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IN REPLY REFER TO:
HWY-DS 2.7647

March 16, 2022

VIA ENVIRONMENTAL REVIEW PROGRAM SUBMITTAL WEBSITE

TO: MARY ALICE EVANS, DIRECTOR
ENVIRONMENTAL REVIEW PROGRAM
OFFICE OF PLANNING AND SUSTAINABLE DEVELOPMENT
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM

FROM: JADE T. BUTAY
DIRECTOR OF TRANSPORTATION

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT AND ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT FOR KAWAIHAE ROAD, REPLACEMENT OF WAIAKA BRIDGE AND REALIGNMENT OF APPROACHES
FEDERAL-AID PROJECT NO. BR-NH-019-1(045)
WAIMEA, ISLAND OF HAWAII, HAWAII

The Hawaii Department of Transportation has reviewed the Draft Environmental Assessment and anticipates a Finding of No Significant Impact determination for the proposed Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches project on the island of Hawaii for publication in the next available edition of *The Environmental Notice*.

Should you have any questions, please contact our Project Manager, Mr. Andrew Hirano, at (808) 692-7546, Technical Design Section, Design Branch, Highways Division or by email at andrew.j.hirano@hawaii.gov.

Enclosure

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Wednesday, March 16, 2022 4:02:04 PM

Action Name

Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches, Project No. BR-NH-019-1(045)

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

South Kohala, Hawaiʻi

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

6-5-001:015; :033; 6-6-001:011; :077; and the right-of-way for Kawaihae Road and Kohala Mountain Road

Action type

Agency

Other required permits and approvals

HRS6E-8 Review, National Pollutant Discharge Elimination System, Community Noise Permit, Community Noise Variance, U.S. Army Corps of Engineers Section 404 and Section 10, Section 401 of the Clean Water Act, Stream Channel Alteration Permit, NEPA, Section 106 of the NHPA, Section 7 of the ESA, CZM, State of Hawaii Disability and Communications Access Board Review / Approval, County of Hawaii Grading, Grubbing, and Stockpiling Permit

Proposing/determining agency

State of Hawaii Department of Transportation, Highways Division

Agency contact name

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United States
Map It

Was this submittal prepared by a consultant?

Yes

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Map It

Action summary

The State of Hawaii Department of Transportation (HDOT) proposes to replace the existing Waiaka Stream Bridge with a new bridge that would be approximately 53 feet wide and up to 80 feet long to accommodate two travel lanes, one in each direction, a roadway shoulder or bike lane, and raised sidewalk. In addition, the roadway approaches to the bridge would be realigned to create a smooth transition to the replacement bridge. The intersection of Kawaihae Road and Kohala Mountain Road would be reconfigured to a roundabout.

Reasons supporting determination

See Chapter 4 of the Draft EA

Attached documents (signed agency letter & EA/EIS)

- HWY-DS-2.7647-Waiaka-Bridge-ERP-Submittal-Letter-BR-NH-019-1045.pdf
- WaiakaStreamBridge-Draft-EA-AFNSI_Optimized.pdf

Action location map

- WaiakaBridge.zip

Authorized individual

Rachel E. Adams

Authorization

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

Draft Environmental Assessment

Kawaihae Road - Waiaka Bridge Replacement and Realignment of Approaches Project No. BR-NH-019-1(045)

Waimea, South Kohala, Hawaii Island

March 2022

DRAFT ENVIRONMENTAL ASSESSMENT
Kawaihae Road – Waiaka Bridge
Replacement and Realignment of Approaches
Federal-Aid Project No. BR-NH-019-1(045)
Waimea, South Kohala, Hawaii Island

Submitted Pursuant to the

Hawaii Environmental Policy Act,
Chapter 343, Hawaii Revised Statutes, and
Title 11, Chapter 200.1, Hawaii Department of Health Administrative Rules

by the:

Department of Transportation, Highways Division
State of Hawaii

The following person may be contacted for additional information concerning this document:

Mr. Andrew Hirano, Project Manager
Department of Transportation, Highways Division
601 Kamokila Boulevard, #688
Kapolei, HI 96707
(808) 692-7546

This Draft Environmental Assessment documents the provisional finding that there would be no significant environmental impacts if the existing Waiaka Bridge were replaced with a proposed 53-foot wide by up to 80-foot long replacement bridge to accommodate two travel lanes, one in each direction, a shoulder/bike lane, and a raised sidewalk. In addition, the roadway approaches, Kawaihae Road (Route 19) and Kawaihae Road (Route 250), would be realigned to create a smooth transition to the replacement bridge. The Kawaihae Road and Kohala Mountain Road intersection would then be reconfigured to a roundabout.

DRAFT ENVIRONMENTAL ASSESSMENT

KAWAIHAE ROAD – WAIAKA BRIDGE
REPLACEMENT AND REALIGNMENT OF APPROACHES
PROJECT NO. BR-NH-019-1(045)

WAIMEA, SOUTH KOHALA, HAWAII ISLAND

March 2022

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CHAPTER 1. DESCRIPTION OF THE PROPOSED ACTION

1.1 Introduction

The State of Hawaii Department of Transportation (HDOT), Highways Division, is proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project in South Kohala on Hawaii Island. This project is located along Kawaihae Road (Route 19) at Waiaka Bridge (Mile Post 58.88), and includes the replacement of the existing bridge and the realignment of the roadway approaches toward the bridge. See Project Location Map in Figure 1-1.

The purpose of this project is to address the bridge's deficiencies such that it meets the current design standards for roadway width, load capacity, bridge railings and roadway transitions. Another project purpose is to improve line-of-sight distances at the bridge approaches from Kawaihae Road and Kohala Mountain Road (Route 250).

To meet the project's objectives, HDOT proposes to replace the existing Waiaka Bridge with a wider and longer bridge that would safely accommodate two travel lanes, one in each direction, a shoulder/bike lane, and a raised sidewalk. In addition, the roadway approaches would be realigned to create a smooth transition to the replacement bridge. The Kawaihae Road and Kohala Mountain Road intersection would also be reconfigured to a roundabout.

The proposed project is listed as a system preservation project (HS 16) in the "Statewide Transportation Improvement Program" (STIP) (Federal Fiscal Year 2022-2025), which programs federal funds for transportation improvements.

1.2 Purpose of this Document

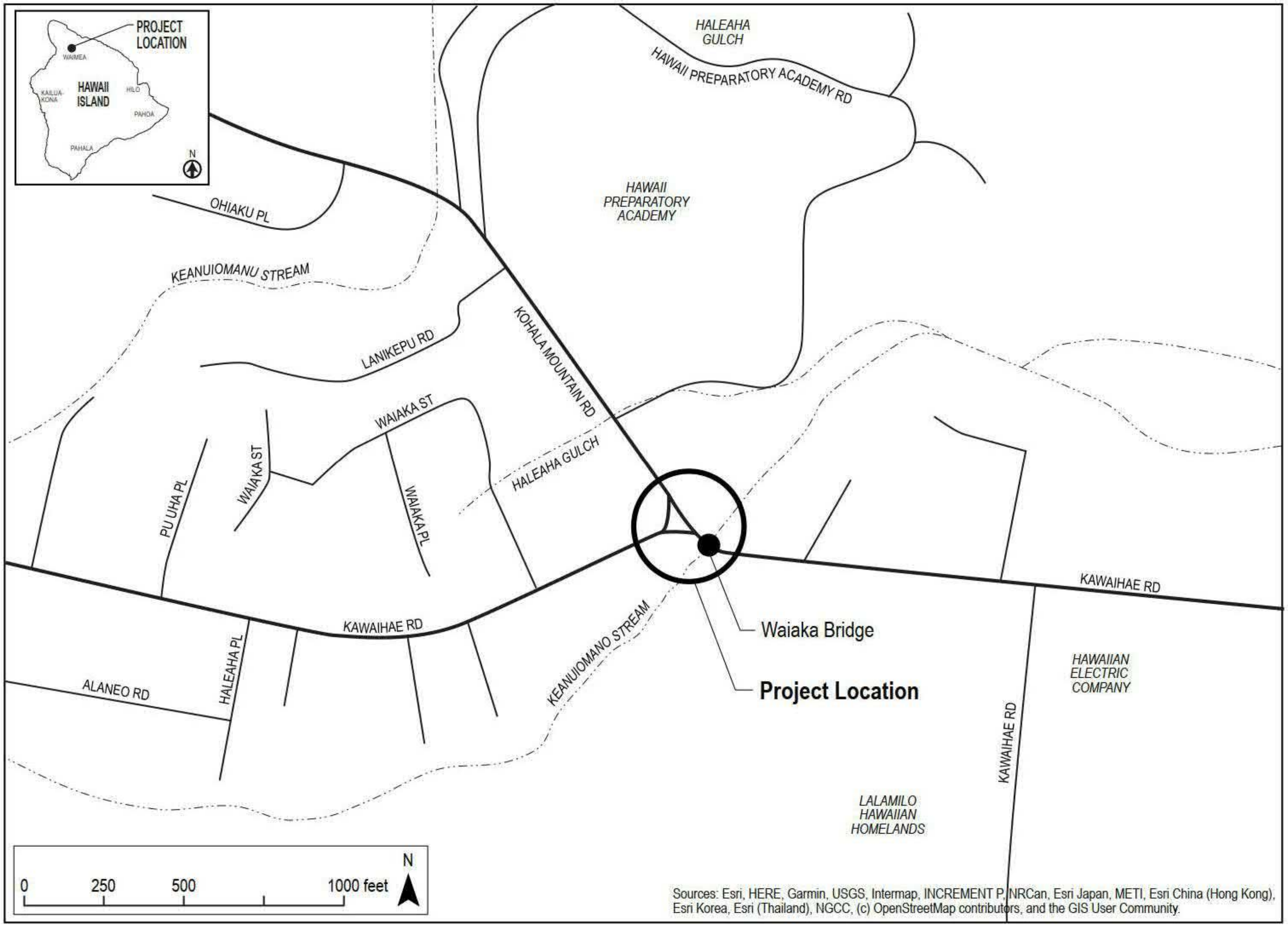
The proposed project requires an environmental review in accordance with Hawaii Revised Statutes (HRS) Chapter 343 because it would use State or County lands and use State funds. HDOT is responsible for preparing this document which must comply with Hawaii Administrative Rules (HAR) Title 11, Chapter 200.1.

This Draft Environmental Assessment (Draft EA) discloses the foreseeable primary, secondary, and cumulative environmental impacts that could result from the proposed project's implementation and commits to specific measures to avoid, minimize, or mitigate adverse impacts to the environment. Additionally, this Draft EA contains a record of consultation activities that have been conducted to date as part of project planning.

HDOT has determined that the proposed project is not likely to have a "significant" effect in accordance with HRS Chapter 343 and HAR 11-200.1-13. Therefore, an EA process was selected for the environmental review. If, during the consideration of comments received on this Draft EA, HDOT determines that a "significant" impact would occur, HDOT will either revise the proposed project to avoid or mitigate the impact's severity and/or start preparing an Environmental Impact Statement (EIS).

Because federal funds administered by the Federal Highway Administration (FHWA) will be used to construct this project, the project is considered a federal action and must also comply with the

Figure 1-1: Project Location Map



National Environmental Policy Act (NEPA), a federally-mandated environmental review process. To comply with NEPA, a Categorical Exclusion (CatEx) is anticipated for this project and will be documented separately. In addition to NEPA, other federal laws that apply to the proposed project include, but are not limited to Section 7 of the Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Section 106 of the National Historic Preservation Act, and Section 4(f) of the 1966 U.S. Department of Transportation Act. These regulations have potential to affect decision-making, including requiring avoidance and mitigation measures, as they are applied to specific resources. For this reason, they are identified and addressed when relevant throughout the document. This Draft EA provides supporting documentation for compliance with NEPA and other federal environmental regulations, the coordination for which is ongoing.

1.3 Organization of this Document

This Draft EA is organized as follows:

- Chapter 1 provides an introduction and discusses the purpose and need for the proposed project.
- 1.5 presents the alternatives that were considered and the proposed project's anticipated schedule and cost. It also lists permits and approvals that may be required.
- Chapter 3 describes existing environmental conditions, potential environmental impacts, and the mitigation measures that are proposed to reduce the level of potential effect.
- Chapter 4 documents agency and public coordination conducted to date related to the proposed project.
- Chapter 4 provides the Anticipated Finding of No Significant Impact (FONSI) statement in accordance with HAR 11-200.1-18 (d)(9).
- Chapter 5 consists of a list of references used in the preparation of this Draft EA.
- Appendices contain records of comments and coordination conducted for the project, as well as various technical reports prepared by specialists.

1.4 Project Purpose and Need

The proposed replacement of the Waiaka Bridge is intended to:

- Address the bridge's functional deficiencies and upgrade it to meet federal and State design guidelines.
- Improve the line-of-sight at the roadway approaches to the bridge at Kawaihae Road and Kohala Mountain Road.
- Improve the hydraulic conditions for Keanuiomano Stream under Waiaka Bridge.

The remainder of this section describes the need associated with each project purpose.

1.4.1 Address Functional Deficiencies

The National Bridge Inventory Standards (NBlS) inspection produces a "sufficiency rating," which is a single number that can vary from a high score of 100 to a low score of 0 (with 100 being a bridge meeting current engineering design standards). The NBI Structure Inventory and Appraisal (SI&A) shows Waiaka Bridge with a sufficiency rating of 26 and identifies the bridge as functionally obsolete.

Bridges that are functionally obsolete typically do not have adequate lane widths, shoulder widths or vertical clearances to serve traffic demand. For Waiaka Bridge, this deficiency results in traffic congestion and delays.

Operating conditions are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. A study of traffic conditions conducted in support of the project identified LOS E and LOS F conditions during the morning and evening peak traffic hours with significant queuing at the Kohala Mountain Road Southbound left-turn onto Kawaihae Road. Section 2.9 describes traffic conditions in greater detail.

As a major transportation link to Kawaihae Harbor, East Hawaii, and West Hawaii, congestion and delays along Kawaihae Road have an important impact on the movement of goods and services, as well the general quality of life. Bringing Waiaka bridge design to current State and federal design guidelines for lane widths, shoulders, pedestrian access, and railing heights is needed for efficient operations.

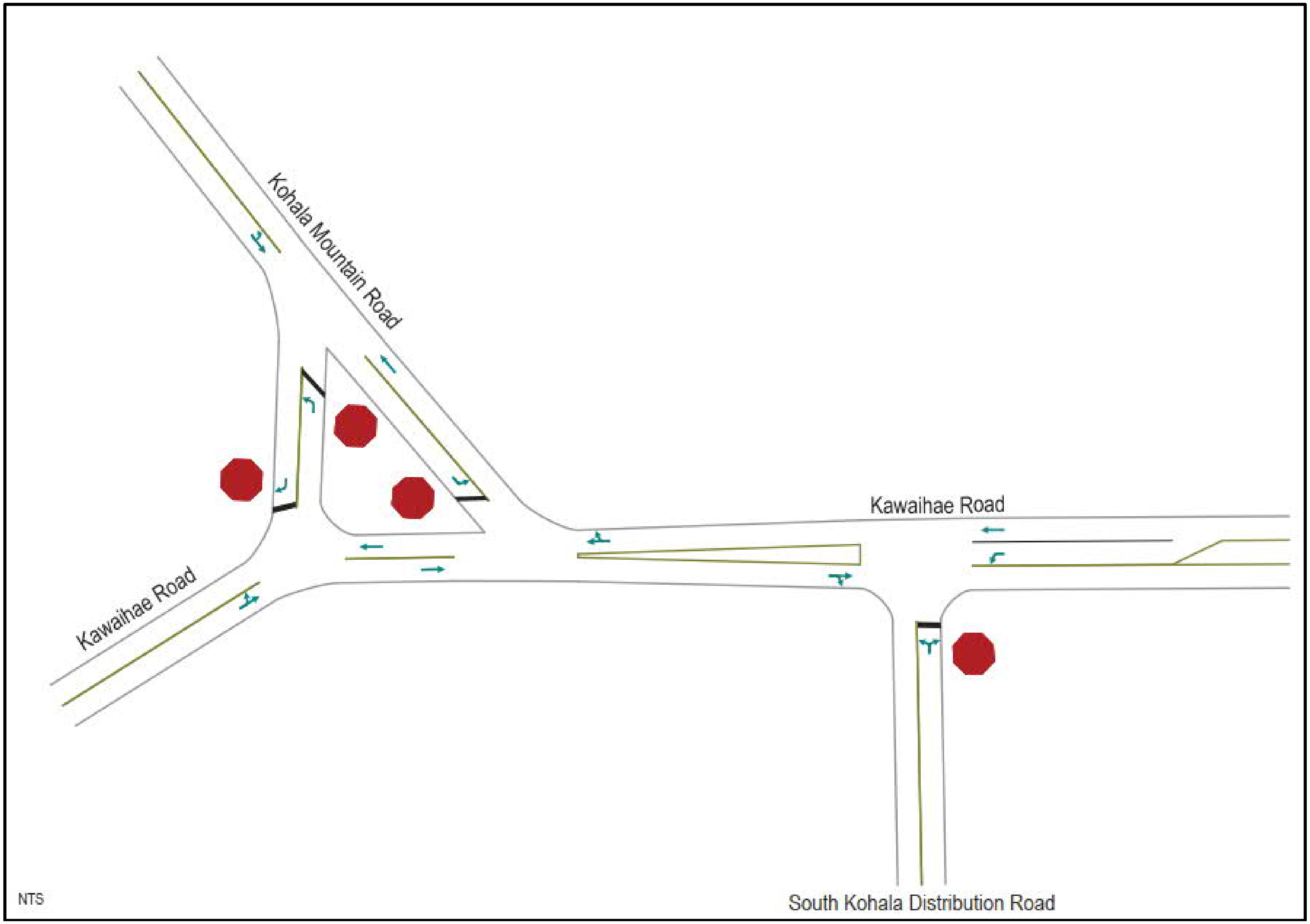
1.4.2 Address Limited Line-of-Sight Distances at the Bridge Approaches

Figure 1-2 shows the existing lane configurations or vehicle turning movements. The alignment of the existing approaches at the intersection of Kawaihae Road and Kohala Mountain Road places the existing bridge in a position with limited sight distance for the southbound approach of Kohala Mountain Road and for eastbound left-turn movements from Kawaihae Road onto Kohala Mountain Road. Views to the east are also affected by the rails on the existing wooden walkway attached to the upstream (north) side of the bridge. Realigning the adjacent intersection approaches would address the placement and orientation of the bridge such that the railings would not impede motorist visibility and would also improve line-of-sight for motorists.

1.4.3 Improve Hydraulic Conditions for Keanuiomano Stream

During storm events, Waiaka Bridge has been overtopped by stream flows, an indication that the hydraulic capacity of the existing bridge is not adequate for large storm events. Additionally, the center pier of the bridge has the potential to impede debris flowing downstream and cause flooding onto adjacent properties upstream of the bridge. Improvements to the hydraulic capacity of the bridge design are needed to accommodate a 100-year rain event, and reduce the potential flood risk to adjacent properties.

Figure 1-2: Existing Lane Configurations for Kawaihae Road and Kohala Mountain Road Near Waiaka Bridge



1.5 Alternatives Addressed in this Environmental Assessment

Two alternatives are evaluated in this environmental assessment (EA): the No Build Alternative and the Build Alternative, also known as the proposed action. Other alternatives that were considered but eliminated are described in Section 1.6.

1.5.1 No Build Alternative

Waiaka Bridge is located at the intersection of Kawaihae Road (State Route 19) and Kohala Mountain Road (State Route 250), at mile marker 58.88. Waiaka Bridge crosses Keanuiomano Stream and provides an arterial thoroughfare between east and west Hawaii island, including Kawaihae Harbor. Constructed in 1932, Waiaka Bridge is a 26-foot wide and 38-foot long concrete bridge with a bolted 3-foot wooden walkway.

Waiaka Bridge, Kawaihae Road, and Kohala Mountain Road are all under the jurisdiction of the State of Hawaii Department of Transportation (HDOT).

The No Build Alternative would leave the site "as is" with no improvements to the bridge, stream bed, or adjoining roadways. The No Build Alternative assumes these current conditions to the year 2024, which is the anticipated timeframe when the proposed action would become operational.

Future roadway improvement assumptions affect forecasts of travel patterns and traffic volumes. Future (Year 2024) roadway improvements assumed are consistent with those included in the current Statewide Transportation Improvements Program for Federal Fiscal Years 2019-2022 (+2) (STIP). The STIP indicates that no major roadway improvements will be constructed in the vicinity of the project site.

