9	12.6	12.9	11.6	8.2	8.2
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			139			1752			1213	
Approach Delay, s/veh		82.1			69.5			12.7			8.3	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	105.0		7.4	6.2	107.6		18.7
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	3.1	40.5		3.7	2.2	19.4		13.1
Green Ext Time (p_c), s	0.0	20.5		0.0	0.0	10.0		0.6

Intersection Summary		
HCM 6th Ctrl Delay		14.1
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Future Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	3	320	12	105	11	1264	281	70	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	197	203	46	311	9	82	222	1575	345	206	2061	17
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.01	0.56	0.56	0.04	0.58	0.58
Sat Flow, veh/h	606	835	188	1034	39	339	1767	2835	621	1767	3526	29
Grp Volume(v), veh/h	26	0	0	437	0	0	11	772	773	70	665	698
Grp Sat Flow(s),veh/h/ln	1629	0	0	1412	0	0	1767	1749	1707	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	23.9	0.0	0.0	0.3	36.2	37.9	1.7	26.6	26.7
Cycle Q Clear(g_c), s	1.1	0.0	0.0	25.0	0.0	0.0	0.3	36.2	37.9	1.7	26.6	26.7
Prop In Lane	0.42		0.12	0.73		0.24	1.00		0.36	1.00		0.02
Lane Grp Cap(c), veh/h	445	0	0	403	0	0	222	972	948	206	1014	1064
V/C Ratio(X)	0.06	0.00	0.00	1.08	0.00	0.00	0.05	0.79	0.82	0.34	0.66	0.66
Avail Cap(c_a), veh/h	445	0	0	403	0	0	379	1577	1539	312	1564	1641
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.0	0.0	0.0	40.8	0.0	0.0	12.4	18.2	18.6	17.6	14.4	14.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	69.6	0.0	0.0	0.1	1.5	1.8	1.0	0.7	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	18.2	0.0	0.0	0.1	13.7	14.1	0.7	9.7	10.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.1	0.0	0.0	110.4	0.0	0.0	12.5	19.8	20.4	18.5	15.2	15.1
LnGrp LOS	C	A	A	F	A	A	B	B	C	B	B	B
Approach Vol, veh/h		26			437			1556			1433	
Approach Delay, s/veh		30.1			110.4			20.0			15.3	
Approach LOS		C			F			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.8	63.3		31.0	5.9	66.3		31.0
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	3.7	39.9		3.1	2.3	28.7		27.0
Green Ext Time (p_c), s	0.1	17.4		0.1	0.0	13.5		0.0

Intersection Summary		
HCM 6th Ctrl Delay		29.6
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	50.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Future Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	110	24	151	23	180	72	24	23	30	116

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	181	0	0	235	0	0	828	757	198	803	801	186
Stage 1	-	-	-	-	-	-	528	528	-	218	218	-
Stage 2	-	-	-	-	-	-	300	229	-	585	583	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1388	-	-	1326	-	-	289	336	841	301	317	854
Stage 1	-	-	-	-	-	-	532	526	-	782	721	-
Stage 2	-	-	-	-	-	-	707	713	-	495	497	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1379	-	-	1315	-	-	194	277	819	200	261	835
Mov Cap-2 Maneuver	-	-	-	-	-	-	194	277	-	200	261	-
Stage 1	-	-	-	-	-	-	451	445	-	663	702	-
Stage 2	-	-	-	-	-	-	562	694	-	338	420	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.5	1	175.7	17.5
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	227	1379	-	-	1315	-	-	457
HCM Lane V/C Ratio	1.219	0.126	-	-	0.019	-	-	0.371
HCM Control Delay (s)	175.7	8	0	-	7.8	0	-	17.5
HCM Lane LOS	F	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	13.8	0.4	-	-	0.1	-	-	1.7

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline Plus Project Conditions
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	280	171	1048	70	103	1505	
Future Volume (veh/h)	280	171	1048	70	103	1505	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	298	0	1115	0	110	1601	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	360		2537		416	2831	
Arrive On Green	0.10	0.00	0.73	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	298	0	1115	0	110	1601	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	11.9	0.0	17.8	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	11.9	0.0	17.8	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	360		2537		416	2831	
V/C Ratio(X)	0.83		0.44		0.26	0.57	
Avail Cap(c_a), veh/h	588		2537		531	2831	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.76	0.76	
Uniform Delay (d), s/veh	61.4	0.0	7.4	0.0	5.2	0.0	
Incr Delay (d2), s/veh	5.1	0.0	0.6	0.0	0.3	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	5.5	0.0	6.2	0.0	0.6	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	66.6	0.0	8.0	0.0	5.4	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	298	A	1115	A		1711	
Approach Delay, s/veh	66.6		8.0			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.9	108.4				119.3	20.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	19.8				2.0	13.9
Green Ext Time (p_c), s	0.2	10.8				22.0	0.8

Intersection Summary	
HCM 6th Ctrl Delay	9.7
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline Plus Project Conditions
AM Peak Hour

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	133	331	10	20	70
Future Vol, veh/h	50	133	331	10	20	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	162	404	12	24	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	431	0	-	0	724	438
Stage 1	-	-	-	-	425	-
Stage 2	-	-	-	-	299	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1123	-	-	-	391	617
Stage 1	-	-	-	-	657	-
Stage 2	-	-	-	-	750	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	357	601
Mov Cap-2 Maneuver	-	-	-	-	357	-
Stage 1	-	-	-	-	608	-
Stage 2	-	-	-	-	740	-

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	12.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	357	601
HCM Lane V/C Ratio	0.055	-	-	-	0.068	0.142
HCM Control Delay (s)	8.4	0	-	-	15.8	12
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.2	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline Plus Project Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	41	10	899	40	23	1398	10
Future Volume (veh/h)	10	10	10	140	10	41	10	899	40	23	1398	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	35	11	956	41	24	1487	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	41	246	2398	103	415	2531	19
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.70	0.70	0.02	0.71	0.71
Sat Flow, veh/h	905	905	0	1320	97	310	1767	3444	148	1767	3586	27
Grp Volume(v), veh/h	22	0	0	195	0	0	11	489	508	24	731	767
Grp Sat Flow(s),veh/h/ln	1810	0	0	1727	0	0	1767	1763	1829	1767	1763	1850
Q Serve(g_s), s	1.7	0.0	0.0	15.5	0.0	0.0	0.3	16.3	16.3	0.5	29.2	29.2
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.5	0.0	0.0	0.3	16.3	16.3	0.5	29.2	29.2
Prop In Lane	0.50		0.00	0.76		0.18	1.00		0.08	1.00		0.01
Lane Grp Cap(c), veh/h	37	0	0	229	0	0	246	1228	1273	415	1244	1305
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.40	0.40	0.06	0.59	0.59
Avail Cap(c_a), veh/h	65	0	0	487	0	0	287	1228	1273	439	1244	1305
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.86	0.86	0.86	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.3	0.0	0.0	8.8	8.9	8.9	6.6	10.4	10.4
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.1	0.8	0.8	0.1	2.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.4	0.0	0.0	0.1	6.2	6.4	0.2	11.1	11.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	8.9	9.8	9.7	6.7	12.4	12.3
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			195			1008			1522	
Approach Delay, s/veh		82.1			67.9			9.7			12.3	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	7.5	102.0		7.4	6.2	103.3		23.1
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.5	18.3		3.7	2.3	31.2		17.5
Green Ext Time (p_c), s	0.0	7.8		0.0	0.0	14.8		1.1

Intersection Summary			
HCM 6th Ctrl Delay			15.8
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	148	11	78	10	1600	218	86	1140	10
Future Volume (veh/h)	10	11	10	148	11	78	10	1600	218	86	1140	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	2	163	12	74	11	1758	233	95	1253	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	151	154	23	220	13	79	291	2009	259	154	2368	21
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.01	0.65	0.65	0.04	0.67	0.67
Sat Flow, veh/h	589	813	122	918	68	417	1767	3102	400	1767	3523	31
Grp Volume(v), veh/h	25	0	0	249	0	0	11	970	1021	95	617	647
Grp Sat Flow(s),veh/h/ln	1523	0	0	1402	0	0	1767	1749	1753	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	21.5	0.0	0.0	0.3	57.7	64.6	2.3	23.8	23.8
Cycle Q Clear(g_c), s	1.5	0.0	0.0	23.0	0.0	0.0	0.3	57.7	64.6	2.3	23.8	23.8
Prop In Lane	0.44		0.08	0.65		0.30	1.00		0.23	1.00		0.02
Lane Grp Cap(c), veh/h	329	0	0	312	0	0	291	1133	1136	154	1166	1223
V/C Ratio(X)	0.08	0.00	0.00	0.80	0.00	0.00	0.04	0.86	0.90	0.62	0.53	0.53
Avail Cap(c_a), veh/h	329	0	0	312	0	0	409	1236	1240	230	1226	1286
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.8	0.0	0.0	52.3	0.0	0.0	9.3	18.3	19.5	31.1	11.0	11.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	13.7	0.0	0.0	0.1	5.8	8.6	4.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	0.0	9.3	0.0	0.0	0.1	23.1	26.6	2.1	8.6	9.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.9	0.0	0.0	65.9	0.0	0.0	9.3	24.1	28.1	35.1	11.4	11.3
LnGrp LOS	D	A	A	E	A	A	A	C	C	D	B	B
Approach Vol, veh/h		25			249			2002			1359	
Approach Delay, s/veh		43.9			65.9			26.1			13.0	
Approach LOS		D			E			C			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	91.2		31.0	6.2	94.4		31.0
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.3	66.6		3.5	2.3	25.8		25.0
Green Ext Time (p_c), s	0.1	18.6		0.1	0.0	11.7		0.0

Intersection Summary		
HCM 6th Ctrl Delay		24.0
HCM 6th LOS		C

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	60	60	178	11	50	20	120	30	11	20	28	60
Future Vol, veh/h	60	60	178	11	50	20	120	30	11	20	28	60
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	70	70	207	13	58	23	140	35	13	23	33	70

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	285	0	0	479	439	191	453	531	90
Stage 1	-	-	-	-	-	-	322	322	-	106	106	-
Stage 2	-	-	-	-	-	-	157	117	-	347	425	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1498	-	-	1271	-	-	495	510	848	515	453	965
Stage 1	-	-	-	-	-	-	688	649	-	897	806	-
Stage 2	-	-	-	-	-	-	843	797	-	667	585	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1484	-	-	1261	-	-	402	467	834	445	415	947
Mov Cap-2 Maneuver	-	-	-	-	-	-	402	467	-	445	415	-
Stage 1	-	-	-	-	-	-	644	607	-	838	789	-
Stage 2	-	-	-	-	-	-	733	780	-	579	547	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.5	1.1	19.8	12.4
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	428	1484	-	-	1261	-	-	614
HCM Lane V/C Ratio	0.437	0.047	-	-	0.01	-	-	0.205
HCM Control Delay (s)	19.8	7.5	0	-	7.9	0	-	12.4
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	2.2	0.1	-	-	0	-	-	0.8

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline Plus Project Conditions
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	170	103	1722	310	122	1124	
Future Volume (veh/h)	170	103	1722	310	122	1124	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	181	0	1832	0	130	1196	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	239		2659		241	2954	
Arrive On Green	0.07	0.00	0.77	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	181	0	1832	0	130	1196	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.3	0.0	36.6	0.0	2.1	0.0	
Cycle Q Clear(g_c), s	7.3	0.0	36.6	0.0	2.1	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	239		2659		241	2954	
V/C Ratio(X)	0.76		0.69		0.54	0.40	
Avail Cap(c_a), veh/h	588		2659		355	2954	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.88	0.88	
Uniform Delay (d), s/veh	64.0	0.0	8.1	0.0	12.7	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.5	0.0	1.6	0.4	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.4	0.0	12.2	0.0	2.0	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.9	0.0	9.6	0.0	14.3	0.4	
LnGrp LOS	E		A		B	A	
Approach Vol, veh/h	181	A	1832	A		1326	
Approach Delay, s/veh	68.9		9.6			1.7	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	11.0	113.3				124.3	15.7
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	4.1	38.6				2.0	9.3
Green Ext Time (p_c), s	0.2	23.4				12.3	0.5

Intersection Summary	
HCM 6th Ctrl Delay	9.7
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline Plus Project Conditions
PM Peak Hour

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	362	193	20	20	40
Future Vol, veh/h	80	362	193	20	20	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	441	235	24	24	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	290	0	-	0	943	309
Stage 1	-	-	-	-	278	-
Stage 2	-	-	-	-	665	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1266	-	-	-	290	729
Stage 1	-	-	-	-	767	-
Stage 2	-	-	-	-	509	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1229	-	-	-	244	687
Mov Cap-2 Maneuver	-	-	-	-	244	-
Stage 1	-	-	-	-	665	-
Stage 2	-	-	-	-	494	-

Approach	EB	WB	SB
HCM Control Delay, s	1.5	0	14.2
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1229	-	-	-	244	687
HCM Lane V/C Ratio	0.079	-	-	-	0.1	0.071
HCM Control Delay (s)	8.2	0	-	-	21.4	10.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.3	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline Plus Project Conditions
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	43	10	1585	150	52	1136	10
Future Volume (veh/h)	10	10	10	90	10	43	10	1585	150	52	1136	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	34	11	1686	156	55	1209	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	42	346	2340	214	208	2633	24
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1165	134	413	1767	3266	298	1767	3579	33
Grp Volume(v), veh/h	22	0	0	141	0	0	11	900	942	55	595	625
Grp Sat Flow(s),veh/h/ln	1810	0	0	1711	0	0	1767	1763	1801	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	11.3	0.0	0.0	0.2	41.4	43.5	1.1	18.9	18.9
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.3	0.0	0.0	0.2	41.4	43.5	1.1	18.9	18.9
Prop In Lane	0.50		0.00	0.68		0.24	1.00		0.17	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	176	0	0	346	1263	1291	208	1297	1360
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.71	0.73	0.26	0.46	0.46
Avail Cap(c_a), veh/h	65	0	0	312	0	0	387	1263	1291	216	1297	1360
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.58	0.58	0.58	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.4	0.0	0.0	6.1	11.5	11.8	13.3	7.4	7.4
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.2	0.0	0.0	0.0	2.0	2.1	0.7	1.2	1.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	15.3	16.4	0.7	6.9	7.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	6.2	13.5	13.9	13.9	8.6	8.5
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			141			1853			1275	
Approach Delay, s/veh		82.1			69.5			13.7			8.8	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.9	104.8		7.4	6.2	107.5		18.9				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5				
Max Q Clear Time (g_c+I1), s	3.1	45.5		3.7	2.2	20.9		13.3				
Green Ext Time (p_c), s	0.0	21.6		0.0	0.0	10.9		0.6				

Intersection Summary			
HCM 6th Ctrl Delay			14.6
HCM 6th LOS			B

HCM 6th AWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Intersection	
Intersection Delay, s/veh	14.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Future Vol, veh/h	150	100	95	21	130	20	155	62	21	20	26	100
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	174	116	110	24	151	23	180	72	24	23	30	116
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	17.6	12.1	14.4	11.3
HCM LOS	C	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	65%	43%	12%	14%
Vol Thru, %	26%	29%	76%	18%
Vol Right, %	9%	28%	12%	68%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	238	345	171	146
LT Vol	155	150	21	20
Through Vol	62	100	130	26
RT Vol	21	95	20	100
Lane Flow Rate	277	401	199	170
Geometry Grp	1	1	1	1
Degree of Util (X)	0.466	0.622	0.336	0.281
Departure Headway (Hd)	6.172	5.581	6.078	5.958
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	587	642	595	606
Service Time	4.172	3.678	4.078	3.97
HCM Lane V/C Ratio	0.472	0.625	0.334	0.281
HCM Control Delay	14.4	17.6	12.1	11.3
HCM Lane LOS	B	C	B	B
HCM 95th-tile Q	2.5	4.3	1.5	1.1

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Future Volume (veh/h)	10	11	10	291	11	103	10	1150	270	64	1230	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.98		0.98	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	4	320	12	105	11	1264	283	70	1352	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	238	251	78	387	13	111	174	1441	318	153	1877	15
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.01	0.51	0.51	0.04	0.53	0.53
Sat Flow, veh/h	609	772	240	1037	39	340	1767	2831	624	1767	3526	29
Grp Volume(v), veh/h	27	0	0	437	0	0	11	773	774	70	665	698
Grp Sat Flow(s),veh/h/ln	1621	0	0	1417	0	0	1767	1749	1706	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	37.0	0.0	0.0	0.4	49.7	52.0	2.4	37.1	37.1
Cycle Q Clear(g_c), s	1.3	0.0	0.0	38.4	0.0	0.0	0.4	49.7	52.0	2.4	37.1	37.1
Prop In Lane	0.41		0.15	0.73		0.24	1.00		0.37	1.00		0.02
Lane Grp Cap(c), veh/h	568	0	0	510	0	0	174	890	868	153	924	969
V/C Ratio(X)	0.05	0.00	0.00	0.86	0.00	0.00	0.06	0.87	0.89	0.46	0.72	0.72
Avail Cap(c_a), veh/h	608	0	0	548	0	0	297	1000	975	235	992	1040
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	29.5	0.0	0.0	41.8	0.0	0.0	19.4	27.6	28.2	27.2	22.6	22.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	12.1	0.0	0.0	0.2	7.6	9.6	2.1	2.4	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	15.1	0.0	0.0	0.2	21.7	22.6	1.1	15.1	15.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	29.5	0.0	0.0	53.9	0.0	0.0	19.5	35.2	37.7	29.3	25.0	24.9
LnGrp LOS	C	A	A	D	A	A	B	D	D	C	C	C
Approach Vol, veh/h		27			437			1558			1433	
Approach Delay, s/veh		29.5			53.9			36.3			25.2	
Approach LOS		C			D			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.1	71.0		47.6	6.1	74.0		47.6
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	73.0		45.0	10.5	73.0		45.0
Max Q Clear Time (g_c+I1), s	4.4	54.0		3.3	2.4	39.1		40.4
Green Ext Time (p_c), s	0.1	11.0		0.1	0.0	11.9		1.2

Intersection Summary	
HCM 6th Ctrl Delay	33.9
HCM 6th LOS	C

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions Mitigated
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	445	11	1561	70	1363
v/c Ratio	0.07	1.02	0.06	0.92	0.45	0.73
Control Delay	26.2	92.8	11.8	40.9	24.6	26.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	92.8	11.8	40.9	24.6	26.3
Queue Length 50th (ft)	15	~452	4	662	25	421
Queue Length 95th (ft)	43	#689	12	814	61	603
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	512	436	233	1839	188	2003
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	1.02	0.05	0.85	0.37	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	160	10	110	10	1130	170	80	1210	10
Future Volume (veh/h)	10	10	10	160	10	110	10	1130	170	80	1210	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	3	176	11	107	11	1242	176	88	1330	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	199	186	45	272	19	130	218	1588	224	237	1954	16
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.01	0.52	0.52	0.05	0.55	0.55
Sat Flow, veh/h	567	747	179	836	78	523	1767	3064	432	1767	3525	29
Grp Volume(v), veh/h	25	0	0	294	0	0	11	705	713	88	654	687
Grp Sat Flow(s),veh/h/ln	1493	0	0	1437	0	0	1767	1749	1747	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	16.4	0.0	0.0	0.3	29.4	29.9	2.0	24.3	24.4
Cycle Q Clear(g_c), s	0.9	0.0	0.0	17.4	0.0	0.0	0.3	29.4	29.9	2.0	24.3	24.4
Prop In Lane	0.44		0.12	0.60		0.36	1.00		0.25	1.00		0.02
Lane Grp Cap(c), veh/h	430	0	0	422	0	0	218	906	906	237	962	1009
V/C Ratio(X)	0.06	0.00	0.00	0.70	0.00	0.00	0.05	0.78	0.79	0.37	0.68	0.68
Avail Cap(c_a), veh/h	472	0	0	462	0	0	401	1804	1802	356	1789	1877
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	25.8	0.0	0.0	31.8	0.0	0.0	12.5	17.5	17.7	15.3	14.4	14.4
Incr Delay (d2), s/veh	0.1	0.0	0.0	4.1	0.0	0.0	0.1	1.5	1.6	1.0	0.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	6.4	0.0	0.0	0.1	11.0	11.2	0.8	8.7	9.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	25.8	0.0	0.0	35.9	0.0	0.0	12.6	19.0	19.2	16.3	15.2	15.2
LnGrp LOS	C	A	A	D	A	A	B	B	B	B	B	B
Approach Vol, veh/h		25			294			1429			1429	
Approach Delay, s/veh		25.8			35.9			19.1			15.3	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.9	52.7		28.5	5.7	56.0		28.5
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.0	31.9		2.9	2.3	26.4		19.4
Green Ext Time (p_c), s	0.1	14.8		0.1	0.0	13.1		0.9

Intersection Summary			
HCM 6th Ctrl Delay			19.0
HCM 6th LOS			B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Intersection	
Int Delay, s/veh	10.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	60	30	120	20	50	70	40	20	30	90
Future Vol, veh/h	120	80	60	30	120	20	50	70	40	20	30	90
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	70	35	140	23	58	81	47	23	35	105

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	172	0	0	725	657	155	719	681	175
Stage 1	-	-	-	-	-	-	417	417	-	229	229	-
Stage 2	-	-	-	-	-	-	308	240	-	490	452	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1401	-	-	1399	-	-	339	383	888	342	371	866
Stage 1	-	-	-	-	-	-	611	590	-	772	713	-
Stage 2	-	-	-	-	-	-	700	705	-	558	569	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1392	-	-	1387	-	-	238	325	865	229	315	847
Mov Cap-2 Maneuver	-	-	-	-	-	-	238	325	-	229	315	-
Stage 1	-	-	-	-	-	-	538	519	-	681	688	-
Stage 2	-	-	-	-	-	-	557	680	-	389	501	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.6	1.4	27.8	16.1
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	339	1392	-	-	1387	-	-	485
HCM Lane V/C Ratio	0.549	0.1	-	-	0.025	-	-	0.336
HCM Control Delay (s)	27.8	7.9	0	-	7.7	0	-	16.1
HCM Lane LOS	D	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	3.1	0.3	-	-	0.1	-	-	1.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	290	100	1010	80	60	1410
Future Volume (veh/h)	290	100	1010	80	60	1410
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No		No			No
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841
Adj Flow Rate, veh/h	309	0	1074	0	64	1500
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	5	4	3	4
Cap, veh/h	371		2534		427	2819
Arrive On Green	0.11	0.00	0.73	0.00	0.07	1.00
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589
Grp Volume(v), veh/h	309	0	1074	0	64	1500
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749
Q Serve(g_s), s	12.4	0.0	16.9	0.0	1.2	0.0
Cycle Q Clear(g_c), s	12.4	0.0	16.9	0.0	1.2	0.0
Prop In Lane	1.00	1.00		1.00	1.00	
Lane Grp Cap(c), veh/h	371		2534		427	2819
V/C Ratio(X)	0.83		0.42		0.15	0.53
Avail Cap(c_a), veh/h	588		2534		546	2819
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.82	0.82
Uniform Delay (d), s/veh	61.2	0.0	7.4	0.0	4.9	0.0
Incr Delay (d2), s/veh	5.8	0.0	0.5	0.0	0.1	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	5.9	0.0	0.4	0.2
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	67.0	0.0	7.9	0.0	5.0	0.6
LnGrp LOS	E		A		A	A
Approach Vol, veh/h	309	A	1074	A		1564
Approach Delay, s/veh	67.0		7.9			0.8
Approach LOS	E		A			A

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.6	108.3				118.9	21.1
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.2	18.9				2.0	14.4
Green Ext Time (p_c), s	0.1	10.1				19.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	10.3
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Intersection	
Int Delay, s/veh	3.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	50	100	270	70	50	70
Future Vol, veh/h	50	100	270	70	50	70
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	61	122	329	85	61	85

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	429	0	-	0	646	400
Stage 1	-	-	-	-	387	-
Stage 2	-	-	-	-	259	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1125	-	-	-	435	648
Stage 1	-	-	-	-	684	-
Stage 2	-	-	-	-	782	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1109	-	-	-	398	631
Mov Cap-2 Maneuver	-	-	-	-	398	-
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	771	-

Approach	EB	WB	SB
HCM Control Delay, s	2.8	0	13.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1109	-	-	-	398	631
HCM Lane V/C Ratio	0.055	-	-	-	0.153	0.135
HCM Control Delay (s)	8.4	0	-	-	15.7	11.6
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5	0.5

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	140	10	40	10	790	30	10	1260	10
Future Volume (veh/h)	10	10	10	140	10	40	10	790	30	10	1260	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	149	11	34	11	840	31	11	1340	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	175	13	40	286	2449	90	460	2531	21
Arrive On Green	0.02	0.02	0.00	0.13	0.13	0.13	0.01	0.71	0.71	0.01	0.71	0.71
Sat Flow, veh/h	905	905	0	1327	98	303	1767	3467	128	1767	3583	29
Grp Volume(v), veh/h	22	0	0	194	0	0	11	427	444	11	659	692
Grp Sat Flow(s),veh/h/ln	1810	0	0	1728	0	0	1767	1763	1832	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	15.4	0.0	0.0	0.2	13.1	13.1	0.2	24.6	24.6
Cycle Q Clear(g_c), s	1.7	0.0	0.0	15.4	0.0	0.0	0.2	13.1	13.1	0.2	24.6	24.6
Prop In Lane	0.50		0.00	0.77		0.18	1.00		0.07	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	228	0	0	286	1245	1294	460	1245	1306
V/C Ratio(X)	0.59	0.00	0.00	0.85	0.00	0.00	0.04	0.34	0.34	0.02	0.53	0.53
Avail Cap(c_a), veh/h	65	0	0	488	0	0	327	1245	1294	501	1245	1306
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.90	0.90	0.90	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	59.4	0.0	0.0	7.8	8.0	8.0	6.2	9.6	9.6
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.5	0.0	0.0	0.0	0.7	0.7	0.0	1.6	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	7.3	0.0	0.0	0.1	4.9	5.1	0.1	9.3	9.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	67.9	0.0	0.0	7.8	8.6	8.6	6.2	11.3	11.2
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			194			882			1362	
Approach Delay, s/veh		82.1			67.9			8.6			11.2	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	103.4		7.4	6.2	103.4		23.0
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.2	15.1		3.7	2.2	26.6		17.4
Green Ext Time (p_c), s	0.0	6.4		0.0	0.0	12.6		1.1

Intersection Summary	
HCM 6th Ctrl Delay	15.4
HCM 6th LOS	B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	50	10	90	10	1580	80	90	1120	10
Future Volume (veh/h)	10	10	10	50	10	90	10	1580	80	90	1120	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	11	2	55	11	61	11	1736	86	99	1231	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	159	147	23	144	40	127	297	2116	104	199	2308	21
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.01	0.62	0.62	0.04	0.66	0.66
Sat Flow, veh/h	611	808	129	535	219	697	1767	3387	166	1767	3522	31
Grp Volume(v), veh/h	24	0	0	127	0	0	11	890	932	99	606	636
Grp Sat Flow(s),veh/h/ln	1548	0	0	1452	0	0	1767	1749	1804	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	5.7	0.0	0.0	0.2	42.7	44.0	2.1	20.3	20.3
Cycle Q Clear(g_c), s	1.2	0.0	0.0	8.4	0.0	0.0	0.2	42.7	44.0	2.1	20.3	20.3
Prop In Lane	0.46		0.08	0.43		0.48	1.00		0.09	1.00		0.02
Lane Grp Cap(c), veh/h	329	0	0	311	0	0	297	1093	1127	199	1136	1192
V/C Ratio(X)	0.07	0.00	0.00	0.41	0.00	0.00	0.04	0.81	0.83	0.50	0.53	0.53
Avail Cap(c_a), veh/h	398	0	0	376	0	0	443	1482	1529	292	1470	1542
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	37.2	0.0	0.0	40.1	0.0	0.0	8.6	15.7	16.0	21.0	10.0	10.0
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.9	0.0	0.0	0.1	2.6	2.9	1.9	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	3.2	0.0	0.0	0.1	15.9	16.9	1.6	7.0	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	37.3	0.0	0.0	40.9	0.0	0.0	8.6	18.3	18.8	22.9	10.4	10.4
LnGrp LOS	D	A	A	D	A	A	A	B	B	C	B	B
Approach Vol, veh/h		24			127			1833			1341	
Approach Delay, s/veh		37.3			40.9			18.5			11.3	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.3	74.6		25.9	5.9	77.9		25.9
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.1	46.0		3.2	2.2	22.3		10.4
Green Ext Time (p_c), s	0.1	22.6		0.1	0.0	11.4		0.6

Intersection Summary		
HCM 6th Ctrl Delay		16.6
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	6.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	50	60	20	40	20	50	30	20	20	20	50
Future Vol, veh/h	50	50	60	20	40	20	50	30	20	20	20	50
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	58	58	70	23	47	23	58	35	23	23	23	58

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	80	0	0	136	0	0	372	343	110	362	367	79
Stage 1	-	-	-	-	-	-	217	217	-	115	115	-
Stage 2	-	-	-	-	-	-	155	126	-	247	252	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1512	-	-	1442	-	-	583	578	941	592	560	979
Stage 1	-	-	-	-	-	-	783	721	-	887	798	-
Stage 2	-	-	-	-	-	-	845	790	-	755	697	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1498	-	-	1431	-	-	497	535	926	515	518	960
Mov Cap-2 Maneuver	-	-	-	-	-	-	497	535	-	515	518	-
Stage 1	-	-	-	-	-	-	745	685	-	842	776	-
Stage 2	-	-	-	-	-	-	750	769	-	663	662	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.3	1.9	13.1	11.1
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	561	1498	-	-	1431	-	-	695
HCM Lane V/C Ratio	0.207	0.039	-	-	0.016	-	-	0.151
HCM Control Delay (s)	13.1	7.5	0	-	7.6	0	-	11.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.8	0.1	-	-	0.1	-	-	0.5

HCM 6th Signalized Intersection Summary
3: Farrington Hwy & Kaukama Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	180	60	1620	320	80	1060	
Future Volume (veh/h)	180	60	1620	320	80	1060	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	191	0	1723	0	85	1128	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	249		2652		261	2943	
Arrive On Green	0.07	0.00	0.76	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	191	0	1723	0	85	1128	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	7.7	0.0	32.6	0.0	1.3	0.0	
Cycle Q Clear(g_c), s	7.7	0.0	32.6	0.0	1.3	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	249		2652		261	2943	
V/C Ratio(X)	0.77		0.65		0.33	0.38	
Avail Cap(c_a), veh/h	588		2652		377	2943	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.91	0.91	
Uniform Delay (d), s/veh	63.7	0.0	7.7	0.0	8.3	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.2	0.0	0.7	0.3	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	3.5	0.0	10.8	0.0	0.8	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.6	0.0	9.0	0.0	8.9	0.3	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	191	A	1723	A		1213	
Approach Delay, s/veh	68.6		9.0			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.8	113.0				123.8	16.2
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.3	34.6				2.0	9.7
Green Ext Time (p_c), s	0.1	21.9				11.1	0.5

Intersection Summary	
HCM 6th Ctrl Delay	9.5
HCM 6th LOS	A

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC
4: Kaukama Rd & Kulauku St

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	80	330	160	50	50	40
Future Vol, veh/h	80	330	160	50	50	40
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	98	402	195	61	61	49

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	287	0	-	0	883	288
Stage 1	-	-	-	-	257	-
Stage 2	-	-	-	-	626	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1269	-	-	-	315	749
Stage 1	-	-	-	-	784	-
Stage 2	-	-	-	-	531	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1232	-	-	-	266	705
Mov Cap-2 Maneuver	-	-	-	-	266	-
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	515	-

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	17.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1232	-	-	-	266	705
HCM Lane V/C Ratio	0.079	-	-	-	0.229	0.069
HCM Control Delay (s)	8.2	0	-	-	22.5	10.5
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.3	-	-	-	0.9	0.2

HCM 6th Signalized Intersection Summary
5: Farrington Hwy & Hookele St

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	90	10	40	10	1440	140	40	1030	10
Future Volume (veh/h)	10	10	10	90	10	40	10	1440	140	40	1030	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	96	11	32	11	1532	145	43	1096	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	120	14	40	387	2346	220	240	2634	26
Arrive On Green	0.02	0.02	0.00	0.10	0.10	0.10	0.01	0.72	0.72	0.03	0.74	0.74
Sat Flow, veh/h	905	905	0	1184	136	395	1767	3257	306	1767	3575	36
Grp Volume(v), veh/h	22	0	0	139	0	0	11	823	854	43	540	567
Grp Sat Flow(s),veh/h/ln	1810	0	0	1714	0	0	1767	1763	1800	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	34.3	35.4	0.9	16.3	16.3
Cycle Q Clear(g_c), s	1.7	0.0	0.0	11.1	0.0	0.0	0.2	34.3	35.4	0.9	16.3	16.3
Prop In Lane	0.50		0.00	0.69		0.23	1.00		0.17	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	174	0	0	387	1270	1296	240	1299	1362
V/C Ratio(X)	0.59	0.00	0.00	0.80	0.00	0.00	0.03	0.65	0.66	0.18	0.42	0.42
Avail Cap(c_a), veh/h	65	0	0	312	0	0	428	1270	1296	251	1299	1362
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.66	0.66	0.66	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.5	0.0	0.0	5.7	10.3	10.4	9.7	7.0	7.0
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.1	0.0	0.0	0.0	1.7	1.7	0.4	1.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.3	0.0	0.0	0.1	12.6	13.2	0.4	5.9	6.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	5.8	12.0	12.2	10.1	8.0	7.9
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			139			1688			1150	
Approach Delay, s/veh		82.1			69.5			12.0			8.0	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	8.6	105.3		7.4	6.2	107.6		18.7				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5				
Max Q Clear Time (g_c+I1), s	2.9	37.4		3.7	2.2	18.3		13.1				
Green Ext Time (p_c), s	0.0	19.5		0.0	0.0	9.3		0.6				

Intersection Summary		
HCM 6th Ctrl Delay		13.7
HCM 6th LOS		B

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Connection
1: Farrington Hwy & St John's Rd — AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	174	11	123	10	1130	175	84	1210	10
Future Volume (veh/h)	10	11	10	174	11	123	10	1130	175	84	1210	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.97		0.97	1.00		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	3	191	12	120	11	1242	181	92	1330	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	194	198	44	276	17	137	215	1579	229	232	1949	16
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.01	0.52	0.52	0.05	0.55	0.55
Sat Flow, veh/h	542	775	172	839	65	534	1767	3052	442	1767	3525	29
Grp Volume(v), veh/h	26	0	0	323	0	0	11	708	715	92	654	687
Grp Sat Flow(s),veh/h/ln	1488	0	0	1439	0	0	1767	1749	1745	1767	1735	1820
Q Serve(g_s), s	0.0	0.0	0.0	18.9	0.0	0.0	0.3	30.5	31.0	2.2	25.1	25.1
Cycle Q Clear(g_c), s	1.0	0.0	0.0	19.9	0.0	0.0	0.3	30.5	31.0	2.2	25.1	25.1
Prop In Lane	0.42		0.12	0.59		0.37	1.00		0.25	1.00		0.02
Lane Grp Cap(c), veh/h	436	0	0	430	0	0	215	905	903	232	959	1006
V/C Ratio(X)	0.06	0.00	0.00	0.75	0.00	0.00	0.05	0.78	0.79	0.40	0.68	0.68
Avail Cap(c_a), veh/h	457	0	0	450	0	0	392	1754	1751	346	1740	1825
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	26.0	0.0	0.0	33.0	0.0	0.0	12.9	18.2	18.3	16.1	14.9	14.9
Incr Delay (d2), s/veh	0.1	0.0	0.0	6.7	0.0	0.0	0.1	1.5	1.6	1.1	0.9	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	7.7	0.0	0.0	0.1	11.5	11.7	0.8	9.1	9.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.1	0.0	0.0	39.7	0.0	0.0	13.0	19.7	19.9	17.2	15.7	15.7
LnGrp LOS	C	A	A	D	A	A	B	B	B	B	B	B
Approach Vol, veh/h		26			323			1434			1433	
Approach Delay, s/veh		26.1			39.7			19.7			15.8	
Approach LOS		C			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.0	54.0		29.7	5.7	57.3		29.7
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.2	33.0		3.0	2.3	27.1		21.9
Green Ext Time (p_c), s	0.1	14.9		0.1	0.0	13.1		0.6

Intersection Summary		
HCM 6th Ctrl Delay		20.0
HCM 6th LOS		C

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Connection
2: Kulaaupuni St & St John's Rd — AM Peak Hour