1.5.2 Build Alternative

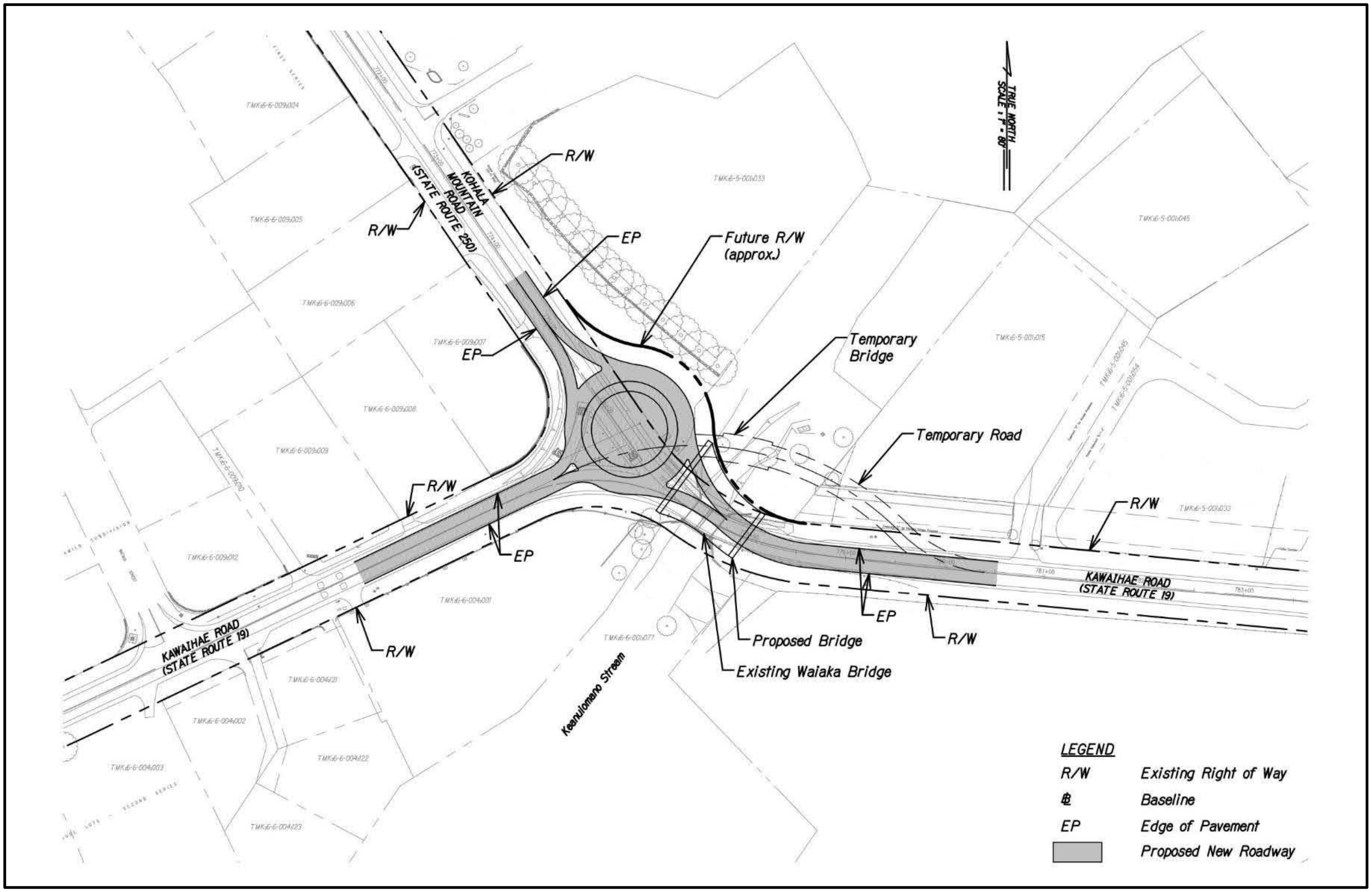
The Build Alternative or proposed action consists of two primary actions: 1) construct a replacement bridge at the existing location and 2) construct a single lane roundabout to replace the Kawaihae Road and Kohala Mountain Road intersection. See Figure 1-3.

Roundabouts are traffic calming devices, which are intended to reduce the speed of traffic and assist motorists in being more aware of their surroundings. Vehicles approaching a roundabout slow down and yield to traffic already in the roundabout. Incorporation of a roundabout at the Kawaihae Road and Kohala Mountain Road intersection would remove the need for a traffic signal.

Design of the roundabout would be in accordance with the Federal Highway Administration's (FHWA) June 2000 guidance, "Roundabouts: An Informational Guide," (FHWA-RD-00-067), which provides guidance on the suitability of roundabouts for a variety of typical conditions found across the United States. FHWA guidelines would be followed to determine the appropriate sizing based on a single 12-foot travel lane for a rural roundabout. An apron at the outer edge of the central island would be used to accommodate wheel tracking of larger vehicles.

To provide sufficient roadway width at the approach to the roundabout, the northern end of the replacement bridge would be 90 feet wide, providing for inbound and outbound 12-foot wide

Figure 1-3: Build Alternative (Replacement Bridge and Roundabout)



vehicular travel lanes, 30-foot wide median island, 8-foot paved shoulders, and 5-foot walkways in both directions of travel. The replacement bridge would be designed in accordance with the current American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications. It would have a wider cross-section than the existing bridge by approximately 35 feet, and would be up to 80 feet long at about the same location as the existing bridge. The project proposes to remove the existing deck, abutments, and central pier prior to constructing the replacement bridge. See Figure 1-4 for a concept of the proposed bridge elevation or side view.

A temporary bypass road and temporary bridge would be constructed to allow Kawaihae Road to continue to operate during construction. Construction easements would be required from the affected parcels shown in Figure 1-3. Once construction is complete, the temporary bypass road and bridge would be removed, the easement would be cancelled, and the land returned to the landowner.

Anticipated construction phasing would likely involve construction of the roundabout first, then the temporary bypass roadway and bridge, followed by demolition of the existing bridge and construction of the replacement bridge. Further analysis would be conducted during the design phase to determine construction phasing.

This alternative would permanently shift the alignment of the Kawaihae Road and Kohala Mountain Road intersection to the east and would require the acquisition of about 9,350 square feet (0.21 ac.) from TMK 6-5-001:033 outside of HDOT's existing 60-foot right-of-way. The existing posted speed would remain at 25 miles per hour (mph).

1.6 Alternative to the Proposed Action

As an alternative to the proposed action, HDOT evaluated replacing Waiaka Bridge, and installing a T-intersection and traffic signal instead of a roundabout at the Kawaihae Road and Kohala Mountain Road intersection. Realignment of the roadways associated with this configuration would require shifting the roadway to the south. See Figure 1-4.

Project limits for this alternative would be approximately 590 linear feet along Kawaihae Road and 250 feet along Kohala Mountain Road.

Similar to the Build Alternative, this alternative would require a temporary bypass road and temporary bridge to allow for continued roadway operations during construction. The bypass would occur on private property, therefore a construction easement north of the existing bridge would be needed. Once construction is complete, the temporary bypass road and its associated temporary bridge would be removed, the easement would be cancelled, and the land returned to the landowner.

This alternative would require acquisition of about 7,360 square feet (0.17 acres) from TMK 6-5-001: 001 and about 2,580 square feet from TMK 6-5-001:077 outside of HDOT's existing 60-foot right-of-way.

The T-intersection alternative has been removed from further evaluation because traffic analysis demonstrates that a roundabout at the Kawaihae Road and Kohala Mountain Road would

Figure 1-4: Proposed Bridge Elevation

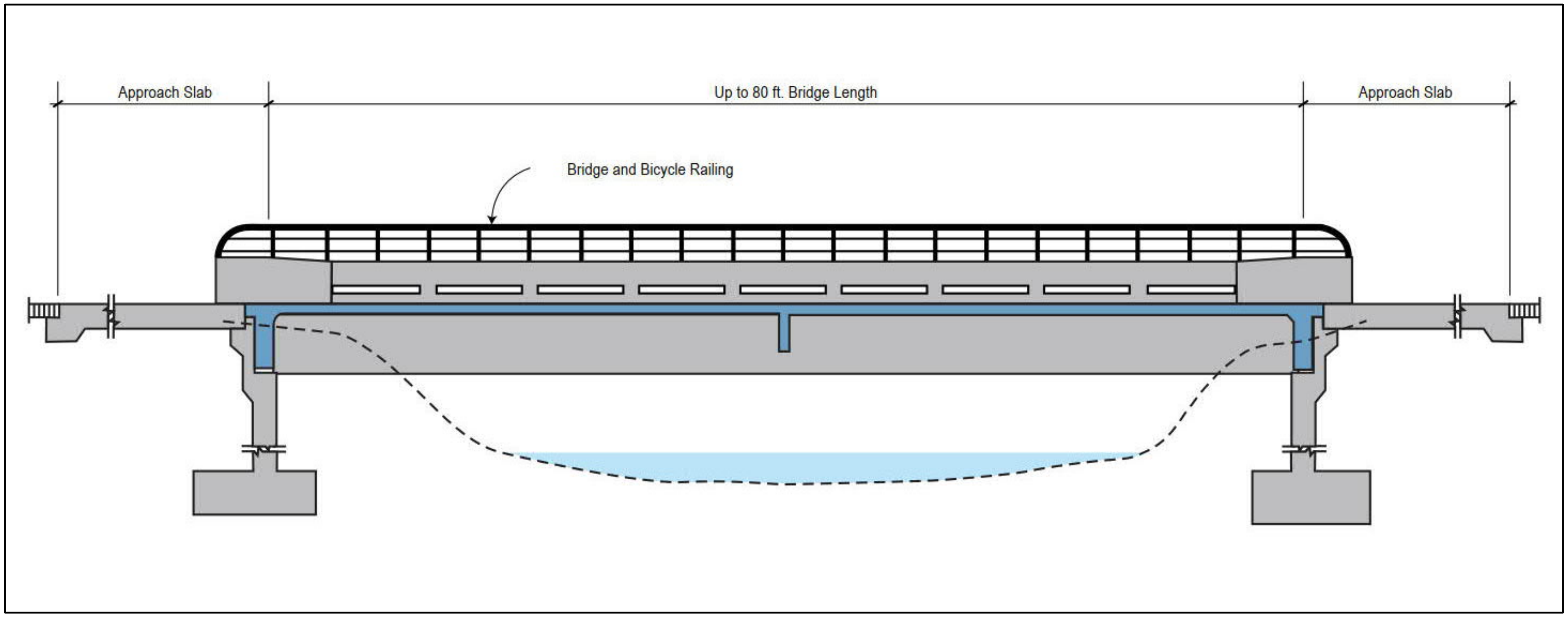
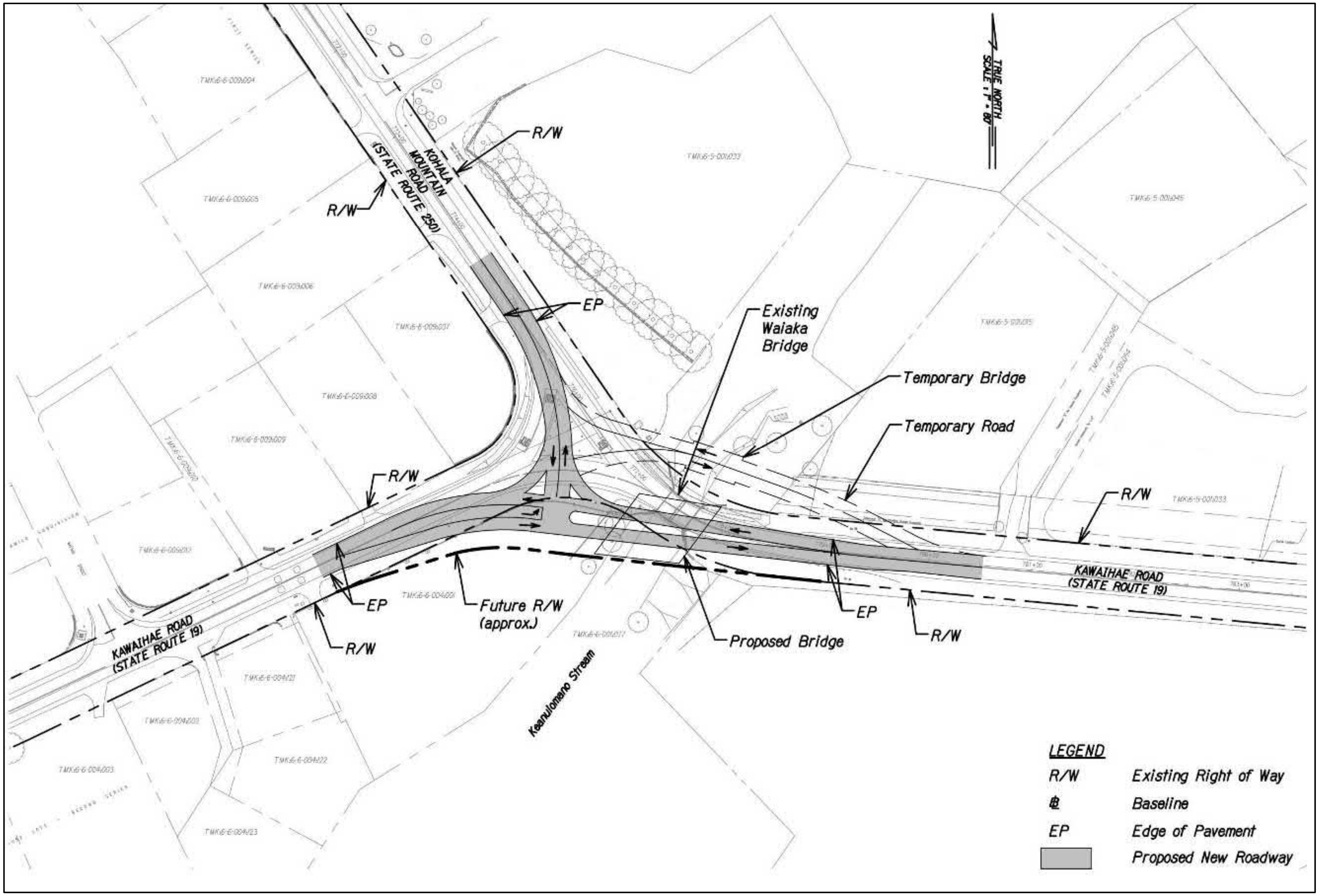


Figure 1-5: Alternative to the Proposed Action (Replacement Bridge and T-Intersection)



outperform a T-intersection for meeting service demands. See Appendix B for the traffic impact analysis prepared for the proposed project.

Because addressing the functional deficiencies experienced at the bridge and its approaches is a primary need for the project (See Section 1.4.1), and the community has expressed strong support for the roundabout configuration, the roundabout was selected as the proposed action. The T-intersection alternative was then eliminated from further consideration.

1.7 Project Cost

Based on conceptual engineering, costs for the Build Alternative are estimated at $10 million (2022 US Dollars). These costs will be refined as engineering details are developed.

1.8 Project Schedule

The proposed project's milestones are:

- Finish Planning and Design Concepts: Summer 2022
- Begin Final Design: Mid-Summer 2022
- Initiate Construction: Summer 2023
- Construction Completion: End of 2024

1.9 Permits and Approvals

Table 1-1 lists approvals and permits that would be required prior to construction of the proposed project. Permits or approvals that may not be required due to construction means and methods selected by the contractor are indicated with an asterisk (*). Coordination and approvals are ongoing.

Table 1-1: List of Permits and Approvals by Agency

Agency	Permit or Approval
County of Hawaii	Grading, Grubbing, and Stockpiling Permit
Department of the Army (DA); (U.S. Army Corps of Engineers, Regulatory Branch)	CWA Section 404 DA Permit.
Department of Business, Economic Development & Tourism, Office of Planning and Sustainable Development	Coastal Zone Management (CZM) Federal Consistency Review: Federal Permit Required
Department of Health (HDOH), Clean Water Branch (CWB)	National Pollutant Discharge Elimination System (NPDES) Permit for storm water discharges related to construction activities;
	*NPDES for project discharges related to dewatering activities;
	CWA Section 401 WQC
Department of Land and Natural Resources (DLNR), State Historic Preservation Division	Hawaii Revised Statutes (HRS) Chapter 6E-8 Review
	Section 106 of the National Historic Preservation Act (NHPA)
DLNR, Commission on Water Resource Management (CWRM)	*Stream Channel Alteration Permit (SCAP)
Department of Health (DOH), Indoor Air and Radiological Branch	Community Noise Permit
	*Community Noise Variance (if night time, weekend or holiday construction needed)

CHAPTER 2. AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND PROPOSED MITIGATION

This chapter describes the existing environmental conditions of the project site, potential long-term impacts of the project, and the proposed mitigation measures to avoid, minimize, or mitigate those potential effects. The relative impact that will likely remain after mitigation is also described. Each section within this chapter is dedicated to analyzing a specific environmental or social discipline. Short-term potential construction phase impacts are discussed in a single section, Section 2.15.

Existing conditions, potential impacts, and proposed mitigation measures presented in this chapter have been developed through (a) review of existing information related to the project areas (see references chapter); (b) studies conducted specifically for the project; (c) coordination with regulatory agencies; and (d) consultation with the general public.

2.1 Physical Geography

2.1.1 Existing Conditions

Waiaka Bridge is at an elevation of 2,418 feet above mean sea level (msl). Three hundred feet west of Waiaka Bridge, the elevation is 2,407 feet above msl. As one travels east along Kawaihae Road, the elevation gradually increases.

The project area is situated on the Waimea Plain, between Kohala and Mauna Kea, and underlain by rocks of the upper member of the Hamakua series of Mauna Kea volcanism. The upper member of the Hamakua series is capped by a surface layer of Pahala Ash. According to the U.S. Department of Agriculture’s Natural Resource Conservation Services (NRCS) Soil Survey of Islands of Hawaii, State of Hawaii (August 1972), the underlying soils within the project area are primarily categorized as Rock Outcrop- Kamakoa Complex with 6 to 20 percent slopes. Soils in the project area are shown in Figure 2-1.

Kamakoa Complex soil is typically comprised of 70 percent basalt rock outcrop, 25 percent Kamakoa and similar soils, and 5 percent minor components. These soils are found at elevations of 1,500 to 4,200 feet on the leeward slopes of Mauna Kea and the Kohala Mountains. They are well-drained soils. Permeability is rapid, and runoff is very low. Kamakoa soils are used for pasture and wildlife habitat. They are not considered prime farmland soils.

While Kamakoa Complex soils are not considered of the quality deemed prime to grow agricultural crops, the State Department of Agriculture has classified much of the project area as prime farmland. See Figure 2-2.

Figure 2-1: Soils in the Project Area

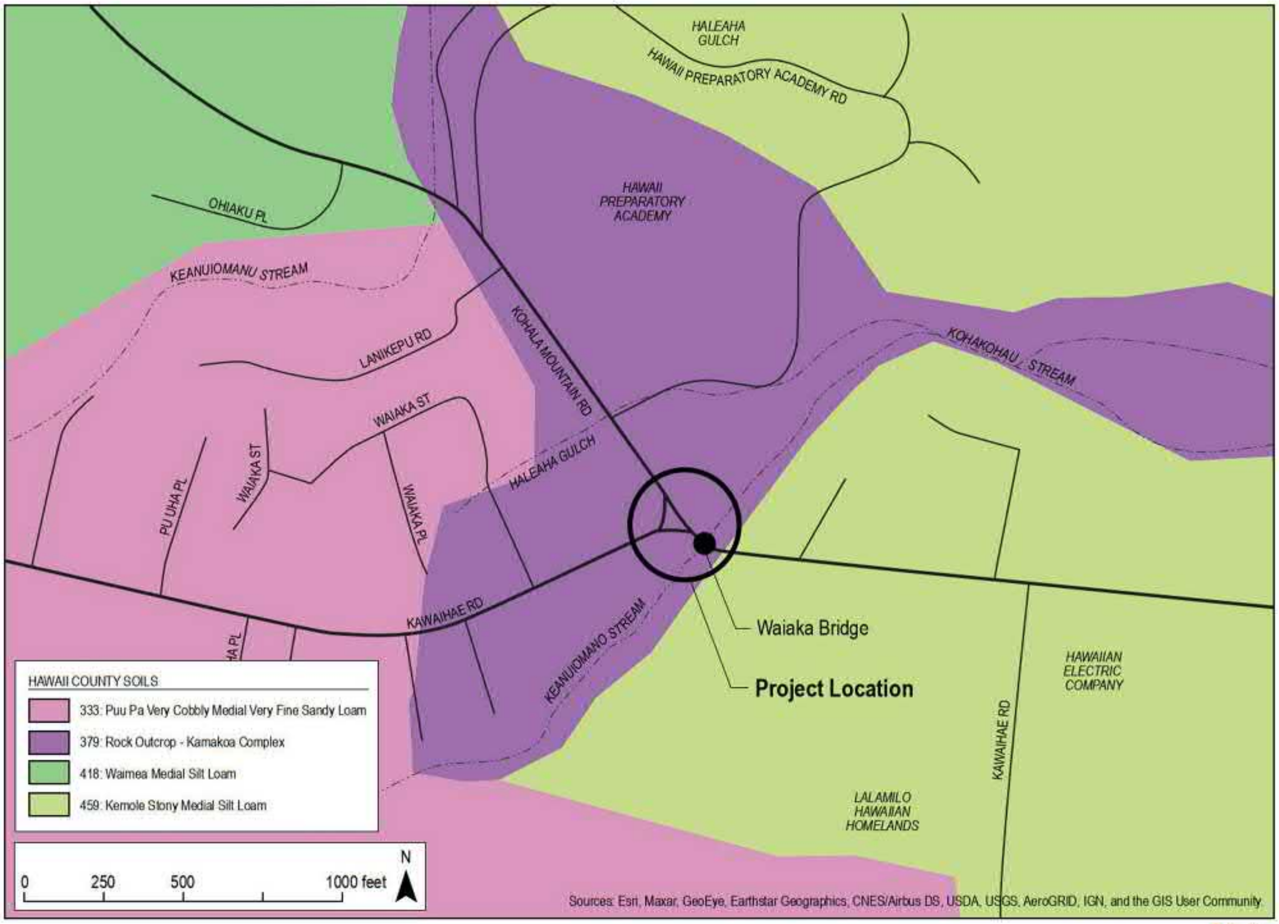
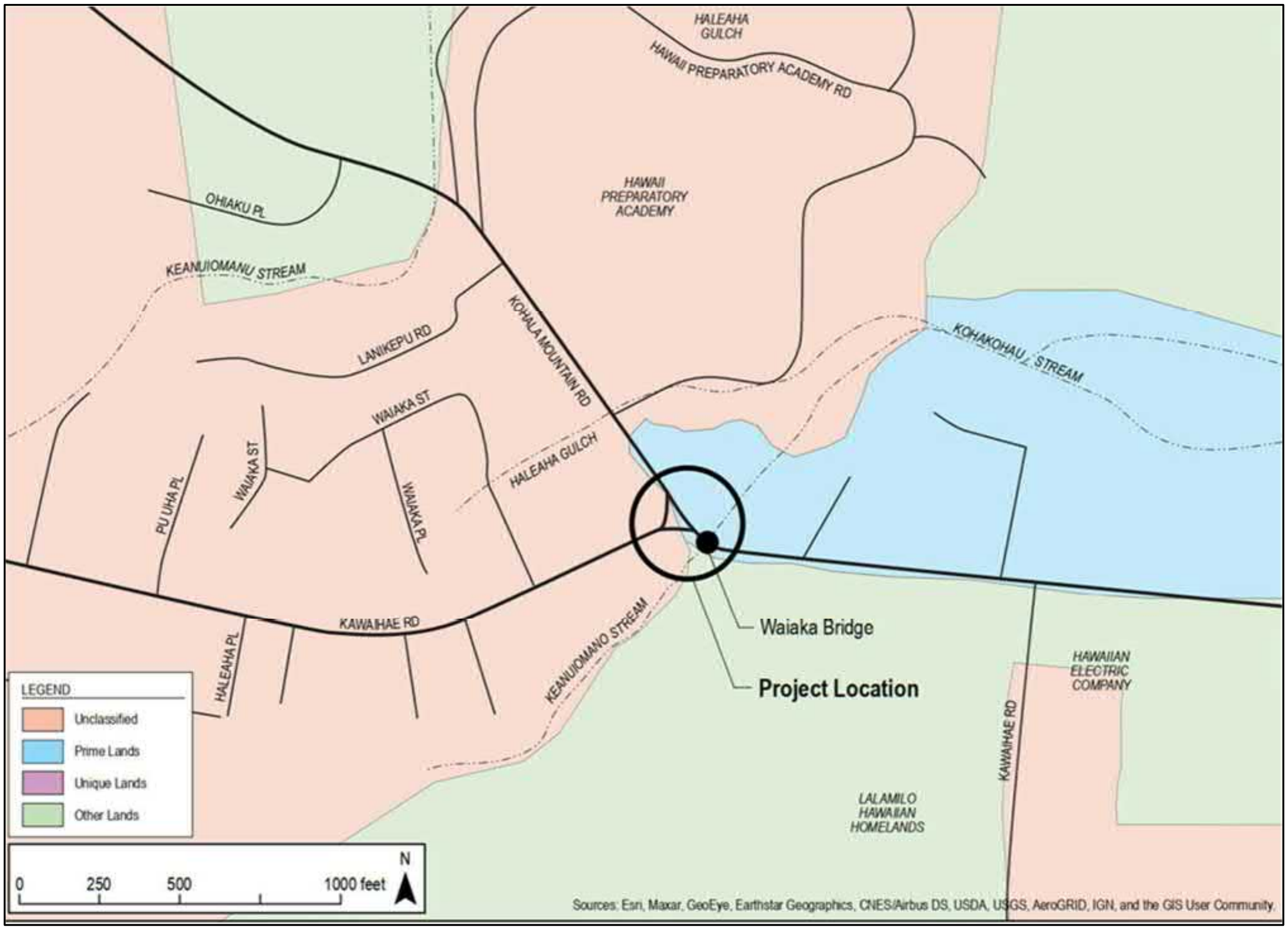


Figure 2-2: Agricultural Lands of Importance to the State of Hawaii



2.1.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, the topography and soil that make up the geographic setting and geologic processes in the project area would not change.

Build Alternative

Under the Build Alternative, the topography and soil that make up the geographic setting and geologic processes in the project area would not change. Although the project would occur on lands considered prime lands, these areas are not in active ranch or farmland use. Furthermore, given the proximity to the active roadway, these areas are considered marginal. Therefore no long term effects are associated with the project. See Section 2.15 for short term or construction related impacts.

Avoidance, Minimization, and Mitigation Measures

No avoidance, minimization or mitigation measures are proposed.

2.2 Land Use

2.2.1 Existing Conditions

The Waiaka Bridge is located in Waimea, a town nestled at the southern foot of Kohala and the northwest base of Mauna Kea. Home of the historic Parker Ranch, Waimea is primarily a ranching and agricultural community with a population of approximately 10,000 (US Census 2010). Due to multiple locations within the state retaining the name Waimea, Waimea town on Hawaii Island is often referred to as Kamuela, to avoid confusion, in honor of Samuel Parker, the founder of Parker Ranch.

State Land Use Districts (SLUD) surrounding the project location is primarily agriculture and conservation with few urban and rural designations, see Figure 2-3. The County of Hawaii's State Land Use Pattern Allocation Guide (LUPAG) further defines the immediate area to contain low density urban, urban expansion, extensive agriculture, and important agriculture land (IAL) designations (HCPD South Kohala CDP).

Figure 2-3: State Land Use Districts

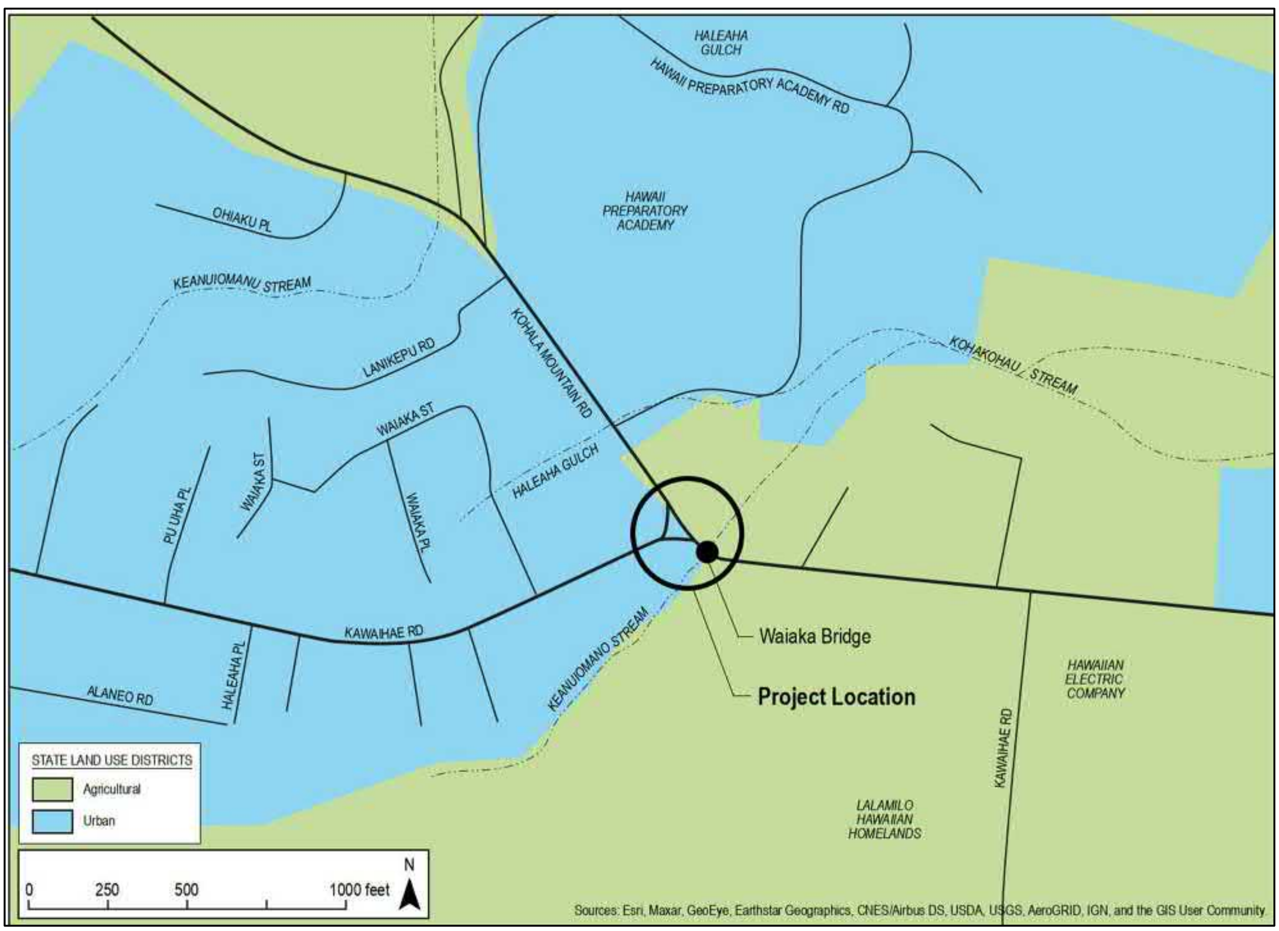


Figure 2-4: County Zoning Map

Landowners within the project area include the Hawaii Preparatory Academy, which is a private education institution that teaches grades from Kindergarten through 12th, the Department of Hawaiian Homelands, and private landowner Steven D. Kittle Trust.

2.2.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no changes to existing land use neither would easements or property acquisition be needed for the shared use path right-of-way.

Build Alternative

Under the Build Alternative, permanent acquisition of 9,350 square feet outside of the existing 60-foot right-of-way would be needed from TMK: 6-5-001:033, which is owned by Hawaii Preparatory Academy, to develop the roundabout.

Additionally, a construction easement north of the existing bridge would be required for the temporary bypass road and bridge while the replacement bridge is being built. The construction easement would affect both TMK: 6-5-001:033 and 6-5-001:015, which is privately-owned by the

Steven D. Kittle Trust. Once construction is complete, the temporary bypass road and bridge would be removed, the easement would be cancelled, and the land returned to the landowner.

Neither the permanent acquisition nor construction easement would displace any of the existing land uses occurring on their respective parcels.

2.2.3 Avoidance, Minimization, and Mitigation Measures

Any real property acquisitions or easements will be procured in accordance with federal, State and local regulations.

2.3 Historic and Archaeological Resources

Section 106 of the National Historic Preservation Act (NHPA) requires actions that are federally funded, authorized, or implemented take into account the effect of such actions on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (National Register, or NRHP). Such resources are considered "significant" historic properties. The Section 106 process involves coordination and consultation with the State Historic Preservation Officer (SHPO) and other agencies and organizations that have an interest in or are mandated to protect historic properties. In addition, the Advisory Council on Historic Preservation (ACHP) is afforded the opportunity to comment on actions that may potentially affect significant these historic properties. At the State level, Chapter 6E-8 of the Hawaii Revised Statutes (HRS) places similar responsibilities on State agencies to evaluate their projects.

Hawaii State Statutes define "historic property" as any building, structure, object, district, area, or site, including heiau and underwater sites that is over 50 years old. Although the State law has a broader definition of what is considered a historic property, similar to Section 106, only those resources that meet the definition of "significant", as defined by Chapter 13-275-6(b) of the Hawaii Administrative Rules (HAR), are protected by HRS 6E-8. This document will refer to those properties that are considered eligible for the National Register or meet the "significant criteria" (protected under Section 106 and HRS 6E-8) as "significant historic properties" to distinguish them from those that are considered historic because they are over 50 years old.

For a district, site, building, structure, or object to be considered a significant historic property, it must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one of the following criteria:

A) Associated with events that have made a significant contribution to the broad patterns of our history; or

B) Associated with the lives of persons significant in our past; or

C) Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D) Have yielded or may be likely to yield information important in prehistory or history.

The Hawaii Register of Historic Places (Hawaii Register) provides an additional criterion:

> E) Has an important value to the native Hawaiian people or to another ethnic group.

In accordance with regulations provided in 36 Code of Federal Regulations (CFR) 800, the federal sponsoring or regulating agency has the responsibility of conducting a good faith effort to identify whether there are any significant historic properties in the project's Area of Potential Effect (APE) after initiating the Section 106 process. If any significant historic property(ies) are identified within the APE, the federal agency would then assess whether it would be adversely affected by the proposed project.

Under NHPA Section 106, the federal agency – in this case, FHWA – is responsible for assessing the effects of the project on all significant historic properties within the APE. Under the State rules, the proposing agency, HDOT, carries the same burden to identify historic properties within the project study area (HAR 13-275-5), assess their significance (HAR 13-275-6), and evaluate the proposed project's impacts (HAR 13-275-7).

Pursuant to Section 106, FHWA can render one of the following three possible findings for SHPD review and concurrence:

- No historic properties affected;
- No adverse effect; and
- Adverse effect.

"No historic properties affected" means that either there are no significant historic properties present, or there are historic properties present but the undertaking would have no effect upon them.

"No adverse effect" means that there could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion in the National Register, "in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." (36 CFR 800.5(a)(1))

An "Adverse effect" means an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property.

Pursuant to HRS 6E-8, HDOT can render one of the following two possible findings for SHPD review and concurrence:

- No historic properties affected; or
- Effect, with proposed mitigation commitments.

"No historic properties affected" means that either there are no significant historic properties present, or there are significant historic properties present but the undertaking would have no effect upon them of any kind (HAR 13-275-7).

"Effect, with proposed mitigation commitments" means that the project will affect one or more significant historic properties, and the effects will be potentially harmful. However, the agency has proposed mitigation commitments involving one or more forms of mitigation to reasonably and acceptably mitigate the harmful effects.

2.3.1 Existing Conditions

ASM Affiliates (ASM) conducted a historic properties assessment for the proposed Kawaihae Road, Waiaka Bridge Replacement and Realignment of the Approaches project. See Appendix C.

The study was prepared to aid project efforts in identifying historic properties for compliance with Section 106 of the NHPA and HRS Chapter 6E-8. The Section 106 Area of Potential Effect (APE) and the HRS Chapter 6E-8 Project Area are coterminous. Initially, the APE comprised 316,143 square feet (7.3 acres), however, to avoid culturally sensitive areas, the APE has been reduced to approximately 6.6 acres. The new APE contains portions of Kawaihae Road, Kohala Mountain Road, and portions of surrounding parcels where equipment and materials storage will take place, as well as portions of surrounding parcels that will be used temporarily during the project construction.

Five previous archaeological studies (Corbin 2007; Haun et al. 2002, 2003; Sinoto 1998; Thompson and Rosendahl 1992) have been conducted within the vicinity of the project area with one study yielding identifiable features. Haun et al. (2002) previously identified three features of a large Precontact agricultural complex (SIHP 50-10-06-22632), a “concrete foundation” (SIHP 50-10-06-23313), and the Waiaka Bridge (SIHP 50-10-06-29221). Figure 2-5 shows the identified sites relative to the APE.

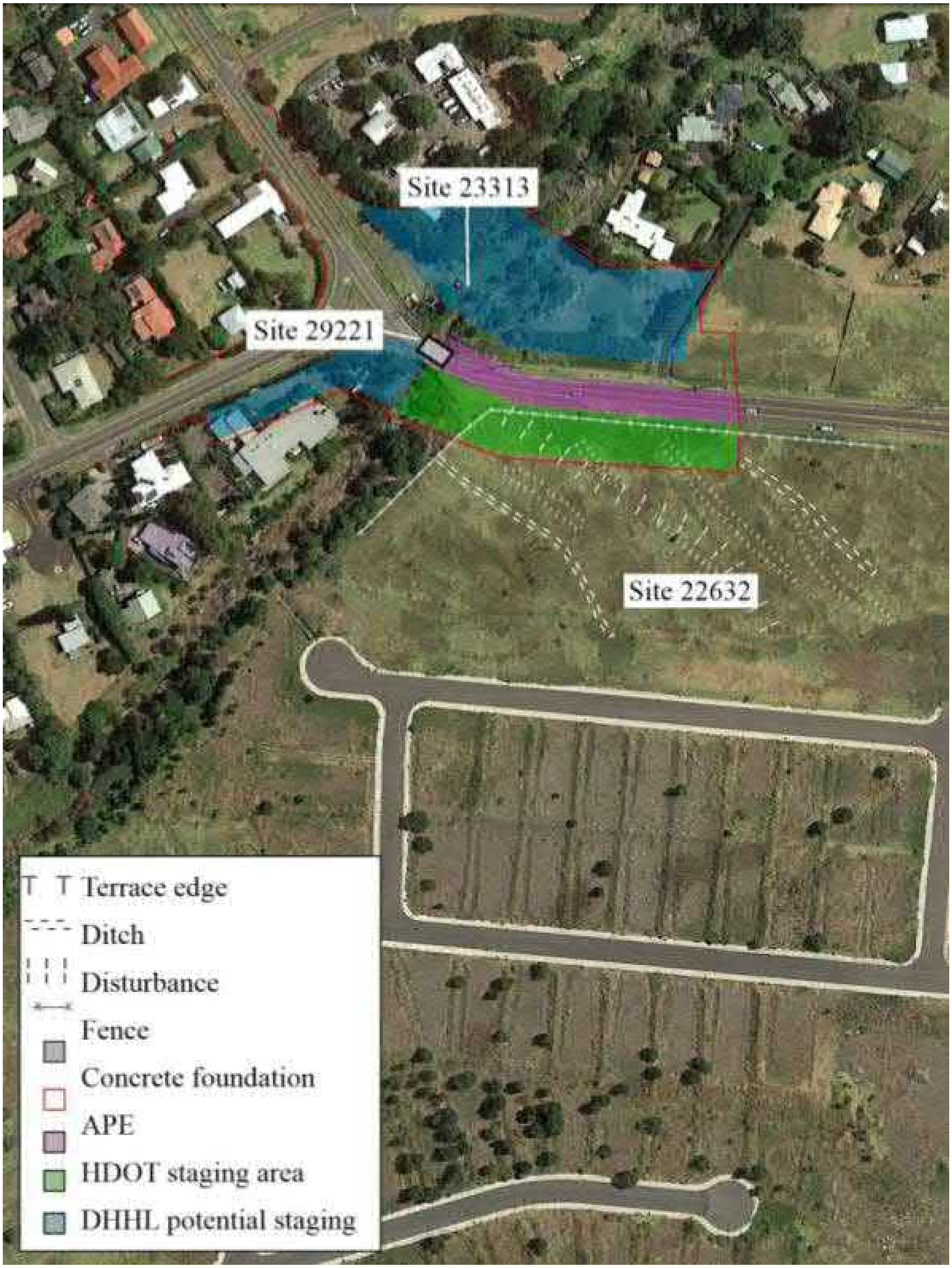
Site 22632: Large Precontact Agricultural Complex

Site 22632 is a large agricultural complex consisting of 700 agricultural features, previously documented by (Haun et al. 2003), located south of Kawaihae Road within the lands owned by the State of Hawaii Department of Hawaiian Home Lands (DHHL). The portion of Site 22632 near Waiaka Bridge contains 11 features between Keanuiomano Stream and South Kohala Distribution Road consisting of a series of terrace/filed boundaries and irrigation ditches which are part of the large agricultural complex. The archaeological survey mapping shows theses irrigation ditches are oriented at an angle of about between 120 to 130 degrees to Kawaihae Road and lie about 60 to 90 feet south of the Road in the areas near Waiaka Bridge.

Portions of three features of Site 22632 – two terraces (Features XN and XO) and a ditch (Feature XR) were identified within the current APE. The northern ends of the features extend between 12.6 and 18.0 meters into the current APE. South of the current APE boundary, these features have been disturbed by the partial development of the Department of Hawaiian Homelands (DHHL) residential lots project.

Site 22632 was previously determined eligible for the National Register of Historic Places (NRHP) under Criteria A, C, and D and significant under HRS Chapter 6E under Criteria a, c, and d. Nothing observed within the APE during the current study suggests that the features of the site have experienced a sufficient loss of integrity to change the NRHP eligibility or HRS Chapter 6E significance of the site as a whole. Therefore, Site 22632 remains recommended eligible for the NRHP under Criteria A, C, and D and significant under Criteria a, c, and d.

Figure 2-5: Identified Historic Resources and the APE



Site 23313: USGS Stream Gage (USGS 16756500)

Site 23313 was previously identified by Haun et al. as a concrete foundation located in Keanuiomano Stream. Additional research found that Site 23313 is the Keanuiomano Stream Gage (USGS 16756500) and that the concrete "foundation" is actually a small weir built for the gage. Previously evaluated as NRHP eligible under Criterion D and HRS Chapter 6E significant under Criterion d. Based on the additional information obtained during the current study the site is no longer recommended NRHP eligible or significant under HRS Chapter 6E-8.

Site 29221: Waiaka Bridge

Site 29221 is Waiaka Bridge, located at the intersection of Kawaihae Road and Kohala Mountain Road. Waiaka Bridge was constructed in 1932, making the bridge 80 years old. Various historic bridge inventory studies were prepared by SHPD, HDOT, and the Counties in 1987, 1996, and 2008. At the time of those studies, Waiaka Bridge was not listed on the National or Hawaii Register of Historic Places or was not determined to be potentially eligible for the National Register. Waiaka Bridge was previously determined to be NRHP eligible Criteria C and D and HRS Chapter 6E significant under Criteria c and d. Based on the observations made during the current study, the Site 29221 continues to be recommended NRHP eligible under Criteria C and D and HRS Chapter 6e significant under Criteria c and d.