Intersection	
Int Delay, s/veh	17.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Future Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Conflicting Peds, #/hr	7	0	9	9	0	7	16	0	18	18	0	16
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	81	36	140	23	91	107	48	23	42	105

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	170	0	0	183	0	0	736	665	161	740	694	175
Stage 1	-	-	-	-	-	-	423	423	-	231	231	-
Stage 2	-	-	-	-	-	-	313	242	-	509	463	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1401	-	-	1386	-	-	333	379	881	331	365	866
Stage 1	-	-	-	-	-	-	607	586	-	770	711	-
Stage 2	-	-	-	-	-	-	696	704	-	545	562	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1392	-	-	1374	-	-	229	322	858	204	310	847
Mov Cap-2 Maneuver	-	-	-	-	-	-	229	322	-	204	310	-
Stage 1	-	-	-	-	-	-	534	516	-	679	685	-
Stage 2	-	-	-	-	-	-	548	679	-	356	495	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.5	1.4	48	17.5
HCM LOS			E	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	313	1392	-	-	1374	-	-	456
HCM Lane V/C Ratio	0.784	0.1	-	-	0.026	-	-	0.372
HCM Control Delay (s)	48	7.9	0	-	7.7	0	-	17.5
HCM Lane LOS	E	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	6.3	0.3	-	-	0.1	-	-	1.7

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Connection
3: Farrington Hwy & Kaukama Rd — AM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	339	100	1022	96	60	1446	
Future Volume (veh/h)	339	100	1022	96	60	1446	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	361	0	1087	0	64	1538	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	423		2482		411	2766	
Arrive On Green	0.12	0.00	0.72	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	361	0	1087	0	64	1538	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	14.4	0.0	18.2	0.0	1.3	0.0	
Cycle Q Clear(g_c), s	14.4	0.0	18.2	0.0	1.3	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	423		2482		411	2766	
V/C Ratio(X)	0.85		0.44		0.16	0.56	
Avail Cap(c_a), veh/h	588		2482		530	2766	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.80	0.80	
Uniform Delay (d), s/veh	60.1	0.0	8.3	0.0	5.6	0.0	
Incr Delay (d2), s/veh	8.7	0.0	0.6	0.0	0.1	0.6	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	6.9	0.0	6.5	0.0	0.4	0.2	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	68.8	0.0	8.8	0.0	5.7	0.6	
LnGrp LOS	E		A		A	A	
Approach Vol, veh/h	361	A	1087	A		1602	
Approach Delay, s/veh	68.8		8.8			0.9	
Approach LOS	E		A			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.6	106.2				116.7	23.3
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.3	20.2				2.0	16.4
Green Ext Time (p_c), s	0.1	10.3				20.1	0.8

Intersection Summary	
HCM 6th Ctrl Delay	11.7
HCM 6th LOS	B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Connection
4: Kaukama Rd & Kulauku St — AM Peak Hour

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	66	100	270	71	53	119
Future Vol, veh/h	66	100	270	71	53	119
Conflicting Peds, #/hr	13	0	0	15	15	13
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	80	122	329	87	65	145

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	431	0	-	0	685	401
Stage 1	-	-	-	-	388	-
Stage 2	-	-	-	-	297	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1123	-	-	-	412	647
Stage 1	-	-	-	-	683	-
Stage 2	-	-	-	-	752	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1107	-	-	-	369	630
Mov Cap-2 Maneuver	-	-	-	-	369	-
Stage 1	-	-	-	-	621	-
Stage 2	-	-	-	-	741	-

Approach	EB	WB	SB
HCM Control Delay, s	3.4	0	13.8
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1107	-	-	-	369	630
HCM Lane V/C Ratio	0.073	-	-	-	0.175	0.23
HCM Control Delay (s)	8.5	0	-	-	16.8	12.4
HCM Lane LOS	A	A	-	-	C	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.6	0.9

HCM 6th Signalized Intersection Summary Baseline Plus Project with Kulaaupuni Connection
5: Farrington Hwy & Hookele St AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	162	10	40	10	795	37	10	1274	10
Future Volume (veh/h)	10	10	10	162	10	40	10	795	37	10	1274	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	172	11	36	11	846	37	11	1355	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	200	13	42	272	2379	104	442	2478	20
Arrive On Green	0.02	0.02	0.00	0.15	0.15	0.15	0.01	0.69	0.69	0.01	0.69	0.69
Sat Flow, veh/h	905	905	0	1359	87	285	1767	3440	150	1767	3583	29
Grp Volume(v), veh/h	22	0	0	219	0	0	11	433	450	11	666	700
Grp Sat Flow(s),veh/h/ln	1810	0	0	1731	0	0	1767	1763	1828	1767	1763	1849
Q Serve(g_s), s	1.7	0.0	0.0	17.3	0.0	0.0	0.3	14.1	14.1	0.3	26.3	26.3
Cycle Q Clear(g_c), s	1.7	0.0	0.0	17.3	0.0	0.0	0.3	14.1	14.1	0.3	26.3	26.3
Prop In Lane	0.50		0.00	0.79		0.16	1.00		0.08	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	254	0	0	272	1219	1264	442	1219	1279
V/C Ratio(X)	0.59	0.00	0.00	0.86	0.00	0.00	0.04	0.36	0.36	0.02	0.55	0.55
Avail Cap(c_a), veh/h	65	0	0	488	0	0	313	1219	1264	483	1219	1279
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.89	0.89	0.89	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	58.3	0.0	0.0	8.7	8.8	8.8	6.9	10.7	10.7
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.4	0.0	0.0	0.1	0.7	0.7	0.0	1.8	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	8.2	0.0	0.0	0.1	5.3	5.5	0.1	10.1	10.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	66.7	0.0	0.0	8.8	9.6	9.5	6.9	12.5	12.4
LnGrp LOS	F	A	A	E	A	A	A	A	A	A	B	B
Approach Vol, veh/h		22			219			894			1377	
Approach Delay, s/veh		82.1			66.7			9.5			12.4	
Approach LOS		F			E			A			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	6.2	101.3		7.4	6.2	101.3		25.1
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	72.5		5.0	5.0	72.5		39.5
Max Q Clear Time (g_c+I1), s	2.3	16.1		3.7	2.3	28.3		19.3
Green Ext Time (p_c), s	0.0	6.5		0.0	0.0	12.7		1.3

Intersection Summary			
HCM 6th Ctrl Delay			16.7
HCM 6th LOS			B

HCM 6th Signalized Intersection Summary
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	11	10	59	11	98	10	1580	95	106	1120	10
Future Volume (veh/h)	10	11	10	59	11	98	10	1580	95	106	1120	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.96		0.95	0.95		0.93	1.00		0.97	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1856	1678	1856	1841	1856	1856	1826	1693
Adj Flow Rate, veh/h	11	12	2	65	12	72	11	1736	101	116	1231	11
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	5	3	15	3	4	3	3	5	14
Cap, veh/h	151	152	22	146	38	129	296	2100	121	194	2312	21
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.01	0.63	0.63	0.04	0.66	0.66
Sat Flow, veh/h	569	825	121	543	206	700	1767	3354	193	1767	3522	31
Grp Volume(v), veh/h	25	0	0	149	0	0	11	897	940	116	606	636
Grp Sat Flow(s),veh/h/ln	1515	0	0	1449	0	0	1767	1749	1798	1767	1735	1819
Q Serve(g_s), s	0.0	0.0	0.0	7.7	0.0	0.0	0.3	44.4	46.1	2.6	20.8	20.8
Cycle Q Clear(g_c), s	1.3	0.0	0.0	10.3	0.0	0.0	0.3	44.4	46.1	2.6	20.8	20.8
Prop In Lane	0.44		0.08	0.44		0.48	1.00		0.11	1.00		0.02
Lane Grp Cap(c), veh/h	325	0	0	313	0	0	296	1095	1126	194	1139	1194
V/C Ratio(X)	0.08	0.00	0.00	0.48	0.00	0.00	0.04	0.82	0.83	0.60	0.53	0.53
Avail Cap(c_a), veh/h	382	0	0	366	0	0	438	1442	1483	283	1431	1501
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	38.0	0.0	0.0	41.6	0.0	0.0	8.8	16.2	16.5	23.2	10.2	10.2
Incr Delay (d2), s/veh	0.1	0.0	0.0	1.1	0.0	0.0	0.1	2.9	3.3	2.9	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	3.9	0.0	0.0	0.1	16.7	18.0	2.1	7.3	7.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	38.1	0.0	0.0	42.7	0.0	0.0	8.8	19.1	19.8	26.1	10.6	10.6
LnGrp LOS	D	A	A	D	A	A	A	B	B	C	B	B
Approach Vol, veh/h		25			149			1848			1358	
Approach Delay, s/veh		38.1			42.7			19.4			11.9	
Approach LOS		D			D			B			B	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	9.4	76.6		26.8	6.0	80.0		26.8
Change Period (Y+Rc), s	4.5	6.0		6.0	4.5	6.0		6.0
Max Green Setting (Gmax), s	10.5	93.0		25.0	10.5	93.0		25.0
Max Q Clear Time (g_c+I1), s	4.6	48.1		3.3	2.3	22.8		12.3
Green Ext Time (p_c), s	0.1	22.5		0.1	0.0	11.4		0.7

Intersection Summary		
HCM 6th Ctrl Delay		17.6
HCM 6th LOS		B

HCM 6th TWSC
2: Kulaaupuni St & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Intersection	
Int Delay, s/veh	7.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	50	92	21	40	20	68	44	21	20	41	50
Future Vol, veh/h	50	50	92	21	40	20	68	44	21	20	41	50
Conflicting Peds, #/hr	10	0	8	8	0	9	8	0	7	9	0	10
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	86	86	86	86	86	86	86	86	86	86	86	86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	58	58	107	24	47	23	79	51	24	23	48	58

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	80	0	0	173	0	0	406	364	129	391	406	79
Stage 1	-	-	-	-	-	-	236	236	-	117	117	-
Stage 2	-	-	-	-	-	-	170	128	-	274	289	-
Critical Hdwy	4.13	-	-	4.13	-	-	7.13	6.53	6.23	7.13	6.53	6.23
Critical Hdwy Stg 1	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.13	5.53	-	6.13	5.53	-
Follow-up Hdwy	2.227	-	-	2.227	-	-	3.527	4.027	3.327	3.527	4.027	3.327
Pot Cap-1 Maneuver	1512	-	-	1398	-	-	554	562	918	566	533	979
Stage 1	-	-	-	-	-	-	765	708	-	885	797	-
Stage 2	-	-	-	-	-	-	830	788	-	730	671	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1498	-	-	1387	-	-	452	519	903	477	492	960
Mov Cap-2 Maneuver	-	-	-	-	-	-	452	519	-	477	492	-
Stage 1	-	-	-	-	-	-	727	672	-	839	775	-
Stage 2	-	-	-	-	-	-	712	766	-	623	637	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2	2	15	12.2
HCM LOS			C	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	515	1498	-	-	1387	-	-	626
HCM Lane V/C Ratio	0.3	0.039	-	-	0.018	-	-	0.206
HCM Control Delay (s)	15	7.5	0	-	7.6	0	-	12.2
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	1.3	0.1	-	-	0.1	-	-	0.8

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Extension
3: Farrington Hwy & Kaukama Rd — PM Peak Hour

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Traffic Volume (veh/h)	211	60	1660	372	80	1083	
Future Volume (veh/h)	211	60	1660	372	80	1083	
Initial Q (Qb), veh	0	0	0	0	0	0	
Ped-Bike Adj(A_pbT)	1.00	1.00		1.00	1.00		
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	No		No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1826	1841	1856	1841	
Adj Flow Rate, veh/h	224	0	1766	0	85	1152	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	
Percent Heavy Veh, %	3	3	5	4	3	4	
Cap, veh/h	284		2617		246	2908	
Arrive On Green	0.08	0.00	0.75	0.00	0.07	1.00	
Sat Flow, veh/h	3428	1572	3561	1560	1767	3589	
Grp Volume(v), veh/h	224	0	1766	0	85	1152	
Grp Sat Flow(s),veh/h/ln	1714	1572	1735	1560	1767	1749	
Q Serve(g_s), s	9.0	0.0	35.7	0.0	1.4	0.0	
Cycle Q Clear(g_c), s	9.0	0.0	35.7	0.0	1.4	0.0	
Prop In Lane	1.00	1.00		1.00	1.00		
Lane Grp Cap(c), veh/h	284		2617		246	2908	
V/C Ratio(X)	0.79		0.67		0.35	0.40	
Avail Cap(c_a), veh/h	588		2617		362	2908	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	2.00	2.00	
Upstream Filter(I)	1.00	0.00	1.00	0.00	0.90	0.90	
Uniform Delay (d), s/veh	63.0	0.0	8.6	0.0	9.8	0.0	
Incr Delay (d2), s/veh	4.9	0.0	1.4	0.0	0.7	0.4	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	4.2	0.0	12.1	0.0	0.9	0.1	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	67.9	0.0	10.0	0.0	10.5	0.4	
LnGrp LOS	E		B		B	A	
Approach Vol, veh/h	224	A	1766	A		1237	
Approach Delay, s/veh	67.9		10.0			1.1	
Approach LOS	E		B			A	

Timer - Assigned Phs	1	2				6	8
Phs Duration (G+Y+Rc), s	10.8	111.6				122.4	17.6
Change Period (Y+Rc), s	6.0	6.0				6.0	6.0
Max Green Setting (Gmax), s	14.0	84.0				104.0	24.0
Max Q Clear Time (g_c+I1), s	3.4	37.7				2.0	11.0
Green Ext Time (p_c), s	0.1	22.2				11.5	0.6

Intersection Summary			
HCM 6th Ctrl Delay			10.6
HCM 6th LOS			B

Notes

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th TWSC — Baseline Plus Project with Kulaaupuni Extension
4: Kaukama Rd & Kulauku St — PM Peak Hour

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	132	330	160	53	52	71
Future Vol, veh/h	132	330	160	53	52	71
Conflicting Peds, #/hr	31	0	0	28	28	31
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	50
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	82	82	82	82	82	82
Heavy Vehicles, %	3	3	3	3	3	3
Mvmt Flow	161	402	195	65	63	87

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	291	0	-	0	1011	290
Stage 1	-	-	-	-	259	-
Stage 2	-	-	-	-	752	-
Critical Hdwy	4.13	-	-	-	6.43	6.23
Critical Hdwy Stg 1	-	-	-	-	5.43	-
Critical Hdwy Stg 2	-	-	-	-	5.43	-
Follow-up Hdwy	2.227	-	-	-	3.527	3.327
Pot Cap-1 Maneuver	1265	-	-	-	264	747
Stage 1	-	-	-	-	782	-
Stage 2	-	-	-	-	464	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1228	-	-	-	206	704
Mov Cap-2 Maneuver	-	-	-	-	206	-
Stage 1	-	-	-	-	630	-
Stage 2	-	-	-	-	450	-

Approach	EB	WB	SB
HCM Control Delay, s	2.4	0	19
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1228	-	-	-	206	704
HCM Lane V/C Ratio	0.131	-	-	-	0.308	0.123
HCM Control Delay (s)	8.4	0	-	-	30.1	10.8
HCM Lane LOS	A	A	-	-	D	B
HCM 95th %tile Q(veh)	0.5	-	-	-	1.2	0.4

HCM 6th Signalized Intersection Summary — Baseline Plus Project with Kulaaupuni Extension

5: Farrington Hwy & Hookele St — PM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	10	10	104	10	40	10	1455	165	40	1039	10
Future Volume (veh/h)	10	10	10	104	10	40	10	1455	165	40	1039	10
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856	1856
Adj Flow Rate, veh/h	11	11	0	111	11	33	11	1548	171	43	1105	11
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	3	3	3	3	3	3	3	3	3
Cap, veh/h	19	19	0	135	13	40	377	2282	249	225	2605	26
Arrive On Green	0.02	0.02	0.00	0.11	0.11	0.11	0.01	0.71	0.71	0.03	0.73	0.73
Sat Flow, veh/h	905	905	0	1231	122	366	1767	3204	350	1767	3575	36
Grp Volume(v), veh/h	22	0	0	155	0	0	11	844	875	43	545	571
Grp Sat Flow(s),veh/h/ln	1810	0	0	1719	0	0	1767	1763	1792	1767	1763	1848
Q Serve(g_s), s	1.7	0.0	0.0	12.4	0.0	0.0	0.2	37.0	38.5	0.9	17.0	17.0
Cycle Q Clear(g_c), s	1.7	0.0	0.0	12.4	0.0	0.0	0.2	37.0	38.5	0.9	17.0	17.0
Prop In Lane	0.50		0.00	0.72		0.21	1.00		0.20	1.00		0.02
Lane Grp Cap(c), veh/h	37	0	0	189	0	0	377	1255	1276	225	1284	1347
V/C Ratio(X)	0.59	0.00	0.00	0.82	0.00	0.00	0.03	0.67	0.69	0.19	0.42	0.42
Avail Cap(c_a), veh/h	65	0	0	313	0	0	419	1255	1276	237	1284	1347
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.63	0.63	0.63	1.00	1.00	1.00
Uniform Delay (d), s/veh	68.0	0.0	0.0	61.0	0.0	0.0	6.1	11.1	11.3	11.1	7.5	7.5
Incr Delay (d2), s/veh	14.1	0.0	0.0	8.6	0.0	0.0	0.0	1.8	1.9	0.4	1.0	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.0	5.9	0.0	0.0	0.1	13.8	14.5	0.4	6.2	6.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	82.1	0.0	0.0	69.5	0.0	0.0	6.2	13.0	13.3	11.5	8.5	8.4
LnGrp LOS	F	A	A	E	A	A	A	B	B	B	A	A
Approach Vol, veh/h		22			155			1730			1159	
Approach Delay, s/veh		82.1			69.5			13.1			8.6	
Approach LOS		F			E			B			A	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	8.6	104.2		7.4	6.2	106.5		19.9
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5
Max Green Setting (Gmax), s	5.0	86.5		5.0	5.0	86.5		25.5
Max Q Clear Time (g_c+I1), s	2.9	40.5		3.7	2.2	19.0		14.4
Green Ext Time (p_c), s	0.0	20.1		0.0	0.0	9.4		0.6

Intersection Summary			
HCM 6th Ctrl Delay			14.7
HCM 6th LOS			B

HCM 6th AWSC — Baseline Plus Project with Kulaaupuni Connection Mitigated
2: Kulaaupuni St & St John's Rd — AM Peak Hour

Intersection	
Intersection Delay, s/veh	12
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Future Vol, veh/h	120	80	70	31	120	20	78	92	41	20	36	90
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	140	93	81	36	140	23	91	107	48	23	42	105
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13.2	11.2	12.2	10.4
HCM LOS	B	B	B	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	37%	44%	18%	14%
Vol Thru, %	44%	30%	70%	25%
Vol Right, %	19%	26%	12%	62%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	211	270	171	146
LT Vol	78	120	31	20
Through Vol	92	80	120	36
RT Vol	41	70	20	90
Lane Flow Rate	245	314	199	170
Geometry Grp	1	1	1	1
Degree of Util (X)	0.383	0.47	0.31	0.258
Departure Headway (Hd)	5.62	5.395	5.616	5.474
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	638	666	638	654
Service Time	3.675	3.446	3.673	3.534
HCM Lane V/C Ratio	0.384	0.471	0.312	0.26
HCM Control Delay	12.2	13.2	11.2	10.4
HCM Lane LOS	B	B	B	B
HCM 95th-tile Q	1.8	2.5	1.3	1

Queues — Existing (2020) Conditions
1: Farrington Hwy & St John's Rd — AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	3	284	7	1396	53	1254
v/c Ratio	0.01	0.78	0.03	0.81	0.26	0.63
Control Delay	0.0	50.9	6.3	23.2	9.3	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.0	50.9	6.3	23.2	9.3	14.6
Queue Length 50th (ft)	0	158	1	357	11	223
Queue Length 95th (ft)	0	#376	6	450	24	368
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	557	364	343	3154	277	3208
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.78	0.02	0.44	0.19	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Existing (2020) Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	6	148	4	1696	66	1132
v/c Ratio	0.03	0.62	0.01	0.76	0.31	0.46
Control Delay	0.2	40.5	4.2	16.0	7.4	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	0.2	40.5	4.2	16.0	7.4	7.3
Queue Length 50th (ft)	0	51	1	356	8	114
Queue Length 95th (ft)	0	152	4	615	26	303
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	397	426	366	3121	291	3133
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.35	0.01	0.54	0.23	0.36

Intersection Summary

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	330	11	1528	66	1363
v/c Ratio	0.08	1.00	0.05	0.83	0.34	0.65
Control Delay	28.5	91.1	5.9	23.2	10.8	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.5	91.1	5.9	23.2	10.8	14.2
Queue Length 50th (ft)	12	~236	2	422	14	256
Queue Length 95th (ft)	45	#524	8	523	27	414
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	392	330	318	2952	254	3006
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	1.00	0.03	0.52	0.26	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	187	11	1890	77	1264
v/c Ratio	0.12	0.80	0.04	0.84	0.46	0.52
Control Delay	37.5	70.7	4.9	22.1	23.3	10.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.5	70.7	4.9	22.1	23.3	10.4
Queue Length 50th (ft)	16	138	2	632	16	218
Queue Length 95th (ft)	50	#273	7	822	65	359
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	334	292	375	2630	212	2686
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.64	0.03	0.72	0.36	0.47

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	445	11	1561	70	1363
v/c Ratio	0.09	1.39	0.05	0.83	0.37	0.64
Control Delay	30.0	228.7	5.8	23.2	12.3	13.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.0	228.7	5.8	23.2	12.3	13.8
Queue Length 50th (ft)	13	~423	2	440	15	256
Queue Length 95th (ft)	47	#775	8	543	33	412
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	393	319	319	2884	248	2946
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	1.39	0.03	0.54	0.28	0.46

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project Conditions
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	261	11	1998	95	1264
v/c Ratio	0.12	1.05	0.04	0.92	0.60	0.53
Control Delay	38.5	122.4	4.9	30.2	38.8	11.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	122.4	4.9	30.2	38.8	11.1
Queue Length 50th (ft)	18	~262	2	771	34	226
Queue Length 95th (ft)	52	#453	7	947	97	359
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	291	248	357	2312	185	2466
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	1.05	0.03	0.86	0.51	0.51

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Connection
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	308	11	1429	88	1341
v/c Ratio	0.08	0.88	0.05	0.80	0.41	0.65
Control Delay	26.0	63.5	6.3	23.1	13.1	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.0	63.5	6.3	23.1	13.1	14.7
Queue Length 50th (ft)	11	181	2	379	19	249
Queue Length 95th (ft)	42	#434	8	478	40	407
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	407	349	322	3108	269	3144
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.88	0.03	0.46	0.33	0.43

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline (2028) with Kulaaupuni Extension
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	165	11	1824	99	1242
v/c Ratio	0.15	0.72	0.03	0.84	0.52	0.51
Control Delay	37.3	54.9	4.5	21.0	25.4	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.3	54.9	4.5	21.0	25.4	9.2
Queue Length 50th (ft)	14	84	2	487	16	162
Queue Length 95th (ft)	50	190	7	760	85	350
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	358	342	412	2836	237	2853
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.48	0.03	0.64	0.42	0.44

Intersection Summary

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaaupuni Connection
AM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	338	11	1434	92	1341
v/c Ratio	0.09	1.00	0.05	0.82	0.43	0.64
Control Delay	26.5	88.2	6.3	24.7	14.4	14.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.5	88.2	6.3	24.7	14.4	14.3
Queue Length 50th (ft)	11	~208	2	382	20	249
Queue Length 95th (ft)	43	#491	8	481	46	406
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	391	337	327	3099	264	3134
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	1.00	0.03	0.46	0.35	0.43

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Queues
1: Farrington Hwy & St John's Rd

Baseline Plus Project with Kulaaupuni Extension
PM Peak Hour

Lane Group	EBT	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	185	11	1840	116	1242
v/c Ratio	0.14	0.77	0.03	0.85	0.62	0.51
Control Delay	38.0	61.8	4.8	22.8	38.1	9.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.0	61.8	4.8	22.8	38.1	9.7
Queue Length 50th (ft)	16	112	2	570	38	185
Queue Length 95th (ft)	52	#225	7	774	114	350
Internal Link Dist (ft)	118	1135		401		789
Turn Bay Length (ft)			75		75	
Base Capacity (vph)	341	324	398	2712	222	2748
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.57	0.03	0.68	0.52	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

APPENDIX H

HYDROLOGIC AND WATER QUALITY CALCULATIONS

Hydrologic and Water Quality Calculations

Hydrologic Data – Rational Method (Q = CIA)
(City *Storm Drainage Standards*, August 2017)

Runoff Coefficient, C (*Storm Drainage Standards*, Table 2)
C = 0.70 Residential Areas

Intensity of 1-hr Rainfall (NOAA Atlas 14)
i_{10} = 2.08 in/hr
i_{50} = 2.86 in/hr

Time of Concentration, Tc (*Storm Drainage Standards*, Plate 3)
Assume 100' @ 1% of Overland Flow with Average Grass Surface
Tc = 15 minutes

Correction Factor, C.F. (*Storm Drainage Standards*, Plate 4)
C.F. = 2.0

Rainfall Intensity
I_{10} = C.F. x i_{10} = 2.0 x 2.08 in/hr = 4.16 in/hr
I_{50} = C.F. x i_{50} = 2.0 x 2.86 in/hr = 5.72 in/hr

Design Flow per Acre
Q_{10}/A= C x I_{10} = 0.70 x 4.16 in/hr = 2.91 cfs/Ac
Q_{50}/A= C x I_{50} = 0.70 x 5.72 in/hr = 4.00 cfs/Ac

Water Quality Volume Calculation

Onsite:

Water Quality Volume (WQV) – Treatment Control BMPs
(City Rules Relating to Water Quality, December 24, 2018)

WQV = PCA x 3630

Volumetric Runoff Coefficient, C
C = 0.05 + 0.009I

Design Storm Runoff Depth, P
P = 1 in (for LID retention BMPs)

Drainage Management Area, A
A = 44 acres

Percent of Impervious Cover, I (expressed as a percentage)
I = 70% (Assumed for Residential)

C = 0.05 + 0.009I = 0.05 + 0.009 x 70 = 0.68

WQV = PCA x 3630 = 1 x 0.68 x 44 x 3630 = 108,610 ft^3

Water Quality Flow Calculation

Onsite (to drain intake):

Water Quality Flow Rate (WQF) – Treatment Control BMPs
(City Rules Relating to Water Quality, December 24, 2018)

WQF = 1.5 x CiA

Flow Rate Runoff Coefficient, C
C = 0.70 (WQ Rules, pg. 53, Asphalt)

Peak Rainfall Intensity, i
i = 0.4 in/hr

Drainage Management Area, A
A = 1.60 Ac

WQF = 1.5 x 0.70 x 0.4 x 1.60 = 0.67 cfs

APPENDIX I

BOARD OF WATER SUPPLY EARLY CONSULTATION RESPONSE LETTER

BOARD OF WATER SUPPLY

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

RICK BLANGIARDI, MAYOR

BRYAN P. ANDAYA, Chair
KAPUA SPROAT, Vice Chair
RAY C. SOON
MAX J. SWORD
NA'ALEHU ANTHONY

JADE T. BUTAY, Ex-Officio
ROGER BABCOCK, Jr., Ex-Officio

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

ELLEN E. KITAMURA, P.E.
Deputy Manager and Chief Engineer

October 6, 2021

Ms. Sheryl E. Nojima
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Ms. Nojima:

Subject: Your Letter Dated September 16, 2021 Requesting Comments on the Environmental Assessment Pre-Consultation for a Residential Development at the Former Voice of America Site off Kulaaupuni Street – Tax Map Key: 8-7-010: 030 & 031

Thank you for the opportunity to comment on the proposed 280-unit single-family and multi-family State of Hawaii Department of Hawaiian Home Lands project.

The existing water system is adequate to accommodate the proposed homestead development. However, please be advised that this information is based upon current data, and therefore, the Board of Water Supply (BWS) reserves the right to change any position or information stated herein up until the final approval of the building permit application. The final decision on the availability of water will be confirmed when the building permit application is submitted for approval.

When water is made available, the applicant will be required to pay our Water System Facilities Charges (WSFC) for resource development, transmission, and daily storage.

Water conservation measures are required for all proposed developments. These measures include utilization of nonpotable water for irrigation using rain catchment, drought tolerant plants, xeriscape landscaping, efficient irrigation systems, such as a drip system and moisture sensors, and the use of Water Sense labeled ultra-low flow water fixtures and toilets.

The construction drawings should be submitted for our review and the construction schedule should be coordinated to minimize impact to the water system.

The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

Ms. Sheryl E. Nojima
October 6, 2021
Page 2

For your information, the BWS is currently in the construction phase of the Lualualei Line Booster upgrade project and are expecting to be completed in the upcoming months. We suggest you check back with us at the beginning of 2022 to confirm the project's status.

In addition, the Farrington Highway Water System Improvements, Hookele Street Vicinity Project is currently in the design phase. This project will affect BWS waterlines on Farrington Highway, Hookele Street, Hookele Place, Laulele Street, Heleuma Street, Maipalaoa Road, Meaulu Road, Manununu Street, Manuu Street, Mamoalii way, Mamoalii Place, Manuulaula Street, Kulaaupuni Street, and St. John's Road. For more information, you may contact the Design and Plans Review Branch of our Capital Projects Division at (808) 748-5710.

BWS may waive the WSFC and new meter costs for qualified on-site affordable and homeless dwelling units, up to 500 dwelling units per year. The waivers will be granted when the building permit is submitted for approval. To qualify, the dwelling units must be certified as either affordable or homeless dwelling units by the appropriate agency of the City and County of Honolulu and the certification provided when the building permit application is submitted for review and approval. For non-qualifying units, the applicant will be required to pay our WSFC for resource development, transmission, and daily storage.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at (808) 748-5443.

Very truly yours,

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

APPENDIX J

WATER SYSTEM CALCULATIONS

Mā'ili Residential Development (Former Voice of America Site)

Water System Calculations

Domestic Consumption

Average Daily Demand (BWS *Water System Standards*, Table 100-18):
- Single Family = 500 gal/unit
- Multi-Family = 400 gal/unit

Number of Units:
- Single Family = 145 units
- Multi-Family = 136 units

Average Daily Demand:
- Single Family = 500 gal/unit x 145 units = 72,500 gal/day (gpd)
- Multi-Family = 400 gal/unit x 136 units = 54,400 gpd
- Total = 126,900 gpd

Maximum Daily Demand = 1.5 x Average Day (BWS *Water System Standards*, Table 100-20):
- Single Family = 1.5 x 72,500 gpd
  = 108,750 gpd
  = 75.5 gal/minute (gpm)
- Multi-Family = 1.5 x 54,400 gpd
  = 81,600 gpd
  = 56.7 gpm
- Total = 1.5 x 126,900 gpd
  = 190,350 gpd
  = 132.2 gpm

Peak Hour = 3.0 x Average Day (BWS *Water System Standards*, Table 100-20):
- Single Family = 3.0 x 72,500 gpd
  = 217,500 gpd
  = 151.0 gpm
- Multi-Family = 3.0 x 54,400 gpd
  = 163,200 gpd
  = 113.3 gpm
- Total = 3.0 x 126,900 gpd
  = 380,700 gpd
  = 264.4 gpm

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Fire Flow Requirements and Pipeline Sizing

(BWS *Water System Standards*, Table 100-19)

Single Family Fire Flow = 1,000 gpm
Multi-Family Fire Flow = 1,500 gpm

Pipeline Sizing (Fire Flow) = Maximum daily flow plus fire flow with a residual pressure of 20 psi at critical fire hydrant.

Single Family = 132 gpm + 1,000 gpm
= 1,132 gpm

Multi-Family = 132 gpm + 1,500 gpm
= 1,632 gpm

Duration = 1 hour

Single Family Fire Hydrant Spacing = 350 feet maximum
Multi-Family Fire Hydrant Spacing = 250 feet maximum

Pipeline Sizing (Peak Hour Flow) = Peak hour flow with a minimum residual pressure of 40 psi.
= 264 gpm

APPENDIX K

APPROVED SEWER CONNECTION APPLICATION

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET * HONOLULU, HAWAII 96813
Phone: (808) 768-8209 * Fax: (808) 768-4210

SEWER CONNECTION APPLICATION

APPLICATION NO.: **2021/SCA-1281** STATUS: **Approved with conditions**

DATE RECEIVED: **09/10/2021** IWDP APP. NO.:

PROJECT NAME: **2021/SCA-1281 Residential Development at the Former Voice of America Site - 450 New SFD**

$2,977,200.00
Estimated Wastewater System Facility Charge*

LOCATION:

Zone	Section	Plat	Parcel
8	7	010	030
8	7	010	031

SPECIFIC LOCATION: **In the Vicinity of 87-576 Kulaaupuni Street**

APPLICANT: **Toby Hanzawa/Gray Hong Nojima & Associates**
201 Merchant St., Ste 1900
Honolulu, HI 96813

DEVELOPMENT TYPE: **Dwelling, Single-family** SEWER CONNECTION WORK DESIRED: **New**

OTHER USES:

NON-RESIDENTIAL AREA: s.f. APPROXIMATE DATE OF CONNECTION:

PROPOSED UNITS	EXISTING UNITS	UNITS TO BE DEMOLISHED
No. of New Units: **450**	No. of Existing Units: **0**	No. of Units to be Demolished: **0**
Studios:	Studios:	Studios:
1-Bedroom:	1-Bedroom:	1-Bedroom:
2-Bedroom:	2-Bedroom:	2-Bedroom:
3-Bedroom: **450**	3-Bedroom:	3-Bedroom:
4-Bedroom:	4-Bedroom:	4-Bedroom:
5-Bedroom:	5-Bedroom:	5-Bedroom:
6-Bedroom:	6-Bedroom:	6-Bedroom:

REMARKS **The sewer connections are allowable on Holt Road and Kulawae Street. Submit construction plans for the new sewer lateral for review and approval. A private sewer easement may be required.**

APPROVAL DATE: **09/14/2021**

EXPIRATION DATE: **09/14/2023**

Valid 2-years after approval date. Construction plans shall be completed and approved within this 2-year period. Construction shall commence within 1-year after approval of plans.
** Applicable WSFC shall be collected at the prevailing rate in accordance with ROH 1990, Chapter 14, Sections 14-10.3, 14-10.4, 14-10.5 and Appendix 14-D.*

REVIEWED BY: ***Jing Meng***

Site Development Division, Wastewater Branch

ExternalID: **095212017-001** JobId: **95212017**

Initial Print Date: Tuesday September 14, 2021 12:19 Page 1 of 1

APPENDIX L

WASTEWATER SYSTEM CALCULATIONS

Mā'ili Residential Development (Former Voice of America Site)

Wastewater System Calculations

Average Daily Per Capita Wastewater Flow = 70 gallons per capita per day (gpcd)

Number of Units:
- Single Family = 145 units
- Multi-Family = 136 units

Density for Residential Occupancy:
- Single Family = 4.0 persons/unit
- Multi-Family = 2.8 persons/unit

Equivalent Population:
- Single Family = 4.0 persons/unit x 145 units
  = 580 persons
- Multi-Family = 2.8 persons/unit x 136 units
  = 380.8 persons
- Total = 960.8 persons

Base Sanitary Flow (BSF):
- Single Family = 70 gpcd x 580 persons
  = 40,600 gal/day (gpd)
- Multi-Family = 70 gpcd x 380.8 persons
  = 26,656 gpd
- Total = 67,256 gpd

Flow Factor = 2.5

Peak Base Sanitary Flow (PBSF):
- Single Family = 40,600 gpd x 2.5
  = 101,500 gpd
- Multi-Family = 26,656 gpd x 2.5
  = 66,640 gpd
- Total = 168,140 gpd

Groundwater Infiltration Rate = 35 gpcd

Groundwater Infiltration (GWI):
- Single Family = 35 gpcd x 580 persons
  = 20,300 gpd
- Multi-Family = 35 gpcd x 380.8 persons
  = 13,328 gpd
- Total = 33,628 gpd

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Average Dry Weather Flow (ADWF):

Single Family	= 40,600 gpd + 20,300 gpd = 60,900 gpd
Multi-Family	= 26,656 gpd + 13,328 gpd = 39,984 gpd
Total	= 100,884 gpd

Peak Dry Weather Flow (PDWF):

Single Family	= 101,500 gpd + 20,300 gpd = 121,800 gpd
Multi-Family	= 66,640 gpd + 13,328 gpd = 79,968 gpd
Total	= 201,768 gpd

Project Area = 44 acres

Wet Weather Infiltration/Inflow (I/I) Peak Hourly Rate = 3,000 gallons per acre per day (gpad)

Wet Weather Infiltration/Inflow (I/I) = 3,000 gpad x 44 acres
= 132,000 gpd

Design Flow (Q_{DES}) = 201,768 gpd + 132,000 gpd
= 333,768 gpd
= 0.33 millions of gallons per day (MGD)
= 0.52 cubic feet per second (cfs)

APPENDIX F

Early Consultation Public Comments

DAVID Y. IGE
GOVERNOR

KEITH T. HAYASHI
INTERIM SUPERINTENDENT

STATE OF HAWAI'I

DEPARTMENT OF EDUCATION

P.O. BOX 2360

HONOLULU, HAWAI'I 96804

OFFICE OF FACILITIES AND OPERATIONS

September 30, 2021

Gray, Hong, Nojima & Associates, Inc.
Attention: Toby Hanzawa, PE
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Re: Early Consultation Request for the Environmental Assessment for the proposed State of Hawaii Department of Hawaiian Home Lands Residential Development, Maili, Waianae, Oahu, Hawaii TMK: (1)8-7-010:030 and 031

Dear Mr. Hanzawa:

Thank you for your letter dated September 16, 2021. The Hawaii State Department of Education (Department) has the following early consultation comments in preparation of a Draft Environmental Assessment (DEA) for the proposed Hawaiian Home Lands Residential Development (Project). The State of Hawaii Department of Hawaiian Home Lands is proposing to build 280 units, consisting of single-family and multi-family residences located at Maili, Waianae, Island of Oahu, TMK (1)8-7-010:030 and 031.