Potential to Encounter Other Sites or Subsurface Resources

No other sites were documented in the current APE in any of the prior archaeological studies. No previously unidentified sites were found during field inspections.

As of the writing of this Draft EA, current Section 106 consultation has yielded concerns from consulting parties regarding the potential to encounter concealed iwi or archaeological resources in caverns along Keanuiomano Stream. However, consultation conducted in 2012 for an earlier iteration of the current undertaking found that the portion of Keanuiomano Stream in the current APE is unlikely to contain concealed iwi or archaeological resources.

Additionally, SHPD has advised that there are two historic properties about 200 meters slightly northeast of TMK: (3) 6-5-001:015, which have been documented as a Hawaiian habitation and burial complex (SIHP 50-10-19648 and SIHP 50-10-06-1649). SHPD notes that additional sites documented further north are likely related. Although these sites are beyond the APE, the subsurface of this area should be treated as culturally sensitive.

2.3.2 Potential Impacts

The Section 106 process is currently in the consultation process, which will be completed prior to filing the NEPA CatEx. For the HRS § 6E process, although HDOT has provided preliminary assessments of archaeological historic properties, SHPD is expected to conduct its HRS § 6E review responsibilities in conjunction with their Section 106 responsibilities. The potential impacts described in this section should be considered cursory as they have not been coordinated with Section 106 consulting parties. Nonetheless, the anticipated impacts described are intended to fulfill the impact disclosure requirements of HRS 343.

No Build Alternative

Under the No Build Alternative, no historic properties would be affected.

Build Alternative

Under the Build Alternative, the current Waiaka Bridge (Site 29221) would be demolished, and the use of staging/potential staging areas located on TMK: (3) 6-6-001:077 may result in physical damage to Site 22632 (Features XO, XP, and XR).

Based on previous and current documentation of the historic and archaeological resources and the impacts to Sites 29221 and 22632, the proposed project is anticipated to have “Adverse effect” under 36 CFR 800.5 and “Effect, with proposed mitigation commitments” under HAR 13-275-7.

2.3.3 Avoidance, Minimization, and Mitigation Measures

The significance and recommended treatment for the two recorded sites is presented in Table 2-1 and discussed below. The significance evaluations and treatment recommendations presented below should be considered preliminary until SHPD provides concurrence with an HRS Chapter 6E-8 review determination of effects.

Table 2-1: Site Significance and Treatment Recommendations

Site #	Site Type	Temporal Affiliation	Significance	Recommended Treatment
22632	Agricultural complex	Cultural	A,C,D	Data Recovery
29221	Bridge	Historic	C,D	Architectural Recordation

Completion of project design, consultation, and concurrence by the SHPD will confirm appropriate mitigation commitments. HDOT will continue to consult to resolve the adverse effect pursuant to 36 CFR 800.6 and HAR 13-275-8. Possible mitigation measures include data recovery at Site 22632 (e.g., high-resolution mapping of the site using LiDAR and/or the recovery of macro- and microbotanical remains from within the fields and field ridges) and architectural recordation (HAER Level I or II) of Site 29221.

2.4 Cultural Resources

A Cultural Impact Assessment (CIA) was prepared by ASM Affiliates to comply with the State of Hawaii’s environmental review process, which requires consideration of the proposed project’s potential effect on cultural beliefs, practices, and resources. The CIA is provided as Appendix D.

Sixteen individuals who were believed to have genealogical ties, long-standing residency, or knowledge of Lalamilo, Kauniho, Waiaka 1st, Waiaka 2nd, and the greater Waimea District we contacted. Of the sixteen individuals and organizations contacted, four responses were received from Dr. Billy Bergin, Leningrad Elarionoff, Kuulei Keakealani, Nicole Lui, and Barbara Robertson.

2.4.1 Existing Conditions

The project area is located at the ascent of the Kohala Mountains. While these places are known as ahupuaa now, traditionally it was one of several ili that made up the kalana of Waimea. As a kalana, Waimea was treated as a subdistrict of Kohala. The lands subject to the kalana of Waimea are those that form present-day South Kohala District including Ouli, Waiaka, Lalamilo, Puako, Kalahuipuaa, Anaehoomalu, Kanakanaka, Alaohia, Paulama, Puukalani, Puukapu, and Waikoloa.

In 1901, the name Kamuela (Samuel) was adopted by the United State post office in Waimea to differentiate from Waimea, Kauai and avoid duplicate names causing confusion. It is said that the new name was to commemorate either the postmaster Samuel Spencer or the famed rancher Samuel Parker.

The moolelo of Manoua (also known as Manaua) recounts the moo wahine and rainmaker who lived in Kohakohau Stream, which starts above the project area and travels makai eventually becoming Waiaka (also known as Waiaka) Stream. The story of Manoua also relates to “The Bird Catcher of Waimea” which recounts three lawaia manu or bird catchers who hunted for kolea and took a dip where the famed moo wahine of Waimea resided.

The arrival of foreigners in the Hawaiian Islands marked the beginning of major changes within the Hawaiian culture, politics, and economy. The focus shifted from subsistence agriculture to food production and goods that could be bartered with foreign ships. By the time Kamehameha conquered the islands of Oahu, Maui, and Molokai in 1795, Hawaii began a market system economy. This new endeavor impacted the landscape of Waimea tremendously beginning with deforestation caused by the overharvesting of sandalwood followed by the introduction of cattle when

Captain George Vancouver gifted seventeen heads of steer to Kamehameha. Early descriptions of Kohala stem from the first Protestant Missionary accounts. In 1823, missionary William Ellis described the Waimea region as fertile, well-watered lands that could sustain a large population. Concentrated areas include Keaalii, Waikoloa, and Puukapu, where major streams traversed the land. The upper Lalamilo-Waimea area was considered to be a highly productive agricultural area from the Precontact to early Historic periods with evidence of a large and intensive cultivated field system known as the Waimea Field System found at an elevation of approximately 2,460 to 2,950 feet above sea level.

Another system known as the Kohala Field System is found along the leeward slopes of the Kohala Mountains and relied almost exclusively on rainfall. The Waimea Field System was supported by auwai. Crops such as uala, kalo, wauke, mamaki, plantains, maia, ko, niu, and hala were cultivated. Previous archaeological studies indicate that the Lalamilo agricultural field system was utilized from Precontact to historic times and included terraces, mounds, enclosures, field boundaries, auwai, stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and other miscellaneous types. An archaeological inventory survey conducted by Haun et al. in 2002 consisted of a 100% pedestrian survey but no subsurface testing. During the survey, four sites and fourteen features were found including Sites 16095 (an auwai system), Site 22632 (a large agricultural complex with 700 features), Site 23313 (concrete foundation within Keanuiomano Stream), and Site 29221 (Waiaka Stream). A visual field inspection conducted by ASM in October 2020 (Barna 2021) noted the same sites except for features related to Site 22632 being entirely outside of the Kawaihae ROW. The field inspection concluded that no additional fieldwork is necessary, however, archaeological monitoring during construction is still recommended.

During the mid-1800s, John P. Parker from Newton, Massachusetts was one of the early foreigners who received permission from the Crown to hunt wild cattle as the gifts that Captain Vancouver ravaged the uplands of Kohala, Kona, and the saddle region of Hawaii Island. By 1830, Parker established his own private cattle herd resulting in a business called Parker Ranch. Eventually, Parker Ranch became the largest cattle ranch on Hawaii Island. By 1840, bullock hunting drastically reduced the population of wild cattle resulting in a five-year restriction on hunting them solely for their hides and tallow. Agricultural products from Waimea continued to be used to replenish ships docked at Kawaihae Harbor. During this time potatoes were grown in the Waimea area and shipped to California to help feed those involved with the gold rush. With the decline of the whaling industry paired with the kapu of cattle, this led to economic hardship and a downturn in the Waimea population.

The Mahele Aina of 1848 divided all the lands of Hawaii including those held by the Moi, alii, konohiki, and hoaaina. Parcels awarded to hoaaina were and still are referred to as kuleana lands. A total of three LCAw. Were awarded in the vicinity of the project area including LCAw. 589 (James Fay), LCAw. 2258 (James Fay), and LCAw.8520-B (M. Lahilahi). Land Grant 662 was awarded to Kamaikui and covers the eastern portion of the Waiaka Bridge project area.

After the Māhele, the population of Waimea expanded exponentially. Prior to the bombing of Pearl Harbor, the United States Army established infantry headquarters in the Pu‘ukapu area. After the United States formally entered WWII, the Army’s presence expanded into one of the largest multi-force military camps known as Camp Tarawa. Shortly after Japan surrendered to the United States, the military left Waimea and by the 1950s most of the camp buildings were demolished with a network of roads still intact.

Two formal interviews were conducted with participants Dr. Billy Bergin and Ms. Ku‘ulei Keakealani, while two emails from Mr. Leningrad Elarionoff and Ms. Nicole Lui provided feedback regarding knowledge of cultural resources in the vicinity and concerns. Dr. Bergin shared that the first Catholic church in Waimea was constructed in the vicinity of the project area by Saint Damien, also known as Father Damien. He believes the location of the former Catholic church once stood within the HPA property but outside of the project area boundaries. He also shared that the current HPA campus is on land once owned by Parker Ranch. According to Dr. Bergin, HPA was originally located east of the project area on the ground of St. James Episcopal Church on Kawaihae Road and named Hawaii Episcopal Academy. When it moved to its current location, the school expanded tremendously, changed its name, and became non-denominational.

Interviewees also mentioned the Kamuela Museum, which is within the project area boundaries and immediately southwest of the Waiaka Bridge. Dr. Bergin and Ms. Lui shared that the museum was built by the Soloman family—a longtime Kohala family—who created a regional museum with an emphasis on the ranching industry in Waimea. Ms. Lui’s great-granduncle Kehau Soloman built the museum, the surrounding wall, and landscaped the property himself. The late Mr. Soloman, along with his wife Hennrietta Waipa (the great-granddaughter of Samuel Parker) operated the museum.

Regarding moolelo and wahi pana, several interviewees shared their knowledge of Manaua—the celebrated moo wahine of Waimea and a pohaku located east of the project area. Dr. Bergin, Ms.

Lui, and Ms. Keakealani shared that the Native Hawaiian cultural traditions of leaving hookupu, pule, performing hula, and other ceremonies are still practiced at the Manaua pohaku, especially during droughts. Ms. Lui shared that the Case Ohana malama (to take care of) the pohaku after it was rediscovered in the 1970s. In terms of the progression of modes and means of transportation, Dr. Bergin pointed out that portions of the Kohala Mountain Road alignment were once part of an ancient foot trail that was converted to a horse and cattle trail and later a wagon trail. Dr. Bergin and Ms. Keakealani mentioned that agricultural and habitation settlements were clustered near the waterways of Waimea and contributed to the Waimea Field System. In terms of the stream, Ms. Keakealani stated that cultural practices still occur within and along the entire Waiaka Stream corridor including ceremonies along the stream, ceremonial baths, and gathering of pohaku to create mele for hula practitioners. She also pointed out that the stream changes its name as it travels from mauka to makai, passing through the land section it is in. According to Ms. Keakealani, the tributary starts as Kohakohau then is referred to as Waiauia, Waiaka, Keanuimano (also known as Keanuimano), and Waiulaula as it drains into the sea. Mr. Elarionoff shared his knowledge of a burial cave with a canoe mauka of the project area but has never been to the site (referred to as Site 2618-7 in Corbin 2007). To his understanding, the cave was closed and sealed. As a former policeman of the area, Mr. Elarionoff was tasked to warn HPA students to not enter the cave. Ms. Keakealani shared that the cultural practice of lawaia manu in Waimea no longer exists due to restrictions surrounding the kolea—the bird that was primarily hunted, caught, and eaten.

Concerning impacts to traditional cultural practices within the project area, feedback from those who responded to the consultation letter all stated that there are no ongoing practices that they know of within the project area. They did mention that there are ongoing traditional practices that still occur within the stream above and below the project area, as well as in the vicinity of the project area. Three of the four respondents mentioned that this is a long-standing project that is a matter of necessity and safety. In terms of recommendations, Ms. Keakealani does not want the stream altered in any way that would affect pohaku, streambanks, and especially the water.

2.4.2 Potential Impacts

No Build Alternative

Data gathered indicate that there are no past or ongoing traditional cultural practices occurring within the current project area.

Build Alternative

Similar to the No Build, data gathered indicate that there are no past or ongoing traditional cultural practices occurring within the current project area. However, ongoing practices are occurring within the same stream corridor, along Keanuiomano Stream, specifically, to the east of the project area limits. Traditional cultural practices within and along the streambanks include ceremonies along the stream; ceremonial baths; and gathering of pohaku for hula practitioners. These practices occur further mauka and makai from the project area.

The pohaku, Manaua (also known as Manoua), and revered moo wahine that hails from Waimea is located outside and east of the Waiaka Bridge project area. The pohaku continues to be honored and cared for by residents and cultural practitioners that include but are not limited to hookupu, pule (especially during droughts), hula and other ceremonies. The Contractor would be advised, and care would be taken to avoid disruption to these practices during construction.

2.4.3 Avoidance, Minimization, and Mitigation Measures

Although no traditional cultural practices were identified within the project limits, measures to protect the stream environment and associated resources during construction activities will be implemented to avoid potential effects to the cultural practices related to the use of the stream that take place beyond the boundaries of the current project area.

2.5 Biological Resources

Section 7 of the Endangered Species Act of 1973 requires federal agencies to consider impacts on endangered or threatened species and critical habitat of such species. For terrestrial species, it requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and National Oceanographic and Atmospheric Administration's National Marine Fisheries Service (NMFS) for marine mammals, regarding the effects of any major construction activity on a listed species or species proposed as endangered, or those effects which could result in the destruction or adverse modification of designated critical habitat (40 Code of Federal Regulations 402).

The State's counterpart law is Chapter 195D, Hawaii Revised Statutes (HRS), as amended, under which species are similarly protected. The remainder of this section discusses the impact to biological resources in this regulatory context.

2.5.1 Existing Conditions

H.T. Harvey & Associates prepared a biological survey report for the project area in April 2021. Figure 2-6 shows the Biological Survey Area (BSA) for this study. USFWS and Hawaii Department of Land and Natural Resources were consulted on July 28, 2021 to obtain a list of species that may occur within the project area. Flora and fauna survey results are and agency correspondence is summarized in the following sections.

Flora

According to the biological survey report, the BSA is highly disturbed as a result of development in the project area. Maintained Vegetation, Stream Bank Vegetation, Scrub vegetation, and Shrubland were the four main vegetation types identified in the BSA.

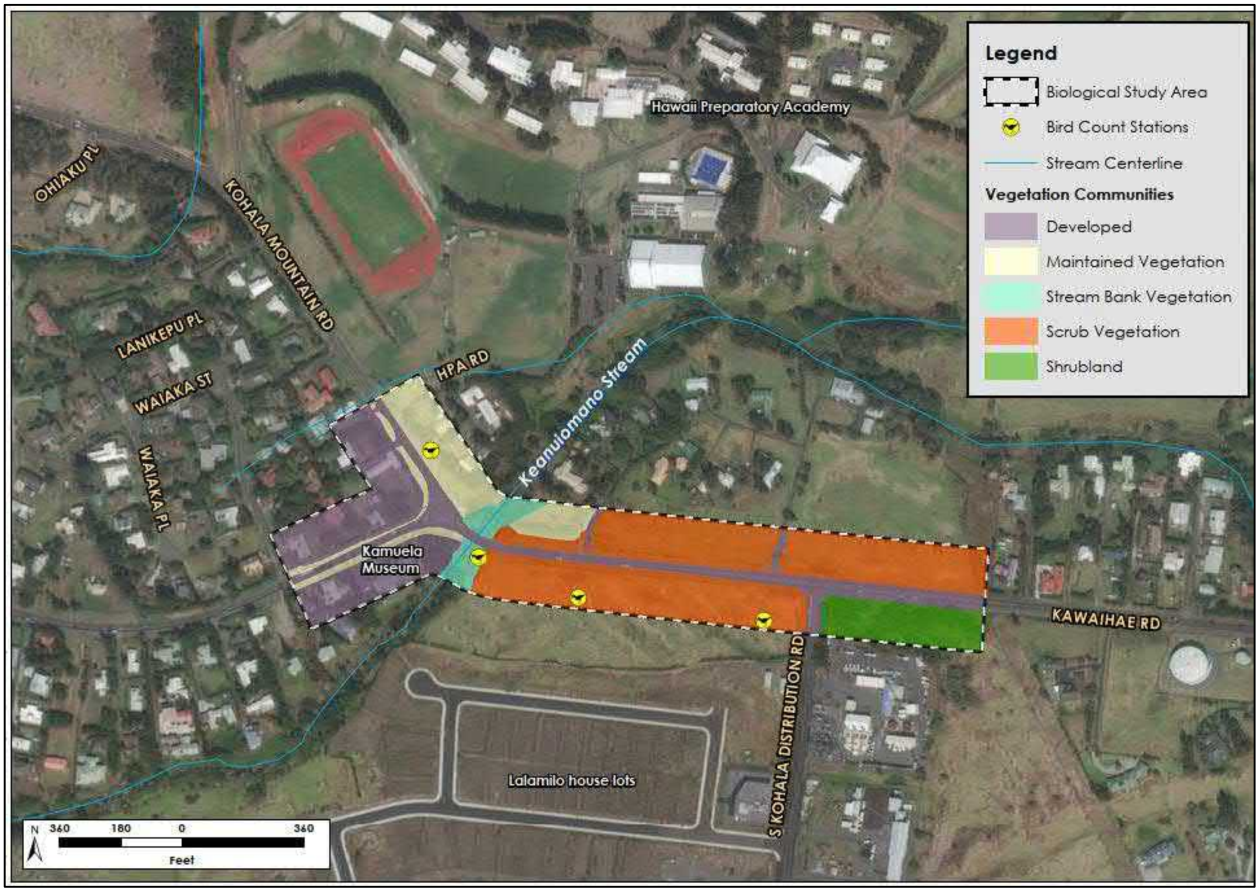
Scrub Vegetation is limited to areas located east of the Waiaka Bridge and both sides of Kawaihae Road and is comprised of spiny amaranth (*Amaranthus spinosus*), creeping indigo (*Indigofera spicata Forssk*), peppergrass (*Lipidium virginicum*), cheese weed (*Malva parviflora*), panini (*Opuntia ficus-indica*), castor bean (*Ricinus communis*), African olive (*Olea europaea*), guinea grass (*Urochloa maxima*), swollen finger grass (*Chloris barbata*), haole koa (*Leucaena leucocephala*), and vining cow pea (*Macroptilium atropurpureum*).

Shrubland Vegetation is limited to the southeastern corner of the BSA and is mainly composed of African olive shrubs.

Stream Bank Vegetation was identified along the banks of Keanuiomano stream and is composed of trees of black wattle (*Acacia mearnsii*), cooks pine (*Araucaria columnaris*), ironwood

(*Casuarina equisetifolia*), silk oak (*Grevillea robusta*), and bougainvillea bushes (*Bougainvillea sp.*) on the south of the bridge and California grass (*Urochloa Mutica*), guinea grass, vining cow pea on the north of the bridge. Cattails (*Typha sp.*) were identified on the lower banks of the stream, while shrub and tree species including Christmas berry (*Schinus terebinthifolius*) and ironwoods were identified on the upper banks of Keanuiomano stream.

Figure 2-6: Biological Study Area and the Vegetation Communities



The remainder of the BSA is classified as Maintained Vegetation which includes the ROW along Kohala Mountain Road and Mamalahoa Highway, residential units and Hawaii Preparatory Academy (HPA) comprised of oleander (*Nerium oleander*), plumbago bushes (*Plumbago auriculata*), cape honeysuckle (*Tecomaria capensis*), California pepper tree (*Schinus mole*), Chinese arborvitae (*Platycladus orientalis*), and cypress (*Cypressus sp.*). A complete list of plant species observed in the BSA is included in Appendix E.

According to the correspondence with USFWS, hala pepe (*Chrysodracon hawaiiensis*) and Blunt chaff flower (*Archyranthes mutica)* are the two listed species in the immediate vicinity of the project area. The biological survey did not identify these species in the BSA.

Fauna

The biological survey identified 10 bird species from point count surveys. No native birds were observed during the survey; however, the endemic Hawaiian Hawk (io) is known to occur in the project site area. The warbling white-eye (*Zosterops japonicus*), zebra doves (*Geopelia striata*), common waxbills (*Estrilda astrild*), common myna (*Acridotheres tristis*), gray francolin (*Francolinus pondicerianus*), red jungle fowl (*Gallus gallus*), house sparrow (*Passer domesticus*), and ring-necked pheasant (*Phasianus colchicus*) were observed during the survey in the BSA. Northern Cardinal (*Cardinalis cardinalis*), a protected species under the Migratory Bird Species Act was observed in the BSA during the survey. The native Hawaiian short-eared owl (*Asio flammeus sandwichensis*), not observed during the survey, may use the open Scrub Vegetation. A complete list of bird species observed in the BSA is included in Appendix E. No mammal species were observed during the survey, however pig scat that appeared to not be recently deposited was found on the streambank.

According to the correspondence with USFWS there are 11 listed species that could occur in the project area and immediate vicinity including: Hawaiian hoary bat (*Lasiurus cinereus semotus*), Hawaiian goose (*Branta sandvicensis*), Blackhurn's sphinx moth (*Manduca blackburni*), water birds (Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alali*), and Hawaiian duck (*Anas wyvilliana*)), Pacific damselfly (*Megalagrion pacificum*), orange-black damselfly (*Megalagrion xanthomelas)*. In addition, Hawaiian petrel (*Pterodrama sandwichensis*), band-rumped storm-petrel (*Oceanodrama castro*), and Newell's shearwater (*Puffinus auricularis newelli*) or Hawaiian seabirds may transit the project area flying to or from upland breeding colonies.

For aquatic species, according to the Atlas of Hawaii Watersheds and their Aquatic Resources for Waiulaula, Hawaii (Division of Aquatic Resources (DAR) Watershed Code: 85003), the Waiuluaula Watershed, in which Keanuiomano Stream occurs, does not meet any of the DAR criteria for biotic importance. Criteria include measures for native insect diversity (greater than 19 species), native macrofauna diversity (greater than 5 species), absence of priority introduced species, abundance of any native species, presence of candidate endangered species, endangered Newcomb's Snail Habitat (Bishop Museum and DAR, 2008).

2.5.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no ground-disturbing activities and no disruption to the existing environment. Existing biological resources would not be affected.

Build Alternative

Under the Build Alternative, there would be ground disturbance in the form of vegetation clearing, grading, grubbing, and other construction-related efforts. The amount of disturbance would depend on the ultimate design of the bridge. No rare native Hawaiian plant species that are State or federally listed as threatened, endangered, or candidates for listing were observed during the biological survey. Nonetheless, USFWS consultation suggests that hala pepe (*Chrysodracon hawaiiensis*) and Blunt chaff flower (*Archyranthes mutica)* may occur in undisturbed areas. Avoidance and minimization measures advised by USFWS will be implemented to prevent significant or adverse effects to these species.

Additionally, Pycreus (*Cyperus polystachyos Rottb*) and uhaloa (*Waltheria indica L.*), the two native plant species identified in the BSA, have widespread distribution on Hawaii Island and other islands in the State. For this reason, should project activities remove these species, it would not result in a significant or adverse effect on these species' populations.

Although none of the 11 wildlife species identified by USFWS were observed in the BSA or the vicinity of the project site, recommendations provided by USFWS will be employed to avoid, minimize, and mitigate potential impacts to these listed species. By implementing these measures, as described in Section 2.5.3, the project may have an affect, but is not likely to have an adverse effect on these species. Such impacts would be considered less than significant.

2.5.3 Avoidance, Minimization, and Mitigation Measures

The following avoidance, minimization, or mitigation measures are being proposed for the project.

Hawaiian Hoary Bat
The Hawaiian Hoary bat roosts in woody vegetation across all islands and will leave their young unattended in trees and shrubs when they forage. If trees or shrubs 15 feet or taller are cleared during the pupping season (June through September), there is a risk that young bats could be inadvertently harmed or killed since they are too young to fly. Additonally, Hawaiian Hoary bats forage from insects from as low as 3 feet to higher than 500 feet above the ground and can become entangled in barbed wire used for fencing. To avoid and minimize impacts to the endangered Hawaiian hoary bat the project:

- Will not disturb, remove, or trim woody plants greater than 15 feet tall during the bat-birthing and pup-rearing season (June 1 through September 14).
- Will not use barbed wire for fencing.

Hawaiian goose
The Hawaiian goose prefer open areas such as pastures, golf courses, wetlands, natural grasslands, shrublands and lava flows. Threats to the species include introduced mammalian and avian predators, wind facilities, and vehicle strikes. To avoid and minimize potential project impacts to the Hawaiian goose the project will incorporate the following measures into the project description:

- The Contractor will notify all construction personnel to not approach, feed, or disturb the Hawaiian goose.
- If a Hawaiian goose is observed loafing or foraging within the project area during the breeding season (September 1 through April 30), a biologist familiar with Hawaiian goose nesting behavior will survey for nests in and around the project area prior to the resumption of any work. Surveys will be repeated after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest).
- If a nest is discovered within a radius of 150 feet of proposed project, or a previously undiscovered nest is found within the 150-foot radius after work begins, work will cease and USFWS will be contacted for further guidance.
- In areas where Hawaiian goose are known to be present, the Contractor will post and implement reduced speed limits, and inform project personnel about the presence of endangered species on-site.

Blackburn's sphinx moth

The adult Blackburn's sphinx moth feeds on nectar from native plants, including *Ipomea pes-*caprae (beach morning glory), *Plumbago zeylanicae* (iliee), *Capparis sandwichiana* (maiapilo), and others. Blackburn's sphinx moth larvae feed on nonnative *Nicotiana glauca* (tree tobacco) and native, federally listed, *Nothocestrum* spp (aiea). To pupte, the larvae burrow into the soil and can remain in a state of torpor for a year or more before emerging from the soul. Soil disturbance can result in the death of the pupae. The following survey recommendations will be implemented to assess whether the Blackburn's sphinx moth occurs within the project area prior to construction:

- A biologist familiar with the species will survey areas of proposed activities for Blackburn's sphinx moth and its larval host plants prior to work initiation.
    - Surveys will be conducted during the wettest portion of the year (usually November-to-April or several weeks after a significant rain) and within 4-to-6 weeks prior to construction.
    - Surveys will include searches for adults, eggs, larvae, and signs of larval feeding (i.e., chewed stems, frass, or leaf damage).
    - If moths, eggs, larvae, or native aiea or tree tobacco over 3-feet tall, are found during the survey, USFWS will be contacted for additional guidance to avoid impacts to this species.

If no Blackburn's sphinx moth, aiea, or tree tobacco are found during surveys, the project will take measures to avoid attraction of Blackburn's sphinx moth to the project location and prohibit tree tobacco from entering the site. The project will:

- Remove any tree tobacco less than 3-feet tall.
- Monitor the site every 4-to-6 weeks for new tree tobacco growth before, during, and after the proposed ground-disturbing activity. Monitoring for tree tobacco will be completed by project staff provided with picture placards of tree tobacco at different life stages.

Hawaiian stilt, Hawaiian coot, Hawaiian duck

Hawaiian waterbirds are attracted to standing water. Because the project may create standing water or open water, Hawaiian waterbirds may be attracted to these sub-optimal habitats and suffer adverse impacts such as predation and reduced reproductive success. To avoid and minimize potential project impacts to Hawaiian waterbirds the project will incorporate the following measures into the project description:

- In areas where waterbirds are known to be present, reduced speed limits will be posted and implemented.
- Project personnel and contractors will be informed about the presence of endangered species on-site.
- A biological monitor that is familiar with the species' biology will conduct Hawaiian waterbird nest surveys where appropriate habitat occurs within the vicinity of the proposed project site prior to project initiation. Surveys will be performed again within three (3) days of project initiation and after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest). If a nest or active brood is found:
    - USFWS will be contacted within 48 hours for further guidance.
    - A 100-foot buffer around all active nests and/or broods will be established until the chicks/ducklings have fledged. No potentially disruptive activities or habitat

alteration will be conducted within this buffer.

- A biological monitor that is familiar with the species' biology will be present on the project site during all construction or earth moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.

Chrysodracon hawaiiensis and *Achyranthes mutica*

Project activities may affect listed plant species by causing physical damage to plan parts (roots, stems, flowers, fruits, seeds, etc.) as well as impacts to other life requisite features of their habitat which may result in reduction of germination, growth and/or reproduction. Activities such as grazing, use of construction equipment and vehicles, and increased human traffic (i.e., trails, visitation, monitoring), can cause ground disturbance, erosion and/or soil compaction, which decrease absorption of water and nutrients and damage plant root systems and may result in reduced growth and/or mortality of listed plants. Soil disturbance or removal has the potential to negatively affect the soil seed bank of listed plan species if such listed species are present or historically occurred in the project area.

To avoid or minimize potential adverse effects to listed plants that may occur on the project site, the project will minimize disturbance outside of existing developed or otherwise modified areas. When disturbance outside existing developed or modified sites is proposed, a botanical survey for listed plant species within the project action area will be conducted, defined as the area where direct and indirect effects are likely to occur. Surveys will be conducted by a knowledgeable botanist with documented experience in identifying native Hawaiian and Pacific Islands plants, including listed plant species. To the extent possible, botanical surveys will be conducted during the wettest part of the year (typically October to April) when plants and identifying features are more likely to be visible, especially in drier areas.

The boundary of the area occupied by listed plants will be marked with flagging by the surveyor. To avoid or minimize potential adverse effects to listed plants, the Project will adhere to the buffer distances for the activities as shown in Table 2-2 below to the extent possible. Where disturbed areas do not need to be maintained as an open area, native plants will be used for landscaping purposes whenever possible.

However, where project activities will occur within the recommended buffer distances, additional consultation with USFWS will be initiated. To the extent possible, the Project will place temporary fencing or other barriers at the boundary of the disturbance, as far from the affected plants as practicable.

All activities, including site surveys, risk introducing nonnative species into project areas. Specifically, the Project will take measures to ensure that all equipment, personnel, and supplies are properly checked and are free of contamination (weed seeds, organic matter, or other contaminants) before entering project areas. Quarantines and / or management activities occurring on specific priority invasive species proximal to project areas will be considered or adequately addressed.

Table 2-2: Recommended Buffer Distances Based on Activities

Action		Buffer Distance (feet (meters)) – Keep Project Activity This Far Away from Listed Plant	
		Grasses / Herbs / Shrubs and Terrestrial Orchids	Trees and Arboreal Orchids
Walking, hiking, surveys		3 feet (1 meter)	3 feet (1 meter)
Cutting and Removing Vegetation by Hand or Hand Tools (e.g., weeding)		3 feet (1 meter)	3 feet (1 meter)
Mechanical Removal of Individual Plants or Woody Vegetation (e.g., chainsaw, weed eater)		3 feet up to height of removed vegetation (whichever greater)	3 feet up to height of removed vegetation (whichever greater)
Removal of Vegetation with Heavy Equipment (e.g., bulldozer, tractor, “bush hog”)		2 times the width of the equipment plus the height of the vegetation	820 feet (250 meters)
Ground / Soil Disturbance / Outplanting / Fencing (Hand tools, e.g., shovel, oo, Small mechanized tools, e.g., auger)		20 feet (6 meters)	2 times the crown diameter
Ground / Soil Disturbance (Heavy Equipment)		328 feet (100 meters)	820 feet (250 meters)
Surface Hardening / Soil compaction	Trails (e.g., human, ungulates)	20 feet (6 meters)	2 times the crown diameter
	Roads / Utility Corridors, Buildings / Structures	328 feet (100 meters)	820 feet (250 meters)

Hawaiian petrel, Newell’s shearwater, and Hawaii Distinct Population Segment of the band-rumped storm petrel

Hawaii seabirds may traverse the project area at night during the breeding, nesting, and fledgling seasons (March 1 to December 15). Outdoor lighting could result in seabird disorientation, fallout, and injury or mortality. Seabirds are attracted to lights and after circling the lights they may become exhausted and collide with nearby wires, buildings, or other structres or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Young birds (fledglings) traversing the project area between September 15 and December 15, in their first flights from their mountain nests to the sea, are particularly vulnerable to light attraction.

To avoid and minimize potential project impacts to seabirds, the project will implement the following measures:

- Fully shield all outdoor lights so the bulb can only be seen from below.
- Install automatic motion sensor switches and controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area.
- Avoid nighttime construction during the seabird fledging period, September 15 through December 15.

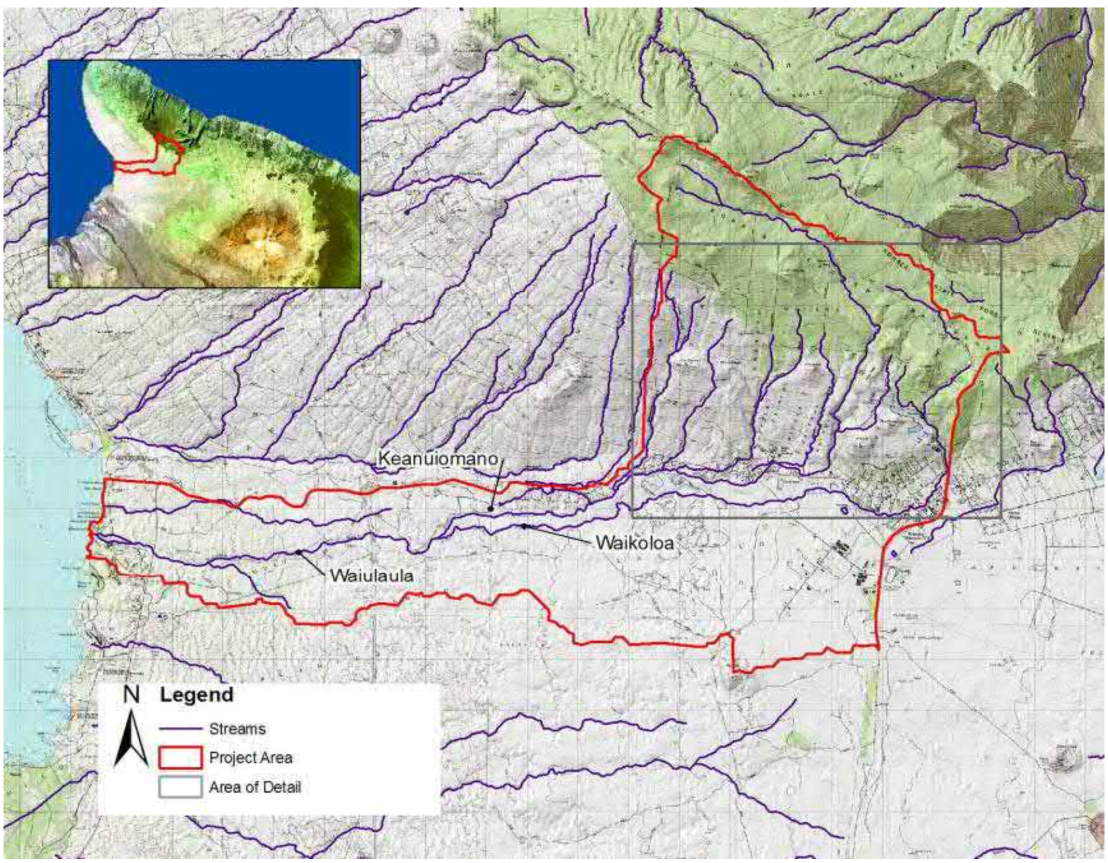
Section 2.15 addresses temporary construction impacts and best management practices that minimize impacts to biological resources through the focus on construction stormwater and runoff management controls. General construction best management practices would be implemented to minimize the potential for temporary impacts to biological resources, including good housekeeping and measures to minimize impacts to water resources.

2.6 Wetland and Surface Water Resources

2.6.1 Existing Conditions

The project area is situated in the Waiulaula watershed. This watershed is encompasses an area of about 32,000 acres stretching from the tops of Kohala Mountain and Mauna Kea, flowing down into inner Kawaihae Bay near the Mauna Kea Beach Resort, a distance of less than 15 miles. The primary tributaries of the Waiulaula watershed are Waikoloa and Keanuiomano streams which flow relatively parallel to one another until they form Waiulaula, which terminates in the ocean in Kawaihae Bay (Figure 2-7)[1].

Figure 2-7: Overview of Streams in the Waiulaula Watershed



Source: Waiulaula Watershed Management Plan, 2009.

[1] Mauna Kea Soil and Water Conservation District, 2009. Waiulaula Watershed Management Plan. Accessed February 14, 2022. [Microsoft Word - FINAL Waiulaula Watershed Management Plan jun09 (wordpress.com)]

The existing Waiaka bridge crosses over Keanuiomano stream. According to the U.S. Department of Interior Geological Survey (USGS) 2013 Water Data Report from the partial gage station (No. 16756500) on Keanuiomano stream, the maximum peak discharge measured during 2013 water year (October 2012 to September 2013) was 223 cubic feet per second (ft^3/s). The maximum discharge recorded at this station was 3,540 ft^3/s in April 1968. From 2005 to 2012, the discharge flow has ranged from 347 ft^3/s to 378 ft^3/s[2]. According to the Hawaii Stream Assessment, Keanuiomano stream is a perennial stream with interrupted flow at lower elevations.

Pursuant to Sections 303(d) and 303(b) of the Clean Water Act (CWA), the Hawaii Department of Health (DOH) reports on the State's water quality every two years. Keanuiomano stream is not listed as an impaired waterbody in the most recent (2022 Public Review Draft and 2018) *State of Hawaii Water Quality Monitoring And Assessment Report.*

In February 2003, the AECOS, Inc. conducted a water quality and aquatic resources survey in three locations of Keanuiomano stream including:

- Station 1 - 2,500 feet upstream from the Waiaka bridge,
- Station 2 - at the Waiaka bridge,
- Station 3 - 2,140 feet downstream from the Waiaka bridge.

The water quality survey results included:

- Both turbidity and total suspended solids (TSS) at Waiaka Bridge appear to be within Hawaii Water Quality Standards criteria for wet season measurements;
- The measurements of pH and dissolved oxygen (DO) meet the criteria of not lower than 5.5 nor higher than 8.0 for pH and not less than 80 percent saturation for DO;
- The concentrations of nitrogen compounds (nitrate, nitrite, ammonia, and organic nitrogen) measured in Keanuiomano stream are fairly typical for Hawaiian streams in rural or undeveloped watersheds, and fall below the perennial streams wet season;
- Total phosphorous (total P) values for Stations 2 and 3 were slightly elevated, but Station 1 exceeds the stream criterion of 50 µg P/L, which could be due to over fertilization in the housing complex next to the stream or from other upstream source; and
- Oil and grease yielded "not detected" (<0.61 mg/l) at all stations.

Overall, the water quality conditions are considered good with limited influence form anthropogenic sources

The National Wetland Inventory (NWI) map identified Riverine habitat associated with Keanuiomano stream in the project area. See Section 2.5 for a description of biological resources.

[2] USGS, 2022. Water-Year Summary of Site USGS 16756500. Accessed February 14, 2022. [USGS Water-Year Summary for Site USGS 16756500]

2.6.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no ground-disturbing activities and no disruption to the existing environment. The central pier would prevent debris from flowing downstream and reduce the bridge capacity to convey flows. Impacts to riparian and aquatic resources, as well as risks of flooding adjacent properties would continue under this alternative.

Build Alternative

Under the Build Alternative, the proposed bridge would be a single span bridge that includes a wider opening with no central pier. This would improve the flow under the bridge without any interruption to the Keanuiomano stream. With the moderate improvement of water flow, longterm, this alternative may be beneficial to the aquatic environment and organisms in the stream.

Potential short-term impacts to surface water quality during demolition of the existing bridge and construction of the replacement bridge could occur; however, minimization and mitigation measures will be implemented. Section 2.15 describes the anticipated short-term impacts associated with land-based and in-water construction activities.

2.6.3 Avoidance, Minimization, and Mitigation Measures

No avoidance, minimization, and mitigation measures are proposed since the project would benefit surface water resources. Section 2.15 describes the short-term impacts to water quality from construction activities.

2.7 Parks and Recreational Resources

2.7.1 Existing Conditions

There are several public park and recreation centers within the Waimea area.

These include:

- Waimea Community Park
- ‘Ouli Park
- Waimea Nature Park (Ulu La`au)
- Anueneu Playground
- Waimea Skate Park

2.7.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there will be no impact to any of the parks and recreational resources in Waimea.

Build Alternative

Under the Build Alternative, access to park and recreational facilities would be enhanced through increased connectivity created from widened lanes and sidewalk improvements. Such enhancements will facilitate pedestrian and bicycle access. In addition, access to these resources would not be hindered during project construction.

2.7.3 Avoidance, Minimization, and Mitigation Measures

No avoidance, minimization and mitigation measures are proposed since parks and recreational areas would not be affected by the project.

2.8 Visual and Aesthetic Resources

2.8.1 Existing Conditions

The Waimea region lies in a plateau between the Kohala Mountains and Mauna Kea. The Kohala Mountains provides a back drop of rolling hills and volcanic cones covered with pastures. Mauna Kea provides a distant but dramatic mass as it rises steeply above the plateau.

The visual setting of Waimea can be described as rural. There are no high-rise buildings, and development in the overall area has been minimal. Waimea is an active agricultural and ranching community.

2.8.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there will be no impact to any of the view planes.

Build Alternative

Under the Build Alternative, the new bridge would not be of a size or scale that would change the overall visual quality of project area. Any changes to the existing bridge and its approaches are considered minor visual changes and compatible with the existing visual character of Kohala Mountain Road and Kawaihae Road. For these reasons the project is not anticipated to negatively impact visual and aesthetic resources.

2.8.3 Avoidance, Minimization, and Mitigation Measures

No avoidance, minimization, and mitigation measures are proposed since the Build Alternative is not anticipated to have a negative impact on visual and aesthetic resources.

2.9 Transportation Infrastructure

2.9.1 Existing Conditions

A traffic impact analysis was prepared for Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches in August 2021. Results of this analysis are summarized in the following sections. See Appendix B for the Traffic Impact Analysis.