Students living in this Project will be attending Maili Elementary, Waianae Intermediate, and Waianae High schools. Additional comments will be provided once the Department has had an opportunity to review the DEA.

Thank you for the opportunity to comment. Should you have questions please contact Robyn Loudermilk, School Land and Facilities Specialist of the Facilities Development Branch, Planning Section, at (808) 784-5093 or by email at robyn.loudermilk@k12.hi.us.

Sincerely,

Roy Ikeda
Interim Public Works Manager
Planning section

RI:ctt

c: Disa Hauge, Complex Area Superintendent, Nanakuli/Waianae Complex Area
Facilities Development Branch

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Keith T. Hayashi, Interim Superintendent
State of Hawai'i
Department of Education
P.O. Box 2360
Honolulu, Hawai'i 96804

Attn: Mr. Roy Ikeda, Interim Public Works Manager

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Hayashi:

Thank you for your correspondence dated September 30, 2021, regarding the subject project. We acknowledge that students residing in the proposed development are likely to attend Mā'ili Elementary, Wai'anae Intermediate, and Wai'anae High schools. We understand that additional comments will be provided once the Department reviews the draft environmental assessment.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

DAVID Y. IGE
GOVERNOR

CATHY BETTS
DIRECTOR

JOSEPH CAMPOS II
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF HUMAN SERVICES
BENEFIT, EMPLOYMENT AND SUPPORT SERVICES DIVISION
1010 Richards Street, Suite 512
Honolulu, Hawaii 96813

Re: 21-0687
BESSD 21.C1005

October 14, 2021

Gray, Hong, Nojima & Associates, Inc.
Toby Hanzawa, PE
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Mr. Hanzawa:

Subject: Early Consultation Process for Environmental Assessment Residential Development at the Former Voice of America (VOA) Site; TMK: (1) 8-7 010: 30 & 31: Maili, Waianae, Oahu, Hawaii

This is in response to your letter dated September 19, 2021 requesting the Department of Human Services (DHS) review and comment on the above-named project.

The DHS has reviewed the Residential Development at the Former VOA Site Project and the map of the area. A check on DHS' internal data system and Google Maps found several licensed Group Child Care Centers and Infant and Toddler Child Care Centers located within a one (1) mile radius of the area that may be affected during the first phase of this project.

Should you have any questions regarding this matter, please contact Ms. Lisa Galino, Child Care Program Specialist at (808) 586-5712.

Sincerely,

Scott Nakasone
Assistant Division Administrator

c: Cathy Betts, Director

AN EQUAL OPPORTUNITY AGENCY

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Ms. Cathy Betts, Director
State of Hawai'i
Department of Human Services
1010 Richards Street, Suite 512
Honolulu, Hawai'i 96813

Attn: Mr. Scott Nakasone, Assistant Division Administrator

Subject: Reference No. 21-0687 BESSD 21.C1005
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Ms. Betts:

Thank you for your correspondence dated October 14, 2021, regarding the subject project. We acknowledge your comment that several licensed Group Child Care Centers and Infant and Toddler Child Care Centers are located within a one (1) mile radius of the project site. We understand that these facilities may be affected during the first phase of the project.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

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

October 18, 2021

LD1065

Gray, Hong, Nojima & Associates
201 Merchant Street, Suite 1900
Honolulu, HI 96813

Via email: thanzawa@grayhongnojima.com

Attn: Toby Hanzawa, PE

Dear Sirs:

SUBJECT: **Early Consultation Process for Environmental Assessment**
Residential Development at the Former Voice of America Site
Mā`ili, Wai`anae, Island of O`ahu, Hawaii
TMK: (1) 8-7-010:030 & 031

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

At this time, the DLNR has no comments to offer on the subject project. If you have any questions, please feel free to contact Barbara Lee at 587-0453 or barbara.j.lee@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

cc: Central Files

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Russell Y. Tsuji, Land Administrator
State of Hawai'i
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawai'i 96809

Attn: Ms. Barbara Lee

Subject: Reference No. LD1065
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Tsuji:

Thank you for your correspondence dated October 18, 2021, regarding the subject project. We acknowledge that the Department of Land and Natural Resources has no comments at this time.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

DAVID Y. IGE
GOVERNOR

JADE T. BUTAY
DIRECTOR

Deputy Directors
DEREK J. CHOW
ROSS M. HIGASHI
EDWIN H. SNIFFEN

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

IN REPLY REFER TO:
DIR 0913
HWY-PS 2.6829

October 21, 2021

VIA EMAIL: thanzawa@grayhongrojima.com

Mr. Toby Hanzawa
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Mr. Hanzawa:

Subject: Request for Comments for Early Consultation for Environmental Assessment
Residential Development at the former Voice of America
Maili, Waianae, Oahu
Tax Map Key Nos.: (1) 8-7-010: 031 and 031

Thank you for your letter dated September 16, 2021, requesting for our comments for an upcoming Draft Environmental Assessment (DEA) pursuant to Chapter 343 of the Hawaii Revised Statutes for the use of State/County lands and funds. The Department of Hawaiian Home Lands proposes a homestead community development, which comprises of 280 single-family and multi-family units. The vacant site at the former Voice of America will be developed through two phases. The proposed work will involve an initial phase related to the development of backbone infrastructure such as roads and utility, and the second phase will be related to design and construction.

As an early consultation, there is no detailed site plan included; however, the proposed site appears to be off State Farrington Highway (Route 93) via Saint John's Road and Kulaaupuni Street, both are County roadways.

The Hawaii Department of Transportation (HDOT) has the following comments:

1. A Transportation Assessment or a Traffic Impact Analysis Report should be prepared by a traffic engineer licensed in the State of Hawaii and should be included in the DEA.

   a. The traffic study should evaluate any local impacts to the State highways such as Farrington Highway, as well as any mitigation measures that may be required.

2. The DEA and the traffic study should include a discussion on any planned bicyclist/pedestrian paths leading into the project site. The HDOT requires that appropriate measures should be taken to mitigate safety and connectivity with the immediate surrounding communities.

If you have any questions, please contact Jeyan Thirugnanam, Systems Planning Engineer, Highways Division, Planning Branch at (808) 587-6336 or by email at jeyan.thirugnanam@hawaii.gov. Please reference file review number PS 2021-165.

Sincerely,

JADE T. BUTAY
Director of Transportation

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www.grayhongnojima.com

November 8, 2021

Mr. Jade T. Butay, Director of Transportation
State of Hawai'i
Department of Transportation
869 Punchbowl Street
Honolulu, Hawai'i 96813

Subject: Reference No. DIR 0913 HWY-PS 2.6829
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Butay:

Thank you for your correspondence dated October 21, 2021, regarding the subject project. We acknowledge your comments relating to the preparation of the Draft Environmental Assessment (DEA) for the proposed project. The following are offered in response to the comments provided:

1. A Mobility Analysis Report (MAR) by Fehr & Peers is being prepared for the project and will be included in the DEA. The MAR will evaluate localized impacts to Farrington Highway and mitigation measures that may be required.

2. The MAR will also include a discussion on bicyclist/pedestrian paths leading to the project site to provide community connectivity.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH
TH::l

3122-00

STATE OF HAWAII
OFFICE OF PLANNING
& SUSTAINABLE DEVELOPMENT

DAVID Y. IGE
GOVERNOR

MARY ALICE EVANS
DIRECTOR

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: https://planning.hawaii.gov/

Coastal Zone Management Program

Environmental Review Program

Land Use Commission

Land Use Division

Special Plans Branch

State Transit-Oriented Development

Statewide Geographic Information System

Statewide Sustainability Program

DTS 202109241402HE

October 7, 2021

Mr. Toby T. Hanzawa, PE, LEED AP
Associate / Project Engineer
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813

Dear: Mr. Hanzawa:

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America Site
TMK: (1) 8-7-010: 030 & 031; Ma'ili, Wai'anae, O'ahu

Thank you for the opportunity to provide comments on this early consultation for the preparation of a Draft Environmental Assessment (Draft EA) for a residential development at the former Voice of America (VOA) site in Wai'anae, O'ahu. The request for comment notification was received by our office via memo dated September 16, 2021.

It is our understanding that the Department of Hawaiian Home Lands (DHHL) is proposing to develop approximately 44-acres of state-owned land as a homestead community. This community will consist of approximately 280 units, comprising of single family and multifamily residences for beneficiaries of the Hawaiian Homes Commission Act.

The Office of Planning and Sustainable Development (OPSD) has the following comments to offer:

1. Coastal Zone Management Act (CZMA) – Federal Consistency
   We note that the review material indicates that the project area is within close proximity to Ma'ili Stream and that a wetland assessment, biological and water quality survey will be included in the Draft EA in accordance with Hawaii Revised Statutes (HRS) Chapter 343.

   The national CZMA requires that federal actions be consistent with approved state coastal program enforceable policies. Federal actions include activities performed by a federal agency; activities that require federal permits or approvals; or state and local government projects that receive federal financial assistance. In this instance, if it is deemed a federal permit is required for the proposed residential development, then this proposed action may be subject to CZMA federal consistency.

   OPSD is the lead state agency with the authority to conduct CZMA federal consistency reviews. Please consult with our office on the policies and procedures applicable to CZMA federal consistency reviews, if it is determined that the proposed action requires federal approval.

2. Hawai'i Coastal Zone Management (CZM) Program
   HRS § 205A-4(a) states that in implementing the objectives of the CZM program, agencies shall give full consideration to ecological, cultural, historic, esthetic, recreational, scenic, and open space values, coastal hazards, and economic development. Additionally, HRS § 205A-5(b) requires all state and county agencies to enforce the CZM objectives and supporting policies.

   As this project is being proposed by a State agency, the Draft EA should include an assessment as to how the proposed action conforms with the provisions of HRS § 205A-2. Compliance with this statute is an important component for satisfying the requirements of HRS Chapter 343. Furthermore, HRS § 205A-2 forms the foundation of the enforceable policies of the Hawai'i CZM Program. If a federal consistency review is needed, this detailed examination can be used as support material by DHHL in its federal consistency determination.

3. Stormwater Runoff, Erosion, and Water Resources
   The review material indicate that the project site is located near Ma'ili Stream. Construction and operational activities that may result in an increase of stormwater runoff, sediment loading, and the degradation of water quality to the downslope marine waters are a concern for OPSD. Pursuant to HAR § 11-200.1-18(d)(7) – identification and analysis of impacts and alternatives considered; to ensure that offshore marine resources along the Wai'anae Coast remain protected, the negative effects of stormwater inundation and sediment loading surrounding the proposed project site should be evaluated.

   Issues that may be examined include, but are not limited to, project site characteristics in relation to flood and erosion prone areas, potential vulnerability of water resources and the coastal resources along Leeward, O'ahu. Pursuant to HAR § 11-200.1-18(d)(8), developing mitigation measures for the protection for surface water resources and the coastal ecosystem should assessed and detailed if needed.

If you have any questions or concerns regarding this comment letter, please contact Joshua Hekekia of our CZM Program at (808) 587-2845; or Debra Mendes at (808) 587-2840 on CZMA federal consistency matters.

Mahalo,

Mary Alice Evans

Mary Alice Evans
Director

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201 Merchant Street, Suite 1900
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November 8, 2021

Ms. Mary Alice Evans, Director
State of Hawai'i
Office of Planning & Sustainable Development
235 South Beretania Street, 6th Floor
Honolulu, Hawai'i 96813

Subject: Reference No. DTS 202109241402HE
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Ms. Evans:

Thank you for your correspondence dated October 7, 2021, regarding the subject project. We acknowledge your comments relating to the preparation of the Draft Environmental Assessment (DEA) for the proposed project as follows:

1. The State Office of Planning and Sustainable Development (OPSD) is the lead state agency with the authority to conduct Coastal Zone Management Act (CZMA) federal consistency reviews. The proposed action may be subject to CZMA federal consistency if it is deemed a federal permit is required. We will consult with the OPSD on the policies and procedures applicable to CZMA federal consistency reviews if it is determined that the proposed action requires federal approval.

2. The DEA will include a discussion of the project's ability to conform with provisions of HRS §205A-2.

3. The project site is located near Mā'ili Stream. Pursuant to HAR § 11-200.1-18(d)(7), the DEA will include identification and analysis of impacts and alternatives considered. We also acknowledge that pursuant to HAR § 11-200.1-18(d)(8), development of mitigation measures for the protection of surface water resources and the coastal ecosystem should be assessed and detailed, if needed.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at tharzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

BOARD OF WATER SUPPLY

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

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Manager and Chief Engineer

ELLEN E. KITAMURA, P.E.
Deputy Manager and Chief Engineer

October 6, 2021

Ms. Sheryl E. Nojima
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Ms. Nojima:

Subject: Your Letter Dated September 16, 2021 Requesting Comments on the Environmental Assessment Pre-Consultation for a Residential Development at the Former Voice of America Site off Kulaaupuni Street – Tax Map Key: 8-7-010: 030 & 031

Thank you for the opportunity to comment on the proposed 280-unit single-family and multi-family State of Hawaii Department of Hawaiian Home Lands project.

The existing water system is adequate to accommodate the proposed homestead development. However, please be advised that this information is based upon current data, and therefore, the Board of Water Supply (BWS) reserves the right to change any position or information stated herein up until the final approval of the building permit application. The final decision on the availability of water will be confirmed when the building permit application is submitted for approval.

When water is made available, the applicant will be required to pay our Water System Facilities Charges (WSFC) for resource development, transmission, and daily storage.

Water conservation measures are required for all proposed developments. These measures include utilization of nonpotable water for irrigation using rain catchment, drought tolerant plants, xeriscape landscaping, efficient irrigation systems, such as a drip system and moisture sensors, and the use of Water Sense labeled ultra-low flow water fixtures and toilets.

The construction drawings should be submitted for our review and the construction schedule should be coordinated to minimize impact to the water system.

The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

For your information, the BWS is currently in the construction phase of the Lualualei Line Booster upgrade project and are expecting to be completed in the upcoming months. We suggest you check back with us at the beginning of 2022 to confirm the project's status.

In addition, the Farrington Highway Water System Improvements, Hookele Street Vicinity Project is currently in the design phase. This project will affect BWS waterlines on Farrington Highway, Hookele Street, Hookele Place, Laulele Street, Heleuma Street, Maipalaoa Road, Meaulu Road, Manununu Street, Manuu Street, Mamoalii way, Mamoalii Place, Manuulaula Street, Kulaaupuni Street, and St. John's Road. For more information, you may contact the Design and Plans Review Branch of our Capital Projects Division at (808) 748-5710.

BWS may waive the WSFC and new meter costs for qualified on-site affordable and homeless dwelling units, up to 500 dwelling units per year. The waivers will be granted when the building permit is submitted for approval. To qualify, the dwelling units must be certified as either affordable or homeless dwelling units by the appropriate agency of the City and County of Honolulu and the certification provided when the building permit application is submitted for review and approval. For non-qualifying units, the applicant will be required to pay our WSFC for resource development, transmission, and daily storage.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at (808) 748-5443.

Very truly yours,

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

Gray • Hong • Nojima & Associates, Inc.
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www.grayhongnojima.com

November 8, 2021

Mr. Ernest Y.W. Lau, Manager and Chief Engineer
City & County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawai'i 96843

Attn: Mr. Robert Chun

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Lau:

Thank you for your correspondence dated October 6, 2021, regarding the subject project. We acknowledge your comments relating to the preparation of the Draft Environmental Assessment (DEA) for the proposed project as follows:

1. The existing water system is presently adequate to accommodate the proposed development; however, the final decision on water availability will be confirmed when the building permit application is submitted for approval.

2. Water System Facilities Charges (WSFC) for resource development, transmission, and daily storage will need to be paid by the applicant when water is made available.

3. Water conservation measures will be required for the proposed development.

4. Construction plan drawings will be submitted for review and approval to the Board of Water Supply (BWS) upon completion.

5. The project will be coordinated with the Honolulu Fire Department.

6. The Lualualei Line Booster upgrade project is currently in construction, and the project status will be confirmed with BWS at the beginning of 2022.

7. The Farrington Highway Water System Improvements, Hookele Street Vicinity Project is currently in the design phase. Our office will coordinate the project scope and status with the BWS Design and Plans Review Branch of the Capital Projects Division.

8. The BWS may waive the WSFC and new meter costs for qualified on-site affordable and homeless dwelling units, up to 500 dwelling units per year pending qualification and certification as either affordable or homeless dwelling units.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

DEPARTMENT OF COMMUNITY SERVICES
CITY AND COUNTY OF HONOLULU
925 DILLINGHAM BOULEVARD, SUITE 200•HONOLULU, HAWAII 96817
PHONE: (808) 768-7762 • FAX: (808) 768-7792
www.honolulu.gov/dcs

RICK BLANGIARDI
MAYOR

SARAH ALLEN
DIRECTOR

JOY BARUA
DEPUTY DIRECTOR

September 30, 2021

Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813
Attn: Toby Hanzawa, PE

Dear Mr. Hanzawa:

SUBJECT: Early Consultation Process for Environmental Assessment
DHHL Residential Development at former Voice of America site
TMK: (1) 8-7-010:030 & 031, Mā'ili, Wai'anae, O'ahu, Hawai'i

Thank you for your early consultation on the upcoming Environmental Assessment for the residential development project proposed by the State of Hawai'i Department of Hawaiian Homelands (DHHL) and located in Mā'ili at the former Voice of America site (TMK (1) 8-7-010:030 & 031).

Our review indicates that the proposed project will have no adverse impacts on any Department of Community Services activities or projects in the surrounding neighborhood.

Thank you for providing us the opportunity to comment on this matter.

Sincerely,

Joy Barua
For Sarah Allen
Director

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

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September 16, 2021

DCS/Admin
4002

Ms. Sarah Allen
Director
Department of Community Services
City & County of Honolulu
715 S. Beretania Street
Honolulu, HI 96813

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Ms. Sarah Allen:

The State of Hawai'i Department of Hawaiian Home Lands (DHHL) is proposing to develop approximately 44 acres of state-owned land as a homestead community in Mā'ili, Wai'anae, O'ahu (refer to Enclosure). This community is envisioned to accommodate approximately 280 units, consisting of single family and multifamily residences which will be offered to beneficiaries of the Hawaiian Homes Commission Act. The long waiting list of over 23,000 residential applicants underscores the extreme urgency to provide needed housing for the native Hawaiian beneficiaries.

Since the proposed project will involve the use of state and/or county lands and state funds, an environmental review is mandated under Chapter 343 of the Hawai'i Revised Statues (HRS). As such, an Environmental Assessment (EA) will be prepared by DHHL as part of the project. As a party with potential interest in the proposed development, your organization is being consulted for comments with respect to content of the EA prior to its preparation.

The site is currently vacant and unoccupied, containing some debris and remnants from the former Voice of America transmitter building, as well as structures which may be remnants of an abandoned elevated railroad bed previously used by the sugar cane plantations. DHHL is proposing to develop the site in two separate phases with expected delivery of homesteads around 2028. The initial phase will involve the design and construction of the project's backbone roads and utility infrastructure that will support the proposed community. In the second phase, DHHL will solicit design-build proposals to develop the residential units, which will commence after the backbone infrastructure has been constructed.

It is anticipated that the first phase will entail the on- and off-site improvements listed below. Because there are no utility services at the existing site, there will be considerable roadway, drainage, water, sewer, and electrical improvements in order to serve the proposed homestead community.

- Site Grading
- Roadways
- Drainage and Storm Water Quality
- Potable Water
- Wastewater System (Approved Sewer Connection – 2019/SCA-1690)
- Electrical, Telephone, and Cable Systems

September 16, 2021
Ms. Sarah Allen
Department of Community Services
Page 2

As mentioned previously, an EA will be prepared in accordance with HRS Chapter 343. The EA will address the project's potential environmental, economic and social impacts (short-term, long term and cumulative). Pertinent areas of detailed study of the EA will include the following:

- Archaeological research and preparation of preservation plans
- Potential impacts to the cultural resources, cultural practices, and beliefs
- Biological survey of flora and fauna species at the project site to identify any threatened and endangered species and critical habitat present
- Wetland assessment, biological and water quality survey of Mā'ili Stream in the project area and an Essential Fish Habitat Assessment (EFHA)
- Geophysical survey and environmental site assessment, as necessary
- Preliminary geotechnical engineering analysis on the general subsurface conditions
- Transportation planning and traffic (mobility) analysis
- Identification of potential applicable permits

Please send any concerns or questions associated with this project to the following address by October 15, 2021:

Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, HI 96813
Attn: Toby Hanzawa, PE

Should you have any comments/questions regarding this matter, please contact Toby Hanzawa at (808) 521-0306 or email thanzawa@grayhongnojima.com.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
President

cc: Mr. Darrell Ing, Department of Hawaiian Home Lands

TH:SN:rl
Enclosure

3122-00

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96313-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Ms. Sarah Allen, Director
City & County of Honolulu
Department of Community Services
925 Dillingham Boulevard, Suite 200
Honolulu, Hawai'i 96817

Attn: Ms. Joy Barua, Deputy Director

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Ms. Allen:

Thank you for your correspondence dated September 30, 2021, regarding the subject project. We acknowledge your comment that the proposed project will have no adverse impacts on any Department of Community Services activities or projects in the surrounding neighborhood.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

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

RICK BLANGIARDI
MAYOR

ALEX KOZLOV, P.E.
DIRECTOR

HAKU MILLES, P.E.
DEPUTY DIRECTOR

October 1, 2021

Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Attn: Toby Hanzawa, PE

Dear Mr. Hanzawa:

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010:30 & 31; Maili, Waianae, Oahu, Hawaii

Thank you for the opportunity to review and comment. The Department of Design and Construction has no comments to offer at this time.

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

Sincerely,

Alex Kozlov, P.E.
Director

AK:krn (862722)

Gray • Hong • Nojima & Associates, Inc.
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201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
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www.grayhongnojima.com

November 8, 2021

Mr. Alex Kozlov, Director
City & County of Honolulu
Department of Design & Construction
650 South King Street, 11th Floor
Honolulu, Hawai'i 96813

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Kozlov:

Thank you for your correspondence dated October 1, 2021, regarding the subject project. We acknowledge that the Department of Design and Construction has no comments at this time.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

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

RICK BLANGIARDI
MAYOR

LAURA H. THIELEN
DIRECTOR

KEHAULANI PU'U
DEPUTY DIRECTOR

November 24, 2021

Ms. Sheryl E. Nojima, Ph.D., P.E., President
Gray Hong Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Ms. Nojima:

SUBJECT: Early Consultation Process for Environmental Assessment – Residential Development at the Former Voice of America (VOA) Site
TMK (1) 8-7-010: 30 & 31
Maili, Waianae, Oahu, Hawaii

The Division of Urban Forestry (DUF), Department of Parks and Recreation (DPR), has reviewed the request for comment letter for the proposed 280 single family and multifamily residences to be offered to the beneficiaries of the Hawaiian Homes Commission Act and has the following comments.

1. Prior to the preparation of the Street Tree Plans, submit first a Street Tree Master Plan of the proposed development to Joyce Shoji, Acting Chief, Urban Design Branch, Department of Planning and Permitting'(DPP) for review and signature approval. Identify the proposed tree species and the width of the planting strip; the area between the curb and sidewalk for each roadway. Do not include the width of the concrete curb for this calculation.

2. Prepare project plans in accordance to the DPP Land Use Ordinances for landscaping and screening, parking lot trees, and park dedication plans.

3. Pursuant to the Mayor's Tree Initiative Directive 20-14, City and County of Honolulu Actions to Address Increasing Temperatures and the Urban Tree Canopy to fight climate change and combat global warming, it is essential that the project include tree planting. Increasing the number of trees will improve the quality of life benefits for the homestead community and surrounding communities.

4. The project should consider "Green Infrastructure;" such as vegetated swales and bioretention systems, that collect and filter storm water run-off through landscaping, mulch, and engineered soil media.

5. Submit plans to the Complete Streets Administrator of the Department of Transportation Services, for staff review.

6. The department encourages the Department of Hawaiian Home Lands to include on site park and recreation improvements to serve this new community that includes playfields, play courts and a playground with a composite play apparatus.

Should you have any questions, please contact Mr. John Reid, Planner at 808-768-3017.

Sincerely,

Laura H. Thielen
Director

LHT:jr
(862894)

Gray • Hong • Nojima & Associates, Inc.
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www.grayhongnojima.com

December 13, 2021

Ms. Laura H. Thielen, Director
Department of Parks and Recreation
City & County of Honolulu
1000 Ulu'ōhi'a Street, Suite 309
Kapolei, HI 96707

Attn: Mr. John Reid

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Ms. Thielen:

Thank you for your correspondence dated November 24, 2021, regarding the subject project. We acknowledge your comments relating to the preparation of the Draft Environmental Assessment (DEA) for the proposed project as follows:

1. Prior to the preparation of Street Tree Plans, a Street Tree Master Plan for the proposed development will be submitted to the Urban Design Branch (UDB), Department of Planning and Permitting (DPP) for review and approval.

2. Construction plans will be prepared in accordance with the DPP Land Use Ordinances for landscaping and screening, parking lot trees, and park dedication plans.

3. Pursuant to the Mayor's Tree Initiative Directive 20-14, City and County of Honolulu Actions to Address Increasing Temperatures and the Urban Tree Canopy to fight climate change and combat global warming, the project will include tree planting.

4. The project will consider the inclusion of "Green Infrastructure" such as vegetated swales and bioretention systems.

5. Construction plans will be submitted for review to the Complete Streets Administrator of the Department of Transportation Services.

6. The Department of Parks and Recreation encourages the inclusion of onsite park and recreation improvements to serve the new community which will be considered for the project.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH TH:rl

3122-00

From: Tagawa, Steve H.
To: Toby Hanzawa
Cc: Beatty, Alexander D
Subject: Early Consultation for a 343 Draft EA: Residential Development at Former Voice of America Site - Mali
Date: Friday, October 29, 2021 12:02:19 PM
Attachments: DHHLMaili.development.pdf

Aloha Toby,

Although we did not provide our early input in the time requested, we have attached previous correspondence between the Department of Planning and Permitting regarding the development on this property, TMK 8-7-010: 30 and 31 (previously Parcel 7), by the Department of Hawaii Homelands.

Please included the DPP in the distribution of the Draft EA when it is completed.

We look forward to reviewing the proposed project, and to updating communications regarding the regulatory regime for the forthcoming Project.

Mahalo,
Steve Tagawa, Staff Planner
Land Use Permits Division
(File No. 2021/ELOG-1918)

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Dean Uchida, Director
City & County of Honolulu
Department of Planning & Permitting
650 South King Street, 7th Floor
Honolulu, Hawai'i 96813

Attn: Mr. Steve Tagawa, Staff Planner

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Uchida:

Thank you for your email correspondence dated October 29, 2021, regarding the subject project. We acknowledge the previous correspondence between the Department of Planning and Permitting regarding the development on the property and the Department of Hawaiian Home Lands (April 8 & 10, 2013) provided as an attachment to the email message. We also acknowledge your request to be included in the distribution of the draft environmental assessment when it is available for review.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

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

RICK BLANGIARDI
MAYOR

LIONEL CAMARA JR.
ACTING FIRE CHIEF

SHELDON K. HAO
ACTING DEPUTY FIRE CHIEF

September 28, 2021

Mr. Toby Hanzawa, PE
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawaii 96813

Dear Mr. Hanzawa:

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America Site
Maili, Waianae, Oahu, Hawaii
Tax Map Keys: 8-07-010: 030 and 031

In response to your letter dated September 16, 2021, regarding the abovementioned subject, the Honolulu Fire Department (HFD) reviewed the submitted information and requires that the following be complied with:

1. Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 feet (46 meters) from fire department access roads as measured by an approved route around the exterior of the building or facility. (National Fire Protection Association [NFPA] 1; 2018 Edition, Sections 18.2.3.2.2 and 18.2.3.2.2.1, as amended.)

   A fire department access road shall extend to within 50 feet (15 meters) of at least one exterior door that can be opened from the outside and that provides access to the interior of the building. (NFPA 1; 2018 Edition, Section 18.2.3.2.1.)

2. An approved water supply capable of supply the required fire flow for fire protection shall be provided to all premises upon which facilities, buildings, or portions of buildings are hereafter constructed or moved into the jurisdiction. The approved water supply shall be in accordance with Section 18.4. (NFPA 1; 2018 Edition, Section 18.3.1.)

3. The fire department access roads shall be in accordance with Section 18.2.3. (NFPA 1; 2018 Edition, Section 18.2.3.)

4. Submit civil drawings to the HFD for review and approval.

Should you have questions, please contact Battalion Chief Reid Yoshida of our Fire Prevention Bureau at 723-7151 or ryoshida@honolulu.gov.

Sincerely,

JASON SAMALA
Assistant Chief

JS/DM:bh

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Lionel Camara, Jr., Acting Fire Chief
City & County of Honolulu
Horolulu Fire Department
636 South Street
Horolulu, Hawai'i 96813

Attn: Mr. Jason Samala, Assistant Chief

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Camara, Jr.:

Thank you for your correspondence dated September 28, 2021, regarding the subject project. We acknowledge your comments relating to the preparation of the Draft Environmental Assessment (DEA) for the proposed project:

1. Fire department access roads will be designed and constructed in accordance with the National Fire Protection Association (NFPA) 1, 2018 Edition, Sections 18.2.3.2.1, 18.2.3.2.2 and 18.2.3.2.2.1, as amended.

2. Water infrastructure will be designed and constructed in accordance with the NFPA 1, 2018 Edition, Section 18.3.1.

3. Fire department access roads will be designed and constructed in accordance with the NFPA 1, 2018 Edition, Section 18.2.3.

4. Construction plan drawings will be submitted for review and approval to the Honolulu Fire Department.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH
TH::l

3122-00

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

RICK BLANGIARDI
MAYOR

RADE K. VANIC
INTERIM CHIEF

OUR REFERENCE EO-DK

October 1, 2021

SENT VIA EMAIL

Mr. Toby Hanzawa, P.E.
thanzawa@grayhongnojima.com

Dear Mr. Hanzawa:

This is in response to your agency's letter of September 16, 2021, requesting input on an Early Consultation, Environmental Assessment, for the proposed Hawaiian Home Lands homestead community development of 44 acres with approximately 280 single and multifamily residences to be located in Maili, Oahu.

Based on the information provided, the Honolulu Police Department (HPD) does not have any comments or concerns at this time. However, the HPD would like to be included in future discussions with stakeholders in the area as it may impact police operations in the future.

If there are any questions, please call Major Gail Beckley of District 8 (Kapolei, Waianae) at 723-8400.

Thank you for the opportunity to review this project.

Sincerely,

DARREN CHUN
Assistant Chief of Police
Support Services Bureau

Serving and Protecting With Aloha

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Rade Vanic, Interim Chief
City & County of Honolulu
Honolulu Police Department
801 South Beretania Street
Honolulu, Hawai'i 96813

Attn: Mr. Darren Chun, Assistant Chief of Police

Subject: Reference No. EO-DK
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Vanic:

Thank you for your correspondence dated October 1, 2021, regarding the subject project. We acknowledge your request to keep the Honolulu Police Department included in future discussions with stakeholders in the area being that it may impact police operations in the future.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

United States Department of the Interior

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

In Reply Refer To:
01EPIF00-2021-TA-0492

October 1, 2021

Mr. Toby Hanzawa. PE
Gray, Hong, Nojima & Associates, Inc.
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813

Subject: Technical Assistance Regarding the Draft Environmental Assessment for the Former VOA Site for Residential Development Mā'ili, O'ahu

Dear Mr. Hanzawa:

Thank you for your recent correspondence requesting technical assistance on species biology, habitat, or life requisite requirements. The Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) appreciates your efforts to avoid or minimize effects to protected species associated with your proposed actions. We provide the following information for your consideration under the authorities of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 *et seq.*), as amended.

Due to significant workload constraints, PIFWO is currently unable to specifically address your information request. The table below lists the protected species most likely to be encountered by projects implemented within the Hawaiian Islands. Based on your project location and description, we have noted the species most likely to occur within the vicinity of the project area, in the '**Occurs In or Near Project Area**' column. Please note this list is not comprehensive and should only be used for general guidance. We have added to the PIFWO website, located at https://www.fws.gov/pacificislands/promo.cfm?id=177175840 recommended conservation measures intended to avoid or minimize adverse effects to these federally protected species and best management practices to minimize and avoid sedimentation and erosion impacts to water quality. If your project occurs on the island of Hawai'i, we have also enclosed our biosecurity protocol for activities in or near natural areas.

If you are representing a federal action agency, please request an official species list following the instructions at our PIFWO website https://www.fws.gov/pacificislands/articles.cfm?id=149489558. You can find out if your project occurs in or near designated critical habitat here: https://ecos.fws.gov/ipac/.

Under section 7 of the ESA, it is the Federal agency's (or their non-Federal designee) responsibility to make the determination of whether or not the proposed project "may affect" federally listed species or designated critical habitat. A "may affect, not likely to adversely affect" determination is appropriate when effects to federally listed species are expected to be discountable (i.e., unlikely to occur), insignificant (minimal in size), or completely beneficial. This conclusion requires written concurrence from the Service. If a "may affect, likely to adversely affect" determination is made, then the Federal agency must initiate formal consultation with the Service. Projects that are determined to have "no effect" on federally listed species and/or critical habitat do not require additional coordination or consultation.

Implementing the avoidance, minimization, or conservation measures for the species that may occur in your project area will normally enable you to make a "may affect, not likely to adversely affect" determination for your project. If it is determined that the proposed project may affect federally listed species, we recommend you contact our office early in the planning process so that we may assist you with the ESA compliance. If the proposed project is funded, authorized, or permitted by a Federal agency, then that agency should consult with us pursuant to section 7(a)(2) of the ESA. If no Federal agency is involved with the proposed project, the applicant should apply for an incidental take permit under section 10(a)(1)(B) of the ESA. A section 10 permit application must include a habitat conservation plan that identifies the effects of the action on listed species and their habitats and defines measures to minimize and mitigate those adverse effects.

We appreciate your efforts to conserve endangered species. We regret that we cannot provide you with more specific protected species information for your project site. If you have questions that are not answered by the information on our website, you can contact PIFWO at (808) 792-9400 and ask to speak to the lead biologist for the island where your project is located.

Sincerely,

AARON NADIG
Digitally signed by AARON NADIG
Date: 2021.10.01 09:27:54 -10'00'

Island Team Manager
Pacific Islands Fish and Wildlife Office

Enclosures (2)

The table below lists the protected species most likely to be encountered by projects implemented within the Hawaiian Islands. For your guidance, we have marked species that may occur in the vicinity of your project, this list is not comprehensive and should only be used for general guidance.