The existing Waiaka bridge provides a 3-foot wide pedestrian walkway along the northern side of the bridge. According to the 2003 Bike Plan Hawaii, Waiaka bridge is listed as a “signed shared road” project with a priority level of II (mid-term project).

In September 2011, the County of Hawaii Department of Parks and Recreation issued the Final Environmental Assessment (EA) for the Waimea Trails and Greenways project. According to the Final EA, the Department of Parks and Recreation in collaboration with the Waimea Preservation Association (formerly Waimea Main Street) proposes to construct an approximately 4.8-mile long multi-use trail for bicycles and pedestrians following the meandering path of Waikoloa Stream. The trail would start near Church Row on the east, run parallel and north of Mamalahoa Highway, cross to the south near the Lindsey Road-Mamalahoa Highway intersection, continue to the west parallel to and south of Kawaihae Road, until it connected to Kawaihae Road well west of the Department of Hawaiian Homelands Lalamilo Subdivision. The trail does not connect to Kawaihae Road near Waiaka Bridge.

Kawaihae Road is a two-lane, undivided principal arterial within the project area with speed limit of 25 miles per hour (mph). Kawaihae Road provides primary regional and sub-regional access within the project area.

Kohala Mountain Road, also known as Route 250, is a two-lane, undivided major collector roadway which connects Waimea to the Kapaau area to the north with speed limit of 25 mph in the immediate vicinity of Kawaihae Road.

South Kohala Distribution Road, generally located on the east side of the project area and south of Kawaihae Road, is a two-lane local roadway which is stop-controlled at it’s T-intersection with Kawaihae Road.

Waiaka Street, generally located on the west side of the project site and north of the Kawaihae Road, is a two-lane local road providing access for residences. It is stop-controlled at it’s T-intersection with Kawaihae Road.

During the traffic impact analysis, morning and afternoon peak hours were found to occur from 7:30 AM to 8:30 AM and 3:00 PM to 4:00 PM at the intersections of Kawaihae Road and Kohala Mountain Road and Kawaihae Road and South Kohala Distribution Road.

During the AM and PM peak hours, the eastbound Kawaihae Road shared left/through lane operates at Level of Service (LOS) A, while the stop-controlled left turn to Kohala Mountain Road operates at LOS B. The southbound left turn to Kawaihae Road operates at LOS E and F during AM and PM peak hours, respectively. The southbound right turn to Kawaihae Road operates at LOS B during both peak hours. Left turns from Kawaihae Road to South Kohala Distribution Road operates at LOS A during both peak hours while, the northbound South Kohala Distribution Road approach operates at LOS C and LOS E during AM and PM peak hours, respectively (Figure 2-8).

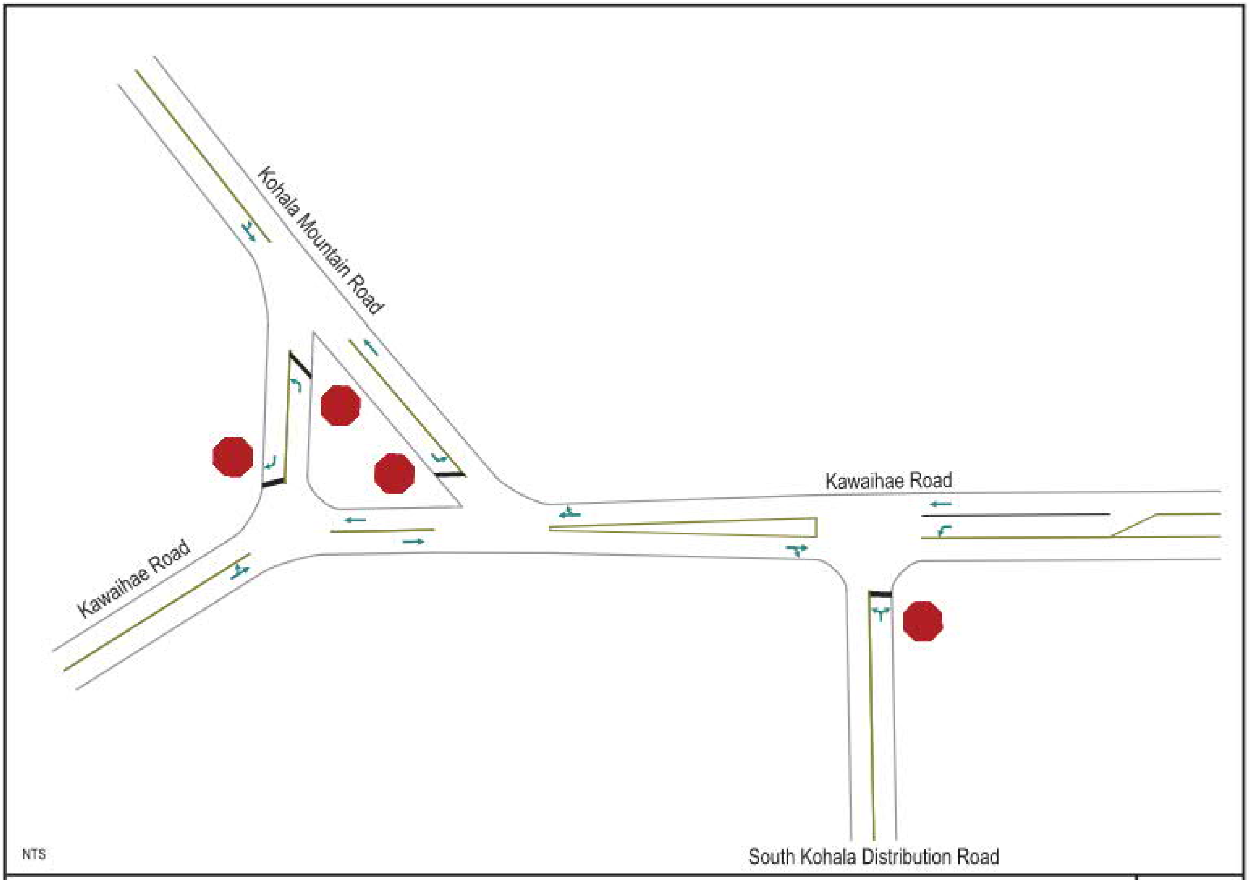


Figure 2-8: Existing Lane Configuration

2.9.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, none of the project's purposes and need would be met. The Waiaka bridge would continue to be functionally obsolete meaning the bridge does not have adequate lane widths, shoulder widths or vertical clearances to serve traffic demands which would result in traffic congestion and delays. The left turn from southbound Kohala Mountain Road to eastbound Kawaihae Road at the Kawaihae Road and Kohala Mountain Road intersection will continue to experience LOS E conditions during the AM peak hour and LOS F conditions during the PM peak hour with significant queuing. At the Kawaihae Road and South Kohala Distribution Road intersection, the South Kohala Distribution Road approach operates at LOS E during the PM peak hour.

Under the No Build Alternative, limited sight distance issues described in Section 1.4.2 would continue. Safety concerns for drivers heading eastbound (from Kawaihae towards Waimea Town) on Kawaihae Road and intending to turn left onto northbound Kohala Mountain Road will remain unaddressed. Because there is no left turn storage lane for this movement, eastbound traffic back-up onto Kawaihae Road, especially during peak travel periods.

Build Alternative

Under the Build Alternative, the Kawaihae Road and Kohala Mountain Road intersection would be reconfigured to a roundabout and a single approach lane would be provided for each leg of the roundabout with no bypass lanes. It is projected that the intersection and approaches will operate at LOS A when construction is completed. Projected LOS and delay are shown in Table 2-3.

Table 2-3: Projected 2024 Roundabout Level of Service

Existing			AM Peak Hour			PM Peak Hour		
Intersection	Movement	Lane Configuration	V/C* Ratio	Delay	LOS	V/C Ratio	Delay**	LOS
Kawaihae Rd / Kohala Mountain Rd	Kawaihae Rd EB Approach	L/R	0.36	6.9	A	0.59	11.2	A
	Kawaihae Rd WB Approach	L/R	0.54	9.0	A	0.50	8.0	A
	Kohala Mountain Rd SB Approach	L/R	0.25	6.8	A	0.30	7.4	A
	Overall		0.54	8.0	A	0.59	9.2	A

** Volume-to-capacity which represents the traffic volume divided by the available capacity*
*** Delay expressed in seconds per vehicle*

Under the Replacement Bridge and Roundabout Alternative, the bridge's functionally would be updated to the current standards and the limited line-of-sight distances at the bridge approaches would be addressed. Under this alternative the overall connectivity and pedestrian safety will increase.

During construction of the proposed action, traffic would be detoured to a temporary road and bridge which may cause disruption in normal traffic patterns. Temporary changes to traffic pattern and travel time would be expected. Temporary movement of construction equipment on the road and bridge may cause delays on the traffic travel time.

2.9.3 Avoidance, Minimization, and Mitigation Measures

The Build Alternative will mitigate existing safety concerns for pedestrians and bicyclists by providing increased space for non-motorized methods of transportation across Waiaka Bridge. No avoidance, minimization, and mitigation is required for this alternative; however, traffic control plans and construction phasing plans would be implemented to minimize traffic delays and avoid hazards from construction activities. See Section 2.15.

2.10 Natural Hazards

2.10.1 Existing Conditions

Generally, natural hazards in Hawaii are considered to be earthquakes, flooding, hurricanes, landslides, climate change, and tsunamis. The project area generally experiences earthquakes at the same rate and proportion as the rest of the island and is not more or less prone to their effect. Annually, the State of Hawaii averages about 100 earthquakes of magnitude 3 or greater, ten of magnitude 4 or greater, and one of magnitude 5 or greater.[3] Typically, people report feeling earthquakes larger than about magnitude 3.

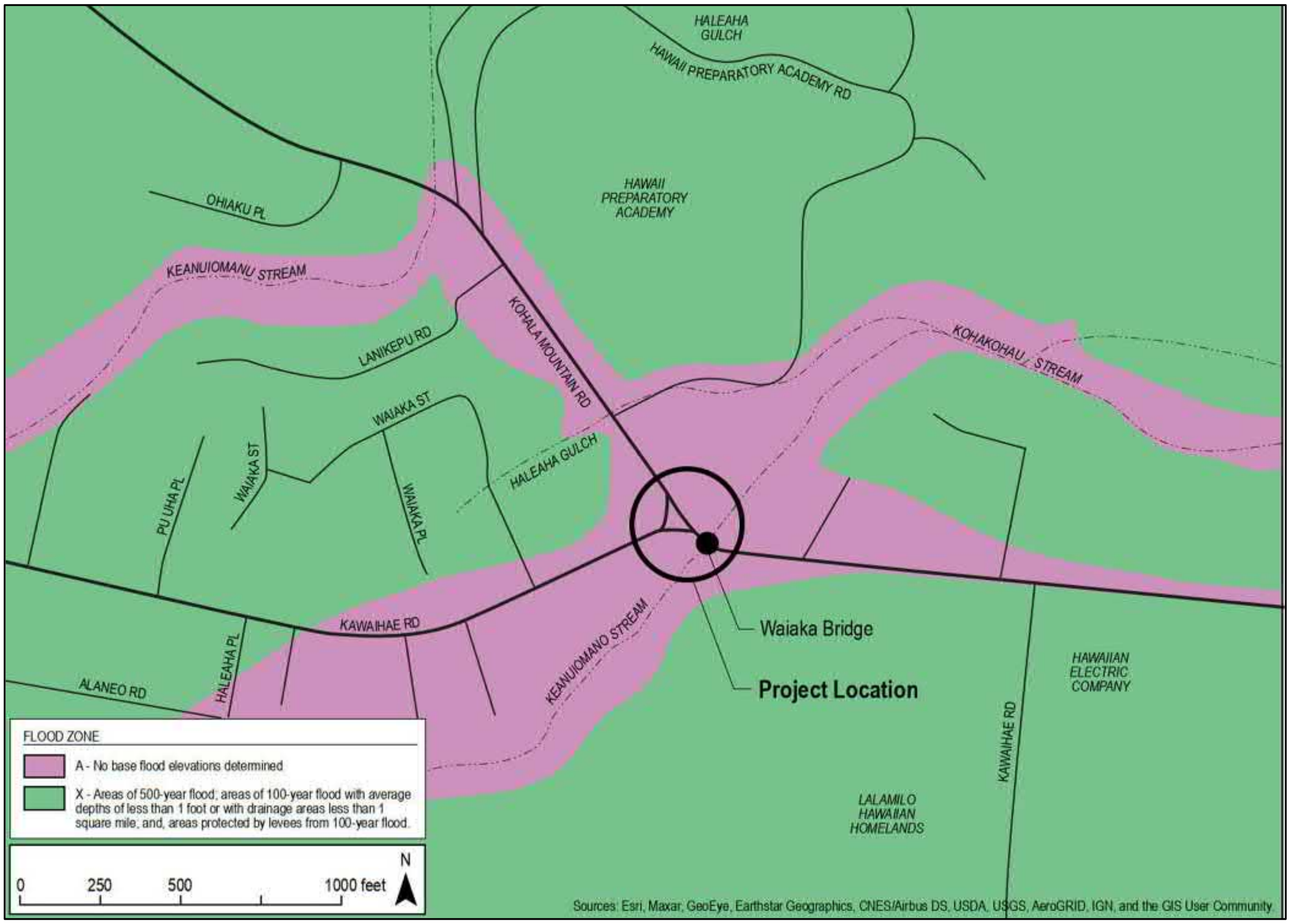
Climate change, while a consideration for the entire State of Hawaii, is not anticipated to be a particular concern in this location. Waimea is located in Southern Kohala, roughly at an elevation of 2500+ ft and approximately 10 miles from the nearest coastline. This distance from the coastline means the project area is not in areas identified by available sea level rise exposure area maps.[4]

Similarly, based on the Tsunami Evacuation Zone maps prepared by County of Hawaii and Hawaii Emergency Management Agency, the project is outside of the current tsunami evacuation zone by at least 8 miles.

The project area is within flood Zone A, which has a 1% annual chance of flooding and for which no base flood elevations have been determined (See Figure 2-9). Hurricanes and severe storms, resulting in intense rainfall events and high winds would have the potential to affect this area similarly as the rest of Hawaii County. Heavy rains do have the potential to raise water levels rapidly at Keanuiomano Stream.

[3] Hawaii Volcano Observatory (HVO). 2017.
[4] Pacific Islands Ocean Observing System (PacIOOS). Hawaii Sea Level Rise Viewer. https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/ Accessed April 1, 2020.

Figure 2-9: Flood Zone Map



2.10.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no changes to vulnerability to natural hazards in project the area. Waiaka Bridge's existing central pier would continue to pose a flood risk to adjacent properties by reducing the bridge capacity to convey flows. Climate change, such as change in precipitation patterns and the frequency and degree of heavy rains may affect conditions long-term in and around nearby streams.

Build Alternative

The proposed project would not increase the project area's vulnerability to earthquakes, landslides, flooding, tsunami or sea level rise. Neither would it have any bearing on the change in precipitation patterns or frequency and degree of heavy rains anticipated with climate change.

The replacement bridge would be designed in accordance with the American Association of State Highway and Transportation Officials (AASHTO's) Load and Resistance Factor Design (LRFD) Bridge Design Specifications, which includes seismic provisions. Additionally, in the event of flooding, the replacement bridge would provide a safer and more effective way for low lying areas to evacuate than the No Build Alternative. This is because the assumed larger hydraulic capacity of the replacement bridge would make it less likely to flood or cause flooding.

2.11 Public Services, Utilities and Infrastructure

2.11.1 Existing Conditions

The South Kohala District or Waimea has access to general public utilities and services, including potable water, electricity, cable, internet, as well as fire, police, and health care services. There are two existing County Department of Water Supply (DWS) water lines attached to the south side of Waiaka Bridge.

The County of Hawaii does not provide solid waste collection services in Waimea.

2.11.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, public facilities and services will remain the same in Waimea.

Build Alternative

The Build Alternative generally would not have long term negative effects on access to public facilities and services. On the contrary, by creating a safer and more efficient transportation network, access to fire, police, and health care services would improve.

2.11.3 Avoidance, Minimization, and Mitigation Measures

Because the project would not result in a noticeable change in the types of public utilities and infrastructure or their availability to residents of Waimea there are no avoidance, minimization, or mitigation measures proposed.

2.12 Noise

2.12.1 Existing Conditions

Noise is defined as any sound that is undesirable or interferes with normal human activities. Energy level equivalent (Leq) is the constant noise level over a specified period of time that is equivalent in energy to a fluctuating (or brief) noise "averaged" over that period of time. Leq is also a function of time and is expressed as Leq (time period). A noise impact occurs when the predicted traffic noise levels approach or exceed the Noise Abatement Criteria (NAC), or when the predicted traffic noise levels substantially exceed the existing noise levels.

A noise impact analysis, presented in the Noise Technical Report (Appendix F) was prepared by WSP USA for the proposed project. This study analyzes the Build Alternative following current HDOT Highway Noise Policy and Abatement Guidelines.

Existing and future noise sensitive land uses and activities located in the vicinity of the project area include residences and a museum. No other noise-sensitive land uses are located within the project area. All residences along the project area are Category B (residential) and the outdoor uses at the museum are Category C (public structures). Category B and Category C activities have an exterior NAC of Leq(h) 67 dBA. The existing and future posted speed limit is 25 miles per hour (mph) on both Kawaihae Road and Kohala Mountain Road that approach the Waiaka Bridge.

According to the noise measurements taken during the noise analysis study, the worst-hour traffic noise levels for residential areas ranges from 57 dBA to 68 dBA depending on the proximity of the receiver to the roadway traffic and the presence of buildings and topography providing noise attenuation between the receiver and the roadway. Four sites approached or exceeded the NAC. Figure 2-10 shows the location of the noise measurement sites which are identified by their applicable Tax Map Key (TMK) numbers. Tables 2-4 shows the noise measurement results for 11 sites studied during the analysis.

Figure 2-10: Noise Measurements, Modeling Locations, and Existing Measurements

Source: WSP USA 2021

Table 2-4: Predicted Existing Worst-Hour Traffic Noise Level

Site ID	Description of Receivers Represented	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion) *	Modeled Existing Worst-Hour Leq(h), dBA	Impact Type* (S, A/E, or None)
TMK: 6-6-009:007	Residence at Kohala Mountain Road - 1st Row	1	B/66	67	A/E
TMK: 6-6-009:008	Residence at Kawaihae Road - 1st Row	1	B/66	68	A/E
TMK: 6-6-009:009	Residence at Kawaihae Road - 1st Row	1	B/66	62	None
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road - 1st Row	1	B/66	66	A/E
TMK: 6-6-004:121	2nd Story Residence at Kohala Mountain Road - 1st Row	1	B/66	68	A/E
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road – 2nd Row	1	B/66	61	None
TMK: 6-6-004:001a	Outdoor use area at Museum	1	C/66	63	None
TMK: 6-6-004:001b	Outdoor use area at Museum	1	C/66	62	None
TMK: 6-6-004:001c	Outdoor use area at Museum	1	C/66	61	None
TMK: 6-5-001:015	Residence at Kawaihae Road – 1st Row	1	B/66	57	None
TMK: 6-5-001:033	Residence at Kohala Mountain Road - 1st Row	1	B/66	59	None

Bold = level approaches or exceeds the NAC.

Measurement Locations A, B, and C were only used to validate the noise model and not included in the impact analysis as each site did not represent a noise-sensitive land use.

A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.

*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NA

2.12.2 Potential Impacts

No Build Alternative

According to the noise impact analysis, predicted 2024 traffic noise levels without the project range from 58dBA to 68dBA. The future worst-hour traffic noise levels without the project would approach or exceed the NAC of 67 dBA Leq(h) at 4 of the 11 modeled sites representing 4 residences. No substantial increase impacts of 15 dBA or more above existing conditions were predicted.

Build Alternative

Similar to the No Build, the predicted 2024 traffic noise levels for the Build Alternative, the NAC of 67 dBA Leq(h) is predicted to be approached or exceeded at 4 of the 11 modeled sites representing 4 residences. An increase of 1 dBA in future noise levels is predicted at 4 sites as a result of realigning the bridge approaches. No substantial increase impacts of 15 dBA or more above existing conditions were predicted.

Noise abatement measures as discussed in the following section would minimize and mitigate the impacts from the proposed action such that the overall long term noise impacts would be less than significant.

Temporary increases in noise will also result during project construction. For discussion regarding construction-related noise impacts, please see Section 2.15.

2.12.3 Avoidance, Minimization, and Mitigation Measures

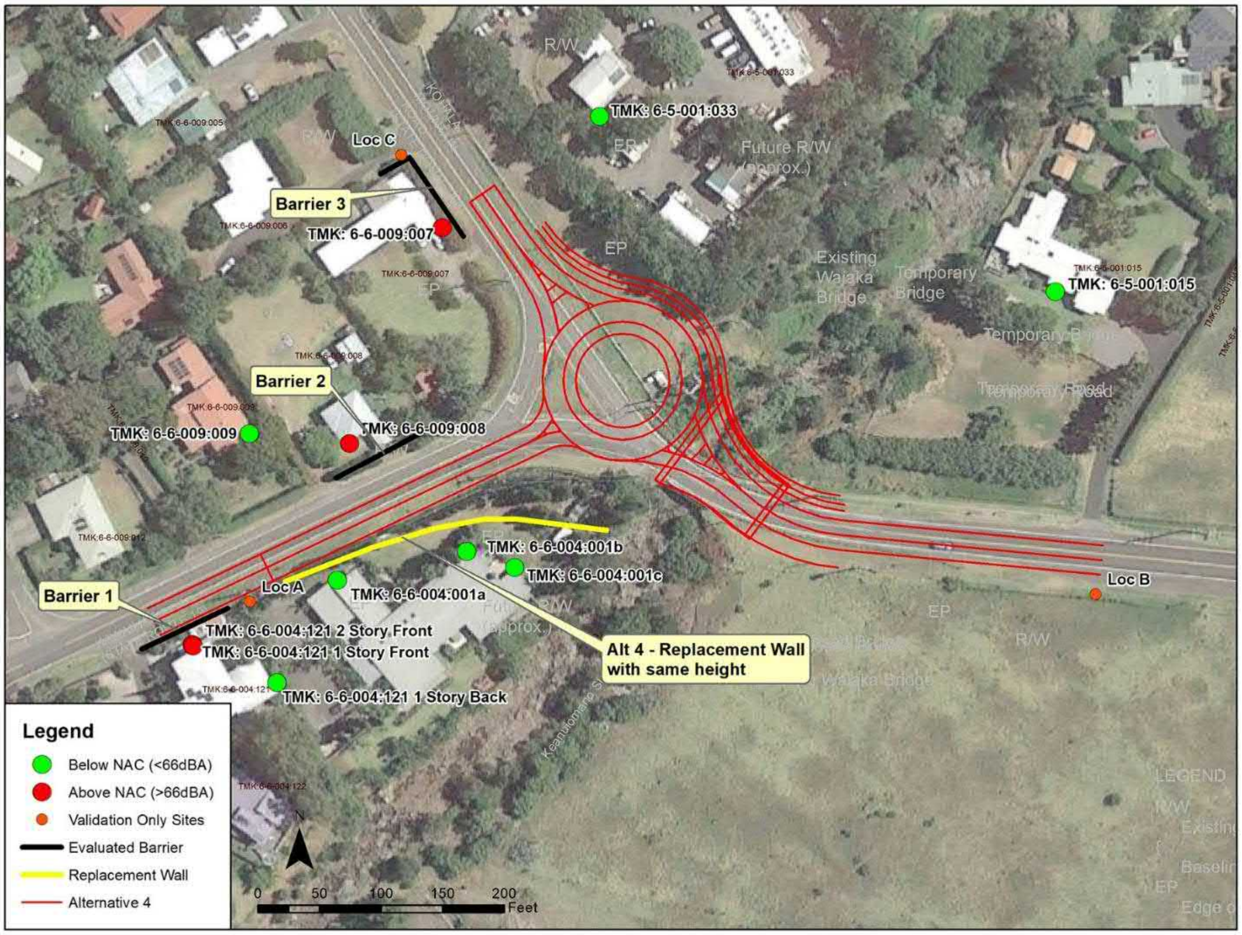
Noise impacts are identified as a result of the proposed action, therefore three noise barriers (NB) as illustrated in Figure 2-11, would be implemented to mitigate impacts on noise-sensitive areas. An existing wall located alongside the museum and Kawaihae Road is planned for removal for construction of the proposed action; however, it would be replaced in kind at a similar location between Kawaihae Road and the museum. Table 2-5 summarizes the details for each noise barrier mitigation for the proposed action.

See Appendix F for a detailed evaluation of each barrier.

Table 2-5: Summary of Proposed Noise Barrier Mitigations

Noise Barrier	Location	Target Receptors	Dimensions
Barrier 1	Along the eastbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road intersection	TMK: 6-6-004:121-1st Story, and TMK: 6-6-004:121-2nd Story	Length: 71 ft Height: 6 ft to 13 ft
Barrier 2	Along the westbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road intersection	TMK: 6-6-009:008 and, resident located at 66-1670 Kawaihae Road	Length: 89 ft Height: 6 ft to 16 ft
Barrier 3	Along the southbound Kahala Mountain Road right-of-way north of the Kawaihae Road/Kahala Mountain Road intersection	TMK: 6-6-009:007 and, resident located at 66-1663 Kahala Mountain Road	Length: 104 ft Height: 6 ft to 16 ft

Figure 2-11: Noise Barrier Locations



2.13 Air Quality

2.13.1 Existing Conditions

As required by the 1977 Clean Air Act (CAA), National Ambient Air Quality Standards (AAQS) were established by the U.S. Environmental Protection Agency (USEPA) for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NOx), ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), sulfur oxides (SOx), and lead. Current standards for ozone and $PM_{2.5}$ were established in September 1997. The State of Hawaii has also established its own standards for these pollutants. Both the National and State AAQS are listed in Table 2-6.

The State of Hawaii is designated as an attainment area for CO, ozone (O3), PM_{10}, and $PM_{2.5}$. The Hawaii Department of Health's (DOH) Clean Air Branch has twelve air monitoring stations on the Island of Hawaii, though it does not operate any stationary air monitoring sites near the project location. The closest station to the project area is located at Waikoloa Elementary School, approximately 8.25 miles away from the project area. The pollutants / parameters monitored at this location are $PM_{2.5}$. No exceedances have been recorded for the 2021 and 2022 calendar years.

Table 2-6: National and State Ambient Air Quality Standards

Pollutant	Standards		
	Hawaii State	Federal Primary[a] (Health)	Federal Secondary[b] (Welfare)
Carbon Monoxide (CO)			
1 Hour[1]	9 ppm	35 ppm	----
8 Hour[1]	4.4 ppm	9 ppm	----
Nitrogen Dioxide (NO_2)			
1 Hour	----	0.1 ppm	----
Annual Mean	0.04 ppm	0.053 ppm	0.053 ppm
PM10[c]			
24 Hour[3]	150 µg /m^3	150 µg /m^3	----
Annual (Arithmetic)[2]	50 µg /m^3	----	----
PM2.5[d]			
24 Hour[5]	----	35 µg /m3	35 µg /m^3
Annual (Arithmetic)[4]	----	12 µg /m3	15 µg /m^3
Ozone (O_3)			
8 Hour Rolling Average	157 µg /m^3 (0.08 ppm)	0.07 ppm	0.07 ppm
Sulfur Dioxide (SO_2)			
1 Hour	----	0.075 ppm	----
3 Hour[1]	0.5 ppm	----	1,300 µg /m^3 (0.5 ppm)
24 Hour Block Average	0.14 ppm	----	----
Annual Average	80 µg /m^3 (0.03 ppm)	----	----
Lead (Pb)			
3 Months (Arithmetic)	1.5 µg /m^3	0.15 µg /m^3	0.15 µg /m^3

Source: State of Hawaii, Department of Health, Clean Air Branch – Hawaii Administrative Rules, Chapter 59. Code of Federal Regulations, Title 40, Part 50, January 2007 and EPA. http://epa.gov/air/criteria.html

Notes: [a] Designated to prevent against adverse effects on public health

[b] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.

[c] Particulate matter 10 microns or less in diameter

[d] Particulate matter 2.5 microns or less in diameter.

(1) Not to be exceeded more than once per year.

(2) Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

(3) Not to be exceeded more than once per year on average over 3 years.

(4) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(5) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3 (effective December 17, 2006).

2.13.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no change in air quality.

Build Alternative

Because the Build Alternative would not result in any meaningful changes in traffic volumes, vehicle mix or any other factor that would cause an increase in emissions, the project is not anticipated to generate any notable air quality impacts or contribute to any air quality concerns during its use. Additionally, the proposed project would not cause or exacerbate a violation of the State or National AAQS.

For construction-related impacts to Air Quality please see Section 2.155

2.13.3 Avoidance, Minimization, and Mitigation Measures

No Avoidance, Minimization, and Mitigation Measures are proposed for any of the alternatives, because no violation of the State or National AAQS is anticipated.

2.14 Social and Economic Conditions

2.14.1 Existing Conditions

General Socio-Economic Conditions

HDOT's Title VI Plan (2019) is designed to fulfill its responsibilities under Title VI of the Civil Rights Act of 1964, as amended, Executive Order (EO) 12898, called "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," was signed by the President of the United States on February 11, 1994. It is intended to address issues regarding Environmental Justice and other related non-discrimination regulations and directives. It directs federal agencies to take appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority or low-income populations.

If minority or low-income populations are found in the project vicinity, good faith effort must be made to ensure that disproportionate and adverse impacts on low-income and minority populations are prevented, minimized, or mitigated. An example of good faith effort is additional public notification or outreach to these groups.

The federal definition of "minority" includes the following groups:

- Black: a person having origins in any of the black racial groups of Africa.
- Hispanic: a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.
- Asian: a person having origins in any of the original peoples of the Far East, Southeast Asia or the Indian subcontinent or the Pacific Islands.
- American Indian or Alaskan Native (AIAN): a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition.
- Native Hawaiian or Other Pacific Islander (NHOPI): a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

Pursuant to EO 12898, "low-income" is defined as households with incomes at or below the U.S. Department of Health and Human Services (DHHS) poverty guidelines. The 2019 poverty guidelines for the state of Hawaii is at or below $29,620 for a family/household of four.

The following discussion is based on selected census data, summarized in Table 2-7 and Table 2-8.

Population and Ethnicity

The State of Hawaii is an unusual, but increasingly common case, where traditionally-defined "minority" populations make up the majority of the population.

The largest ethnic group in Hawaii is Asian. This group makes up 36.53% of the overall State population. Those who classify themselves as "Two or More Races" make up 20% of the population.

Table 2-7 exhibits demographic characteristics for the State of Hawaii, County of Hawaii (Island of Hawaii), and the town of Waimea. Demographic characteristics for Waimea was summarized from census tracts 217.05, 217.06 and 217.07.

Table 2-7: Demographic Characteristics

	Hawaii State	Hawaii County	Waimea (Census Tracts 217.05, 217.06, and 217.07)
Population	1,455,271	200,629	15,158
Ethnicity			
White	21.6%	32.24%	32.02%
Black or African American	1.5%	0.6%	1.3%
American Indian/Alaska Native	0.16%	0.3%	0.2%
Asian	36.53%	19.11%	15.56%
Hispanic or Latino	9.55%	11.1%	9.58%
Native Hawaiian/Other Pacific Islander	10.24%	13.05%	14.9%
Other	0.36%	0.49%	0.44%
Two or More Races	20%	23.08%	26.9%

Source: U.S. Census Bureau, 2020 Census Redistricting Data (Public Law 94-171)

Survey/Program Decenniel Census, Universe: Total Population, Year: 2020, Table ID: P1.

As indicated in Table 2-7, the ethnic characteristics of the residents of Waimea are similar to that of the general population of Hawaii County and the State, except for a few variations. A slightly higher portion (32.02%) of the population in Waimea is White than that of the State. The other difference is a slightly higher (14.9%) Native Hawaiian/Other Pacific islander population in Waimea in comparison to the island and State, as well as a slightly higher population of those reporting as Two or More Races (26.9%).

Income and Employment

In terms of income, the proportion of persons living below the poverty line in Waimea is similar to the State, but lower than the County, as shown in Table 2-8. In Waimea, 21.8% of households earn incomes that may be considered below the poverty line, while in comparison, the State was at 19.9% and the island is at 28.3%[5].

[5] Statement assumes the Health and Human Services Poverty Guidelines of $29,620 for a household/family of four.

Table 2-8 shows the median household incomes and other general income characteristics. Median household incomes in Waimea were higher than the median incomes for the island and the State. Generally the household incomes in Waimea are more consistent with the State trends than with the island or County trends.

Table 2-8: Income in the Past 12-Months (In 2019 Inflation-Adjusted Dollars)

	Hawaii State	Hawaii County	Waimea (Zipcode Tabulation Area 96796)
Number of Households	465,299	71,193	5,546
Earn Less than $34,999	19.9%	28.3%	21.8%
$35,000 to $74,999	25.5%	25.1%	17.5%
$75,000 to $99,999	13.5%	13.1%	12.7%
$100,000 to $200,000	30.2%	25.4%	29%
$200,000 or more	10.9%	7.1%	8.8%
Median Income (dollars)	$83,102	$67,075	$83,523
Mean Income (dollars)	$106,247	$88,393	$92,991

Source: U.S. Census Bureau (2019-2022). *American Community Survey 1-year estimates.*

2.14.2 Potential Impacts

No Build Alternative

Under the No Build Alternative, there would be no changes or impacts experienced by the surrounding community.

Build Alternative

In accordance with the federal definition of “minority” as presented earlier, which includes those of Asian and Native Hawaiian/Pacific Island ancestry, the proposed project improvements would affect minority populations. Additionally, socio-economic trends illustrate that there are populations where the household income is lower than the DHHS poverty guidelines for Hawaii.

However, the project would not disproportionately affect the community in an adverse manner. Impacts such as noise and air will not worsen as a result of the Build Alternative, and will be temporary in relation to construction activities. Benefits include a more efficient (less delay) and safer transportation system.

2.14.3 Avoidance, Minimization, and Mitigation Measures

Because the proposed project would not disproportionately affect a “minority” community, and would provide a pedestrian/bicycle facility that would be accessible to all for non-motorized users, there are no proposed avoidance, minimization, or mitigation measures for the Build Alternative.

2.15 Construction Impacts

2.15.1 Maintenance of Traffic

Construction activities could cause motorists traveling on Kohala Mountain Road and Kawaihae Road to experience delay and congestion. To minimize traffic and access problems, construction phasing and traffic control plans would be developed and implemented. The public would be routinely informed of planned construction activities and lane closures throughout the construction period.

2.15.2 Historic and Archaeological Resources

Project construction workers and all other personnel involved in the construction and related activities of the project will be informed of the possibility of inadvertent cultural finds, including human remains. In the event that any potential historic properties are identified during construction activities, all activities will cease and SHPD will be notified pursuant to HAR §13-280-3. In the event that human remains are encountered, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. In addition, in the event of an inadvertent discovery of human remains, the completion of a burial treatment plan, in compliance with HAR §13-300 and HRS §6E-43, is recommended.

In the event that iwi kupuna and/or cultural finds are encountered during construction, project proponents will consult with cultural and lineal descendants of the area to develop a reinternment plan and cultural preservation plan for proper cultural protocol, curation, and long-term maintenance.

2.15.3 Biological Resources

Section 2.5 describes the project's potential impact to native species, as well as those protected by Section 7 of the Endangered Species Act and the Migratory Bird Treaty Act.

Another potential impact of implementing the proposed project is the introduction and spread of invasive species during the construction phase. Best management practices (BMPs) and good housekeeping procedures would be incorporated to minimize the introduction and spread of invasive species at the construction site. BMPs may include the following:

- All construction equipment and vehicles should arrive at the work site the first time clean and free of: any soil; plants or plant parts, including seeds; insects, including eggs; and reptiles and amphibians, including their eggs. Similarly, all construction equipment and vehicles should also be cleaned after use on the work site before leaving to another site.
- All materials imported to the project site, including gravel, soil, rock, and sand, should be free of invasive plants. Invasive species found on the stockpile should be removed either chemically or mechanically.
- Only plants grown on Hawaii Island should be used for landscaping purposes. If locally grown plants are unavailable, then imported plants may be used, but they should be thoroughly inspected or quarantined if necessary to ensure that they are free from invasive pests such as the coconut coqui frogs (*Eleutherodactylus coqui*) and little fire ants

(*Wasmannia auropunctata*), and invasive plant seeds and seedlings that could arrive inadvertently.

- Only weed-free seed mixtures should be used for hydroseeding and hydromulching on the project site. A qualified botanist should inspect the seeded areas a minimum of 60 days after the hydroseed / hydromulch is applied. Any species of plant other than those intended to be in the hydroseed / hydromulch should be removed. In particular, plant species that are not known to occur on Hawaii Island and those that are actively being controlled on the island should be removed.

2.15.4 Wetland and Surface Water Resources

The potential for construction-phase water resource impacts would be associated with erosion and sedimentation generated from the project's land-based earth disturbing activities and stormwater runoff, as well as potential in-water work from demolishing the central pier for the existing bridge.

Land-Based Stormwater Impacts

As soil disturbance of the project area may exceed one acre, a NPDES General Permit for Storm Water Associated with Construction Activities will be required from State of Hawaii, Department of Health (DOH). During construction, BMPs would be implemented to prevent debris and polluted runoff from reaching Keanuiomano Stream or other natural waters. Storm water runoff and erosion would be mitigated through the use of construction BMPs that will be established before work begins through a project specific Erosion and Sediment Control Plan and Stormwater Pollution Prevention Plan.

Generally accepted BMPs such as the following would be used:

- Installation of perimeter controls and sediment barriers, such as silt fences;
- Minimizing disturbed areas;
- Excavated / Stockpiled material protection, including the covering of stockpiles;
- Storm drain inlet and catch basin protection devices; and
- Proper waste management, including separation of recyclable materials.

Potential Impacts from In-Water Activities

Construction of the new bridge, detour road, and temporary bridge would occur from the stream banks and would not require equipment in the stream or below the stream's ordinary high water mark. However, demolition of existing structures, such as the central pier, may require equipment in the stream. If placement of equipment in the stream (i.e. below the stream ordinary high water line) is needed, this would be limited and best management practices (BMPs) will be implemented. Furthermore, any in-water work is subject to federal and State regulatory controls.

Section 404 of Clean Water Act (CWA) regulates the discharge of dredge and fill materials into the waters of the U.S. Coordination with the U.S. Army Corps of Engineers (USACE) will be conducted for the potential Section 404 of CWA permit requirements associated with removal of the central pier. When work requires a Section 404 permit, a Section 401 of the CWA permit is also required to regulate discharges into the waters of the United States. BMPs that have been either pre-approved or coordinated with regulatory agencies will be utilized to minimize the potential for water quality impacts to the stream.

2.15.5 Noise

Construction activities would involve heavy machinery and vehicles that at times may exceed the maximum levels allowed by Community Noise Control regulations for daytime within Class C Zoning Districts (agriculturally zoned areas or similar). A Community Noise Permit would be required, and the Contractor will be required to comply with Community Noise regulations.

Construction of the Build Alternative would involve the use of heavy machinery that may cause temporary noise impacts to adjacent noise sensitive land uses. Table 2-9 presents a range of noise levels for various construction equipment anticipated to be used during construction of the proposed project. Equipment noise levels vary depending on the make and model of the equipment, the operation being performed, the condition of the equipment, and other variables. The noise levels listed are based on published measurement taken at a distance of 50 feet from the equipment.

Table 2-9: Construction Equipment Noise Levels

Equipment	Decibels	Equipment	Decibels (dBA)
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	Jack Hammer	81 - 98
Saw	72 - 81	Jumping Jack	81 - 97
Light Tower	62 - 72		
Cold Planer	79 - 88	Heavy Impact Equipment	
Paving Machine	86 - 88	Hoe rams	95 - 106
Roller	63 - 70	Vibratory Sheetpile driver	90 - 100
Striping machine	75 - 86		
Concrete Truck	75 - 88		
Backhoe/Loader	72 - 83		
Compressor	74 - 87		
Generator	71 - 82		
Crane	75 - 87		

Since HDOH maintains community noise control standards (HAR Section 11-46) that apply to construction noise, these specifications would be followed. A Community Noise Permit would be obtained for construction activities performed during standard work hours (Monday through Friday 7:00 a.m. through 6:00 p.m. and Saturday 9:00 a.m. through 6:00 p.m., and holidays).

If nighttime, weekend, or holiday work is determined to be necessary, a Community Noise Variance would also be obtained by the Contractor.

2.15.6 Air Quality

Air quality impacts during construction generally consist of fugitive dust and mobile source emissions from construction equipment.

Fugitive dust is airborne particulate matter, of usually large particle size, generated by construction vehicles operating around construction sites and from material blown from uncovered haul trucks, stockpiles, and exposed areas. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because its generation varies greatly depending upon the type of soil, the amount and type of dirt-disturbing activity, the moisture content of exposed soil, and wind speed. Frequent watering would control fugitive dust at construction sites. In addition, wind screens may be used in areas near residences and commercial districts, as well as limiting the areas of disturbance at any given time. Landscaping would be re-established as early as possible to limit fugitive dust. To prevent haul trucks from tracking dirt onto paved streets, tire washing, or road cleaning may be appropriate. State regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting wind-erodible materials.

2.15.7 Solid Waste Management and Hazardous Waste and Materials

According to the State of Hawaii, "Hazardous Substances" include materials and wastes that are considered severely harmful to human health and the environment, as defined by the United States Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (also commonly known as "Superfund")[6].

Areas near Waiaka Bridge have been involved in agricultural activities, therefore it is possible that fertilizer and fuel from farm equipment or abandoned vehicles may be encountered in the soils during ground disturbing activities.

During construction, the Contractor will watch for key signs of soil pollution (e.g., smell, sight – sheen on soil, etc.). If hazardous materials are identified, the Contractor would be required to consolidate such soils immediately and independently of other excavated materials for individual testing and appropriate disposal upon testing results.

HDOT will work with the Contractor to ensure that all excess material from the site will be handled and disposed of properly at a solid waste permitted facility. If the project material is deemed hazardous, the Contractor will take necessary measures to dispose of the material according to federal, State and County statutes.

Good housekeeping and BMPs would be required of the contractor, such as ensuring that:

- All waste materials be collected and stored in securely lidded dumpsters that are emptied before becoming overly full and not buried on site;
- Materials stored on-site be stored in a neat, orderly manner in appropriate containers (i.e., per manufacturer recommendations);
- All on-site vehicles be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage;
- A spill cleanup kit be located on-site where petroleum products, paints, or other hazardous materials are stored; and
- All sanitary waste generated during the construction phase be collected from portable units as required and directed to a HDOH-permitted treatment facility.