Enclosure 1. Federal Status of Animal Species

Scientific Name	Common Name / Hawaiian Name	Federal Status	May Occur In Project Area
Mammals			
Lasiurus cinereus semotus	Hawaiian hoary bat/ʻōpeʻapeʻa	E	☒
Reptiles			
Chelonia mydas	green sea turtle/honu - Central North Pacific distinct population segment (DPS)	T	☐
Eretmochelys imbricata	hawksbill sea turtle/ honu ʻea or ʻea	E	☐
Birds			
Anas wyvilliana	Hawaiian duck/koloa	E	☐
Branta sandvicensis	Hawaiian goose/nēnē	T	☐
Fulica alai	Hawaiian coot/ʻalae keʻokeʻo	E	☐
Gallinula galeata sandvicensis	Hawaiian gallinule/ʻalae ʻula	E	☐
Himantopus mexicanus knudseni	Hawaiian stilt/aeʻo	E	☐
Oceanodroma castro	band-rumped storm-petrel Hawaiʻi DPS/ʻakēʻakē	E	☒
Pterodroma sandwichensis	Hawaiian petrel/ʻuaʻu	E	☒
Puffinus auricularis newelli	Newell's shearwater/ʻaʻo	T	☒
Ardenna pacificus	wedge-tailed shearwater/ʻuaʻu kani	MBTA	☒
Buteo solitarius	Hawaiian hawk/ʻio	MBTA	☐
Gygis alba	white tern/manu-o-kū	MBTA	☐
Insects			
Manduca blackburni	Blackburn's sphinx moth	E	☐
Megalagrion pacificum	Pacific Hawaiian damselfly	E	☐
Megalagrion xanthomelas	orangeblack Hawaiian damselfly	E	☐
Megalagrion nigrohamatum nigrolineatum	blackline Hawaiian damselfly	E	☐

Enclosure 2. Federal Status of Plant Species

Plants				
Scientific Name	**Common Name or Hawaiian Name**	**Federal Status**	**Locations**	**May Occur In Project Area**
Abutilon menziesii	koʻoloaʻula	E	O, L, M, H	☐
Achyranthes splendens var. *rotundata*	ʻewa hinahina	E	O	☐
Bonamia menziesii	no common name	E	K, O, L, M, H	☐
Canavalia pubescens	ʻāwikiwiki	E	Ni, K, L, M	☐
Colubrina oppositifolia	kauila	E	O, M, H	☐
Cyperus trachysanthos	puʻukaʻa	E	K, O	☐
Gouania hillebrandii	no common name	E	Mo, M	☐
Hibiscus brackenridgei	maʻo hau hele	E	O, Mo, L, M, H	☐
Ischaemum byrone	Hilo ischaemum	E	K, O, Mo, M, H	☐
Isodendrion pyrifolium	wahine noho kula	E	O, H	☐
Marsilea villosa	ʻihiʻihi	E	Ni, O, Mo	☐
Mezoneuron kavaiense	uhiuhi	E	O, H	☐
Nothocestrum breviflorum	ʻaiea	E	H	☐
Panicum fauriei var. *carteri*	Carter's panicgrass	E	Molokini Islet (O), Mo	☐
Panicum niihauense	lauʻehu	E	K	☐
Peucedanum sandwicense	makou	E	K, O, Mo, M	☐
Pleomele (Chrysodracon) hawaiiensis	halapepe	E	H	☐
Portulaca sclerocarpa	ʻihi	E	L, H	☐
Portulaca villosa	ʻihi	E	Le, Ka, Ni, O, Mo, M, L, H, Nihoa	☐
Pritchardia affinis (maideniana)	loulu	E	H	☐
Pseudognaphalium sandwicensium var. *molokaiense*	ʻenaʻena	E	Mo, M	☐
Scaevola coriacea	dwarf naupaka	E	Mo, M	☐
Schenkia (Centaurium) sebaeoides	ʻāwiwi	E	K, O, Mo, L, M	☐
Sesbania tomentosa	ʻōhai	E	Ni, Ka, K, O, Mo, M, L, H, Necker, Nihoa	☐
Tetramolopium rockii	no common name	T	Mo	☐
Vigna o-wahuensis	no common name	E	Mo, M, L, H, Ka	☐

Location key: O=Oʻahu, K=Kauaʻi, M=Maui, H=island of Hawaiʻi, L=Lānaʻi, Mo=Molokaʻi, Ka=Kahoʻolawe, Ni=Niʻihau, Le=Lehua

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Aaron Nadig
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

Subject: Reference No. 01EPIF00-2021-TA-0492
Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Nadig:

Thank you for your correspondence dated October 1, 2021 regarding the preparation of the Draft Environmental Assessment (DEA) for the proposed project. We acknowledge the list provided for general guidance which indicates the protected species most likely to be encountered based on the project location, as well as the resources for recommended conservation measures. The DEA will discuss the protected species most likely to occur in or near the project area. The DEA will also include a natural resources assessment prepared by AECOS, Inc. which will identify the threatened and endangered species and critical habitat present or likely to be present in the vicinity of the project site, as well as a determination of the project's impact on those protected species and habitats.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

From: Liu, Rouen
To: Toby Hanzawa
Cc: Kuwaye, Kristen
Subject: RE: Pre-Assessment Consultation - Homestead Community Residential Development draft EA
Date: Thursday, September 23, 2021 2:51:52 PM

Dear Mr. Hanzawa,

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company has no objection to the project. Should Hawaiian Electric 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 Homestead Community Residential Development project comes to fruition, please continue to keep us informed.

Should there be any questions, please contact me at 543-7245.

Thank you,
Rouen Liu
Permit Engineer

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From: Toby Hanzawa
To: Liu, Rouen
Cc: Kuwaye, Kristen; Ing, Darrell H; Choy, Andrew H; Fukuba, Pearlyn L; Sheryl Nojima; Richard Luga
Subject: RE: Pre-Assessment Consultation - Homestead Community Residential Development draft EA
Date: Tuesday, October 5, 2021 11:36:16 AM

Dear Mr. Liu,
Thank you for your timely comments in response to the Early Consultation letter regarding the Department of Hawaiian Home Lands' proposed Residential Development at the Former Voice of America Site. We acknowledge your request for continued access to any existing Hawaiian Electric easements and facilities at the project site.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Please don't hesitate to contact us if you have any additional questions.
Thank you,

Toby Hanzawa, PE, LEED AP
Gray•Hong•Nojima & Associates, Inc.
201 Merchant St, Suite 1900 -- Honolulu HI 96813
(808) 521-0306 ext 108 | (808) 531-8018 fax
thanzawa@grayhongnojima.com
www.grayhongnojima.com

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From: Liu, Rouen <rouen.liu@hawaiianelectric.com>
Sent: Thursday, September 23, 2021 2:52 PM
To: Toby Hanzawa <thanzawa@grayhongnojima.com>
Cc: Kuwaye, Kristen <kristen.kuwaye@hawaiianelectric.com>
Subject: RE: Pre-Assessment Consultation - Homestead Community Residential Development draft EA

Dear Mr. Hanzawa,

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company has no objection to the project. Should Hawaiian Electric 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 Homestead Community Residential Development project comes to fruition, please continue to keep us informed.

Should there be any questions, please contact me at 543-7245.

Thank you,
Rouen Liu
Permit Engineer

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Charter
COMMUNICATIONS

October 14th, 2021

GRAY, HONG, NOJIMA & ASSOCIATES, INC.
201 Merchant Street, Suite 1900
Honolulu, HI 96813-2926
(808) 521-0306

Attn: Mr. Toby Hanzawa

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Ma'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Hanzawa,

Thank you for your submittal of the above project. Spectrum Oceanic is currently working with Ronald N. S. Ho & Associates in regards to potential service connection points and has no major issues or concerns at this time.

Should you have any questions or concerns, please feel free to contact me at 625-9734 or 222-1019, or email me at kerick.fujimura@charter.com.

Sincerely,

Kerick Fujimura
OSP Engineer / Construction Coordinator III

200 Akamainui Street Mililani, HI 96789-3912 t (808) 625-2100

1

Gray • Hong • Nojima & Associates, Inc.
CONSULTING ENGINEERS
201 Merchant Street, Suite 1900
Honolulu, Hawai'i 96813-2926
Telephone: (808) 521-0306
email@grayhongnojima.com
www.grayhongnojima.com

November 8, 2021

Mr. Kerick Fujimura, OSP Engineer/Construction Coordinator III
Charter Communications
Spectrum Oceanic
200 Akamainui Street
Mililani, Hawai'i 96789-3912

Subject: Early Consultation Process for Environmental Assessment
Residential Development at the Former Voice of America (VOA) Site
TMK: (1) 8-7-010: 30 & 31; Mā'ili, Wai'anae, O'ahu, Hawai'i

Dear Mr. Fujimura:

Thank you for your correspondence dated October 14, 2021, regarding the subject project. We acknowledge that Spectrum Oceanic is currently working with Ronald N.S. Ho & Associates in regards to potential service connection points and has no major issues or concerns at this time.

We will notify you early next year when the draft environmental assessment is available for review and look forward to your continued interest in the project. Should there be any questions, please contact Toby Hanzawa of our office at 521-0306 or email at thanzawa@grayhongnojima.com. Again, thank you for your participation in the environmental review process.

Sincerely,

GRAY, HONG, NOJIMA & ASSOCIATES, INC.

Sheryl E. Nojima, PhD, PE
Principal-in-Charge

cc: Department of Hawaiian Home Lands

TH:rl

3122-00

APPENDIX G

Approved Sewer Connection Application

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET * HONOLULU, HAWAII 96813
Phone: (808) 768-8209 * Fax: (808) 768-4210

SEWER CONNECTION APPLICATION

APPLICATION NO.: **2021/SCA-1281** STATUS: **Approved with conditions**

DATE RECEIVED: **09/10/2021** IWDP APP. NO.:

PROJECT NAME: **2021/SCA-1281 Residential Development at the Former Voice of America Site - 450 New SFD**

$2,977,200.00
Estimated Wastewater System Facility Charge*

LOCATION:

Zone	Section	Plat	Parcel
8	7	010	030
Zone	Section	Plat	Parcel
8	7	010	031

SPECIFIC LOCATION: **In the Vicinity of 87-576 Kulaaupuni Street**

APPLICANT: **Toby Hanzawa/Gray Hong Nojima & Associates**
201 Merchant St., Ste 1900
Honolulu, HI 96813

DEVELOPMENT TYPE: **Dwelling, Single-family** SEWER CONNECTION WORK DESIRED: **New**

OTHER USES:

NON-RESIDENTIAL AREA: s.f. APPROXIMATE DATE OF CONNECTION:

PROPOSED UNITS	EXISTING UNITS	UNITS TO BE DEMOLISHED
No. of New Units: **450**	No. of Existing Units: **0**	No. of Units to be Demolished: **0**
Studios:	Studios:	Studios:
1-Bedroom:	1-Bedroom:	1-Bedroom:
2-Bedroom:	2-Bedroom:	2-Bedroom:
3-Bedroom: **450**	3-Bedroom:	3-Bedroom:
4-Bedroom:	4-Bedroom:	4-Bedroom:
5-Bedroom:	5-Bedroom:	5-Bedroom:
6-Bedroom:	6-Bedroom:	6-Bedroom:

REMARKS **The sewer connections are allowable on Holt Road and Kulawae Street. Submit construction plans for the new sewer lateral for review and approval. A private sewer easement may be required.**

APPROVAL DATE: **09/14/2021**

EXPIRATION DATE: **09/14/2023**

Valid 2-years after approval date. Construction plans shall be completed and approved within this 2-year period. Construction shall commence within 1-year after approval of plans.
** Applicable WSFC shall be collected at the prevailing rate in accordance with ROH 1990, Chapter 14, Sections 14-10.3, 14-10.4, 14-10.5 and Appendix 14-D.*

REVIEWED BY: ***Jing Meng***

Site Development Division, Wastewater Branch

ExternalID: **095212017-001** JobId: **95212017**

APPENDIX H

Draft Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, February 2021

— Draft —

Archaeological Assessment for the Department of Hawaiian Home Lands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā‘ili, Lualualei Ahupua‘a, Wai‘anae Moku, Island of O‘ahu

TMK (1) 8-7-010:030

Prepared by:
Carly Walker
Darby Filimoehala

Prepared for:
Department of Hawaiian Home Lands
Land Development Division
91-5420 Kapolei Parkway
Kapolei, Hawai‘i 96707

Under Contract to:
Gray, Hong, Nojima & Associates
201 Merchant Street, Suite 1900
Honolulu, Hawai‘i 96813

International Archaeology, LLC

February 2021

IA201947

— DRAFT —

ARCHAEOLOGICAL ASSESSMENT FOR THE DEPARTMENT OF HAWAIIAN HOME LANDS VOICE OF AMERICA PROPERTY, KULAAUPUNI STREET ROAD CORRIDOR EXTENSION, MĀ‘ILI, LUALUALEI AHUPUA‘A, WAI‘ANAE MOKU, ISLAND OF O‘‘AHU

TMK (1) 8-7-010:030

Prepared by:
Carly Walker, B.A.
Darby Filimoehala, M.A.

Prepared for:
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International Archaeology, LLC
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February 2021

ABSTRACT

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands (DHHL), International Archaeology, LLC completed an archaeological inventory survey (AIS) of the proposed Kulaaupuni Street extension within the former Voice of America (VOA) property. The project area is 1.8 acres in Māʻili, Oʻahu (TMK [1] 8-7-010:030). The sole landowner is the DHHL. The planned residential development at the former VOA site includes a road extension from the intersection of Kulaaupuni Street and Holt Road potentially to the Kulawae and Kulauku Streets intersection 525 m to the south. Survey and testing was limited to the road corridor and included mechanical excavation of four trenches.

No archaeological sites were documented by the pedestrian survey and subsurface testing. The depositional sequence for the road corridor consists of a basal reef-derived Pleistocene limestone bedrock below multiple alluvial deposits, which are capped by modern fills deposited by 20th century activities. No further work is recommended for the project area. However, if finds are encountered during construction, the State Historic Preservation Division should be contacted immediately.

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I. INTRODUCTION

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands (DHHL), International Archaeology, LLC (IA) completed an archaeological inventory survey (AIS) of the proposed Kulaaupuni Street extension within the former Voice of America (VOA) property. The project area is 1.8 acres in Mā‘ili, O‘ahu (TMK [1] 8-7-010:030) (Figure 1 and Figure 2). The sole landowner is the DHHL. The AIS testing plan was sent to the State Historic Preservation Department (SHPD) via email on November 2, 2020, and the SHPD concurred with the fieldwork strategy on November 19, 2020 (email confirmation by S. Hemenway to D. Filimoehala). Due to negative findings during the AIS, this report is presented as an archaeological assessment (AA) pursuant to Hawaii Administrative Rules (HAR) §13-284-5(b)(5)(A). This AA meets the minimum standards specified in HAR §13-276 pertaining to AIS reports.

The planned residential development at the former VOA site includes a road extension from the intersection of Kulaaupuni Street and Holt Road possibly to the Kulawae and Kulauku Streets intersection 525 m to the south. Survey and testing was limited to the road corridor and included mechanical excavation of four trenches.

PROJECT LOCATION

The project area is in Lualualei Ahupua‘a on the leeward side of O‘ahu. The corridor runs along the west side of the DHHL VOA property and is approximately 500 m inland from the shore. The western edge of the corridor is bordered by residential houses. The currently undeveloped DHHL VOA property and the Kamehameha Schools' Community Learning Center abut the east side of the corridor.

PROJECT PERSONNEL AND DATES OF FIELDWORK

Timothy M. Rieth, M.A., was the Principal Investigator for the project and was responsible for overall management, ensuring that appropriate research standards were maintained, and providing research direction and oversight. Darby Filimoehala, M.A., was the Project Director. Ms. Filimoehala directed the fieldwork and was assisted in the field by Field Technician Carly Walker, B.A. Fieldwork was conducted on November 30, 2020.

DISPOSITION OF FIELD NOTES AND OTHER MATERIALS

Project field notes and electronic files produced during the project are temporarily stored at the IA Honolulu office. The final disposition of these materials will be determined through consultation with the DHHL and the SHPD.

ORGANIZATION OF THE REPORT

This report is organized as follows. Section I provides an overview of the project. Section II summarizes the physical environmental characteristics and important cultural background information, and describes the archaeological resources that have been documented in the area. Section III presents the

research questions that guided the fieldwork and describes the field methods. Section IV presents the results of the investigation. Section V is a discussion of the results as they relate to the project's research questions. Section VI presents the conclusions and recommendations. All references cited in the body of the report are presented after Section VI. A glossary of Hawaiian words used in the report follows the references. Appendix A provides copies of correspondence with the SHPD. Test trench soil and sediment descriptions are provided in Appendix B.

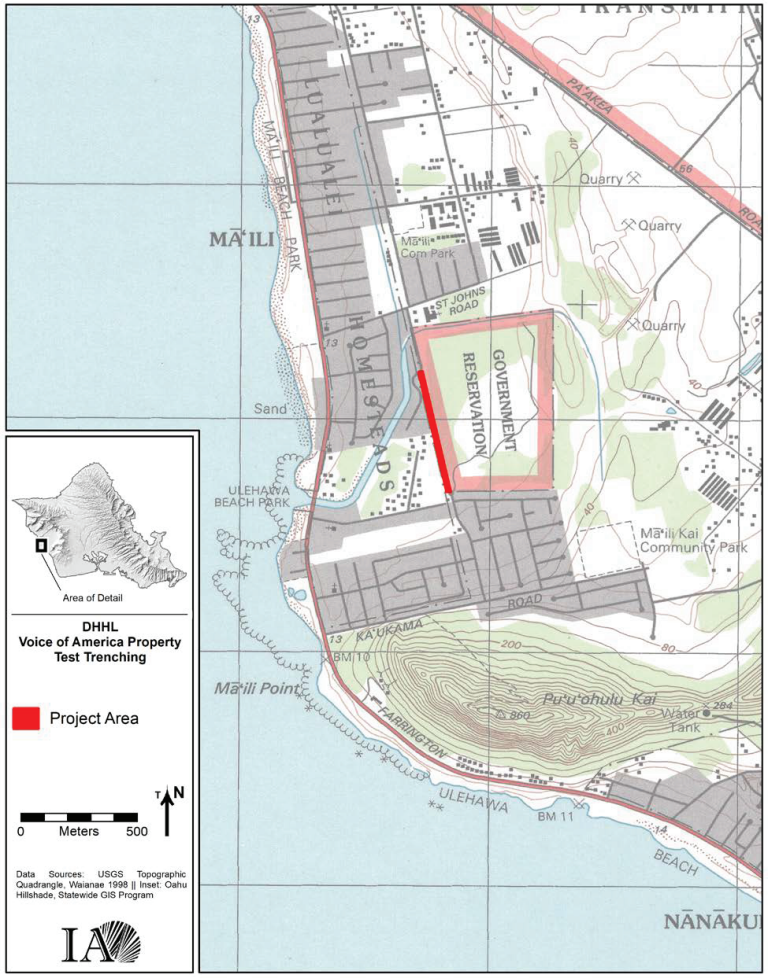

Figure 1. Location of the Kulaaupuni Street extension corridor project area overlaid on the 1998 USGS Waiʻanae topographic quadrangle.

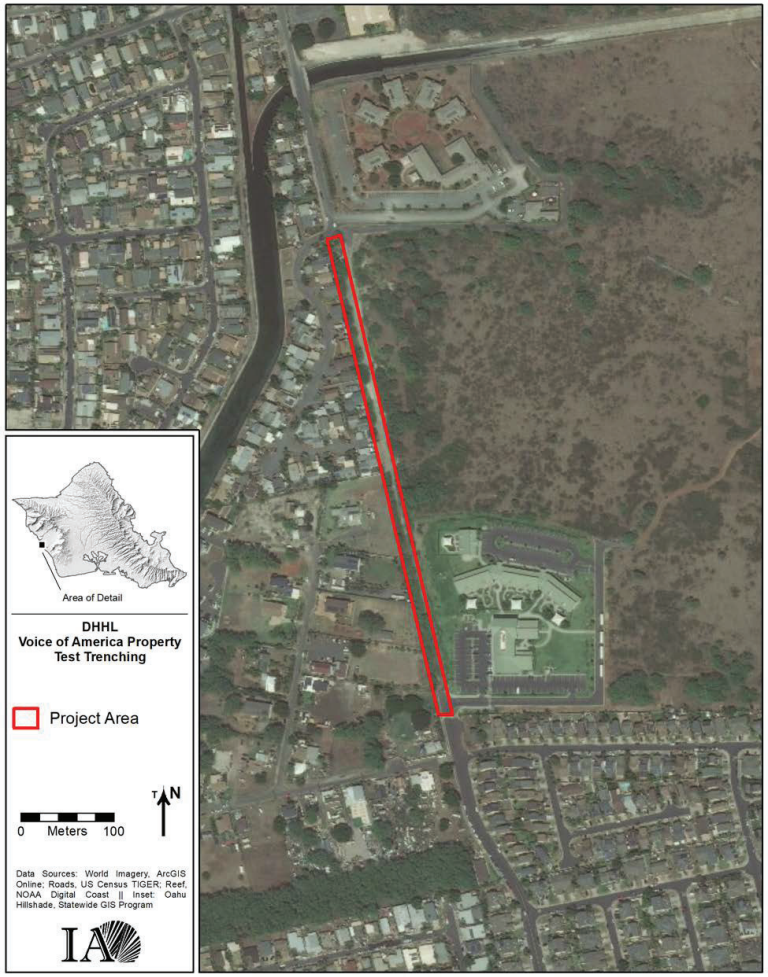

Figure 2. Detail of the Kulaaupuni Street extension corridor overlaid on the World Imagery Aerial.

II. BACKGROUND

This section provides environmental, cultural, historical, and archaeological background information to contextualize the project.

PHYSICAL ENVIRONMENT

The project area is within the remnant caldera of the Wai‘anae Volcano, which formed the Wai‘anae Range. The broad amphitheater valleys of the western Wai‘anae Range are characteristic of late-stage valley development (Macdonald et al. 1983:430). Thin, often discontinuous, ridges separate the valleys, which have broad, flat bases. The flat valley bottoms have been formed by massive accumulations of alluvial and colluvial sediment, which in Lualualei Valley is up to 360 m in thickness (Macdonald et al. 1983:429). Reef limestone substrate is present in the valley, particularly in the project area and adjacent near-shore areas. Limestone exposures and escarpments are common.

Soils in the project area are primarily Mokuleia clay (Mtb)and Mamala stony silty clay loam (MnC), 0 to 12 percent slopes, with a smaller area of Keaau clay (KmbA), saline, 0 to 2 percent slopes (Figure 3). Mokuleia clay is nearly level at the surface and is characterized by a dark grayish brown clay surface layer about 41 cm thick with an underlying layer of dark brown and light gray single grain sand and loamy sand 86-122 cm thick (Foote et al. 1972:95). The surface permeability is slow and the clay is extremely sticky and plastic. Mamala stony silty clay loam, 0 to 12 percent slopes, has a representative profile with a surface layer of dark reddish brown stony silty clay loam approximately 20 cm thick. This layer is underlain by coral limestone and consolidated calcareous sand (Foote et al. 1972:93). Keaau clay, saline, 0 to 2 percent slopes, has a very dark grayish brown clay surface layer measuring about 38 cm thick underlain by a very dark grayish brown and dark brown mottled clay subsoil. The subsoil is deposited atop reef limestone or consolidated coral sand. This soil is strongly affected by salt (Foote et al. 1972:65).

Twentieth-century earth-moving and construction activities for the construction of the former VOA antenna station significantly modified the terrain within the corridor and adjoining parcel. Sediment and stone berms created during previous bulldozing are numerous across the area, often extending for over 10 m in length and greater than 1 m in height.

Precipitation in the project area and surrounding valleys is limited by the rain-shadow effect of the Ko‘olau and Wai‘anae Ranges. The annual adjusted mean rainfall for two of the closest rain gauges are 548 mm (Mikilua, Station No. 725.00) and 654 mm (Lualualei, Station No. 804.00) (Giambelluca et al. 1986). In general, the average mean annual rainfall for this region ranges from less than 600 mm to 800 mm (Giambelluca et al. 1986:138). The greater amount falls during the winter months, particularly December to February. Winter storms associated with Kona winds often produce rapid and abundant rainfall.

Average minimum temperatures for Wai‘anae range from the low 60°s to 70° Fahrenheit (approximately 16-22° Celsius) with average maximum temperatures from the low to upper 80° Fahrenheit (approximately 31° Celsius) (Price 1973:58).

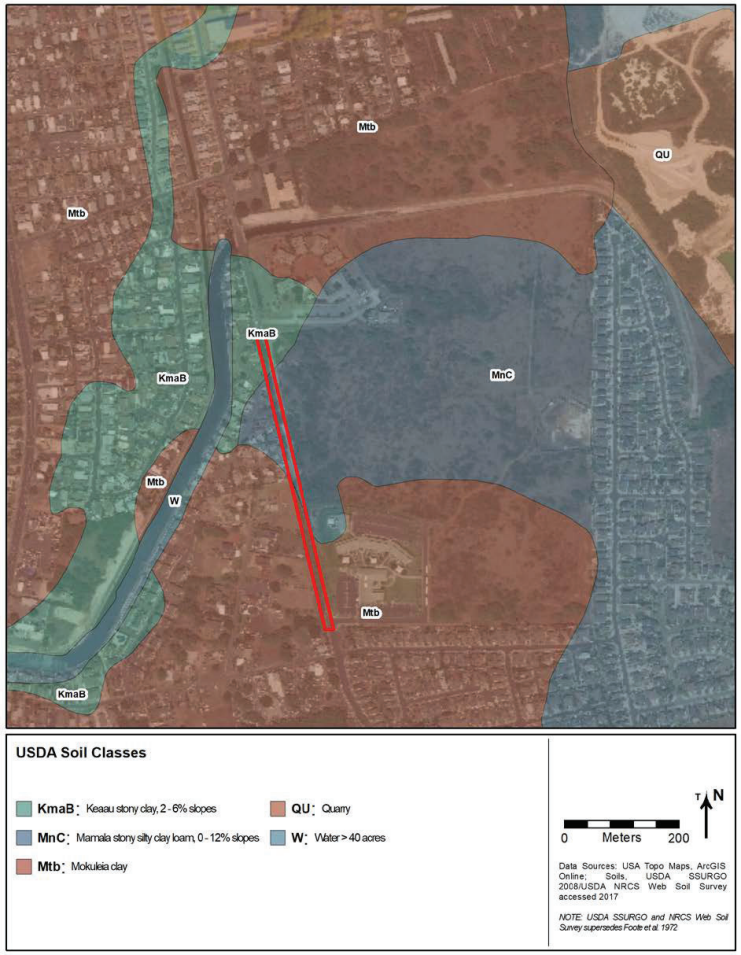

Figure 3. Overlay of Kulaaupuni Street extension corridor project area on the soils map for O‘ahu (data source: U.S. Department of Agriculture, Natural Resources, Conservation Services; Soil Survey Geographic [SSURGO] database for Island of O‘ahu, Hawai‘i file hi990 http://websoilsurvey.nrcs.usda.gov. Accessed December 8, 2020).

No perennial stream flow is present in the surrounding area of Lualualei. The channelized Māʻili Stream borders the DHHL parcel along its northern boundary before discharging to the west at Ulehawa Beach. The intermittent Māʻiliʻili Stream, with its multiple branches and tributaries, is to the north and east of the project area with Ulehawa Stream to the south.

Historically introduced grasses, *koa haole* (*Leucaena leucocephala*), and *kiawe* (*Prosopis pallida*) are the dominant vegetation in the area. Multiple historically introduced bird taxa, pigs (*Sus scrofa*), dogs (*Canis familiaris*), cats (*Felis catus*), mice (*Mus musculus*), rats (*Rattus* spp.), and mongoose (*Herpestes javanicus*) have been observed on the parcel.

CULTURAL GEOGRAPHY

The project area is towards the center, near-shore area of Lualualei Ahupuaʻa (Photo 1) within the *moku* of Waiʻanae along the western coast of Oʻahu. Although currently recognized as an *ahupuaʻa*, Lualualei was not designated as such during the mid-19th century Mahele, which created a system of private land ownership in the archipelago. Traditionally, Lualualei appears to have been an *ʻili ʻaina* of Waiʻanae Ahupuaʻa (see Nakamura and Pantaleo 1994:5-8). Hālona, Pūhāwai, Mikilua, and Pāhoa are additional *ʻili ʻaina* within Lualualei Valley that are now considered subdivisions of Lualualei Ahupuaʻa (Kelly 1991: 313-314; Soehren 2002-2004). Māʻili, the current name for the residential area and beach park surrounding the project area, may have originally been an *ʻili ʻaina* as well (Soehren 2002-2004).

Photo 1. View of Lualualei Valley from Puʻu O Hulu, view to the north (All Trails,` https://www.alltrails.com/trail/hawaii/oahu/puu-o-hulu?u=i, accessed December 4, 2020).

The surrounding Waiʻanae Range and inter-valley ridges are prominent components of the landscape, which define the cultural boundaries of the land at multiple scales from a district level to smaller land holdings. Along the Waiʻanae Range, which forms the eastern boundary for Waiʻanae Moku and Lualualei Valley, Mount Kaʻala and Kolekole Pass are complementary geographical places. Mount Kaʻala, at the head of Waiʻanae Ahupuaʻa immediately north of Lualualei Ahupuaʻa, is the highest peak on Oʻahu. This peak forms a topographic contrast with Kolekole Pass at the northeastern boundary of Lualualei, which provides access to the central plateau of Oʻahu. Mauna Kuwale, Puʻu Kailio, Kauaʻōpuʻu, and Puʻu Pāheʻeheʻe are topographical features of the ridge separating the Waiʻanae and Lualualei Valleys, with Puʻu Heleakalā dividing Lualualei and Nānākuli to the south. The discontinuous ridge Puʻu O Hulu Kai and Puʻu O Hulu Uka incompletely divides the southern half of Lualualei Valley.

HISTORICAL BACKGROUND

The following section summarizes the traditional, pre-Contact Hawaiian history and post-Contact history of Lualalei based on oral traditions, archaeological research, and written documents.

TRADITIONAL HISTORY

The traditional history of the Waiʻanae District is rooted in stories of Hawaiian *akua*. One tradition identifies ʻUlehawa in southern Lualualei as the birthplace of the heroic demigod Māui (Sterling and Summers 1978:65). Māui pulled the Hawaiian Islands from the waters off the Waiʻanae coast with his magic fishhook and learned the secret of fire making in this area. His mother, the moon goddess Hina, made *kapa* in Kāneana Cave along the coast (Sterling and Summers 1978:64). The goddess Hiʻiaka, sister of the volcano goddess Pele, also visited this district when she climbed Pōhākea Pass. The normally subservient younger sister viewed Pele's destruction of her beloved forests on Hawaiʻi Island from this vantage point, thus providing her courage to resist Pele (Kelly 1991:316). Kamapuaʻa is also referenced to this area (Pukui et al. 1974:174).

Multiple radiocarbon determinations obtained from archaeological deposits in Waiʻanae and Mākaha Ahupuaʻa calibrating between the 12th and 15th centuries provide the earliest possible evidence for occupation and/or activities in this area (contra Cordy 2002). However, these dates were obtained from unidentified charcoal, and therefore may reflect inbuilt age (Allen and Huebert 2014; Rieth and Athens 2013); corroborating dates from charcoal of short-lived taxa are required. Initial settlement may have centered along the coast, emphasizing the procurement of marine resources, with dryland agriculture immediately inland (Green 1980). Permanent settlement and agriculture in mid- and upper valley areas of Mākaha (Green 1980) and Nānākuli Valleys (Cordy 2002:20) did not occur until the 15th to 16th centuries. Residence in upper Lualualei occurred between the late 14th to mid-17th centuries (Dixon et al. 2008). The rich fishing grounds along the Waiʻanae coast provided marine protein, salt, and seaweed, while *kalo* and *ʻuala* were starch staples in irrigated and dryland fields, respectively.

With respect to chiefly lineages and genealogies, the Kumuhonua line from Waiʻanae retained seniority over other Nanaʻulu descendants from approximately the early-15th to early/mid-16th centuries (Cordy 1996). During this period, three polities were present on Oʻahu—ʻEwa, Kona, and Koʻolaupoko—with the ʻEwa polity subsuming the ʻEwa, Waiʻanae, and Waialua Districts (Cordy 2002). Laʻakona (ruling approximately AD 1420-1440 based on genealogical reckoning) of the Kumuhonua line ruled the ʻEwa polity and was recognized as the overall ruler for Oʻahu (Cordy 2002:24). This lineage fell from dominance with the killing of Haka (ruling approximately AD 1520-1540), an unpopular chief. The Waiʻanae District again came to prominence a century later when the heirs of the overall chief of Oʻahu, Kalaimanuia, fought over control of the island. Kalaimanuia's younger son, Haʻo, was killed by order of his brother Kaʻihikapu,

prompting Ha‘o’s son, Nāpūlānahumahiki, to flee to Wai‘anae (Cordy 2002:31). In Wai‘anae, he briefly formed an independent kingdom until his line reunified with the O‘ahu kingdom through marriage in the mid-17th century (Fornander 1880:272-273). However, later periods of struggle between district-level chiefs and the overall chief of O‘ahu occurred periodically until Kahekili, the high chief of Maui, conquered O‘ahu in AD 1783.

Kahekili was followed by Kamehameha as an external ruler of O‘ahu. This occurred during the period of initial trade and contact between Western ships and the Hawaiian people. Kamehameha appointed the chief Boki as governor of O‘ahu and chief of Wai‘anae District in 1816. In this position, Boki demanded that Wai‘anae *maka‘āinana* harvest sandalwood in order that he might make payments on his debts to Honolulu merchants and continue his purchase of foreign goods (Sahlins 1992). Spending time harvesting timbers impinged on growing food, and it is presumed that many *maka‘āinana* left Wai‘anae at this time to become laborers in Honolulu (Dixon et al. 2003). The movement of people to town, combined with increased mortality from introduced diseases, led to a significantly decreased population for Lualualei and Wai‘anae District as a whole.

THE MAHELE AND CHANGES IN LAND TENURE

Traditional land tenure at the time of Western contact had *ali‘i* and *konohiki* controlling land units, with the disenfranchisement of *maka‘āinana* from land ownership. The chiefly claims to land were dynamic, with their control dependent upon the fortunes of warfare and the political success of higher-ranking *ali‘i*.

The Mahele of the mid-19th century marked a profound change in land tenure, creating a system of private land ownership as a replacement for the traditional structure. In 1845 and 1846, legislation was enacted to establish the Board of Commissioners to Quiet Land Titles. The Land Commission determined an individual’s right to land, issuing an award if the claim was successful, which was authorized by a Royal Patent from the minister of the interior upon payment of a fee. Claims had to be received by the board between 1846 and 1848, a survey of the property had to be completed, and claimants needed to testify before the commission between 1850 and 1855 (Moffat and Fitzpatrick 1995:50).

A key phase of the Mahele involved the division of lands between Kamehameha III (Kauikeaouli) and the major *ali‘i* and *konohiki*; Kauikeaouli subsequently gave a portion of his lands to the government. Although the “Principles Adopted by the Board of Commissioners to Quiet Land Titles in Their Adjudication of Claims Presented to Them” reserved one-third of the kingdom’s land for the *maka‘āinana*, this principle was never executed (Moffat and Fitzpatrick 1995:49). Instead, *kuleana* awards and government land-grant sales were aimed at providing the *maka‘āinana* with fee simple private ownership of land. *Kuleana* awards required that the claimant prove he or she had cultivated the land for two or more years. For those *maka‘āinana* who did not receive *kuleana* awards, government land grants were available. This fee simple sale of land, however, was also open to non-Hawaiian residents.

Through the Mahele, Kamehameha III claimed the *ahupua‘a* of Lualualei along with Wai‘anae and Nānākuli. Only six Land Commission Awards (LCA) were given in Lualualei Valley, all in the *‘ili ‘aina* of Pūhāwai. These six awards, and two other rejected land claims, indicate that at least eight families resided in Lualualei during the mid-19th century. The LCA for Lualualei document 163 *lo‘i*, multiple *kula* plots possibly used for dryland agriculture as well as *pili* harvesting, and plots of land planted in *wauke* used for *kapa* production. The project area was not claimed as an LCA.

NINETEENTH AND TWENTIETH-CENTURY LAND OWNERSHIP AND AGRICULTURE

With changes in land tenure, population, and economics in Lualualei during the 19th century, two agricultural industries began to dominate the valley: cattle ranching and sugarcane production. Later, the U.S. military became, and remains, a significant presence in the district.

Land Ownership

The project area and larger DHHL VOA property are within Grant 4751. The approximately 3,000-acre parcel (described among various sources as between 2,600 acres and 3,600 acres) that became Grant 4751 was first offered for sale by the Commissioner of Public Lands, E. S. Boyd, in 1902. The parcel was described as “pasture and arable land, and some is partially covered with algaroba forests,” and was initially expected to be sold in separate lots of about 500-600 acres each (*The Independent* August 8, 1902:4). J. M. Dowsett, a major shareholder in the Waianae Sugar Company, attempted to purchase the entire parcel in 1903 at four to five times the valued price ($32,000), but the sale was denied due to questions raised by Territorial Senator Lincoln Loy McCandless about Dowsett’s United States citizenship (*Evening Bulletin* May 20, 1903:1; *The Hawaiian Star* May 21, 1903:8; *The Independent* June 12, 1903:3). Approximately one month after the aborted sale, Heinrich (Henry) Martens von Holt (H.M. von Holt) purchased the parcel for almost an identical price ($32,100), prompting a letter from the Dowsett Company, Limited, to the Superintendent of Public Works challenging the legality of the sale (*The Independent* June 12, 1903:3; Dowsett Company, Limited 1903). Ownership of Grant 4751 passed to the George Holt Trust Estate by the 1930s, and a roughly 93-acre portion was transferred to the United States Government for the Voice of America radio transmitter station by 1948 or 1949, as recorded on tax maps of the area (Figure 4).

Cattle Ranching

Cattle ranching began in Lualualei in 1851 when William H. Jarrett leased nearly 17,000 acres of Crown Land from Kamehameha III (Kelly 1991). Lualualei Ranch, as it was named, changed hands, with partnerships variously between Jarrett, his son Paul Jarrett, and Paul Manini; Jarrett and George Galbraith; and Galbraith and James Dowsett (Kelly 1991:326-327). The lease on the Lualualei Ranch eventually held by Galbraith and Dowsett expired in 1901 and was not renewed. Soon after annexation by the United States in 1898, the Territorial Government initiated the division and auction of the Crown Lands in Lualualei Valley for homesteads primarily associated with ranching (Kelly 1991:328). Between 1909 and 1915, L.L. McCandless purchased more than half of the homestead lots in Lualualei and used the majority of this land for cattle ranching. The U.S. military condemned and acquired most of McCandless’s land in 1929, although grazing leases continued for several decades.

Sugarcane: The Waianae Sugar Company

The Waianae Company sugar plantation was formed in 1879 and the company had 300 acres of sugarcane planted in Lualualei Valley by 1892. The amount of land in Lualualei under cultivation varied during the next half century. The company leased 3,332 acres in Lualualei from the Territorial Government in 1901; however, in 1910 only 1,600 acres were planted in sugarcane in Wai‘anae and Lualualei Valleys. By 1913, much of the DHHL VOA parcel was planted in sugarcane (United States Army Corps of Engineers 1913). In 1931, cane land in Wai‘anae, Mākaha, and Lualualei went from 3,000 acres to 1,200 acres in order to concentrate irrigation and increase yields (Kelly 1991:337). A private narrow-gauge railroad transported the sugarcane from the fields to the mill, while the Oahu Railway and Land Company (OR&L) moved the sugar to Honolulu. After the OR&L discontinued service to Wai‘anae in 1946, the Waianae Company closed.

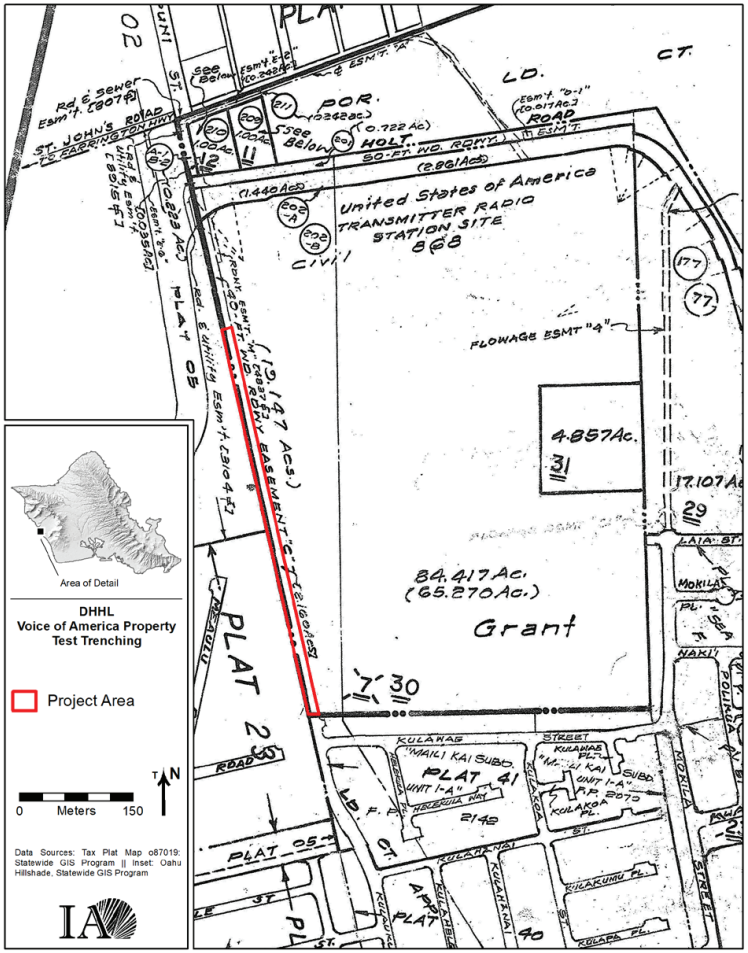

Figure 4. The Kulaaupuni Street Road Extension Corridor project area with TMK boundaries.

U.S. Military

The presence of the U.S. military in Lualualei and adjacent areas of leeward O‘ahu began incrementally in 1917 but greatly expanded to become the major landholder in 1929. Camp Andrew, a 31-acre military recreation area, was created along the Nānākuli coast in 1917 (Nakamura and Pantaleo 1994). In 1918, the U.S. Army established an amphibious training camp at Pōka‘i Bay as part of the Wai‘anae Military Reservation (Flood et al. 1994), and Kolekole Road was improved to provide access to the bay in 1923 (Kelly 1991). Between 1929 and 1933, the U.S. Navy obtained approximately 8,000 acres at the head of Lualualei Valley to establish the Naval Ammunition Depot and Naval radio transmission station. Infrastructure at the Ammunition Depot was expanded during World War II (WWII) with the construction of additional magazines, storage buildings, and houses (Landrum et al. 1997). During this time, the OR&L laid railroad tracks into the valley so that the military could transport munitions to the storage areas (Kelly 1991:340). After the end of WWII, the Lualualei Branch experienced renewed activity during the Korean War. Between the late 1980s and late 1990s, it was downsized significantly and now functions primarily as an ammunition depot.

In 1944, the Voice of America radio transmitter station was constructed in Mā‘ili. The station operated until at least 1964, and in 1971 the property was transferred to the U.S. Coast Guard for use as a transmitting station. The VOA antenna and transmission buildings were razed in the 1980s with remediation of hazardous materials beginning in 2018.

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

A substantial portion of Lualualei Valley has been subject to archaeological research, including an AIS of the entire DHHL VOA property by Rieth (2009) and Dagher and Spear (2013) (Table 1-Table 2;Figure 5-Figure 6).

Archaeology Investigations Outside of the Project Area

Several studies are relevant to the current project: archaeological investigations within the Mā‘ili Kai Property to the east and south of the project area (Barrera 1975; Cordy 1976; Jimenez 1994; Mayberry and Rosendahl 1994) and an archaeological assessment for the transitional housing at the northwestern corner of the project area (Tulchin and Hammatt 2007, 2008).

Barrera (1975) surveyed approximately 80 acres within the Mā‘ili Kai parcel and documented six sites (Sites 50-80-07-5309 through 5314). These sites are a possible religious structure, C-shape, two house site features, one possible site, and a subsurface midden scatter (Barrera 1975). Cordy (1975) conducted archaeological excavations at Site 50-80-07-5309 and determined that there was no evidence to support Barrera’s interpretation it was a religious structure; the site was determined to be a historical structure built no earlier than 1930-1940. Cordy (1976) also conducted an additional survey of 130 acres within Mā‘ili Kai (parcel previously referred to as the Kaiser Pacific Properties Land in Mā‘ili) which resulted in the identification of 19 sites, most of which are rock walls.

Mayberry and Rosendahl (1994) conducted a reconnaissance survey of the approximately 415-acre Mā‘ili Kai Property. Twenty-six sites were documented, 12 of which were newly identified (Sites 50-80-07-3333 to 3344), and 14 were re-located from previous survey work. Eleven previously recorded sites were not re-located and were determined to have been destroyed by land modification related to large-scale ranching, land clearing, and quarrying. Twenty-four of the 26 sites date to the 20th century. Jimenez (1994) completed an additional inventory survey at four archaeological sites (Sites 50-80-07-3339, 3344, 3750, and 3755)

previously recommended for further data collection by Mayberry and Rosendahl (1994). The findings of the additional work confirmed the initial site interpretations presented by Mayberry and Rosendahl (1994), with the exception of Site 50-80-07-3750. Excavations at Site 50-80-07-3750 resulted in the documentation of a cultural deposit containing small amounts of marine shell, charred *kukui* (*Aleurites molucanna*) endocarp, and charcoal. A single radiocarbon date (Beta-69585) indicates occupation may have begun sometime between the 15th to 17th centuries.

Tulchin and Hammatt (2007, 2008) surveyed a 6-acre parcel at the northern end of the VOA corridor and documented a single VOA antenna pedestal foundation (recorded as Site 50-80-07-7081 Feature 1 by Rieth 2009). No traditional Hawaiian features were documented.

Archaeological work along the shoreline to the west has documented intact pre-Contact cultural deposits (McDermott and Hammatt 2000) and burials (Hammatt and Shideler 1991). McDermott and Hammatt's (2000) inventory survey of 'Ulehawa Beach Park documented two subsurface cultural strata approximately 1 m below the surface (Sites 50-80-07-5762 and 5763) that contained vertebrate and invertebrate midden, and traditional and historical artifacts. The deposits are interpreted as being intermittent or temporary habitation locales that likely date to the late pre-Contact or very early post-Contact periods.

Seven burials (Site 50-80-07-4224) were encountered during the installation of a Board of Water Supply water main on Liopolo Street (Hammatt and Shideler 1991). The relatively high density of the burials suggests this area was a specific pre-Contact burial site for one or more Hawaiian families (Hammatt and Shideler 1991).

ARCHAEOLOGICAL INVESTIGATION WITHIN THE PROJECT AREA

Rieth (2009) and Dagher and Spear (2013) completed archaeological inventory surveys of the DHHL VOA parcel, including the road extension corridor. Three sites were recorded, none of which are within the current project area. Sites 50-80-07-7081 and 7082 are remnants of the VOA facility. Site 50-80-07-7081 consists of 18 concrete pedestal foundations for the former VOA antenna array and a historical trash dump. Rieth (2009) originally documented the site as including 16 pedestals, with Dagher and Spear (2013) recording two additional pedestals and the trash dump. The pedestal foundations are configured in three nearly linear parallel arrangements oriented northeast-southwest and extending across the length of the parcel. Site 50-80-07-7082 included four features that are the remnants of the VOA transmitter buildings and associated structures. All of these features were destroyed or razed to the post-hazardous material removal surface in 2018.

Site 50-80-07-7083 is a drylaid masonry structure Rieth (2009) interprets as a Waianae Company elevated railroad bed and Dagher and Spear (2013) interpret as a plantation cart path. The originally continuous structure is divided into three segments by breaches created during the construction of the VOA facility. It is constructed with dry laid angular and tabular basalt and coral boulders and cobbles. The faces of the structure have a slight batter angle. Basalt boulders are often present as the lower courses, with the majority of the structure constructed with limestone boulders and slabs.

Table 1. Archaeological Projects within 1.0 km of the Project Area; Listed Chronologically.

Author(s)	Description	Location
Barrera (1975)	Reconnaissance survey; 6 sites (religious structure, C-shape, two house site features, a possible site, and a subsurface midden scatter)	Mā'ili Kai Property (previously Kaiser Pacific Properties Corp. land)
Cordy (1975)	Excavation of Site 5309 (Ch-Oa-1) (possible religious structure first recorded by Barrera [1975])	Mā'ili Kai Property (previously Kaiser Pacific Properties Corp. land)
Cordy (1976)	Reconnaissance survey; 19 sites (walls, highly disturbed sites, or seemingly recent)	Mā'ili Kai Property
Hammatt and Shideler (1991)	Burial recovery of inadvertent finds during archaeological monitoring for Board of Water Supply water main; Site 50-80-07-4224	Liopolo Street
Mayberry and Rosendahl (1994)	Reconnaissance survey within Mā'ili Kai Property (TMK 8-7-10: 2, 14); 26 sites were found (14 previously recorded [Cordy 1976])	Mā'ili Kai Property (TMK 8-7-10:2, 14)
Jimenez (1994)	Additional AIS within Mā'ili Kai property; Sites 50-80-07-3339, 3344, 3750, 3755 (previously identified)	Mā'ili Kai Property
McDermott and Hammatt (2000)	Inventory survey; Site 50-80-12-9714 (previously recorded) and Sites 50-80-07-5761, 5762, 5763	'Ulehawa Beach Park Parcel (TMK 8-7-05:01, 03; 8-7-06:01; 8-7-07:01; 8-7-08:26)
Tulchin and Hammatt (2007, 2008)	Inventory survey; no sites	Northwest corner of VOA property
Rieth (2009)	Inventory survey; Sites 50-80-07-7081, 7082, 7083	DHHL VOA property
Dagher and Spear (2013)	Inventory survey; Sites 50-80-07-7081, 7082, 7083 (previously identified)	DHHL VOA property

Table 2. Summary of Sites within 1.0 km of the Project Area.

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3333	Complex; one standing structure, two collapsed structures, and associated post-WWII trash; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3334	Complex; cement and rock charcoal kiln, two collapsed wood and tin structures, small rock cairn; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3335	Sinkhole/well and wall; destroyed between 1987 and 1993; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994) , Jimenez (1994)
3336	Complex; two modified natural sinkholes, stone wall, two channeled concrete slabs; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3337	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3338	Complex; two small rock mounds; (not depicted in Figure 6)	Unknown	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3339	Two stone enclosures and a wall; (not depicted in Figure 6)	Unknown	Mā‘ili Kai Property	Mayberry and Rosendahl (1994), Jimenez (1994)
3340	C-shaped enclosure; (not depicted in Figure 6)	Mid to late-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3341	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3342	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3343	Stone wall enclosure and associated C- shape; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994)
3344	Platform; (not depicted in Figure 6)	Early to mid-20th century	Mā‘ili Kai Property	Mayberry and Rosendahl (1994), Jimenez (1994)
3345	Rock mound and wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3346	Boundary wall; (not depicted in Figure 6)	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3347	Rock wall associated with Sites 3345 and 3346	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3348	Two circular mounds	Early 20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3349	C-shaped stone wall enclosure (or semi-enclosure) and a smaller wall	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3750	C-shape stone wall enclosure	15th to 17th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994) , Jimenez (1994)
3751	Rock mound	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3752	Two small low rock mounds	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3753	Rock mound	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3754	Stone bridge and shallow trench	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
3755	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994) , Jimenez (1994)
3756	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3757	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
3758	Rock mound/platform	Early to mid-20th century	Mā‘ili Kai Property	Cordy (1976), Mayberry and Rosendahl (1994)
4224	Burial area (seven localized burials)	Pre-Contact	Liopolo Street, Mā‘ili	Hammatt and Shideler (1991)
5309	Possible religious structure; destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975), Cordy (1975)
5310	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5311	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5312	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5313	Destroyed; (not depicted in Figure 6)	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)
5314	Subsurface midden scatter	20th century	Mā‘ili Kai Property (previously Kaiser Pacific Properties Corp. land)	Barrera (1975)

Site No. (50-80-07-)	Description	Age	Site Location	Reference
5761	Three concrete bunkers and two foundations (not depicted in Figure 6)	WWII era	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
5762	Subsurface cultural layer (not depicted in Figure 6)	Pre-Contact or early post-Contact	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
5763	Subsurface cultural layer (not depicted in Figure 6)	Pre-Contact or early post-Contact	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
7081	VOA Antenna Foundations	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
7082	VOA Building Foundations and Support Structures	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
7083	Probable Sugarcane Railroad Bed	20th century	VOA property	Rieth (2009), Dagher and Spear (2013)
9714	Tracks of O.R.&L. Railroad line (not depicted in Figure 6)	Late 19th century	‘Ulehawa Beach Park	McDermott and Hammatt (2000)
Ch-Oa-11	Stone wall; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-17	Central enclosure of two stone alignments; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-18	Stone enclosure; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-25	Rectangular stone platform; destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)
Ch-Oa-27	Trail (300 m long); destroyed (not depicted in Figure 6)	20th century	Mā‘ili Kai Property	Cordy (1976)

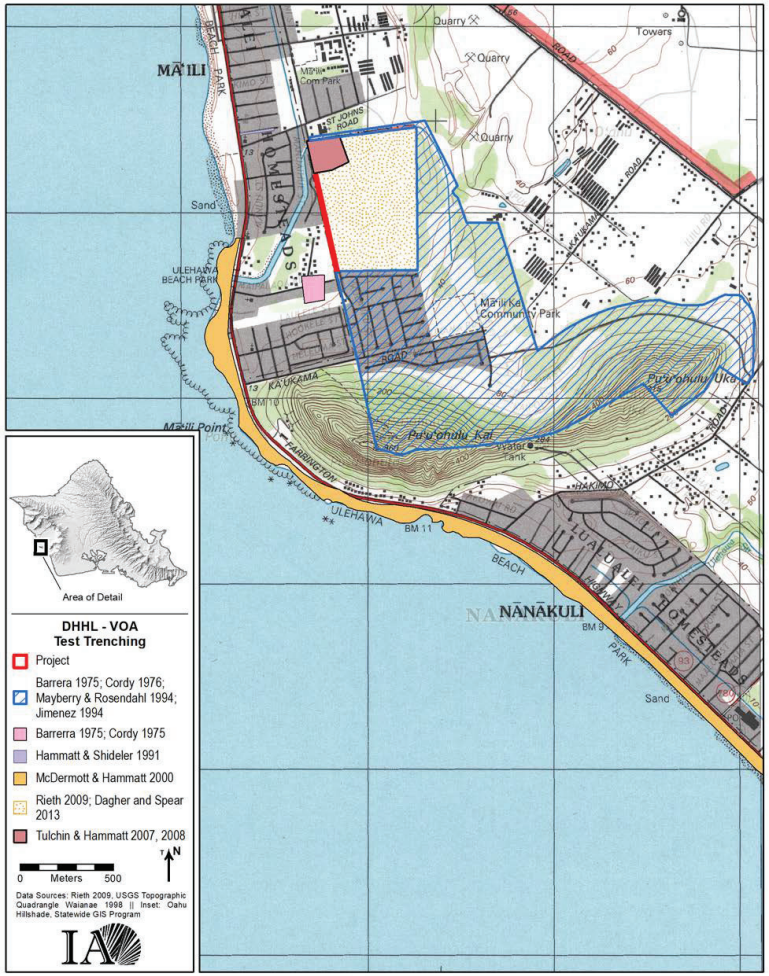

Figure 5. Previous archaeological investigations within 1 km of the project area.

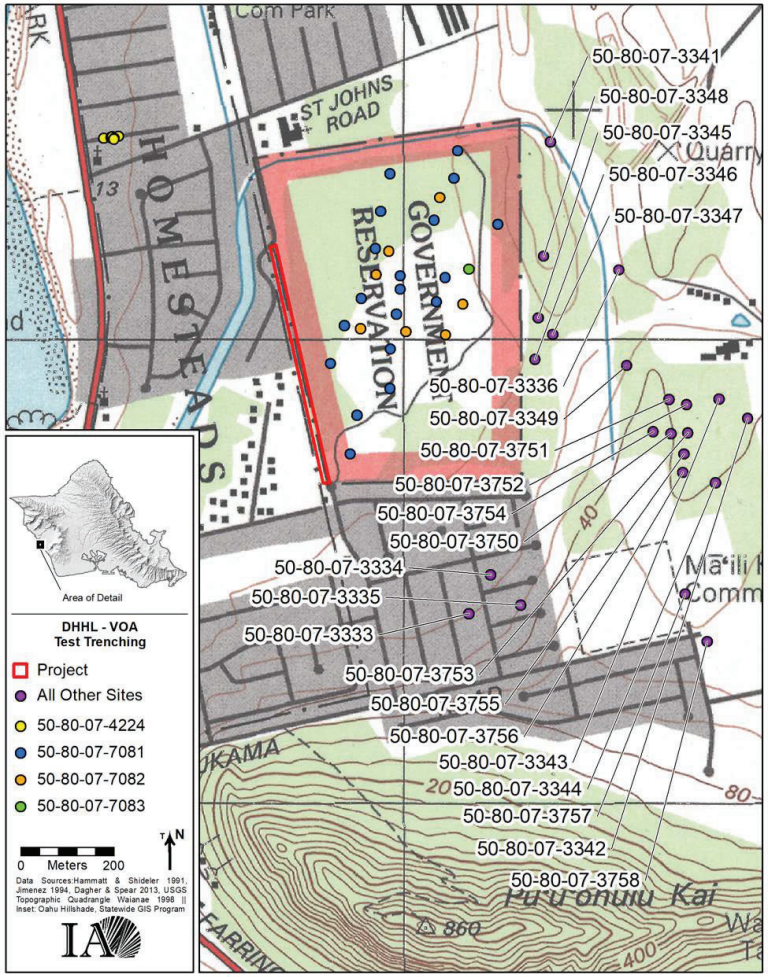

Figure 6. Previously identified archaeological sites near the project area.

III. RESEARCH METHODS

This section presents the project's research questions and fieldwork procedures.

RESEARCH QUESTIONS

Four research questions guided the survey and data analyses.

1) What is the depositional and soil forming sequence for the project area? Both natural and cultural deposits were assessed as to the depositional agent(s) and mode(s) that created them, what soils are present and how they formed, and the condition of the deposits.

2) Are pre-Contact cultural deposits present? If so, what activities are represented? As noted, legendary and historical evidence suggest the project area and surrounding areas were locations used for pre-Contact habitation.

3) Are historical period cultural deposits present? If so, what activities are represented? Sugarcane production was present in Lualualei during the late 19th and early 20th century, and it is possible that other agricultural activities took place in this area. These historical activities may have created archaeological deposits.

4) Are burials or isolated human skeletal remains present? Previous archaeological investigations along the coastline to the west have documented burials and isolated human skeletal remains.

FIELDWORK METHODS

The project area was systematically surveyed with transect lines spaced a few meters apart. Following the survey, four test trenches were mechanically excavated at locations distributed across the project area. Trenches ranged from 4.8-10.4 m long, and all trenches were 0.65 m wide and were excavated to an average depth of 1.0 m bs. All trenches were excavated with a mini excavator under the supervision of the Project Director and Field Technician. Exposed sediments and soils were examined for cultural material. Soils were documented following U.S. Soil Survey and Soil Conservation Service nomenclature (Soil Science Division Staff 2017) for texture; structural grade, size, and form (or absence of structure); dry or moist consistence; wet consistence (stickiness, plasticity); root frequency and size; presence of charcoal or other cultural materials; and lower boundary distinctness and topography. Color was recorded using the Munsell color system (Munsell 2000). Each deposit was also examined for signs of sedimentary structures such as bedding, and for any other additional information (e.g., evidence for basaltic or coralline origin) that can help clarify depositional and soil forming history. Scaled stratigraphic profiles were drawn for at least one long sidewall of each trench. Each profiled trench exposure was photographed using a Samsung Galaxy Tab S3 tablet, and the photographs were curated with the other archaeological project records. All trenches were backfilled at the end of the work day.

The locations of the trenches were recorded with a Trimble Geo 7X Global Positioning System (GPS) unit using the North American Datum of 1983 in Universal Transverse Mercator Zone 4 North (NAD 83 UTM 4N). GPS data were differentially corrected to produce data with submeter accuracy.

IV. RESULTS

This section presents the fieldwork results and is organized as follows.

RESULTS OF SUBSURFACE TESTING AND STRATIGRAPHIC INTERPRETATIONS

The four trenches were spaced at about 70 m intervals along the proposed full road extension corridor (Figure 7). Strata were correlated between the trenches with six primary layers (Layers I-VI) documented. Table 3 presents the descriptions of these layers and interpretations about their deposition. General consistencies in stratigraphy were documented across the project area. Appendix B presents individual soil and sediment descriptions for each trench.

TRENCH 1

Trench 1 was the northernmost excavation and was closest to the intersection of Kulaaupuni Street and Holt Road. The trench was behind 87-87122 Mamoalii Place. Trench 1 was 4.8 m long, 0.65 m wide, and 1.0 m deep (Photo 2; Figure 8). A buried fiber optic line conduit was exposed at 90 cm bs. Rainwater collecting within the conduit flooded the base of the trench and prohibited further excavation (Photo 3). No archaeological deposits were present. Recent fills atop alluvium were recorded.

TRENCH 2

Trench 2 was approximately 70 m southeast of Trench 1 along the road corridor. The trench was behind 226 Mamoalii Place. Trench 2 was 7.3 m long, 0.65 m wide, and 1.1 m deep (Photo 4; Figure 9). The water table was present around 1.0 m below surface. A modern *imu* originating from a fill (Layer Ia) was documented on the west wall of the trench. The *imu* extended to 78 cm bs. A modern concrete slab was encountered at 20 cm bs in the west and north walls, which prohibited further excavation in this portion of the trench. No archaeological deposits were present and recent fills capping several alluvial strata were recorded.

TRENCH 3

Trench 3 was approximately 90 m south-southeast of Trench 2, behind 87-702 Mealu Road. It was 10.4 m long, 0.65 m wide, and 1.35 m deep, ending at limestone bedrock (Photo 5; Figure 10). No archaeological deposits were present and recent fill capping two alluvial strata were recorded.

TRENCH 4

Trench 4 was the southernmost excavation, just west of the Kamehameha Schools' Community Learning Center and behind 87-722 Meaulu Road. It was 10 m long, 0.65 m wide, and 1.1 m deep, ending at limestone bedrock (Photo 6; Figure 11). Mottling of the upper fills and the presence of large concrete fragments, sawn tree roots and branches, and modern rubbish attest to recent mechanical ground disturbance. No archaeological deposits were present and recent fill capping two alluvial strata were recorded.

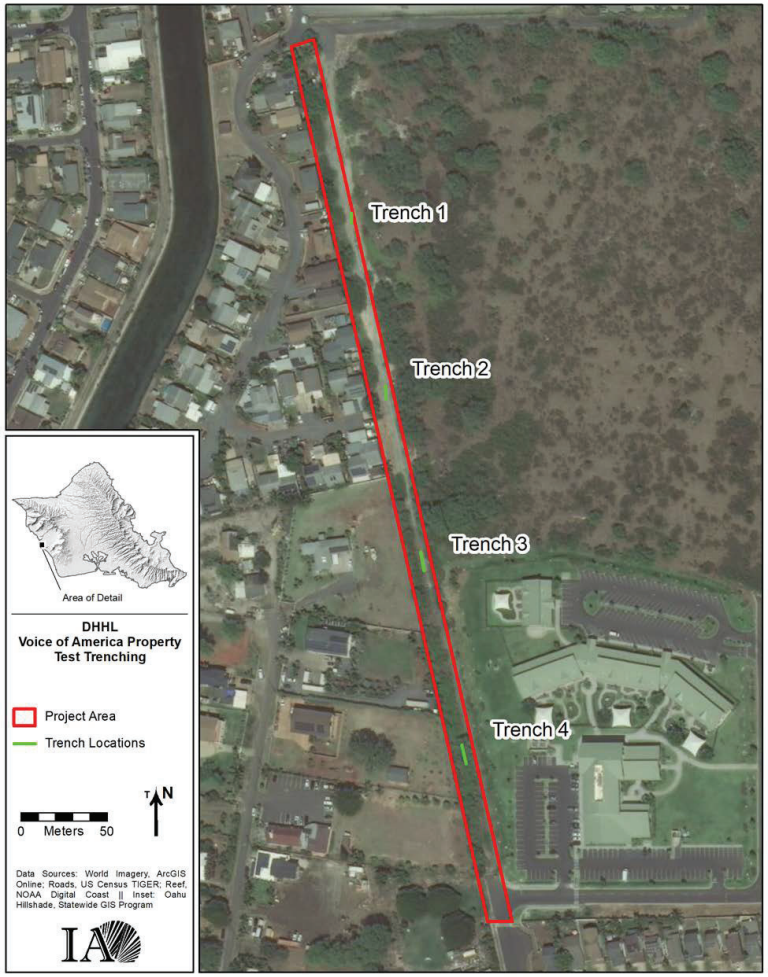

Figure 7. The locations of the trenches excavated within the project area.

Table 3. Soils and Sediments Documented Across the Project Area.

Layer	Interpretation	Description	Trenches
Ia	Fill	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	1, 2, 3, 4
Ib	Fill	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	1, 2
Ic	Fill	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	1, 2
Id	Fill	Very dark grayish brown (10YR 3/2) silt loam; moderate, coarse or thick, granular structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 10% subangular pebbles to cobbles; abrupt, wavy boundary	3
Ie	Fill	Very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; common, coarse roots; 15% subangular pebbles to cobbles; clear, wavy boundary	4
II	Alluvium	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic	1, 2, 3
IIIa	Alluvium	Light gray (10YR 7/2) clay; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; clear, wavy boundary	2
IIIb	Alluvium	Very dark grayish brown (10YR 3/2) clay loam; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; abrupt, wavy boundary	2

Layer	Interpretation	Description	Trenches
IV	Alluvium	Greenish gray (GLEY 1 6/5GY) sandy clay; weak structure; moist consistency: very friable; wet consistence: slightly sticky, slightly plastic; base of excavation	2
V	Alluvium	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; base of excavation	3, 4
VI	Alluvium	Very dark gray (10YR 3/1) sandy clay; weak structure; moist consistency: very friable; wet consistency: slightly sticky, plastic; base of excavation	4

Photo 2. West sidewall of Trench 1.

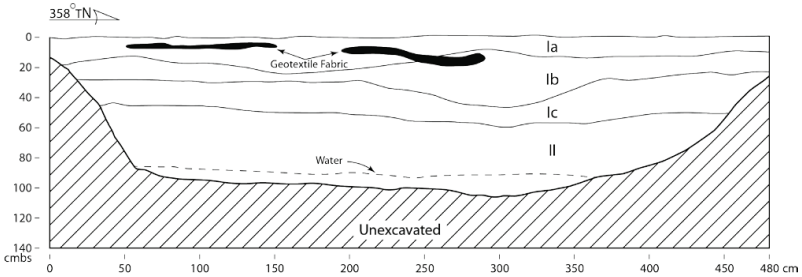

Figure 8. West sidewall of Trench 1.

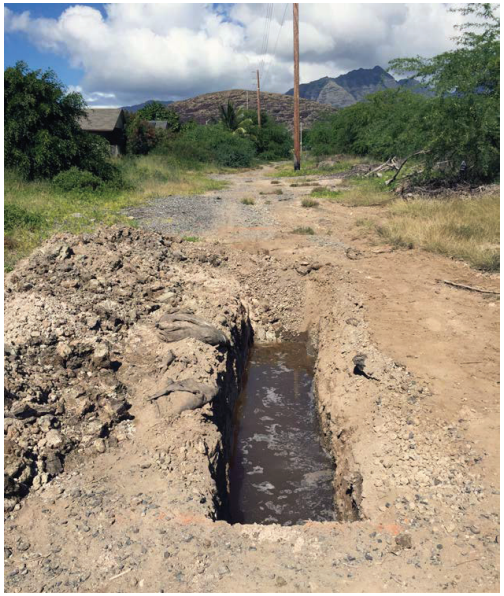

Photo 3. Overview of Trench 1 after excavation; view to the north.

Photo 4. West sidewall of Trench 2.

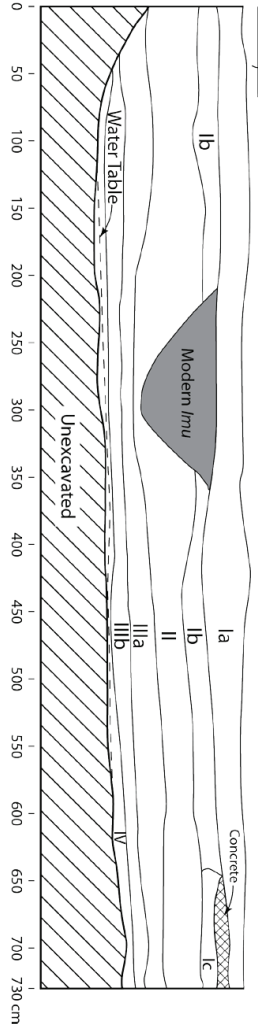

Figure 9. West sidewall of Trench 2.

Photo 6. West sidewall of Trench 4.

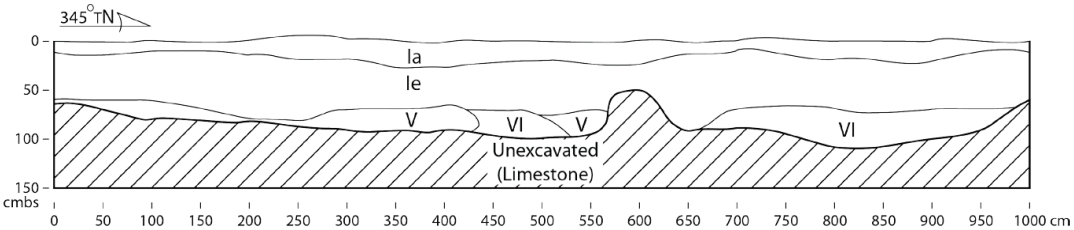

Figure 11. West sidewall of Trench 4.

Photo 5. West sidewall of Trench 3.

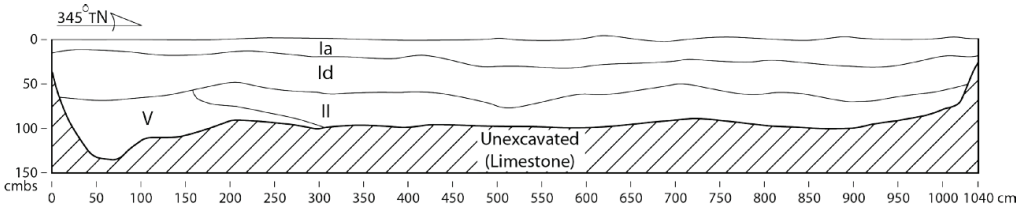

Figure 10. West sidewall of Trench 3.

V. DISCUSSION

The research questions outlined in Section III guided the analyses. These are addressed using data generated by the project along with results from other projects in the area.

1) What is the depositional and soil forming sequence for the project area?

The depositional sequence within the project area consists of three primary events. Basal reef-derived limestone bedrock formed during the last interglacial sea level highstand ca. 134-113,000 ka, associated with the Waimānalo reef formation (Fletcher et al. 2008:458). Multiple alluvial deposits accumulated atop the bedrock and formed soils (Layers II-VI). The alluvium is capped by multiple modern fills (Layers Ia-Ie) deposited by 20th century construction.

2) Are pre-Contact cultural deposits present? If so, what activities are represented?

No pre-Contact cultural deposits were observed.

3) Are historical period cultural deposits present? If so, what activities are represented?

No historical period cultural features or deposits were present in the project area.

4) Are burials or isolated human skeletal remains present?

No burials or human skeletal remains were encountered during excavations.

VI. CONCLUSION

Under contract to Gray, Hong, Nojima & Associates, and on behalf of the Department of Hawaiian Home Lands, International Archaeology, LLC completed an archaeological inventory survey of the proposed Kulaaupni Street extension corridor. No archaeological sites were documented by the pedestrian survey and subsurface testing. No further work is recommended for the project area. However, if finds are encountered during construction, the State Historic Preservation Division should be contacted immediately.

REFERENCES

Allen, M.S.
2004 Bet-hedging Strategies, Agricultural Change, and Unpredictable Environments: Historical Development of Dryland Agriculture in Kona, Hawaii. *Journal of Anthropological Archaeology*, 23(2), pp.196-224.

Allen, Melinda S., and Jennifer M. Huebert
2014 Short-Lived Plant Materials, Long-Lived Trees, and Polynesian ^{14}C Dating: Considerations for ^{14}C Sample Selection and Documentation. *Radiocarbon* 56:257-276.

Barrera, William
1975 *Archaeological Site Survey at Mā'ili, O'ahu.* Prepared for Kaiser Pacific Properties Corporation. Chiniago, Inc., Kaneohe.

Cordy, Ross
1975 *Archaeological Excavation at CH-Oa-1 (Mā'ili, Oahu)*. Prepared for Kaiser Pacific Properties Corporation. Manuscript on file, State Historic Preservation Division, Department of Land and Natural Resources, Kapolei.

1976 *An Archaeological Survey of Kaiser Pacific Properties' Land, Mā'ili Kai, O'ahu.* Manuscript on file, Department of Land and Natural Resources-Historic Sites Section.

1996 The Rise and Fall of the O'ahu Kingdom: A Brief Overview of O'ahu's History. In *Oceanic Culture History: Essays in Honour of Roger Green* by Janet Davidson, Geoff Irwin, B. Leach, Andrew Pawley, and D. Brown (eds.), pp. 591-613. New Zealand Journal of Archaeology Special Publication.

2002 *The Rise and Fall of the O'ahu Kingdom*. Mutual Publishing, Honolulu.

Dagher, Cathleen A., and Robert L. Spear
2013 *An Archaeological Inventory Survey for the Kamehameha Schools Community Learning Center at Mā'ili, Lualualei Ahupua'a, Wai'anae District, Island of O'ahu, Hawai'i [TMK: (1) 8-7-010:007 (POR.)]* (Draft Report). Prepared for PBR Hawaii and Associates, Inc. Scientific Consultant Services, Honolulu.

Dixon, Boyd, Dennis Gosser, and Scott Williams
2008 Traditional Hawaiian Men's Houses and Their Socio-political Context in Lualualei, Leeward West O'ahu, Hawai'i. *Journal of the Polynesian Society* 117:267-295.

Dixon, Boyd, Dennis Gosser, Scott Williams, Jennifer Robins, Constance O'Hare, Laura Gilda, and Stephan Clark
2003 *Cultural Resources Survey of Selected Lands Naval Magazine Pearl Harbor, Lualualei Branch, Island of O'ahu, Hawai'i*. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. AMEC Earth and Environmental, Honolulu.

Dowsett Company, Limited
1903 Letter to the Superintendent of Public Works, Commissioner of Public Lands, and H. M. von Holt, Esq. 23 June 1903. Hawaii State Archives, Box 65.

Evening Bulletin
1903 "Senator McCandless Protests Against Lualualei Exchange." *Evening Bulletin* May 20, 1903. http://chroniclingamerica.loc.gov/lccn/sn82016413/1903-05-20/ed-1/seq-1/ (retrieved May 5, 2014).

Fletcher, Charles H., Chris Bochicchio, Chris L. Conger, Mary S. Engels, Eden J. Feirstein, Neil Frazer, Craig R. Glenn, Richard W. Grigg, Eric E. Grossman, Jodi N. Harney, Ebitari Isoun, Colin V. Murray-Wallace, John J. Rooney, Ken H. Rubin, Clark E. Sherman, and Sean Vitousek
2008 Geology of Hawai'i 'Reefs. In *Coral Reefs of the World*, Volume 1, edited by B.M. Riegl and R.E. Dodge, pp. 435-487, Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-6847-8_11

Flood, Krista, Paul Christiaan Kieger, Susan A. Lebo, Boyd Dixon, Stephan Clark, and Scot Parry
1994 *An Archaeological Inventory Survey and Mitigation Plan of a Seven Acre Parcel (TMK: 8-5-28: Por. 42) in Wai'anae Kai Ahupua'a, Wai'anae District, O'ahu Island, Hawai'i*. Prepared for Franklin Wong and Associates Limited. Bishop Museum Anthropology Department, Honolulu.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens
1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. United States Department of Agriculture Soil Conservation Service in cooperation with the University of Hawaii Agricultural Experiment Station.

Fornander, Abraham
1880 *An Account of the Polynesian Race: Its Origin and Migrations and the Ancient History of the Hawaiian People to the Times of Kamehameha I; Volume II*. Trubner, London.

Giambelluca, Thomas W., Michael A. Nullet, and Thomas A. Schroeder
1986 *Rainfall Atlas of Hawai'i*. Department of Land and Natural Resources, Honolulu.

Green, Roger
1980 *Makaha Before 1880 A.D., Makaha Valley Historical Project-Summary; Report 5*. Pacific Anthropological Records 31. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

Hammatt, Hallett H., and David W. Shideler
1991 *Archaeological Monitoring at Liopolo Street, Mā'ili 8" Water System, Part III, Mā'ili, Wai'anae, O'ahu, With a Discussion of Burial State Site No. 50-80-07-4244*. Cultural Surveys Hawai'i, Inc., Kailua.

Hawaiian Star
1903 "News in a Nutshell: Paragraphs That Give Condensed News of the Day." *The Hawaiian Star* May 21, 1903. http://chroniclingamerica.loc.gov/lccn/sn82015415/1903-05-21/ed-1/seq-8/, retrieved May 6, 2014.

Independent
1902 "Want Public Lands?" *The Independent* August 8, 1902. http://chroniclingamerica.loc.gov/lccn/sn85047097/1902-08-08/ed-1/seq-4/ (retrieved May 5, 2014).

1903 "Local and General News." *The Independent* June 12, 1903. http://chroniclingamerica.loc.gov /lccn/sn85047097/1903-06-12/ed-1/seq-3/ (retrieved May 5, 2014).

Jimenez, Joseph
1994 *Additional Archaeological Inventory Survey Mā'ili Kai Project Area, Land of Lualualei, Waianae District, Island of O'ahu*. Prepared for PBR Hawai'i. Paul H. Rosendahl, Ph.D., Inc., Hilo.

Kelly, Marion
1991 Notes on the History of Lualualei. In *An Archaeological Survey of the Naval Magazine and Naval Communications Area Transmission Facility Lualualei, O'ahu, Hawai'i* by Alan Haun. Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Applied Research Group, Bishop Museum, Honolulu.

Landrum, James, Robert Drolet, and Katherine Bouthillier
1997 *Cultural Resources Overview Survey Naval Magazine Lualualei, Island of O'ahu, Hawai'i; In Conjunction with Department of Defense Legacy Resource Management Program: Demonstration Project #70.* Prepared for Department of the Navy, Pacific Division, Naval Facilities Engineering Command, Pearl Harbor. Ogden Environmental and Energy Services Co., Inc., Honolulu.

MacDonald, Gordon A., Agatin T. Abbott, and Frank L. Peterson
1983 *Volcanoes in the Sea: The Geology of Hawaii*. University of Hawaii Press, Honolulu.

Mayberry, James, and Paul H. Rosendahl
1994 *Archaeological Reconnaissance Survey for Environmental Impact Statement (EIS) Maili Kai Property, Land of Lualualei,* Wai'anae District*, Island of O'ahu (TMK:8-7-10:2, 14)*. Prepared for PBR Hawai'i. Paul H. Rosendahl, Ph.D., Inc., Hilo.

McDermott, Matt. and Hallett H. Hammatt
2000 *Archaeological Inventory Survey of the 57.65 Acre 'Ulehawa Beach Park Parcel, Ahupua'a of Lualualei, Wai'anae District, Island of O'ahu (TMK:8-7-05:01, 03 and 05; 8-7-06:03; 8- 7-08:01; 8-7-08:26; 8-7-08:26)*. Cultural Surveys Hawai'i, Inc., Kailua.

Moffat, Riley M., and Gary L. Fitzpatrick
1995 *Surveying the Mahele*. Editions Limited, Honolulu.

Munsell (Color)
2000 *Munsell Soil Color Charts*. Revised washable edition. GretagMacbeth, New Windsor, New York.

Nakamura, Barry S., and Jeffrey Pantaleo
1994 *Aspects of the History of Lualualei and Nanakuli, Wai'anae District, O'ahu*. Prepared for DHM, Inc. Aki Sinoto Consulting, Honolulu.

Price, Saul
1973 Climate. In *Atlas of Hawaii* edited by R. Warwick Armstrong, pp. 53-60. University of Hawai'i Press, Honolulu.

Pukui, Mary Kawena, Samuel H. Elbert, and Esther T. Mookini
1974 *Place Names of Hawai'i*. University of Hawai'i Press, Honolulu.

Rieth, Timothy M.
2009 *An Archaeological Inventory Survey of the Former Voice of America Site, Mā'ili, Lualualei Ahupua'a, Wai'anae District, O'ahu; TMK: (1) 8-7-010:007*. Prepared for Element Environmental, LLC. International Archaeological Research Institute, Inc., Honolulu.

Rieth, Timothy M., and J. Stephen Athens
2013 Suggested Best Practices for the Application of Radiocarbon Dating to Hawaiian Archaeology. *Hawaiian Archaeology* 13:3-29.

Sahlins, Marshall
1992 Historical Ethnography. Volume I. In *Anahulu: The Anthropology of History in the Kingdom of Hawai'i* by Patrick V. Kirch and Marshall Sahlins (eds.). University of Chicago Press, Chicago.

Soehren, Lloyd J.
2002-2004 Ulukau: The Electronic Hawaiian Dictionary; Hawaiian Place Names. http://ulukau.org/cgi-bin/hpn?l=en.

Soil Science Division Staff
2017 *Soil Survey Manual*. United States Department of Agriculture Handbook No. 18. Government Printing Office, Washington, D.C.

Sterling, Elspeth, and Catherine Summers
1978 *Sites of Oahu*. Bernice Pauahi Bishop Museum Press, Honolulu.

Tulchin, Jon, and Hallett H. Hammatt
2007 *Archaeological Assessment for the Leeward Coast Emergency Homeless Shelter Project, Lualualei Ahupua 'a, Wai'anae District, Island of O'ahu (TMK: [1] 8-7-010:007)*. Prepared for Stanford Carr Development, LLC. Cultural Surveys Hawai'i, Inc., Kailua.

2008 *Addendum to an Archaeological Assessment for the Leeward Coast Emergency Homeless Shelter Project, Lualualei Ahupua'a, Wai'anae District, Island of O'ahu (TMK: [1] 8-7- 010:por. 007)*. Prepared for Stanford Carr Development, LLC. Cultural Surveys Hawai'i, Inc., Kailua.

United States Army Corps of Engineers
1913 Island of Oahu, Territory of Hawai'i Sheet IX [map]. (1:18000).

GLOSSARY OF HAWAIIAN WORDS

Hawaiian Spelling	Definition
ahupuaʻa	land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (ahu) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief
akua	god, goddess, spirit, ghost, devil, image, idol, corpse
aliʻi	chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander
ʻili ʻāina	an ʻili land division whose chief pays tribute to the chief of the ahupuaʻa of which it is a part, rather than directly to the king
imu	underground oven
kalo	taro, *Colocasia esculenta*
kapa	paperbark cloth; as made from *wauke* or *māmaki* bark; formerly clothes of any kind or bedclothes
kiawe	introduced leguminous tree (first planted in Hawaiʻi in 1828), *Prosopis pallida*
koa haole	introduced leguminous tree, *Leucaena leucocephala*
konohiki	head man of an ahupuaʻa land division under the chief
kula	plain, field, open country, pasture; "an act of 1884 distinguished dry or kula land from wet or taro land" (Pukui and Elbert 1986:178)
kuleana	small piece of property, as within an ahupuaʻa; right, privilege, concern, title, property, estate, portion, interest, claim, ownership
loʻi	irrigated terrace, especially for taro (*loʻi kalo*)
makaʻāinana	commoner
moku	district; island
pili	grass used for construction material, *Heteropogon contortus*
ʻuala	sweet potato, *Ipomoea batatas*
wauke	paper mulberry, *Broussonetia papyrifera*

* Adapted from Mary K. Pukui and Samuel H. Elbert, 1986, *Hawaiian Dictionary*, University of Hawaii Press, Honolulu, unless otherwise noted.

APPENDIX A: SHPD REVIEW LETTERS

INTERNATIONAL ARCHAEOLOGY, LLC

November 2, 2020

Dr. Alan Downer
SHPD Administrator
Kakuhihewa Building
601 Kamokila Blvd., Suite 555
Kapolei, Hawai‘i 96707

SUBJECT: Proposed Archaeological Inventory Survey Subsurface Testing Plan for the Department of Hawaiian Homelands Voice of America Property, Kulaaupuni Street Road Corridor Extension, Mā‘ili, Lualualei Ahupua‘a, Wai‘anae District, Island of O‘ahu TMK: (1) 8-7-010:007 (portion). [IA201947]

Dear Mr. Downer;

Based on a November 6, 2019, meeting with Susan Lebo, Andrew McCallister, and Samantha Cragen to discuss the Department of Hawaiian Homelands (DHHL) planned development of the Voice of America (VOA) (also referred to as the "Coast Guard site") property, we are submitting an archaeological inventory survey (AIS) subsurface testing plan (see Log. 2017.00028, Doc. 1709SH05 for earlier correspondence about this project). As part of the residential development at the former VOA site, DHHL is proposing a road extension from the intersection of Kulaaupuni Street and Holt Road to the Kulawae and Kulauku Streets intersection 525 m to the south (Figure 1-Figure 3). We are proposing the systematic pedestrian survey of the road extension corridor and the mechanical excavation of four trenches. These trenches will allow for the opportunity to document sedimentary and soil stratification within the corridor and test for buried archaeological deposits. Figure 4 presents the proposed locations of the trenches. These locations have not been ground-truthed and it is possible that substitutions or adjustments in placement may be required; any changes would be coordinated with the SHPD.

The AIS will be completed independently of the to-be-determined mitigation measures for Sites 50-80-08-7081 (former VOA antenna foundations), 7082 (VOA transmitter building remnants), and 7083 (masonry railroad berm), which are located outside of the road extension corridor but within the larger development area.

Subsurface Testing Methods

Trenches will be mechanically excavated with a backhoe under the direct supervision of the Project Director. They will range from 8-10 m long by 0.8 m wide, with depths dictated by findings (based on previous trenching in the former VOA site, most are expected to be dug to less than 1 m bs). Soil will be removed in roughly 10-15 cm lifts. If a possible archaeological deposit is encountered, the archaeologist will halt the mechanical excavation and will manually inspect the soil. This may entail the excavation of a shovel probe and screening of the soil to determine the presence/absence of archaeological material. If an archaeological deposit or feature is confirmed, the SHPD will be consulted on additional actions.

PREHISTORIC & HISTORIC INVESTIGATIONS • CULTURAL RESOURCES ASSESSMENTS & PLANNING • PALEOENVIRONMENTAL STUDIES

HAWAI‘I: 2081 Young Street, Honolulu, Hawai‘i 96826-2231 - Tel: (808) 946-2548 - Fax: (808) 943-0716 - E-mail: HonoluluOffice@internationalarchaeologyllc.com
GUAM: P.O. Box 22621, GMF, Guam 96921 - Tel/Fax: (671) 646-7552 - E-mail: GuamOffice@internationalarchaeologyllc.com

Scaled profile drawings will be completed for at least one of the long sidewalls in each trench. Soils will be described and trench sidewalls and locations will be photographed. Stratigraphic profiles and soil descriptions will be described using a fresh vertical face. The following soil characteristics will be recorded, at a minimum: color, including moisture condition (wet, moist, dry) when color read; texture; structural grade, size, and form (or absence of structure); dry or moist consistence; wet consistence (stickiness, plasticity); root frequency and size; presence of charcoal or other cultural materials; and lower boundary distinctness and topography (Munsell Color 2000; Soil Science Division Staff 2017). Each deposit will be examined for signs of sedimentary structures such as bedding, and for any other information (e.g., evidence for basaltic or coralline origin) that can help to clarify depositional and soil forming history.

The locations of all trenches will be recorded using a professional-grade Trimble GPS unit using the North American Datum of 1983 (NAD 83) in Universal Transverse Mercator Zone 4 North (UTM 4N). Data will be differentially corrected.

Laboratory Analyses

Artifacts and faunal remains recovered from the trenches will be cleaned, sorted, and analyzed. Artifacts will be classified by material and form, and metric and nonmetric characteristics will be recorded. Faunal remains will be sorted to the lowest taxonomic categories possible using standard reference guides and collections.

Reporting

The survey, trenching, and laboratory results will be presented in an archaeological inventory survey report that conforms to HAR §13-276-5.

* * * * * *

Please do not hesitate to contact me if you should have any questions or concerns. I can be reached at (808) 946-2548, ext. 115 or at dfilimoehala@iarii.org.

Thank you,

Darby Filimoehala

Darby Filimoehala
Project Director

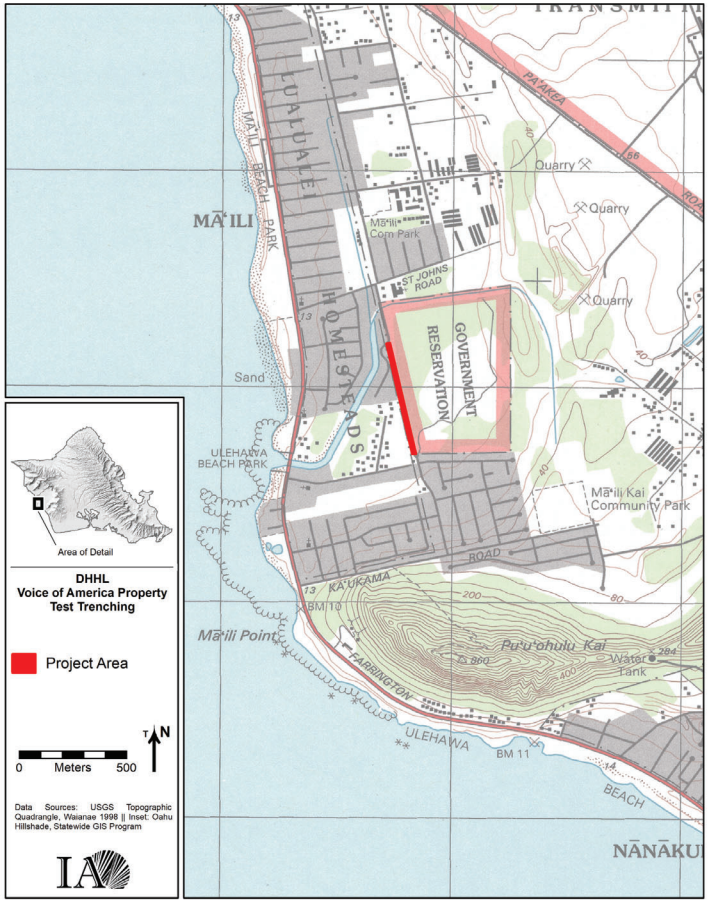

Figure 1. Location of the Kulaaupuni Street Road Extension Corridor project area, shown in red (base map is 1998 Wai'anae Quadrangle).

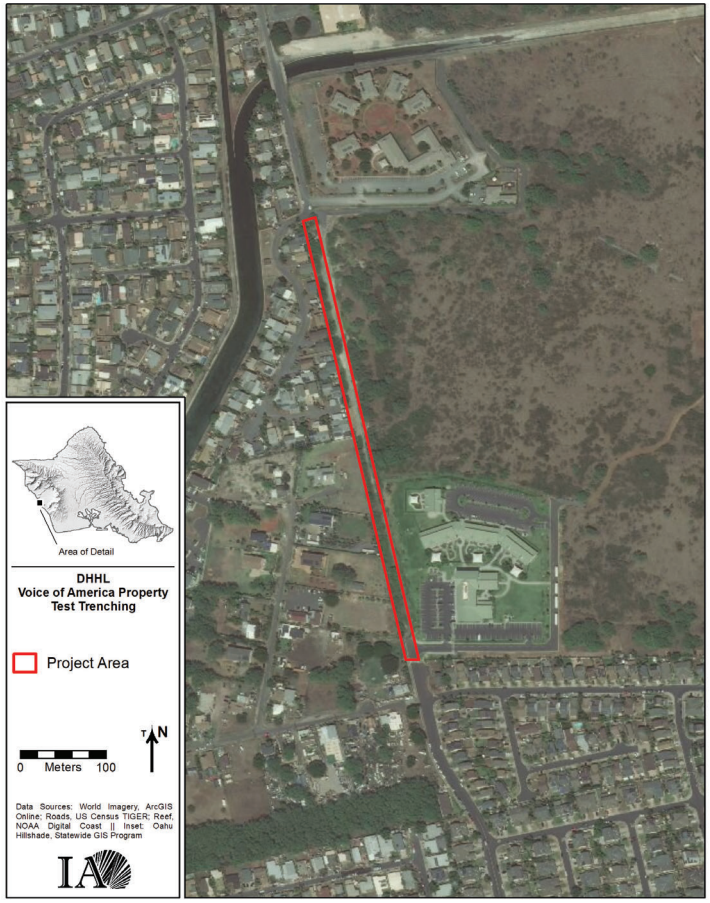

Figure 2. Detail of the Kulaaupuni Street Road Extension Corridor on World Imagery Aerial.

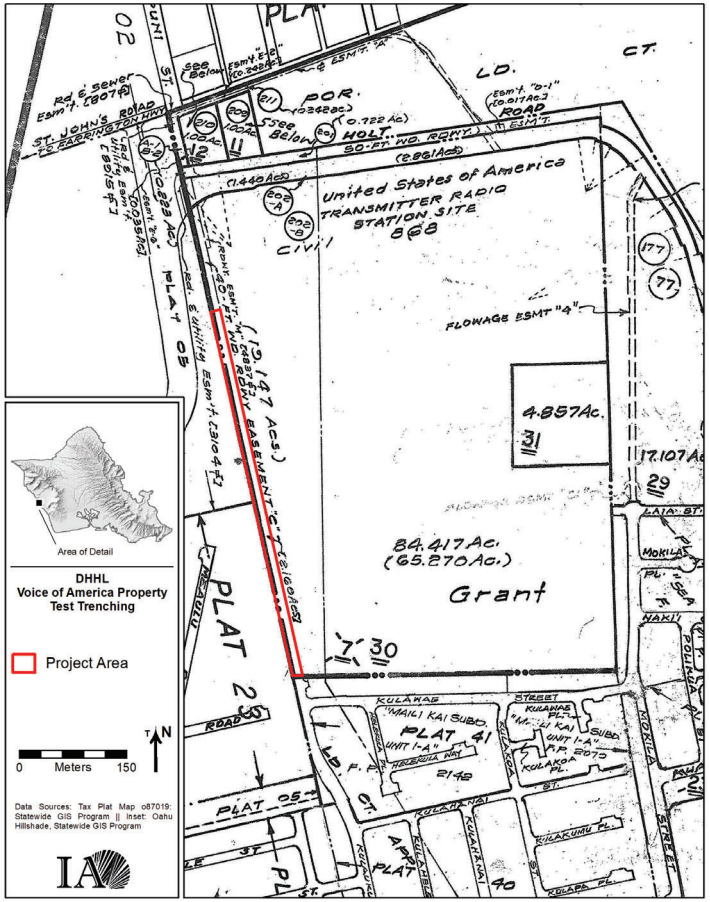

Figure 3. The Kulaaupuni Street Road Extension Corridor project area with TMK boundaries.

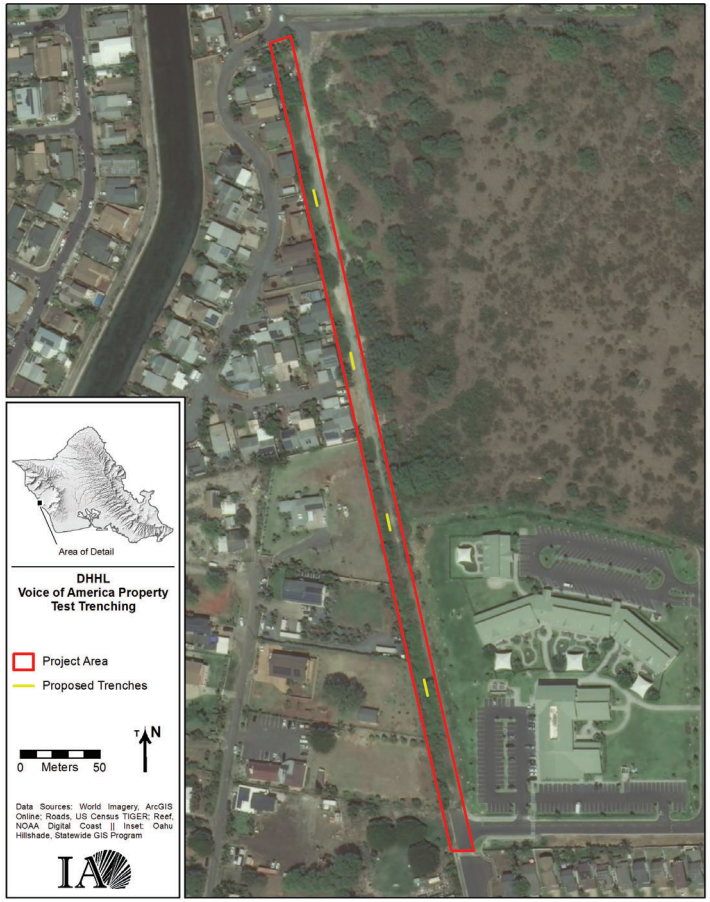

Figure 4. Proposed trench locations.

Darby Filimoehala <dbrown@iarii.org>

RE: [EXTERNAL] DHHL VOA, Kulaaupuni Street Road Corridor Extension, Proposed AIS Testing Plan

1 message

Hemenway, Samantha <samantha.hemenway@hawaii.gov> Thu, Nov 19, 2020 at 3:55 PM
To: Darby Filimoehala <DFilimoehala@iarii.org>, "Lebo, Susan A" <susan.a.lebo@hawaii.gov>
Cc: Timothy Rieth <TRieth@internationalarchaeologyllc.com>, Toby Hanzawa <thanzawa@grayhongnojima.com>, Sheryl Nojima <snojima@grayhongnojima.com>

Hello,

SHPD approves this AIS testing plan.

Please coordinate with SHPD if any adjustments to the trenches are needed.

Thank you,

Samantha C. Hemenway

O'ahu Island Archaeologist

State Historic Preservation Division

Department of Land and Natural Resources

Kakuhihewa Building

601 Kamakila Blvd., Suite 555

Kapolei, HI 96707

(808) 692-8011

From: Darby Filimoehala <DFilimoehala@iarii.org>
Sent: Monday, November 2, 2020 9:39 AM
To: Lebo, Susan A <susan.a.lebo@hawaii.gov>; Hemenway, Samantha <samantha.hemenway@hawaii.gov>
Cc: Timothy Rieth <TRieth@internationalarchaeologyllc.com>; Toby Hanzawa <thanzawa@grayhongnojima.com>; Sheryl Nojima <snojima@grayhongnojima.com>
Subject: [EXTERNAL] DHHL VOA, Kulaaupuni Street Road Corridor Extension, Proposed AIS Testing Plan

Good morning Susan and Samantha,

Based on a November 6, 2019, meeting with the SHPD to discuss the Department of Hawaiian Homelands (DHHL) planned development of the Voice of America (VOA) (also referred to as the "Coast Guard site") property, we are submitting the attached archaeological inventory survey (AIS) subsurface testing plan.

Please do not hesitate to contact me if you should have any questions or concerns.

Darby

--

Darby Filimoehala, M.A.
Project Director and Laboratory Manager

International Archaeological Research Institute Inc.
2081 Young Street
Honolulu, HI, 96826-2231 U.S.A.
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website: www.iarii.org

APPENDIX B: TEST TRENCH SOIL AND SEDIMENT DESCRIPTIONS AND INTERPRETATIONS

Trench	Layer	Layer Depths	Description	Interpretation
1	Ia	0-25 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
1	Ib	10-45 cm bs	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	Fill
1	Ic	22-60 cm bs	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	Fill
1	II	45-100 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; base of excavation	Alluvial deposit
2	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
2	Ib	15-45 cm bs	Very dark brown (10YR 2/2) silty clay; moderate, fine or thin, crumb structure; moist consistency: friable; wet consistency: sticky, plastic; <10% subangular granules to pebbles; clear, wavy boundary	Fill
2	Ic	15-30 cm bs	Light yellowish brown (2.5Y 6/2) extremely gravelly sandy loam; structureless; moist consistency: loose; wet consistency: non-sticky, non-plastic; 85% subangular granules to pebbles; abrupt, wavy boundary	Fill

Trench	Layer	Layer Depths	Description	Interpretation
2	II	42-80 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; abrupt, wavy boundary	Alluvial deposit
2	IIIa	60-90 cm bs	Light gray (10YR 7/2) clay; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; clear, wavy boundary	Alluvial deposit
2	IIIb	70-100 cm bs	Very dark grayish brown (10YR 3/2) clay loam; weak structure; moist consistency: very friable; wet consistency: sticky, plastic; abrupt, wavy boundary	Alluvial deposit
2	IV	80-110 cm bs	Greenish gray (GLEY 1 6/5GY) sandy clay; weak structure; moist consistency: very friable; wet consistence: slightly sticky, slightly plastic; base of excavation	Alluvial deposit
3	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
3	Id	10-75 cm bs	Very dark grayish brown (10YR 3/2) silt loam; moderate, coarse or thick, granular structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 10% subangular pebbles to cobbles; abrupt, wavy boundary	Fill
3	II	50-100 cm bs	Light greenish gray (GLEY 1 7/5GY) clay; weak structure; moist consistency: very friable; wet consistency: very sticky, very plastic; abrupt, wavy boundary	Alluvial deposit
3	V	58-135 cm bs	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; base of excavation	Alluvial deposit

Trench	Layer	Layer Depths	Description	Interpretation
4	Ia	0-30 cm bs	Light brownish gray (10YR 6/2) very gravelly sandy loam; weak, very fine or thin, crumb structure; moist consistency: very friable; wet consistency: slightly sticky, non-plastic; 65% subangular granules; clear, smooth lower boundary	Fill
4	Ie	10-90 cm bs	Very dark brown (10YR 2/2) silt loam; moderate, medium, granular structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; common, coarse roots; 15% subangular pebbles to cobbles; clear, wavy boundary	Fill
4	V	60-98 cm bs	Dark yellowish brown (10YR 4/4) sandy clay loam; weak structure; moist consistency: very friable; wet consistency: slightly sticky, slightly plastic; clear, wavy boundary	Alluvial deposit
4	VI	64-110 cm bs	Very dark gray (10YR 3/1) sandy clay; weak structure; moist consistency: very friable; wet consistency: slightly sticky, plastic; base of excavation	Alluvial deposit

APPENDIX I

Report on UAV-Based Magnetic Survey, August 2020

DUDEK
970 NORTH KALAHEO AVENUE
KAILUA, HAWAII 96734
T 808.202.0022 F 808.892.2001

August 5, 2020

Arlene Campbell, LG
Element Environmental LLC
98-030 Hekaha Street, Unit 9
Aiea, Hawaii 96701

Subject: Report on UAV-Based Magnetic survey for the purpose of UXO and other ferrous material detection in the Ma'ili site.

Aloha Arlene:

This report describes a UAV-Based UXO and infrastructure detection survey carried out by DUDEK at the project site located in Ma'ili, HI, (21.414079°, -158.169512°) over approximately 50 acres.

The principal geophysical sensors included a Geometrics MFAM magnetometer system mounted on a UAV platform and a Gem Systems GSM-19 Overhauser Proton Procession magnetometer used as a base station.

The total survey distance for the Ma'ili site was ~55 line k/m (4m line spacing). The survey work described in this report took place July 6th to July 8th, 2020. The data was examined for highly susceptible ferro-metallic object magnetic anomalies, which display the potential to be buried waste or Unexploded Ordinance (UXO). A discussion of the results is presented in the Interpretation section of this report, along with an Analytic Signal Map and list of identified anomalies.

Sincerely,

Steven Hochart

Practice Director

Mapping and Surveying Division, Dudek

PROJECT SITE

The site is located near the town of Ma'ili, HI (21.414079°, -158.169512°) It is approximately 50 acres and is bound by extensive housing on the eastern and western boundaries and a concrete spillway/ flood channel on the northern boundary.

The site is mostly flat with terrain elevation changes approximately 2 meters in Northing and 9 meters Easting.

The site is mostly hard volcanic soil and rock sparsely treed with vegetation ranging from 1-meter grasses to 17 meter trees. There are several deposits of large rocks possibly related to previous excavations and construction on the site. The site is littered with various debris and trash related to vagrant activity.

The site was accessed by vehicle to a central site location where the UAV operations were conducted from.

Flight operations were conducted at a nominal line spacing of 4 meters at an altitude of approximately 15 meters AGL (sensor height). The altitude was selected based on highest tree height within the survey area plus a margin of safety.

Aerial data collection was conducted between July 6th and July 8th 2020. The weather during collection was mostly light winds between 5mph and 12mph with average temperatures around 85 degrees F. Aerial data collection was terminated if winds exceeded 14 mph.

FLIGHT OPERATIONS

The daily survey procedure consisted of an early morning safety and survey plan meeting. The GSM-19W Overhauser Base Station was set up, and the crew travelled to the designated takeoff and landing position. Access to the takeoff and landing zones was facilitated by on-site road access.

Prior to takeoff, pre-flight briefing and safety hazards were discussed. All flight equipment was assembled and pre-flight checked and prior to the flight logging was initiated on the MFAM sensor package. The UAV flight was initiated manually, and the ground crew monitored the ground control station, and maintained visual line of sight with the UAV during flight.

The position and altitude of the aircraft and magnetometer payload was achieved autonomously using a combination of Barometric Pressure Measurement, GPS, Compass, Inertial Measurement

Unit (IMU) and RADAR altimeter. Altitudes above ground level of the senor payload were 15 meters AGL. Above ground altitude was maintained using a combination of RADAR altitude measurement and barometric pressure readings.

Upon survey flight completion, the UAV returned to the predefined landing position, was taken over by manual flight control, and landed to ensure a safe position of the sensor payload. Between flights, the UAV was brought back to the staging area to swap batteries and check the sensor operation and data. The landing zone was marked with high visibility cones.

Raw survey data was downloaded at the completion of each flight and quality checked.

The magnetometer was suspended from the UAV in a fixed orientation by a vibration isolated mounting system at a sensor distance of approximately 1.3 meters to reduce UAV noise and magnetic interference. Nominal survey speed was maintained at 5 meters per second ground speed. Scan rates for data acquisition was 1000 hertz (Hz) for the magnetometer and 1 Hz for GPS positioning. Data was collected with a line spacing of 4m for Ma'ili site.

Navigation of the UAV was maintained by the onboard GPS-Compass system. Pre-programmed flight plans were uploaded to the UAV prior to takeoff, and the aircraft flew the flight lines autonomously, returning to its takeoff location, or a pre-programed landing location once the lines were completed. Landing and Takeoff were conducted manually by the UAV pilot and ground crew.

The operator was responsible for ensuring the MFAM magnetometer was properly warmed up and oriented prior to departure and that the instruments operated properly during flight.

The data was recorded for each flight and stored in real-time on-board the UAV with solid state memory. On return of the craft, the magnetometer was shut off and data were downloaded and checked for errors.

AIRCRAFT EQUIPMENT

The unmanned aircraft used was a Hexacopter. The platform has a maximum takeoff weight of 55lbs and contains various onboard systems specifically developed for use in geophysical surveys while providing the highest level of safety possible. Some of these features are: Triple redundant IMUs, Barometers, and Compass Systems. Dual GPS system, dual battery systems and redundant power management systems. The aircraft has 6 propulsion motors which can maintain flight in the event of a motor failure. The aircraft also has emergency features such as autonomous return to home, battery failsafe and Autoland.

AIRBORNE MAGNETOMETER SYSTEM:

The Magnetometer payload is centered around a Geometrics Micro Fabricated Atomic Magnetometer (MFAM) sensor package. It is a dual sensor 1000 hz logging rate device with onboard SD logging, GPS and Wi-Fi capabilities. Specifications listed below.

Operating Principle: Laser pumped cesium vapor (Cs133 non-radioactive) total field scalar magnetometer.

Operating Range: 20,000 to 100,000 nT.

Gradient Tolerance: 10,000nT/m.

Operating Zones: Configured for operation anywhere in the world without dead zones.

Dead Zone: None.

Noise/Sensitivity: 0.005nT/ Hzrms typical.

Sample Rate: 1000 Hz. synchronized to GPS 1PPS.

Bandwidth: 400Hz.

Heading Error: ± 5 nT over entire 360° equatorial and polar spins typical.

Output: WiFi data download over 2.4GHz WiFi access point.

GPS: Commercial grade with typical 1 m accuracy.

USB Port: Port for USB flash drive. Used for field upgrades.

Data Logger: Built in Data Logger.

Data Storage: 32 Gbyte Micro SD card, U3 speed class

MAGNETOMETER BASE STATION

A Gem Systems GSM-19W Overhauser base station magnetometer was set up each day at least 30 min prior to surveying to record the diurnal variations of the Earth's magnetic field. The base station was automatically time synchronized to UTC time using a GPS-integrated GSM-19 mobile magnetometer by Gem Systems. The base station collected data at a rate of one reading every 4 seconds.

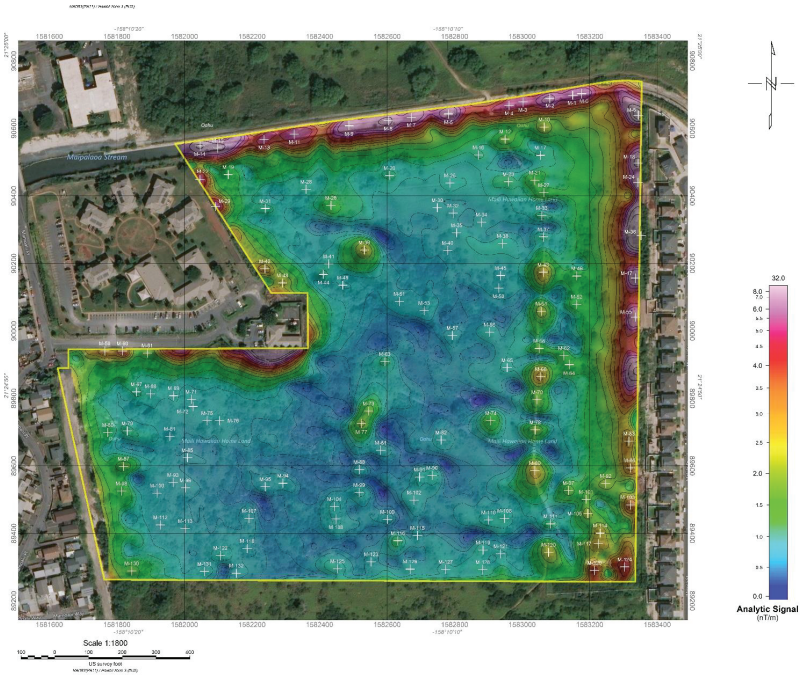
DATA PROCESSING

For each mission, raw data files were initially batch processed into a single comma-delimited file using custom software.

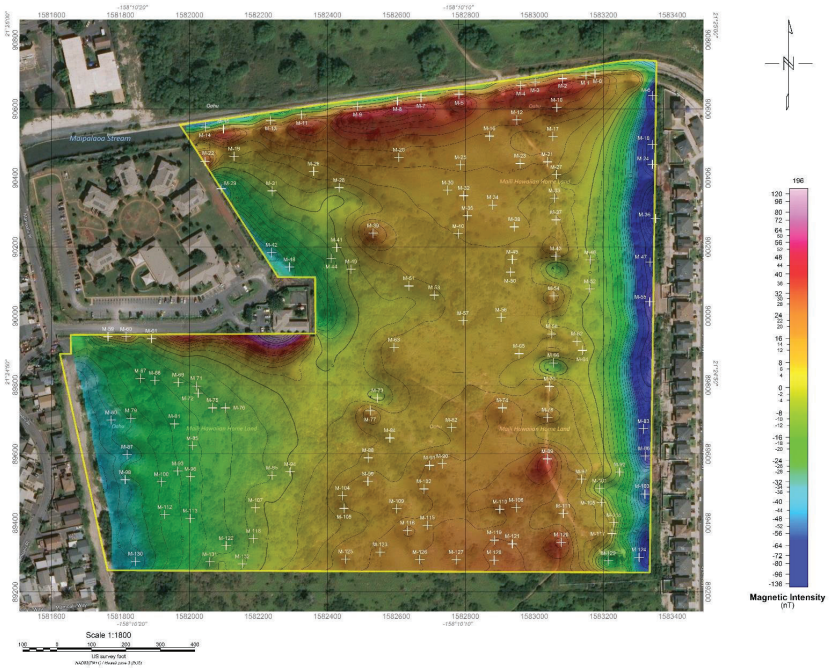
- The concatenated files from each mission were imported into Oasis Montaj for all remaining processing.
- Applied corrections:
  - Instrument Lag
  - Magnetic Heading
  - Major attitude noise due to wind
  - Diurnal variation
  - 1D filtering
  - Combining sorties into one dataset
  - Trend removal filter
  - Analytic signal grid filter
  - Other 2D smoothing filters
- Two maps for each site were published:
  - Magnetic intensity map
    - Best reflects the real-world magnetic field without major geologic trends.
    - Both negative and positive anomalies are visible
    - Units are nT (nanotesla)
  - Analytic Signal
    - Analytic Signal is a 2D grid filter applied to the gridded Total Magnetic Intensity data (measured by the sensor in nanoTeslas). The calculation is performed using this formula: Analytic Signal = sqrt (dx*dx + dy*dy + dz*dz) (2019 Geosoft Inc.). The output grid contains all positive values (in nanoTeslas per meter) and better resolves the source location of dipolar and monopolar anomalies, especially where the Earth's magnetic inclination is low and/or remanence of the anomaly source is unknown.
    - Used to pick magnetic anomaly peak locations with minimum thresholds determined based on the statistics of each data set.
    - The minimum selection threshold for Ma'ili site is 0.65 nT/m

- Estimated positional error:
  - Approximately +/- 1m in the direction of flight (N-S)
- Less than or equal to half the line spacing orthogonal to flight lines (E-W).
  - +/- 2m for the Ma'ili site.

Ma'ili Site: Analytic Signal Map



Ma'ili Site: Magnetic Intensity Map



Subject: Ma'ili Magnetometer Survey

LIST OF ANOMALIES

A total of 133 analytic signal anomalies for the Ma'ili site (denoted M-0 through M-132), as noted within this report on Table 1.

-Possible higher priority targets at Ma'ili: M-39, 63, 73, 74, 77, 87, 116

-Possible linear feature following dirt road starting with M-12 and ending around M-120

-Influence of cement river channel from M-0 to M-14

-Strong influence parallel to the east survey boundary, probably due to residential structures outside the survey area.

DISCLAIMER AND RELEASE OF LIABILITY

The enclosed report, data, results and interpretation were conducted as a wide area survey to aid in the identification of both buried infrastructure and potential UXO objects within the Ma'ili Site. The user of this data, results, report and provided interpretations, agrees to release DUDEK and its personnel of any and all liability related to the use and reliance upon the contained results. Furthermore, the users agree to release liabilities, perceived or otherwise, toward DUDEK, caused by actions or recommendations or lack thereof related to the discovery, deliberate or accidental of any UXO objects within the surveyed sites.

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-0	6.313515663	1583176.03	90703.21752	586200	2368448	-158.1682797	21.41627927
M-1	6.357232094	1583149.743	90698.13403	586192	2368446.4	-158.168357	21.4162652
M-2	6.936715126	1583081.415	90688.06746	586171.2	2368443.2	-158.1685578	21.41623729
M-3	5.680233479	1583002.586	90678.06781	586147.2	2368440	-158.1687895	21.41620953
M-4	5.593936443	1582960.513	90667.8339	586134.4	2368436.8	-158.1689132	21.41618123
M-5	7.525891304	1582781.818	90642.71764	586080	2368428.8	-158.1694384	21.41611156
M-6	10.99851227	1583343.655	90639.1369	586251.2	2368428.8	-158.1677867	21.41610336
M-7	7.228228569	1582671.484	90632.91878	586046.4	2368425.6	-158.1697628	21.41608426
M-8	8.441026688	1582603.156	90622.85219	586025.6	2368422.4	-158.1699636	21.41605634
M-9	8.103217125	1582487.538	90607.83598	585990.4	2368417.6	-158.1703035	21.41601466
M-10	2.316671848	1583065.127	90604.15485	586166.4	2368417.6	-158.1686054	21.41600624
M-11	5.620354652	1582324.595	90582.61931	585940.8	2368409.6	-158.1707824	21.41594475
M-12	1.81584239	1582949.375	90568.13538	586131.2	2368406.4	-158.1689456	21.41590674
M-13	5.294892311	1582235.231	90567.43576	585913.6	2368404.8	-158.1710451	21.41590269
M-14	9.845835686	1582046.068	90547.63722	585856	2368398.4	-158.1716011	21.41584762
M-15	8.623025894	1582098.542	90542.05176	585872	2368396.8	-158.1714468	21.4158324
M-16	1.035866737	1582870.312	90521.38003	586107.2	2368392	-158.1691779	21.4157778
M-17	0.998209298	1583054.09	90520.20878	586163.2	2368392	-158.1686376	21.41577512
M-18	8.669820786	1583342.751	90497.36499	586251.2	2368385.6	-158.1677889	21.41571308
M-19	1.451021194	1582129.545	90463.08872	585881.6	2368372.8	-158.1713554	21.41561512
M-20	1.070107579	1582607.37	90460.04348	586027.2	2368372.8	-158.1699507	21.41560816
M-21	1.559384108	1583037.869	90446.79779	586158.4	2368369.6	-158.1686851	21.41557298
M-22	5.138063431	1582045.432	90447.8717	585856	2368368	-158.1716027	21.41557297
M-23	1.13275671	1582959.074	90442.04894	586134.4	2368368	-158.1689167	21.41555967
M-24	8.271954536	1583342.383	90439.60606	586251.2	2368368	-158.1677898	21.41555408
M-25	0.886181474	1582785.763	90437.90244	586081.6	2368366.4	-158.1694262	21.41554774
M-26	0.975162745	1582360.314	90419.60977	585952	2368360	-158.1706769	21.41549612
M-27	1.497774601	1583063.889	90409.87478	586166.4	2368358.4	-158.1686084	21.41547141
M-28	1.374714375	1582433.524	90371.88394	585974.4	2368345.6	-158.1704615	21.41536496
M-29	5.786299706	1582092.187	90368.80827	585870.4	2368344	-158.171465	21.41535546
M-30	0.650867224	1582748.539	90364.6253	586070.4	2368344	-158.1695354	21.41534591
M-31	1.055828094	1582239.177	90362.62047	585915.2	2368342.4	-158.1710328	21.41533887
M-32	0.69180572	1582795.696	90348.57168	586084.8	2368339.2	-158.1693967	21.41530186
M-33	1.092463255	1583058.203	90341.64768	586164.8	2368337.6	-158.1686249	21.41528358
M-34	0.698772192	1582879.542	90321.78219	586110.4	2368331.2	-158.1691501	21.41522836
M-35	0.757671893	1582805.83	90290.7458	586088	2368321.6	-158.1693667	21.4151427
M-36	15.74589443	1583351.881	90282.01479	586254.4	2368320	-158.1677614	21.41512028
M-37	1.038030863	1583063.053	90278.60447	586166.4	2368318.4	-158.1686105	21.41511004
M-38	0.942944765	1582942.15	90258.37087	586129.6	2368312	-158.1689659	21.41505399
M-39	2.493532181	1582532.453	90239.97776	586004.8	2368305.6	-158.1701702	21.41500213
M-40	0.665885806	1582779.241	90238.40498	586080	2368305.6	-158.1694447	21.41499854
M-41	0.970149755	1582427.169	90198.6405	585972.8	2368292.8	-158.1704796	21.41488802
M-42	3.037794113	1582238.039	90184.09272	585915.2	2368288	-158.1710356	21.41484741
M-43	2.733634472	1583062.383	90173.58821	586166.4	2368286.4	-158.1686121	21.41482095
M-44	1.029805779	1582411.215	90167.236	585968	2368283.2	-158.1705264	21.41480152

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-45	0.708988845	1582936.297	90163.8897	586128	2368283.2	-158.1689828	21.41479388
M-46	1.533357501	1583162.082	90162.45079	586196.8	2368283.2	-158.168319	21.41479058
M-47	8.124481201	1583335.325	90156.0957	586249.6	2368281.6	-158.1678097	21.4147736
M-48	2.484975338	1582290.279	90141.75157	585931.2	2368275.2	-158.1708819	21.41473101
M-49	0.818558991	1582468.774	90135.36301	585985.6	2368273.6	-158.1703571	21.41471395
M-50	0.69824183	1582930.812	90127.16747	586126.4	2368272	-158.1689988	21.41469277
M-51	0.74475497	1582636.499	90087.03487	586036.8	2368259.2	-158.1698639	21.41458141
M-52	1.297810078	1583161.546	90078.43779	586196.8	2368257.6	-158.1683203	21.41455931
M-53	0.724699676	1582709.843	90060.31232	586059.2	2368251.2	-158.1696482	21.41450807
M-54	2.241557121	1583056.396	90058.1038	586164.8	2368251.2	-158.1686294	21.41450302
M-55	8.250247002	1583334.589	90040.57785	586249.6	2368246.4	-158.1678115	21.41445559
M-56	0.809754133	1582903.721	89996.06445	586118.4	2368232	-158.169078	21.41433178
M-57	0.690473199	1582793.387	89986.26553	586084.8	2368228.8	-158.1694023	21.41430448
M-58	1.699289799	1583050.443	89947.87019	586163.2	2368217.6	-158.1686465	21.41419954
M-59	3.143860817	1581763.893	89940.31596	585771.2	2368212.8	-158.1724287	21.4141749
M-60	3.838171005	1581816.401	89939.98133	585787.2	2368212.8	-158.1722743	21.41417414
M-61	1.895073056	1581889.879	89934.26205	585809.6	2368211.2	-158.1720583	21.41415861
M-62	1.546783328	1583123.82	89926.39847	586185.6	2368211.2	-158.1684307	21.41414065
M-63	1.10607934	1582593.354	89908.77488	586024	2368204.8	-158.1699901	21.41409056
M-64	1.526090264	1583139.405	89900.04403	586190.4	2368203.2	-158.1683848	21.41406815
M-65	0.846681952	1582955.56	89890.71357	586134.4	2368200	-158.1689253	21.41404192
M-66	2.945874214	1583055.158	89863.82373	586164.8	2368192	-158.1686324	21.41396819
M-67	1.034710407	1581857.638	89818.94483	585800	2368176	-158.1721527	21.41384107
M-68	0.939007103	1581899.611	89813.42632	585812.8	2368174.4	-158.1720293	21.413826
M-69	0.825450599	1581967.838	89807.74051	585833.6	2368172.8	-158.1718287	21.41381056
M-70	1.873985171	1583044.222	89795.63009	586161.6	2368171.2	-158.1686643	21.41378043
M-71	0.778621912	1582020.279	89796.90426	585849.6	2368169.6	-158.1716745	21.41378088
M-72	0.773337603	1582025.396	89775.86753	585851.2	2368163.2	-158.1716594	21.41372299
M-73	1.867669821	1582545.16	89762.05322	586009.6	2368160	-158.1701314	21.41368652
M-74	1.553893447	1582907.299	89733.49032	586120	2368152	-158.1690667	21.41360896
M-75	0.784622908	1582067.135	89733.5933	585864	2368150.4	-158.1715366	21.41360674
M-76	0.79090029	1582103.891	89733.35908	585875.2	2368150.4	-158.1714285	21.4136062
M-77	2.091414928	1582523.923	89725.43136	586003.2	2368148.8	-158.1701937	21.41358564
M-78	2.050991774	1583038.402	89706.39973	586160	2368144	-158.1686812	21.41353478
M-79	1.071354628	1581830.647	89703.59415	585792	2368140.8	-158.1722317	21.41352344
M-80	1.202615738	1581772.855	89698.71141	585774.4	2368139.2	-158.1724016	21.41350983
M-81	0.719525158	1581956.567	89687.03863	585830.4	2368136	-158.1718615	21.41347825
M-82	0.659242153	1582759.908	89676.66829	586075.2	2368134.4	-158.1694998	21.4134521
M-83	3.279120684	1583316.494	89673.12142	586244.8	2368134.4	-158.1678635	21.41344399
M-84	0.695989668	1582581.18	89646.30107	586020.8	2368124.8	-158.1700251	21.41336798
M-85	0.654823601	1582008.673	89623.69422	585846.4	2368116.8	-158.1717081	21.41330403
M-86	3.329485416	1583321.243	89594.32579	586246.4	2368110.4	-158.1678493	21.41322709
M-87	1.853775382	1581819.477	89598.64472	585788.8	2368108.8	-158.1722642	21.4132345
M-88	0.735354364	1582517.802	89588.94364	586001.6	2368107.2	-158.1702112	21.41320989
M-89	2.628010511	1583037.632	89585.63104	586160	2368107.2	-158.168683	21.41320232

List of Anomolies. Table 1.

Anomaly ID	Analytic Signal	SPC_Easting HI_zone3_NAD83_PA11	SPC_Northing HI_zone3_NAD83_PA11	UTM_Easting zone4N_WGS84	UTM_Northing zone4N_WGS84	Longitude	Latitude
M-90	0.966847777	1582732.985	89571.81931	586067.2	2368102.4	-158.1695786	21.41316339
M-91	0.893975616	1582696.196	89566.80272	586056	2368100.8	-158.1696867	21.41314947
M-92	2.132704258	1583247.431	89547.53693	586224	2368096	-158.1680661	21.41309807
M-93	0.684414089	1581966.198	89550.45047	585833.6	2368094.4	-158.1718327	21.41310227
M-94	0.680797637	1582291.749	89548.37592	585932.8	2368094.4	-158.1708757	21.41309754
M-95	0.695671916	1582239.174	89538.20889	585916.8	2368091.2	-158.1710302	21.41306939
M-96	0.706300855	1582002.854	89534.46379	585844.8	2368089.6	-158.1717249	21.41305837
M-97	1.773312211	1583137.03	89527.23635	586190.4	2368089.6	-158.1683906	21.41304186
M-98	1.516258359	1581813.757	89525.16673	585787.2	2368086.4	-158.1722808	21.41303221
M-99	0.851448119	1582517.367	89520.68304	586001.6	2368086.4	-158.1702123	21.41302198
M-100	0.731378853	1581918.74	89519.24671	585819.2	2368084.8	-158.1719721	21.41301623
M-101	1.767214537	1583189.371	89500.64769	586206.4	2368081.6	-158.1682367	21.41296882
M-102	0.773930311	1582680.008	89498.64252	586051.2	2368080	-158.1697341	21.41296179
M-103	3.712013006	1583320.54	89484.05874	586246.4	2368076.8	-158.167851	21.41292354
M-104	0.875454783	1582443.588	89479.14497	585979.2	2368073.6	-158.1704291	21.41290741
M-105	2.321354389	1583194.354	89458.60773	586208	2368068.8	-158.1682219	21.4128531
M-106	0.970717907	1582947.465	89444.42791	586132.8	2368064	-158.1689477	21.41281334
M-107	0.67249316	1582191.314	89443.99534	585902.4	2368062.4	-158.1711706	21.41280989
M-108	0.831118584	1582448.604	89442.3558	585980.8	2368062.4	-158.1704142	21.41280615
M-109	0.702700138	1582600.878	89441.38546	586027.2	2368062.4	-158.1699665	21.41280393
M-110	0.913122654	1582900.174	89439.47824	586118.4	2368062.4	-158.1690867	21.41279957
M-111	1.143409014	1583083.886	89427.80551	586174.4	2368059.2	-158.1685466	21.41276798
M-112	0.710143328	1581928.64	89424.66507	585822.4	2368056	-158.1719427	21.41275589
M-113	0.686349869	1582002.084	89413.695	585844.8	2368052.8	-158.1717268	21.41272591
M-114	2.715984583	1583230.741	89400.61458	586219.2	2368051.2	-158.1681147	21.41269356
M-115	0.720769405	1582689.841	89393.55931	586054.4	2368048	-158.1697049	21.41267254
M-116	1.169720292	1582631.981	89378.17493	586036.8	2368043.2	-158.1698749	21.41263002
M-117	2.817724705	1583225.29	89369.14316	586217.6	2368041.6	-158.1681307	21.41260691
M-118	0.655612648	1582185.495	89354.76493	585900.8	2368035.2	-158.1711874	21.41256424
M-119	0.933571517	1582883.853	89350.31479	586113.6	2368035.2	-158.1691344	21.41255407
M-120	2.441253424	1583078.1	89343.82597	586172.8	2368033.6	-158.1685633	21.41253678
M-121	0.837968528	1582936.294	89339.47857	586129.6	2368032	-158.1689802	21.41252439
M-122	0.955043614	1582106.599	89334.26355	585876.8	2368028.8	-158.1714193	21.41250756
M-123	0.664812684	1582552.818	89315.66705	586012.8	2368024	-158.1701074	21.4124577
M-124	4.655443668	1583303.617	89300.38072	586241.6	2368020.8	-158.1679002	21.41241785
M-125	0.953961611	1582452.918	89295.29952	585982.4	2368017.6	-158.170401	21.41240134
M-126	0.816744328	1582668.202	89293.92768	586048	2368017.6	-158.1697682	21.4123982
M-127	0.840810776	1582773.218	89293.25849	586080	2368017.6	-158.1694594	21.41239667
M-128	0.951334119	1582883.485	89292.55584	586113.6	2368017.6	-158.1691353	21.41239507
M-129	4.22790575	1583214.286	89290.4479	586214.4	2368017.6	-158.1681628	21.41239024
M-130	1.818381548	1581843.757	89288.67918	585796.8	2368014.4	-158.1721918	21.41238128
M-131	0.922531188	1582059.04	89287.30734	585862.4	2368014.4	-158.1715589	21.41237816
M-132	0.67103076	1582153.521	89281.45425	585891.2	2368012.8	-158.1712812	21.41236233

APPENDIX J

Geophysical Survey Anomaly Verification Letter Report,
August 31, 2021

element environmental llc
environmental · engineering · water resources

August 31, 2021

Ms. Sheryl E. Nojima, PhD, PE
Gray Hong Nojima & Associates, Inc.
201 Merchant St., Suite 1900
Honolulu HI 96813

Via e-mail: snojima@grayhongnojima.com

Subject: **Letter Report**
Geophysical Survey Anomaly Verification
87 576 Kulaaupuni Street
Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031
Maili, Oahu, Hawaii

Dear Ms. Nojima:

Element Environmental, LLC (E2) is pleased to submit this letter report to describe the Geophysical Survey Anomaly Verification activities and findings completed for the 38.817-acre portion of land designated as Tax Map Key: (1) 8-7-010: Parcel 030 (portion) and 031 (*the subject property or the site*), located in Maili, Oahu, Hawaii (Figure 1). The land is currently undeveloped and is owned by the State of Hawaii Department of Hawaiian Home Lands (DHHL).

Figure 1: Site Location Map

98-030 Hekaha Street Unit 9 Aiea Hawaii 96701 **tel:** (808) 488-1200 **fax:** (808) 488-1300
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GEOPHYSICAL SURVEY FINDINGS

On August 5, 2020, Dudek, a geophysical mapping consultant, completed an infrastructure detection survey of the subject property using an unmanned aerial vehicle (UAV) with a Geometrics Miniature Fabricated Atomic Magnetometer (MFAM) system mounted on a UAV platform and a Gem Systems GSM-19 Overhauser Proton Procession magnetometer used as a base station.

The total survey distance for the Maili site was approximately 55 line k/m (4-meter line spacing). The survey work took place July 6 to July 8, 2020. The west boundary of the subject property was not included in the magnetometer survey due to elevated power lines along the planned roadway area. The data was examined for highly susceptible ferro-metallic object magnetic anomalies, which display the potential to be buried waste (Figure 2). A discussion of the results is presented in the *Conclusions* section of this report, along with an Analytic Signal Map (Figure 3) and list of identified anomalies (attached).

A total of 133 analytic signal anomalies were identified for the Maili site (denoted M-0 through M-132), with seven (7) identified as possible higher priority targets located at M-39, -63, -73, -74, -77, -87, and -116 (circled in red in Figures 2 and 3).

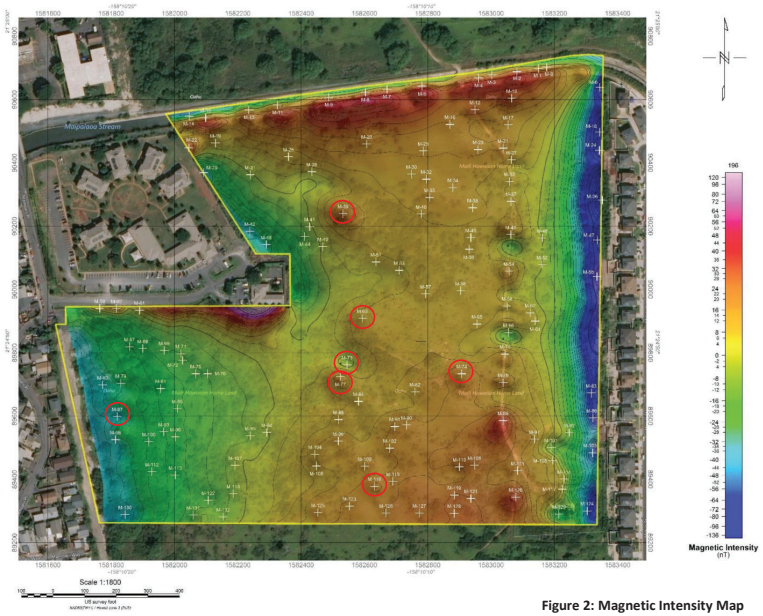

Figure 2: Magnetic Intensity Map

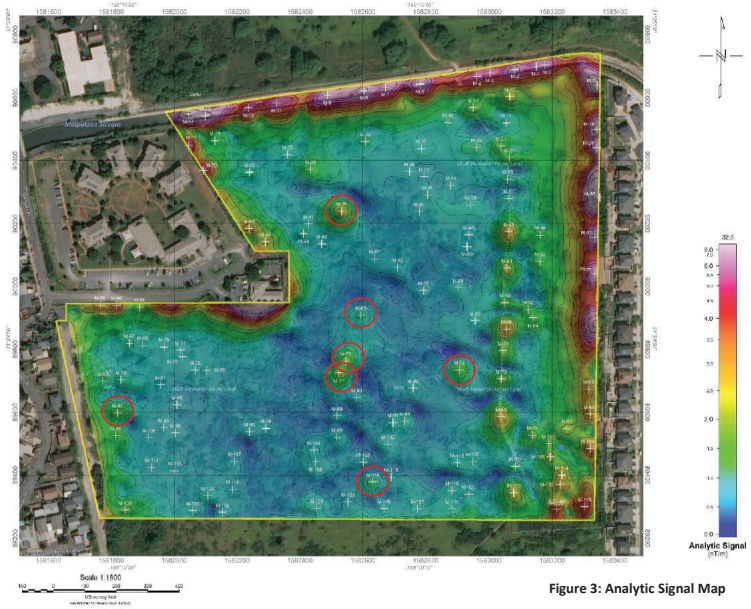

Figure 3: Analytic Signal Map

ANOMALY VERIFICATION INSPECTION

On July 12 to 15, 2021, Mr. John Ellis and Mr. Daniel Amato with E2 completed the anomaly verification inspection (AVI) of the subject property.

Using a Schonstedt GA-52CD Magnetic Locator, a SubSurface ML-1M Magnetic Locator, and a Leica Zeno GG04 global positioning system (GPS) antenna, E2 mobilized to 133 points of interest throughout the subject property as marked on the magnetic intensity report provided by Dudek. At each point of interest, if the magnetic anomaly was not apparent, E2 used the magnetic locators to attempt to identify the source of the anomaly within an approximate 15-foot diameter of the GPS point.

Magnetic identities within the 15-foot diameter of the GPS point were investigated using a pickaxe and shovel to dig to a maximum depth of 1 foot below ground surface (bgs) or until natural limestone bedrock was observed. Identified anomalies were documented and large anomalies or high-priority points of interest were photographed. Photographs are included in attachment.

Table 1 lists each anomaly that was identified during the AVI, briefly describes the anomaly, and lists the corresponding photo plate number when available, excluding:

- Anomalies associated with the Maipalaoa Stream concrete channel: M-0, -1, -2, -3, -4, -5, -7, -8, -9, -11, -13, -14, and -15;
- Anomalies associated with steel fencing along the northwest boundary of the subject property: M-22, -29, -42, -48, -59, -60, and -61;

- Anomalies associated with adjacent residential housing along the east boundary of the subject property: M-36, -47, -55, and -103; and
- Identified but unconfirmed anomalies likely associated with an underground utility adjacent to the east of an unimproved roadway bisecting the site from the north to the south: M-12, -21, -27, -33, -37, -43, -54, -58, -66, -70, -78, and -89.

Table 1: Identified Anomalies

Anomaly ID	Description	Photo Plate
M-06	Large metal pipe.	1
M-10	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-18	Buried scrap metal.	2
M-24	Rebar stake.	3
M-28	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	4, 5
M-34	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-39	Stockpile containing remnant guy-wire and/or metal scrap.	6
M-50	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-53	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-62	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-63	Metal pipe.	7
M-73	Remnant guy-wire associated with the former Coast Guard VOA antenna.	8
M-74	Remnant guy-wire associated with the former Coast Guard VOA antenna.	9
M-77	Remnant guy-wire associated with the former Coast Guard VOA antenna.	10
M-80	Abandoned washing machine and other metal waste.	11
M-83	North end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	No Photo
M-84	Remnant guy-wire associated with the former Coast Guard VOA antenna.	12
M-86	South end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	13
M-87	Abandoned vehicle frame and other metal waste.	14
M-88	Concrete block, creosote pole, metal fittings, and remnant guy-wire associated with the former Coast Guard VOA antenna.	15
M-92	Former fence post base and foundation.	No Photo
M-94	Metal scrap associated with the former Coast Guard VOA antenna.	16
M-95	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-97	Former fence post base and foundation.	No Photo
M-99	Metal scrap associated with the former Coast Guard VOA antenna.	17
M-101	Four metal bollards/fence poles.	18
M-104	Remnant guy-wire associated with the former Coast Guard VOA antenna.	19
M-105	Former fence post base and foundation.	No Photo
M-108	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-109	Metal scrap associated with the former Coast Guard VOA antenna.	20
M-111	Concrete pad with vertical metal beams.	21
M-114	Former fence post base and foundation.	No Photo
M-116	Rebar associated with former building foundation.	No Photo
M-117	Rebar associated with former building foundation.	No Photo
M-120	Remnant guy-wire associated with the former Coast Guard VOA antenna.	22
M-122	Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	No Photo
M-124	Rebar associated with former building foundation.	No Photo
M-129	Rebar associated with former building foundation.	No Photo

Anomalies that were not observed with the magnetic locaters within 15 feet of the GPS point were excluded from this report. Active trespassing, squatting, illegal dumping, and clean-up activities may have resulted in anomalies located on the ground surface being moved within or from the subject property in the time between the magnetometer survey and the AVI.

It is likely that remnant guy-wires associated with the former Coast Guard Voice of America (VOA) site antennas remain throughout the subject property and may have affected the magnetometer survey.

CONCLUSIONS

Based on the magnetometer survey and the anomaly verification inspection, E2 concludes the following:

- Antenna supports structures and guy-wire remnants associated with the former Coast Guard VOA station are located throughout the property.
- A suspect underground utility line is likely located immediately east of the unimproved dirt roadway that bisects the subject property from the north to the south along points M-12, -21, -27, -33, -37, -43, -54, -58, -66, -70, -78, and -89.
- The higher priority targets located at M-39, -63, -73, -74, -77, -87, and -116 were determined to be surface debris.
- With the exception of the suspected underground utility line, no magnetic sub-surface items or structures were observed during the magnetometer survey and subsequent anomaly verification inspection.
- The results of this survey and inspection apply only to magnetic items. Furthermore, certain metals such as aluminum, brass, copper, and lead have weak magnetic properties and the presence or absence of these materials cannot be confidently confirmed.

Should you have any questions, please call me on my mobile at 551-9552.

Sincerely,

Arlene H. Campbell

Arlene H. Campbell, L.G.
Senior Geologist

Enclosures:
Photo Plates
Table of GPS Coordinates

ATTACHMENTS

E2 Project No.: 190051	Description	M-06: Large metal pipe.	Photo 1
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-18: Buried scrap metal.	Photo 2
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-24: Rebar stake.	Photo 3
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/12/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-28: Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	Photo 4
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-28: Concrete block and remnant guy-wire associated with former Coast Guard VOA antenna.	Photo 5
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-39: Stockpile containing remnant guy-wire and/or metal scrap.	Photo 6
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-63: Metal pipe.	Photo 7
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-73: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 8
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-74: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 9
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-77: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 10
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-80: Abandoned washing machine and other metal waste.	Photo 11
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-84: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 12
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-86: South end of a C&D waste stockpile containing metal scrap, ceramic tile, and concrete.	Photo 13
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-87: Abandoned vehicle frame and other metal waste.	Photo 14
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-88: Concrete block, creosote pole, metal fittings, and remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 15
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-94: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 16
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-99: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 17
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-101: Four metal bollards/fence poles.	Photo 18
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-104: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 19
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-109: Metal scrap associated with the former Coast Guard VOA antenna.	Photo 20
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/15/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-111: Concrete pad with vertical metal beams.	Photo 21
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

E2 Project No.: 190051	Description	M-120: Remnant guy-wire associated with the former Coast Guard VOA antenna.	Photo 22
	Site Name	Geophysical Survey Anomaly Verification 87-576 Kulaaupuni Street, Maili, Oahu, Hawaii Tax Map Key: (1) 8-7-010: Parcel 030 (Portion) and 031	Photo Date 7/13/2021
	Client	Gray, Hong, Nojima and Associates, Inc.	

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-0	6.313516	1583176	90703.22	586200	2368448	-158.168	21.41628
M-1	6.357232	1583150	90698.13	586192	2368446	-158.168	21.41627
M-2	6.936715	1583081	90688.07	586171.2	2368443	-158.169	21.41624
M-3	5.680233	1583003	90678.07	586147.2	2368440	-158.169	21.41621
M-4	5.593936	1582961	90667.83	586134.4	2368437	-158.169	21.41618
M-5	7.525891	1582782	90642.72	586080	2368429	-158.169	21.41611
M-6	10.99851	1583344	90639.14	586251.2	2368429	-158.168	21.4161
M-7	7.228229	1582671	90632.92	586046.4	2368426	-158.17	21.41608
M-8	8.441027	1582603	90622.85	586025.6	2368422	-158.17	21.41606
M-9	8.103217	1582488	90607.84	585990.4	2368418	-158.17	21.41601
M-10	2.316672	1583065	90604.15	586166.4	2368418	-158.169	21.41601
M-11	5.620355	1582325	90582.62	585940.8	2368410	-158.171	21.41594
M-12	1.815842	1582949	90568.14	586131.2	2368406	-158.169	21.41591
M-13	5.294892	1582235	90567.44	585913.6	2368405	-158.171	21.4159
M-14	9.845836	1582046	90547.64	585856	2368398	-158.172	21.41585
M-15	8.623026	1582099	90542.05	585872	2368397	-158.171	21.41583
M-16	1.035867	1582870	90521.38	586107.2	2368392	-158.169	21.41578
M-17	0.998209	1583054	90520.21	586163.2	2368392	-158.169	21.41578
M-18	8.669821	1583343	90497.36	586251.2	2368386	-158.168	21.41571
M-19	1.451021	1582130	90463.09	585881.6	2368373	-158.171	21.41562
M-20	1.070108	1582607	90460.04	586027.2	2368373	-158.17	21.41561
M-21	1.559384	1583038	90446.8	586158.4	2368370	-158.169	21.41557
M-22	5.138063	1582045	90447.87	585856	2368368	-158.172	21.41557
M-23	1.132757	1582959	90442.05	586134.4	2368368	-158.169	21.41556
M-24	8.271955	1583342	90439.61	586251.2	2368368	-158.168	21.41555
M-25	0.886181	1582786	90437.9	586081.6	2368366	-158.169	21.41555
M-26	0.975163	1582360	90419.61	585952	2368360	-158.171	21.4155
M-27	1.497775	1583064	90409.87	586166.4	2368358	-158.169	21.41547
M-28	1.374714	1582434	90371.88	585974.4	2368346	-158.17	21.41536
M-29	5.7863	1582092	90368.81	585870.4	2368344	-158.171	21.41536
M-30	0.650867	1582749	90364.63	586070.4	2368344	-158.17	21.41535
M-31	1.055828	1582239	90362.62	585915.2	2368342	-158.171	21.41534
M-32	0.691806	1582796	90348.57	586084.8	2368339	-158.169	21.4153
M-33	1.092463	1583058	90341.65	586164.8	2368338	-158.169	21.41528
M-34	0.698772	1582880	90321.78	586110.4	2368331	-158.169	21.41523
M-35	0.757672	1582806	90290.75	586088	2368322	-158.169	21.41514
M-36	15.74589	1583352	90282.01	586254.4	2368320	-158.168	21.41512
M-37	1.038031	1583063	90278.6	586166.4	2368318	-158.169	21.41511
M-38	0.942945	1582942	90258.37	586129.6	2368312	-158.169	21.41505
M-39	2.493532	1582532	90239.98	586004.8	2368306	-158.17	21.415
M-40	0.665886	1582779	90238.4	586080	2368306	-158.169	21.415
M-41	0.97015	1582427	90198.64	585972.8	2368293	-158.17	21.41489
M-42	3.037794	1582238	90184.09	585915.2	2368288	-158.171	21.41485
M-43	2.733634	1583062	90173.59	586166.4	2368286	-158.169	21.41482
M-44	1.029806	1582411	90167.24	585968	2368283	-158.171	21.4148
M-45	0.708989	1582936	90163.89	586128	2368283	-158.169	21.41479

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-46	1.533358	1583162	90162.45	586196.8	2368283	-158.168	21.41479
M-47	8.124481	1583335	90156.1	586249.6	2368282	-158.168	21.41477
M-48	2.484975	1582290	90141.75	585931.2	2368275	-158.171	21.41473
M-49	0.818559	1582469	90135.36	585985.6	2368274	-158.17	21.41471
M-50	0.698242	1582931	90127.17	586126.4	2368272	-158.169	21.41469
M-51	0.744755	1582636	90087.03	586036.8	2368259	-158.17	21.41458
M-52	1.29781	1583162	90078.44	586196.8	2368258	-158.168	21.41456
M-53	0.7247	1582710	90060.31	586059.2	2368251	-158.17	21.41451
M-54	2.241557	1583056	90058.1	586164.8	2368251	-158.169	21.4145
M-55	8.250247	1583335	90040.58	586249.6	2368246	-158.168	21.41446
M-56	0.809754	1582904	89996.06	586118.4	2368232	-158.169	21.41433
M-57	0.690473	1582793	89986.27	586084.8	2368229	-158.169	21.4143
M-58	1.69929	1583050	89947.87	586163.2	2368218	-158.169	21.4142
M-59	3.143861	1581764	89940.32	585771.2	2368213	-158.172	21.41417
M-60	3.838171	1581816	89939.98	585787.2	2368213	-158.172	21.41417
M-61	1.895073	1581890	89934.26	585809.6	2368211	-158.172	21.41416
M-62	1.546783	1583124	89926.4	586185.6	2368211	-158.168	21.41414
M-63	1.106079	1582593	89908.77	586024	2368205	-158.17	21.41409
M-64	1.52609	1583139	89900.04	586190.4	2368203	-158.168	21.41407
M-65	0.846682	1582956	89890.71	586134.4	2368200	-158.169	21.41404
M-66	2.945874	1583055	89863.82	586164.8	2368192	-158.169	21.41397
M-67	1.03471	1581858	89818.94	585800	2368176	-158.172	21.41384
M-68	0.939007	1581900	89813.43	585812.8	2368174	-158.172	21.41383
M-69	0.825451	1581968	89807.74	585833.6	2368173	-158.172	21.41381
M-70	1.873985	1583044	89795.63	586161.6	2368171	-158.169	21.41378
M-71	0.778622	1582020	89796.9	585849.6	2368170	-158.172	21.41378
M-72	0.773338	1582025	89775.87	585851.2	2368163	-158.172	21.41372
M-73	1.86767	1582545	89762.05	586009.6	2368160	-158.17	21.41369
M-74	1.553893	1582907	89733.49	586120	2368152	-158.169	21.41361
M-75	0.784623	1582067	89733.59	585864	2368150	-158.172	21.41361
M-76	0.7909	1582104	89733.36	585875.2	2368150	-158.171	21.41361
M-77	2.091415	1582524	89725.43	586003.2	2368149	-158.17	21.41359
M-78	2.050992	1583038	89706.4	586160	2368144	-158.169	21.41353
M-79	1.071355	1581831	89703.59	585792	2368141	-158.172	21.41352
M-80	1.202616	1581773	89698.71	585774.4	2368139	-158.172	21.41351
M-81	0.719525	1581957	89687.04	585830.4	2368136	-158.172	21.41348
M-82	0.659242	1582760	89676.67	586075.2	2368134	-158.169	21.41345
M-83	3.279121	1583316	89673.12	586244.8	2368134	-158.168	21.41344
M-84	0.69599	1582581	89646.3	586020.8	2368125	-158.17	21.41337
M-85	0.654824	1582009	89623.69	585846.4	2368117	-158.172	21.4133
M-86	3.329485	1583321	89594.33	586246.4	2368110	-158.168	21.41323
M-87	1.853775	1581819	89598.64	585788.8	2368109	-158.172	21.41323
M-88	0.735354	1582518	89588.94	586001.6	2368107	-158.17	21.41321
M-89	2.628011	1583038	89585.63	586160	2368107	-158.169	21.4132
M-90	0.966848	1582733	89571.82	586067.2	2368102	-158.17	21.41316
M-91	0.893976	1582696	89566.8	586056	2368101	-158.17	21.41315

Anomaly ID	Analytic Signal	Hawaii Zone 3 NAD 83 Easting	Hawaii Zone 3 NAD 83 Northing	UTM Zone 4N, WGS 84 Easting	UTM Zone 4N, WGS 84 Northing	Longitude	Latitude
M-92	2.132704	1583247	89547.54	586224	2368096	-158.168	21.4131
M-93	0.684414	1581966	89550.45	585833.6	2368094	-158.172	21.4131
M-94	0.680798	1582292	89548.38	585932.8	2368094	-158.171	21.4131
M-95	0.695672	1582239	89538.21	585916.8	2368091	-158.171	21.41307
M-96	0.706301	1582003	89534.46	585844.8	2368090	-158.172	21.41306
M-97	1.773312	1583137	89527.24	586190.4	2368090	-158.168	21.41304
M-98	1.516258	1581814	89525.17	585787.2	2368086	-158.172	21.41303
M-99	0.851448	1582517	89520.68	586001.6	2368086	-158.17	21.41302
M-100	0.731379	1581919	89519.25	585819.2	2368085	-158.172	21.41302
M-101	1.767215	1583189	89500.65	586206.4	2368082	-158.168	21.41297
M-102	0.77393	1582680	89498.64	586051.2	2368080	-158.17	21.41296
M-103	3.712013	1583321	89484.06	586246.4	2368077	-158.168	21.41292
M-104	0.875455	1582444	89479.14	585979.2	2368074	-158.17	21.41291
M-105	2.321354	1583194	89458.61	586208	2368069	-158.168	21.41285
M-106	0.970718	1582947	89444.43	586132.8	2368064	-158.169	21.41281
M-107	0.672493	1582191	89444	585902.4	2368062	-158.171	21.41281
M-108	0.831119	1582449	89442.36	585980.8	2368062	-158.17	21.41281
M-109	0.7027	1582601	89441.39	586027.2	2368062	-158.17	21.4128
M-110	0.913123	1582900	89439.48	586118.4	2368062	-158.169	21.4128
M-111	1.143409	1583084	89427.81	586174.4	2368059	-158.169	21.41277
M-112	0.710143	1581929	89424.67	585822.4	2368056	-158.172	21.41276
M-113	0.68635	1582002	89413.7	585844.8	2368053	-158.172	21.41273
M-114	2.715985	1583231	89400.61	586219.2	2368051	-158.168	21.41269
M-115	0.720769	1582690	89393.56	586054.4	2368048	-158.17	21.41267
M-116	1.16972	1582632	89378.17	586036.8	2368043	-158.17	21.41263
M-117	2.817725	1583225	89369.14	586217.6	2368042	-158.168	21.41261
M-118	0.655613	1582185	89354.76	585900.8	2368035	-158.171	21.41256
M-119	0.933572	1582884	89350.31	586113.6	2368035	-158.169	21.41255
M-120	2.441253	1583078	89343.83	586172.8	2368034	-158.169	21.41254
M-121	0.837969	1582936	89339.48	586129.6	2368032	-158.169	21.41252
M-122	0.955044	1582107	89334.26	585876.8	2368029	-158.171	21.41251
M-123	0.664813	1582553	89315.67	586012.8	2368024	-158.17	21.41246
M-124	4.655444	1583304	89300.38	586241.6	2368021	-158.168	21.41242
M-125	0.953962	1582453	89295.3	585982.4	2368018	-158.17	21.4124
M-126	0.816744	1582668	89293.93	586048	2368018	-158.17	21.4124
M-127	0.840811	1582773	89293.26	586080	2368018	-158.169	21.4124
M-128	0.951334	1582883	89292.56	586113.6	2368018	-158.169	21.4124
M-129	4.227906	1583214	89290.45	586214.4	2368018	-158.168	21.41239
M-130	1.818382	1581844	89288.68	585796.8	2368014	-158.172	21.41238
M-131	0.922531	1582059	89287.31	585862.4	2368014	-158.172	21.41238
M-132	0.671031	1582154	89281.45	585891.2	2368013	-158.171	21.41236

APPENDIX K

Beneficiary Consultation: Mā‘ili Homestead Community Residential Development Plans, Virtual Beneficiary Consultation Meeting, June 22, 2021

Beneficiary Consultation: Māʻili Homestead Community Residential Development Plans
Virtual Beneficiary Consultation Meeting
June 22, 2021, 6:30 pm to 8:00 pm

Background

Background: The Department of Hawaiian Home Lands (DHHL) is planning the design of approximately 40 acres of DHHL lands in Māʻili, Waiʻanae, Oʻahu. The purpose of the project is to provide residential opportunities for DHHL's waitlist beneficiaries.

Meeting recap includes:

- Comments and Questions from meeting attendees
- Project Information and Answers from DHHL/Gray Hong Nojima

Question: How many homes are planned?
Answer: For the single family alternative, roughly 200 units
For the combination single family/multi-family, roughly 330 units. The breakdown would be about ⅓ single family and ⅔ multi-family.

Question: Do we know at this time if utilities will be above ground or underground?
Answer: In the neighboring areas, some utilities are overhead and some utilities are underground. For this project, we are in discussions with the electrical engineer.

Question: Where is the access road for the project?
Answer: The main entry would be off Kulaaupuni Street.

Comment: I'm representing my grandmother who is a waitlist lessee and I also come forward as neighborhood board member for Nānākuli / Māʻili. I voice our support for multi-family as we move into this new generation understanding not every family needs their own lot so when you do those multi-family things, I think it makes home ownership more accessible for a lot of folks so I voice that support.

Comment: I have concern because as a former resident of Ulu Ke Kukui (UKK), I echo a lot of the concern that's been brought up in the chat.

Comment: Traffic and residents' safety.

Comment: As a tenant under Ulu Ke, we were constantly harassed by neighbors across the street. I wonder if DHHL has taken into consideration putting homes there already and thinking about safety moving forward.

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Question: When you say safety, you mean not necessarily traffic safety but safety from other neighbors that may threaten personal harm?
Answer: Yes, both traffic safety and personal safety but ultimately a development that size I don't think there's much influence they do have, but it is an issue and I'd think of ways to avoid that, but I don't think you can avoid neighbor dispute like that. Sharing that as somebody who used to live in UKK.

Comment: Not sure if they mentioned that UKK, they're working towards closure. Relocating homeless Catholic Charities project there. It is DHHL's property and they have a Request for Proposal (RFP) for development of homes there.

Question: So UKK would be transferred to DHHL property and DHHL would potentially maintain the property and use it?
Answer: About a year ago, the Department went out with a request for proposal to develop the UKK project into affordable rentals for beneficiaries so there was a developer selected and they are currently securing their financing and design of their new project. Eventually the transitional housing residence will depart and the current activations on that site will cease and those units will be rehabilitated and used as affordable rentals for beneficiaries.

Question: There's a handful of questions about access and egress in traffic issues. Some questions are how will they access from Farrington Highway? Traffic's been a big issue, do we have a plan to resolve that? Whether only one way in and one way out into the project?
Answer: As far as traffic studies, I mentioned we were fortunate to have the same traffic engineer that worked on the traffic impact assessment for Kamehameha Schools' (KS) Community Learning Center Project. That project was actually a 3 phase project. What you see on the screen is just phase 1. Recent discussions, we understand that KS does not have the resources at this time to further develop that area.

Question: How many access points to the property?
Answer: The main access point would be what I showed at the bottom left hand corner of our site. That would come off Farrington Highway, at St. John's, and down to our site. This is something that has come up in a previous discussion, even in the previous traffic impact report and so when we do model, depending on the layout selected, our traffic engineer will model the trip generations. Vehicle trip rates will be modeled for the full build out and so through those models we'll find out the level of service we can expect to see for the different roads surrounding the project site then at that point would need to make recommendations as to what kind of improvements will be necessary, if any.

To answer the question, we're not sure yet, but once we nail down the site plan, we'll get to work on finishing that traffic study

Question: To clarify, there's one existing planned access right now, but there might be others? Is there is a potential to extend the Kulaaupuni Street to the KS exit so that could be another access point?
Answer: Right. We can't determine what the traffic impact is yet, until the Department comes to a decision on which site plan we will select, which is what we're here tonight to get beneficiary feedback on preference.

Question: Just to clarify, the lot sizes we discussed in the plan were 5,000 square feet?
Answer: Right, 5,000 square foot lots. We haven't made a determination as to whether these are going to be turnkey homes or vacant lots.

Question: We haven't talked at all about what the vertical's going to look like?
Answer: No and actually those are questions we have for the group later on to see what beneficiary preference would be.

Question: One of the questions is how many bedrooms and what the price will be?
Answer: Those are things we can tackle later on.

Question: Wouldn't it be faster for people to access their homes from Kaukama and better for those of us passing that road?
Answer: I think that is an option we can look at and see if access from Kaukama makes sense

Question: Will there be a bus through the neighborhood?
Answer: We don't know right now if there will be a bus system. During the planning process, we can consult with the City & County to see what their requirements would be to provide bus service to the new homestead community.

Question: I heard everyone's concerns and I've expressed concerns in the past about the traffic. I want to point out that I understand you are going to try to look for access other than St. John's Road and coming through Sea Country, same access as the Kamehameha Learning Center. I want to point out I live in Nānākuli. I'm a Nānākuli lessee. I've lived here since I was born in 1967. My grandparents were already here. I basically grew up in Nānākuli and on Farrington Highway, through Nānākuli, is the one and only access to get to Māʻili, Waiʻanae, Mākaha and so what I want to say is that growing up in Nānākuli, my tutu has always been open to homes, especially homes for individuals in the community, for their families, their children, and for multi generations to grow up in. I understand concerns about traffic but I want it to be acknowledged that for those of us in Nānākuli have always kept our hearts open and especially those that live on Farrington Highway living on Nānākuli Homestead, getting impacted by all those additional cars that went to Sea Country and other developments in Waiʻanae and so I want that to be taken into consideration by everyone and at the same time I acknowledge that there needs to be traffic safety as far as road safety when it comes to getting off Farrington Highway

into the project. I want to point out it's very important to me that it is acknowledged that those of us in Nānākuli have always been impacted as those that go past us, further into the West Coast. Just to maka all of that information as well.
Answer: Based on the feedback that we received so far from meeting participants, it does seem like the Environmental Assessment (EA), when we go through it, we will need to address the traffic and identify traffic mitigation efforts that are appropriate to this project

Question: Can I add something in regarding traffic: I wanted to see if you could reconsider and look by Sea Country, the back side of the project, if somehow we can utilize the connecting road. There's an emergency access road. I'm not sure if that can be used for this project. Have development from UKK and the Voice of America Property so the access area would be on your right side of Sea Country. They have an exit to the emergency access road, back side of Sea Country. You can take that into consideration too.
Answer: We can take a look at that too and the potential to use that emergency access road as an access to the property.

Question: There's one other comment asking if the infrastructure work will include sewer lines or if it's going to be septic?
Answer: The intention was to provide sewer service to the property. I want to highlight for everyone that we will be making a copy of the chat so there are some statements in the chat, not necessarily questions, so we are recording anything you are putting in the chat as far as a statement of concern or anything like that. We are making sure that's included as part of this beneficiary consultation (BC).

BENEFICIARY SURVEY and ADDITIONAL Q&A

DHHL: We have questions for the meeting participants that we were hoping to get feedback and guidance to help us get through the planning process. As said, one of the things we have to get feedback on is what type of community the beneficiaries would like to live in. This brings us back to some initial survey questions. I will be launching a poll. You can tell us what your preference is. There was a question earlier from a participant, is it going to be a turnkey house, is it going to be a vacant lot?

Right now, we don't know but what will help us make a decision is beneficiary feedback on your preference. A turnkey house, for those of you who don't know, is a house that the Department constructs. We construct a standard house. We have standard floor plans the lessee can select from. When the Department is done, you get your key and turn it.

A vacant lot, on the other hand, allows a lessee to construct a home to the lessee's preferences.

The Department's turn key products are usually limited in the option that you can choose for your house. Vacant lot allows for more flexibility. Allows lessee to build to what he or she can afford.

I saw a comment in the chat that we should provide both opportunities in the development. These numbers just give us a gauge

DHHL: It does seem like there is feedback from beneficiaries that both should be considered. I'm going to end the poll right now and share the results so you can see. Seems like there is a significant percentage of beneficiaries that would like both products but it does look like the majority would like a turnkey so maybe the Department, in the future, can plan for mostly turnkey but allow for vacant lots in some portions of that area. Seems like the overall feedback is we should plan for providing both types of products

DHHL: The next 2 questions are related to beneficiaries' financial situation. We donʻt want to be nosy about your personal business, but it gives us a sense of whether or not folks would like to be homeowners or whether we should consider rental options as well. Even for myself, I don't know what my income will be in 8 years. It's ok to mark unsure in this one. This question I'll post as a poll, for those of you not financially ready, would you be interested in affordable rental options. I'm going to launch the poll and you can enter the results

Question: Will this new housing have a rent to own option?
Answer: The Department did do a rent with option to purchase in Kapolei and we just launched one in Kona. We have not determined if this project will be available for that, but will include there was some interest in a rent with option to purchase in the report

Question: Who will be the management for the rentals? For UKK, I don't know the name of Kaliʻs group. There is a manager that has been selected for the UKK project.
Answer: If the Department were to offer a rent to own option, we would have to go through competitive procurement process to select the developer and manager of that project.

DHHL: For those calling in and not able to see the chat, our Land Development Division (LDD) did say that we will consult with the State Department of Transportation during the EA process with regard Farrington Highway access.

Question: Would the rent to own be open to allow Section 8?
Anser: Depends how the competitive process works and how the respondents put together a rent with option to purchase product.

Question: Will the multi-family dwellings be available for rental option if we do the version that has single family with some multi-family in the middle?

Answer: With regards to the Section 8 housing, we don't know that yet. You can let us know what your preference would be if that is something you'd like to see or you would not like to see it. Sometimes we get the feedback that some beneficiaries in other geographies that are in the gap group but they don't qualify for the lower income programs but they don't make enough to afford in the regular housing market so they're stuck in between. If you can let us know if you prefer or would like the Department to look into Section 8 type of income qualification, that would be good input for us to know.

DHHL: Looks like everyone had an opportunity to take the poll. I'm going to close the poll and share the results. It looks like the majority of folks attending tonight's meeting are most interested in becoming a homeowner.

There are some folks that aren't sure what their financial status will be

Looks like there's a mix of folks that would be very interested or somewhat interested in rentals.

A good portion of the folks that are not really interested in rentals at this time.

A couple folks, 3 persons, that don't know right now. For those who indicated that you don't know right now, if you can let us know what questions or information you'd need to make a decision. Can do in chat or let me know vocally right now. Can let us know what other information you might need to arrive at a decision.

Question: Couple questions in the chat seem to be related to what the cost of the rental would be, if it would stay the same, if it would increase. Is there interest in a Hoʻolimalima Project in Kapolei, which is the rent with option to purchase project.
Answer: There were barriers that developers had with that project so that's good feedback. The potential interest in renting is dependent upon the rent price and people want to make sure the rent price stays pretty stable. That's one, the other is there could be an appetite for an option to purchase if there was a rental. I'm glad people have asked questions on what would be rental options and they'd like to see rent with purchase options.

Question: Would multi-families would be rentals?
Answer: It is a possibility and we want feedback if they think that would be desirable. We know our population is aging so there might be interest in kūpuna housing. A lot of you have already voiced interest in rent to rent with option to purchase of single family homes.

For this one, feel free to choose more than one choice. If you're interested in more than one, feel free to indicate that to us. 2 minutes for people to take the poll.

Question: For rental housing, would there be a homeowner's association? What are the risks if there is a hiccup in finances?

Answer: I don't think we have a definitive answer right now. I do believe in the Hoʻolimalima Project as well as our current rent to own project in North Kona on Hawaiʻi Island, in Laʻi ʻŌpua, that there is a homeowner's association that makes sure the property is in good condition so at the time of purchase the property is in good condition so we might have a similar model for that and might use a lot of our lessons learned from the Hoʻolimalima and Laʻi ʻŌpua experiences.

In regards to financing hiccups, I don't think we're ready to answer something like that yet until we know more about what that could potentially look like.

DHHL: I think everyone has had an opportunity to take the poll. I'm going to close the poll and share the results. It looks like the vast majority of folks would like to rent a single family home versus a townhouse or low rise apartment. There's some interest in kūpuna housing. For those of you who indicated you don't know right now, let us know what information you might need to make a decision. This is the last survey question. The meat of the feedback from beneficiaries. Given that we may have a multi-family opportunity or just single family lots and the different types of housing opportunities: turnkeys, vacant lots, rent with option to purchase. Which would you prefer the Department pursue in this development? Alternative 1 - All single family lots. Alternative 2 - Single family and multi-family lots. You don't know, it depends. Will launch the poll. Let us know what your preference is.

Question: Can you explain what a multi-family lot is?
Answer: A multi-family lot is a townhome or a low rise type of apartment. Townhouse is more popular these days.

Comment: Give about one more minute for people to take the poll. Chairman William Ailā joined the conversation. Just wanted to acknowledge William Ailā, the Chair of the Department, for taking the time to join us this evening

Chair Aila: Great conversation so far

Question: I don't know if I missed it, but Alternative 2, how many single family homes in Alternative 2?
Answer: Alternative 2, we can go up to 100 single family and 200 multi-family, roughly 300 versus Alternative 1 would be all single family, about 200 lots, just for round numbers.

DHHL: There's couple of individuals who said they answered incorrectly to the poll. Just for your reference, we'll take that into consideration when we look at the final results and assign your correct response to the tally.

Question: Is there going to be yards for the multi-families and has it been determined how many bedrooms in the townhouse mix?

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Answer: We have not determined the bedroom size at this point in the planning process. Looking at the site plan, there could be a mini yard but I don't think we've made exact plans of what the multi-family lot would be like. That would probably be handled in the next phase when the Department goes out with a RFP for the vertical or the development of the housing units but there could be gardens in addition to... not really individual yards, but maybe gardens in that multi-family area. So, when we get closer to the actual design, we might be able to make those determinations.

Question: Will parking too come up in the next phase?
Answer: That's correct. There will be many BC on this project as we go through the production pipeline. It does seem like more meeting participants would prefer Alternative 1, the all single family lot option. But I note there is a significant portion of meeting participants that are interested in Alternative 2.

Question: How many Oʻahu waitlist did the postcard go out to?
Answer: All Oʻahu applicants. We dropped the whole list for this one. There are other comments coming in about the benefits of multi-family would provide opportunity for kūpuna. Some may not have the income for single family lots or the time to maintain the yard for a single family home

DHHL: Thank you for taking the time to share your manaʻo with us during the meeting. These are the immediate next steps in the planning process. We're in the planning phase and need to do the design and engineering phase, then the construction phase then the awards phase. In the immediate future, for the planning phase, these are the next steps. We will be compiling the results from this consultation meeting. We will incorporate the manaʻo into a master plan and present that feedback to the Commission. We also have to complete the preliminary engineering. Have to go through the EA process. All of the comments related to traffic, that's the type of impact that we need to assess and figure out how we can best mitigate those types of impact both to Waiʻanae residents and Nānākuli residents. The EA process will be ongoing and into 2022 and 2023 and hope to be pau with the EA process by 2023. The EA needs to be approved by the Hawaiian Homes Commission. The information from tonight's meeting will be on the same website you used to log in to tonight's meeting. It will be on the DHHL.hawaiʻi.gov site

If you have any questions, here is our contact information. A lot of the questions tonight we might not be able to answer because we're still in the early planning phase but to the extent possible we can try to address your question we will try. Some of the detailed questions like the size of the yard or how many bedrooms, we don't know yet in this early planning phase. With that, just wanted to give Chair Aila and opportunity if he had any closing remarks since he was kind enough to join us this evening.

Chair Ailā: Mahalo Andrew and staff. This was a pretty good, comprehensive presentation of what we know now. We know there'll be further discussion and further refinement. I'm sure

we'll be back with the refinements to the beneficiaries. I would recommend everybody think of the opportunity that's presented here. The last project Waiʻanae was the Waiʻanae Kai project more that 20 years ago so it's a great opportunity to assist folks on the waitlist with this vision of Kuhio and the opportunity to either have a single family home or be part of a multi-family situation. Once we get through the process, we still will need assistance from beneficiaries on the waitlist and beneficiaries that are lessees to assist us when lobbying the legislature for the construction fund. By no means is this project completely funded at this point. We look forward to your assistance in making this project come to fruition. Mahalo nui to all of you who gave up your evening tonight, especially to staff because I know you had a long day today

Question: Is there an opportunity for a single person to qualify to purchase a single family home?
Answer: I believe the answer is yes, but I'm going to put a link in our chat to our Department's free financial literacy courses where we have financial counselors you can work with directly to have them assess your income and prepare over the next couple of years while we develop this project.

Question: Will the poll questions be posted on the DHHL website to give others an opportunity to respond?
Answer: We will provide that opportunity. The presentation for sure will be on the website. The video of this BC will be there as well as all this contact information so you can communicate directly with the Department. I think the most important thing is you, as beneficiaries, get your opinions and voices over to us anyway so we can compile if before we present to the Hawaiian Homes Commission. To add on to that, we typically take comments up to 30 days after the meeting is held.

Chair Ailā: This presentation and the questions you posted on the screen will be posted on the website so with that 30 day additional comment period, people can view the presentation and provide the answers to the questions by going back and watching this presentation one more time so thank you.

Question: Will applicants on the waitlist prior to 1985 be considered when lots are offered?
Answer: We don't have someone from our Contact & Awards Division here on the call. I do know their process is when they go out for lot offers, they start from application date so they go from the beginning and start offering until we have enough people in the pipeline to produce a list to invite for the lot offering event. As we go through the BC, we can invite somebody from the Contact & Awards Division to be here to answer those types of future questions a little more in depth.

Comments about townhomes, upstairs and downstairs, those are things we will get to as we continue with this process. Whether those multi-family units should have elevators. Yes, we would've liked more people to join our BC as well.

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Question: Has there been any communication with elementary school and will they be making preparations for increased families?
Answer: As part of the EA process, we do need to consult with agencies such as the Department of Education (DOE) to see if they have comments on how our proposed project will impact their ability to deliver services so we will be reaching out to the DOE to get their comments.

Questionn: I had a quick question going back to the waitlist. If you're on the waitlist, for instance I'm like 7,000 on the waitlist, when you begin to award, you start from the top again? It doesn't go from where you left off?
Answer: It starts from the top. The beneficiaries who've been on the waiting list have an opportunity to accept an offer, accept an opportunity to select or defer. If they defer, we keep going until someone doesn't defer.

DHHL: Mahalo for taking the time to spend your evening with us and give us your manaʻo. Our contact information is up there so feel free to continue to share manaʻo with us. We will be posting the information from tonight's meeting on the website. Mahalo nui everyone and have a good evening.

Question: Regarding the waiting list, if you're on the list and you qualify, is there any way or chance you have a better chance?
Answer: Being qualified is something we recommend for everyone. Either be qualified on your own or work with our financial literacy program to get qualified. We do go in order so if you're qualified and ready to go when your names comes up, clearly that's going to be good for you and your ʻohana but we do go in order of application date.

Synthesis

Q: How many homes? What were the different amounts that were mentioned?
For single family alternative, we're looking at roughly 200 units. For combination single family / multi-family, we could go up to about 330 units. Breakdown would be about ⅓ single family and ⅔ multi-family.
Q: Do we know at this time if utilities will be above ground or underground?
In the neighboring areas, some is overhead and some is underground. That's something for our electrical engineer, we've already been in discussions about that.
Q: Are you able to say where the access road for the project is?
The main entry would be off Kulaaupuni Street.
Q: Ulu Ke Kukui would be transferred to DHHL property and DHHL would potentially maintain the property and use it?
About a year ago, the Department went out with a request for proposal to develop the UKK project into affordable rentals for beneficiaries so there was a developer selected and they are currently securing their financing and design of their new project. Eventually the

transitional housing residence will depart and the current activations on that site will cease and those units will be rehabilitated and used as affordable rentals for beneficiaries.

Clarification: DHHL has owned the land since 2011. Upon termination of the general lease to Hawaii Public Housing Authority in 2020, the improvements reverted to DHHL; no transfer involved.

Q: How will they access from Farrington Highway?

The main access point would be what I showed at the bottom left hand corner of our site. That would come off Farrington Highway, at St. John's, and down to our site.

We will consult with the State Department of Transportation during the EA process with regard to Farrington Highway access.

Clarification: From St. John's Road, the project entry will be off Kulaʻaupuni Street.

Q: Traffic's been a big issue, do we have a plan to resolve that?

This is something that has come up in a previous discussion, even in the previous traffic impact report and so when we do model, depending on the layout selected, our traffic engineer will model the trip generations. Vehicle trip rates will be modeled for the full build out and so through those models we'll find out the level of service we can expect to see for the different roads surrounding the project site then at that point would need to make recommendations as to what kind of improvements will be necessary, if any. To answer the question, we're not sure yet, but once we nail down the site plan, we'll get to work on finishing that traffic study.

To summarize what you said, we can't determine what the traffic impact is yet, until the Department comes to a decision on which site plan we will select, which is what we're here tonight to get beneficiary feedback on preference.

Based on the feedback that we received so far from meeting participants, it does seem like the Environmental Assessment (EA), when we go through it, we will need to address the traffic and identify traffic mitigation efforts that are appropriate to this project. We will flag that for the EA.

Q: Only one way in and one way out into the project?

There's one existing planned access right now, but there is a potential to extend the Kulaaupuni Street to the KS exit so that could be another access point.

Q: What are the lot sizes?

5,000 square foot lots. We haven't made a determination as to whether these are going to be turnkey homes or vacant lots.

Q: How many bedrooms? What will the price be?

Those are things we can tackle later on.

Q: Can we get a copy of this presentation?

Yes, we will have a copy of this presentation as well as a recording of tonight's meeting on the DHHL website for this development project.

Q: Wouldn't it be faster for people to access their homes from Kaukama and better for those of us passing that road?

I think that is an option we can look at and see if access from Kaukama makes sense.

Q: Will there be a bus through the neighborhood?

We don't know right now if there will be a bus system. During the planning process, we can consult with the City & County to see what would be their requirements to provide bus service to the new homestead community.

Q: Will the infrastructure work include sewer lines or will it be septic?

The intention is to provide sewer service to the property.

Q: Will this new housing have a rent to own option?

The Department did do a rent with option to purchase in Kapolei and we just launched one in Kona. We have not determined if this project will be available for that, but will include there was some interest in a rent with option to purchase in the report. If the Department were to offer a rent to own option, we would have to go through competitive procurement process to select the developer and manager of that project.

Q: Who will be the management for the rentals?

For UKK, I don't know the name of Kali's group. There is a manager that has been selected for the UKK project.

Q: Would the rent to own be open to allow Section 8?

Depends how the competitive process works and how the respondents put together a rent with option to purchase product.

With regards to the Section 8 housing, we don't know that yet. You can let us know what your preference would be if that is something you'd like to see or you would not like to see it. Sometimes we get the feedback that some beneficiaries in other geographies that are in the gap group but they don't qualify for the lower income programs but they don't make enough to afford in the regular housing market so they're stuck in between. If you can let us know if you prefer or would like the Department to look into Section 8 type of income qualification, that would be good input for us to know.

Q: Will the multi-family dwellings be available for rental option if we do the version that has single family with some multi-family in the middle?

It is a possibility and we want feedback if they that would be desirable.

Q: What would the cost of the rental be? Would it stay the same? Could it increase?

The potential interest in renting is dependent upon the rent price and people want to make sure the rent price stays pretty stable.

Q: For rental housing, would there be a homeowner's association?

I don't think we have a definitive answer right now. I do believe in the Hoʻolimalima Project as well as our current rent to own project in North Kona on Hawaiʻi Island, in Laʻi ʻŌpua, that there is a homeowner's association that makes sure the property is in good condition so at the time of purchase the property is in good condition so we might have a similar model for that and might use a lot of our lessons learned from the Hoʻolimalima and Laʻi ʻŌpua experiences.

Clarification: There are no owners in a rental project, there would be a facility manager to administer and enforce House Rules.

Q: What are the risks if there is a hiccup in finances?

I don't think we're ready to answer something like that yet until we know more about what that could potentially look like.

Q: Can you explain what a multi-family lot is?

A multi-family lot is a townhome or a low rise type of apartment.

Q: How many single family homes in Alternative 2?

Alternative 2, we can go up to 100 single family and 200 multi-family, roughly 300 versus Alternative 1 would be all single family, about 200 lots, just for round numbers.

Q: Are there going to be yards for multi-family homes? Have you determined bedrooms in the town house mix?

We have not determined the bedroom size at this point in the planning process. Looking at the site plan, there could be a mini yard but I don't think we've made exact plans of what the multi-family lot would be like.

That would probably be handled in the next phase when the Department goes out with a RFP for the vertical or the development of the housing units but there could be gardens in that multi-family area.

Q: What about parking?

That would be determined in the next phase. There will be many BC on this project as we go through the production pipeline

Q: How many Oʻahu waitlist did the postcard go out to?

We sent to all Oʻahu applicants.

Q: Is there an opportunity for a single person to qualify to purchase a single family home?

I believe the answer is yes, but I'm going to put a link in our chat to our Department's free financial literacy courses where we have financial counselors you can work with directly to have them assess your income and prepare over the next couple of years while we develop this project.

Clarification: Marital status is not a factor in eligibility for a homestead award.

Q: Will poll questions be posted on the DHHL website to give others an opportunity to respond?

We will work to provide that opportunity. The presentation for sure will be on the website. The video of this BC will be there as well as all this contact information so you can communicate directly with the Department. I think the most important thing is you, as beneficiaries, get your opinions and voices over to us anyway so we can compile if before we present to the Hawaiian Homes Commission.

Q: Will applicants on the waitlist prior to 1985 be considered when lots are offered?

We don't have someone from our Contact & Awards Division here on the call. I do know their process is when they go out for lot offers, they start from application date so they go from the beginning and start offering until we have enough people in the pipeline to produce a list to invite for the lot offering event. As we go through the BC, we can invite somebody from the Contact & Awards Division to be here to answer those types of future questions a little more in depth.

Q: Has there been any communication with elementary school and will they be making preparations for increased families?

Beneficiary Consultation: Māʻili Homestead Community Residential Development Plans
Virtual Beneficiary Consultation Meeting
June 22, 2021, 6:30 pm to 8:00 pm

As part of the EA process, we do need to consult with agencies such as the Department of Education (DOE) to see if they have comments on how our proposed project will impact their ability to deliver services so we will be reaching out to the DOE to get their comments.

Q: If you're on the waitlist, when you begin to award, you start from the top again? It doesn't go from where you left off?

It starts from the top. The beneficiaries who've been on the waiting list have an opportunity to accept an offer, accept an opportunity to select or defer. If they defer, we keep going until someone doesn't defer.

Q: If you're on the list and you qualify, is there any way or chance you have a better chance?

Being qualified is something we recommend for everyone. Either be qualified on your own or work with our financial literacy program to get qualified. We do go in order so if you're qualified and ready to go when your names comes up, clearly that's going to be good for you and your 'ohana but we do go in order of application date.

Community Member Feedback

General Concerns About Traffic and Safety -- given planned construction of new homes and highlighting the impact on Nānākuli as the entry point to the Waiʻanae Coast.

Access Concerns -- these include access to and from Farrington Highway and other options for access, such as access from Kaukama, coming through Sea Country, and the existing emergency access road at the back side of the project.

Support for Multi-Family Homes -- due to the understanding that not every family needs their own lot and the option for multi-family homes makes home ownership more accessible for a lot of folks, including kūpuna, and some families may not have the income for single family lots or the time to maintain the yard for a single family home.

Concerns About Traffic and Personal Safety at Ulu Ke Kukui -- past issues as tied to traffic and Ulu Ke Kukui residents being harassed by neighbors across the street.

Interest in Rent to Own and Rental Options -- numerous questions and feedback as tied to rent to own and rental options, which also includes questions about Section 8 eligibility.