2.16 Consistency with Government Plans, Policies, and Controls

This section describes the project's consistency with government plans, policies, and controls.

[6] State of Hawaii. Hazard Mitigation Plan. 2018

2.16.1 State of Hawaii Plans and Controls

Hawaii 2050 Sustainability Plan

The Hawaii 2050 Sustainability Plan, revised June 2021 (Hawaii State Plan), serves as a guide for the future long-range development of the State. The State Plan promotes the growth and diversification of the State's economy, the protection of the physical environment, the provision of public facilities, and the promotion of and assistance to socio-cultural advancement.

The project is consistent with the Sustainable Development Goal 9 "Industry, Innovation, and Infrastructure", to "Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation."

Hawaii Statewide Federal-Aid Highways 2035 Transportation Plan

The Statewide Federal-aid Highways 2035 Transportation (July 2014) provides a basis for transportation decision-making through the year 2035. It embraces the people of Hawaii's values and identifies needs for the movement of people and goods for all modes of land-based transportation. The project is consistent with the following goals:

- Goal 3.2 - Maintain safe, efficient, complete transportation system for the longterm.
- Goal 7.1 – Provide appropriate and reliable transportation access options statewide to all users.
- Goal 8.1 – Maintain a safe transportation system for all land transportation modes.
- Goal 8.2 – Improve safety of the community through connectivity of the transportation infrastructure.

2.16.2 County of Hawaii Plans

County of Hawaii General Plan 2040

The most recent County of Hawaii General Plan document is the Draft General Plan 2040, which was drafted in August 2019. It contains goals, measurable sustainability objectives, and policies and actions to achieve the plan's goals.

The project is most consistent with Section 2: Infrastructure, in which the stated goal is "Hawaii will use progressive planning strategies to ensure communities are adequately served by safe and efficient infrastructure networks based on sound design principles that reflect a focus on environmental sustainability, social equity, and preserving community character".

South Kohala Community Development Plan

The South Kohala Community Development Plan (November 2008) communicates the policies and actions from the County of Hawaii General Plan for implementation into the regional community. The plan calls for reducing traffic congestion in Waimea, and as part of its district-wide policies, it includes the following relevant transportation objectives:

- 2.2 -Establish bicycle, pedestrian, and equestrian travel ways to link up the communities within the District.
- 2.3 – Build safe roads.

CHAPTER 3. COMMENTS AND COORDINATION

This chapter summarizes public and agency consultation and coordination activities associated with this project that have been conducted to date. Project pre-assessment consultation and coordination activities included meetings and correspondence with government agencies, and the affected communities.

3.1 Pre-Assessment and Early Consultation

Prior to initiation of the Draft EA in December 2019, scoping letters were sent to community stakeholders to request input on environmental concerns, solicit input on designs and alternatives, community outreach, and identify studies or issues for further study. A list of recipients is provided below and an asterisk appears next to those entities that responded to the letter.

A copy of the responses is provided in Appendix A.

- Ms. Carol Buck
- Mr. David Gomes
- Mr. & Mrs. Mike Hannah
- Ms. Joyce O'Connor*
- Ms. Fran Tabor
- Ms. Margaret Wille
- Mr. and Ms. John and Marion Barton*
- Mr. Chuck Clarke
- Mr. Ross Fulmer
- Ms. Kathryn Wiese
- Mr. Leningrad Elarionoff
- Mr. Barrie Rose
- Mr. Sherman Warner
- Ms. Linda Paisley
- Mr. Andrew Paisley
- Mr. Peter Paisley
- Mr. Sean Paisley
- Ms. Lauren Paisley
- Ms. Gillian Culff
- Mr. Wayne Kuwaye
- Mr. J. William Sanborne
- Mr. Clemson Lam
- Dr. William and Ms. Patricia Bergin
- Ms. Michelle Medeiros
- Dr. Michael Aronowitz*
- Mr. James Hustace
- Mr. T.J. Kalaniopio*

Five responses were received in response to the request for pre-assessment consultation. A summary of the responses are provided in Appendix A.

3.2 Regulatory Coordination

Because the project must comply with certain federal and State environmental laws and regulations, the following coordination and consultation activities are being conducted. See Appendix A for copies of written correspondence referenced in the discussions below.

3.2.1 Section 106 of the National Historic Preservation Act and Hawaii Revised Statutes Chapter 6E-8

The National Historic Preservation Act (NHPA) requires that actions that are federally funded, authorized, or implemented take into account the effect of such actions on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Such resources are called historic properties. The Section 106 process involves coordination and consultation with the State Historic Preservation Officer (SHPO), and other agencies and organizations that have an interest in or is mandated to protect historic properties. In addition, the Advisory Council on Historic Preservation (ACHP) is afforded the opportunity to comment on actions that may adversely affect historic properties. At the State level, Hawaii Revised Statutes (HRS) Chapter 6E-8 (HRS 6E-8) places similar responsibilities on State agencies to evaluate their projects. Since the project is both a federal and State action, both regulations apply to the project.

A Historic Properties Assessment to support the Section 106 of the NHPA and HRS 6E-8 review provided as Appendix C. Section 2.3 of this document contains a preliminary summary of the study, HDOT's initial findings, and project's anticipated impacts.

The following consultation and coordination activities were conducted in fulfillment of HRS 6E-8 and Section 106:

- Letter on July 21, 2021 from HDOT to SHPD to initiate Section 106 consultation, consult on the area of potential effects (APE), and request information on properties eligible for the NRHP from SHPO.
- Letter dated February 11, 2022, from HDOT to NHOs, individuals and families with cultural and lineal ties to the project area, and knowledgeable stakeholders inviting them to participate in Section 106 consultation for the project. A list of recipients is noted in Appendix A.
- Letter dated March 7, 2022 from SHPD to HDOT clarifying the APE, and identifying potential for sub-surface archaeology in the APE.

3.2.2 Section 7 of the Endangered Species Act and HRS Chapter 195D

Section 7 of the Endangered Species Act (ESA) requires that federally-funded actions not jeopardize any species listed as threatened or endangered, or adversely modify designated critical habitat. HRS Chapter 195D, the State counterpart law to the ESA, provides for the protection of aquatic life, wildlife, or land plant species that are indigenous to Hawaii.

The following consultation and coordination activities were conducted with the U.S. Fish and Wildlife Service (USFWS) pursuant to Section 7 and to support compliance with HRS 195D:

- Letter dated July 21, 2021 from HDOT to the Department of Land and Natural Resources (DLNR) Division of Aquatic Resources (DAR) requesting information on a) threatened and endangered species that may be present in or pass through the project area, b) the presence of identified critical habitat, and c) any other input or concerns regarding the project.
- Letter dated July 21, 2021 from HDOT to DLNR's Division of Forestry and Wildlife (DOFAW) requesting information on a) threatened and endangered species that may be present in or pass through the project area, b) the presence of identified critical habitat, and c) any other input or concerns regarding the project.
- Letter dated September 28, 2021 from DLNR's DOFAW to HDOT identifying protected species (Hawaiian hoary bat, Hawaiian hawk, and Blackburn's sphinx moth as potentially

occurring in the project vicinity, as well as potential impacts to seabirds from artificial lighting).

- Letter dated July 21, 2021 from HDOT to the U.S. Fish and Wildlife Service requesting a list of threatened and endangered plant and animal species and critical habitat.
- Letter dated July 28, 2021 from U.S. Fish and Wildlife Service offering a species list and project recommendations.

CHAPTER 4. ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT

In accordance with HRS Chapter 343 and Hawaii Administrative Rules (HAR), Section 11-200.1-19, HDOT anticipates issuing a Finding of No Significant Impact (FONSI) for the proposed project. This assessment is based on an evaluation of project impacts in relation to the "Significance Criteria" specified in HAR 11200.1-13.

The discussion below is the preliminary significance evaluation, subject to changes that may be made upon receipt of public and agency review comments that may be filed during the public comment period of this Draft EA. The Significance Criteria appear below in italics, followed by a discussion of the project in relation to the specific criterion. The nature of the project's potential impacts is discussed in detail in Chapter 2.

1. *Irrevocably commit a natural, cultural, or historic resource* – The proposed project involves demolition of the existing Waiaka Bridge Structure (SIHP 29221), which is eligible for the NRHP and deemed a "significant historic resource". An "adverse effect" under Section 106 and an "Effect with mitigation" under HRS 6e-8 is anticipated. A Section 106 MOA would be needed to memorialize mitigation commitments to mitigate the impact. See Section 2.3

   The proposed project would not cause any loss or destruction of natural or cultural resources. See Section 2.4, Section 2.5. Biological surveys conducted for the project indicate that areas directly affected by the proposed project do not contain species of concern, or related critical habitat. HDOT has consulted with the U.S. Fish and Wildlife Services to identify avoidance, minimization, and mitigation measures to protect species of concern.

2. *Curtails the range of beneficial uses of the environment* – The proposed project will not curtail beneficial uses of the environment. On the contrary, the project would enhance the existing transportation environment for all users in the area. The replacement bridge and the realigned roadway approaches would provide a safer experience for all users.

3. *Conflicts with the State's environmental policies or long-term environmental goals established by law* – The proposed project is consistent with the environmental goals and objectives of the State of Hawaii, as demonstrated in this section and in Section 2.16.

4. *Have a substantial adverse effect on the economic welfare, social welfare, and cultural practices of the community or State* – The proposed project would not have an adverse effect on the economic or social welfare nor the cultural practices of the community or State. Rather, the project would support the social welfare of the community by providing a safer commute.

5. *Have a substantial adverse effect on public health* – The proposed project would not adversely affect public health.

6. *Involve adverse secondary impacts, such as population changes or effects on public facilities* – The proposed project is not expected to cause secondary impacts as it does not increase any roadway capacity. The project is not anticipated to induce

development of the area or lead to population growth as a direct result of its construction.

7. *Involve a substantial degradation of environmental quality* – The proposed project would not result in a substantial degradation of environmental quality. The project will not result in adverse environmental conditions, as demonstrated in Chapter 2.
8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions* –The proposed project is a complete, independent project and would not result in commitments to other projects, nor would it result in cumulative, considerable impacts on the environment.
9. *Have a substantial adverse effect on a rare, threatened, or endangered species or its habitat* –The project would not adversely affect any species of concern or associated habitat. See Section 2.5. General mitigation measures will be implemented during construction so as to not cause any adverse impacts to the area.
10. *Have a substantial adverse effect on air or water quality or ambient noise levels* – The proposed project would not lead to any violations of State or National Ambient Air Quality Standards. The project would comply with State of Hawaii environmental regulations and standards. BMPs would be implemented to minimize the potential for impacts to water quality during construction. While there would be short-term construction noise impacts, overall no long-term adverse noise impacts are anticipated due to the proposed project.
11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters* – The proposed project is not located in an environmentally-sensitive area. The project will be designed considering the impacts to Keanuiomano Stream due to the reconstruction of Waiaka Bridge.
12. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies* – The proposed project is the reconstruction of an existing bridge and the realignment of approaching roadways to the bridge that would not affect any identified views / vistas. Input from the community will continue to inform the project's final design to ensure that the bridge fits within the geographical context.
13. *Require substantial energy consumption or emit substantial greenhouse gases* – The proposed project would not result in substantial energy consumption. There may be a short-term increase in energy consumption during the project's construction; however, it could be offset by the project's long-term benefits as the realigned roadways and increased line-of-sight benefits are anticipated to help traffic flow more efficiently at this intersection.

CHAPTER 5. REFERENCES

2018 State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress; Pursuant to Chapter 303(d) and Chapter 305(d), CleanWater Act (P.L. 97-117)

2019-2022 American Community Survey 1-Year Estimates

2020 State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress; Pursuant to Chapter 303(d) and Chapter 305(d), CleanWater Act (P.L. 97-117)

County of Hawaii, General Plan 2040. Draft August 2019.

County of Hawaii, Real Property Tax, accessed: March 15, 2022. http://www.hawaiipropertytax.com

County of Hawaii, South Kohala Community Development Plan. November 2008.

Department of Health, Hawaii Administration Rules Chapter 11-54

Department of Transportation and Federal Highway Administration, Statewide Federal-Aid Highways 2035 Transportation Plan

Hawaii Volcano Observatory. 2017. https://volcanoes.usgs.gov/observatories/hvo/about_earthquakes.html

Hawaii 2050 Sustainability Plan. July 2021.

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State of Hawaii Department of Land and Natural Resources, Commission on Water Resource Management. https://dlnr.hawaii.gov/cwrm/surfacewater/permits/. Accessed April 2020

State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources. Atlas of Hawaiian Watersheds & Their Aquatic Resources. Waiulaula, Hawaii, DAR Watershed Code:85003. April 7, 2008.

State of Hawaii. Hazard Mitigation Plan. 2018.

U.S. Census Bureau, 2020 Census Redistricting Data (Public Law 94-171), Survey/Program Decenniel Census, Universe: Total Population, Year: 2020, Table ID: P1.

APPENDIX A
CONSULTATION AND REGULATORY CORRESPONDENCE

APPENDIX A-1: PRE-ASSESSMENT CONSULTATION

Summary Log of Responses to December 2019
Pre-Assessment Scoping Request
Public Involvement

Date: 12/13/19, 9:12am by phone
Name: John Barton, husband of Marion Barton from Waimea called
Phone: (808) 896-7014
Phone call to HWY-DS.
Comment: They received the letter. Corrected wife's name to Marion Barton. They are in favor of a roundabout. Less congestion. Makes driving through the intersection easier. Wondered why the previous design was halted. HWY-DS informed caller it was due to a court case contesting the EA.

Date: 12/20/19 by mail
Name: Joyce O'Connor
Phone: (808) 443-9087
I Strongly support the roundabout. It will maintain a smooth continuous flow thru this busy intersection.

Date: 1/6/20, 8:20am by phone
Name: Dr. Michael Aronowitz
Phone: (808) 885-3217
He is concerned with noise as he lives 30 something feet from the bridge. Wanted to know if there will be night work. Andy Hirano replied that is a possibility that will have to be assessed and the amount of noise evaluated. Wanted to know when construction will be. Andy Hirano replied, if everything goes well, Jun 2022 is the projected date. He anticipates moving to another location during the construction and wanted to know how soon. It also depends upon design schedule and processing applicable permits. He prefers the roundabout due to less noise of stopping and accelerating of vehicles. Offered to pay for construction. He is a psychologist that may be retiring soon. Got an email address and verified phone numbers.

Date: 1/9/20, 9:45am by phone
Name: TJ Kalaniopia from Hawaii Preparatory Academy
Phone: (808) 881-4032
Left message to call him back as he had a couple of questions regarding the 5 concepts he received in the mail.
Tried calling back 1/9/20 at 4pm, but no answer. Left message I'll try calling tomorrow afternoon. He returned call on 1/15/20; 9:05am. He is the Director of Facilities. Mailer was to Ken Melrose who retired. Provided contact info. They own the property that the by-pass bridge will be. Concerned with HELCO utilities and HawaiianTelcom box.

Date: 1/14/20, 2:35pm by phone
Name: James Hustace, Chairman of the South Kohala Traffic Safety Committee
Phone: (920) 540-3983
P.O. Box 2874, Kamuela, HI 96743

sktscsecretary@gmail.com
Wanted to know more about public meetings and wanted to be informed of such. When asked what scheme he preferred, he said most of the members desired the roundabout but they are aware it may cost more and require more land to do. The South Kohala Traffic Safety Committee meets monthly and they are interested in the project.

APPENDIX A-2: REGULATORY CORRESPONDENCE

DAVID Y. IGE
GOVERNOR

HIGHWAY DESIGN BRANCH, ROOM 688A
BRIDGE DESIGN SECTION, ROOM 611
CADASTRAL DESIGN SECTION, ROOM 600
ENVIRONMENTAL DESIGN SECTION, ROOM 688A
HIGHWAY DESIGN SECTION, ROOM 609
HYDRAULIC DESIGN SECTION, ROOM 636
TECHNICAL DESIGN SECTION, ROOM 688

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

JADE T. BUTAY
DIRECTOR

Deputy Directors
LYNN A.S. ARAKI-REGAN
DEREK J. CHOW
ROSS M. HIGASHI
EDWIN H. SNIFFEN

IN REPLY REFER TO:
HWY-DS 2.4574

July 21, 2021

VIA: Hawaii Cultural Resource Information System website

TO: SUZANNE D. CASE, CHAIRPERSON
AND STATE HISTORIC PRESERVATION OFFICER
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: ALAN S. DOWNER, Ph.D.
ADMINISTRATOR AND DEPUTY STATE HISTORIC PRESERVATION OFFICER
STATE HISTORIC PRESERVATION DIVISION

FROM: KAREN CHUN Karen Chun
ENGINEERING PROGRAM MANAGER
DESIGN BRANCH, HIGHWAYS DIVISION

SUBJECT: NATIONAL HISTORIC PRESERVATION ACT: INITIATION OF SECTION 106, REQUEST FOR CONTACT INFORMATION, AND AREA OF POTENTIAL EFFECT (APE) CONCURRENCE
KAWAIHAE ROAD, REPLACEMENT OF WAIAKA STREAM BRIDGE AND REALIGNMENT OF APPROACHES, AHUPUAA OF LALAMILO, KEANUIOMANO
DISTRICT (MOKU) OF KOHALA, ISLAND OF HAWAII
PROJECT NO. 19D-01-19
TAX MAP KEYS: (3) 6-5-001:015, :033, (3) 6-6-001:011, :077; (3) 6-6-004:001; KAWAIHAE ROAD RIGHT-OF-WAY AND KOHALA MOUNTAIN ROAD RIGHT-OF-WAY

On behalf of the Federal Highway Administration (FHWA), the State of Hawaii Department of Transportation (HDOT) would like to initiate consultation under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (2006), for the subject bridge rehabilitation project. In addition, HDOT requests the State Historic Preservation Officer's (SHPO) concurrence on the proposed Area of Potential Effect (APE), pursuant to Section 106 of the NHPA and Title 36 of the *Code of Federal Regulations (CFR)*, § 800.4(a)(1).

This proposed project is currently state-funded, but there is the potential for federal funds to be used, which would result in the project being a federal action and undertaking, as defined by 36 CFR § 800.16(y).

If federal funds become involved, then the federally funded HDOT project would be considered a federal action and undertaking as defined in 36 CFR, §800.16(y). Effective May 1, 2016, FHWA issued a Delegation of Authority allowing the HDOT and local public agencies to conduct NHPA Section 106 Consultations with the SHPO, Native Hawaiian organizations (NHOs), and qualified consulting parties per 36 CFR, §800.2(c)(4). The FHWA will remain responsible for all findings and determinations charged to the agency during the Section 106 process.

Consultations

In addition to consulting with your agency, HDOT is simultaneously consulting with NHOs listed on the U.S. Department of Interior, Office of Native Hawaiian Relations, NHO List, with an applicable interest in the APE, including other qualified consulting parties per 36 CFR, §800.2(c)(4). Initial contact for the purpose of Section 106 consultation is by formal letter.

A Section 106 notice/advertisement will also be published in both *The Hawaii Tribune-Herald* and *West Hawaii Today* newspapers. NHOs and native Hawaiian descendants with ancestral, lineal or cultural ties to, cultural and historical property knowledge of and/or concerns for, and cultural or religious attachment to the proposed APE will be asked to provide a response within 30 days of notification. In addition, other individuals and organizations with demonstrated legal, economic or historic preservation interest will also be asked to respond to the Section 106 notice/advertisement.

Request for Information

Pursuant to *36 CFR* §800.3(f) in consultation with the State Historic Preservation Division, we are interested if your agency is acquainted with any persons or organization that is knowledgeable about the proposed project area, or any descendants with ancestral, lineal or cultural ties to or cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area. We would appreciate receiving their names and contact information within the 30 days of notification.

Per 36 CFR § 800.2(a)(4)(c)(5) we request the names of individuals and organizations who have demonstrated their legal, economic, historic preservation interest to SHPO on the proposed subject undertaking. As the office of record for this undertaking, we also request the SHPO provide us with a copy of the correspondence initiated by interested parties who have approached SHPO to request consulting party status for this undertaking.

Proposed Area of Potential Effect

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. The proposed APE includes the existing highway right-of-way that encompasses this intersection and Waiaka Bridge (Mile Post 58.88), which carries Kawaihae Road over Keanuiomano Stream leaving Waimea Town. The proposed APE also includes areas for construction staging and a temporary roadway and bridge facilities.

Please refer to the enclosed map of the proposed APE. The area of the APE is approximately 7.3 acres. The APE includes the following, as measured from the center of the existing intersection:

- 450 feet along Kohala Mountain Road (roughly 130 feet wide).
- 500 feet along Kawaihae Road toward Kawaihae (roughly 105 feet wide at its widest point).
- 550 feet along Kawaihae Road, including Waiaka Stream Bridge, approaching the intersection while leaving Waimea Town (roughly 190 feet wide).
- This includes use of a privately-owned parcel, (3)6-5-001:015 – 13,865 square feet / 0.32 acre.
- This includes use of a Department of Hawaiian Homelands (DHHL)-owned parcel, (3)6-6-001:077 – 31,090 square feet / 0.7 acre.
- This includes use of a DHHL-owned parcel, (3)6-6-001:011 – 8,544 square feet / 1.872 acres.

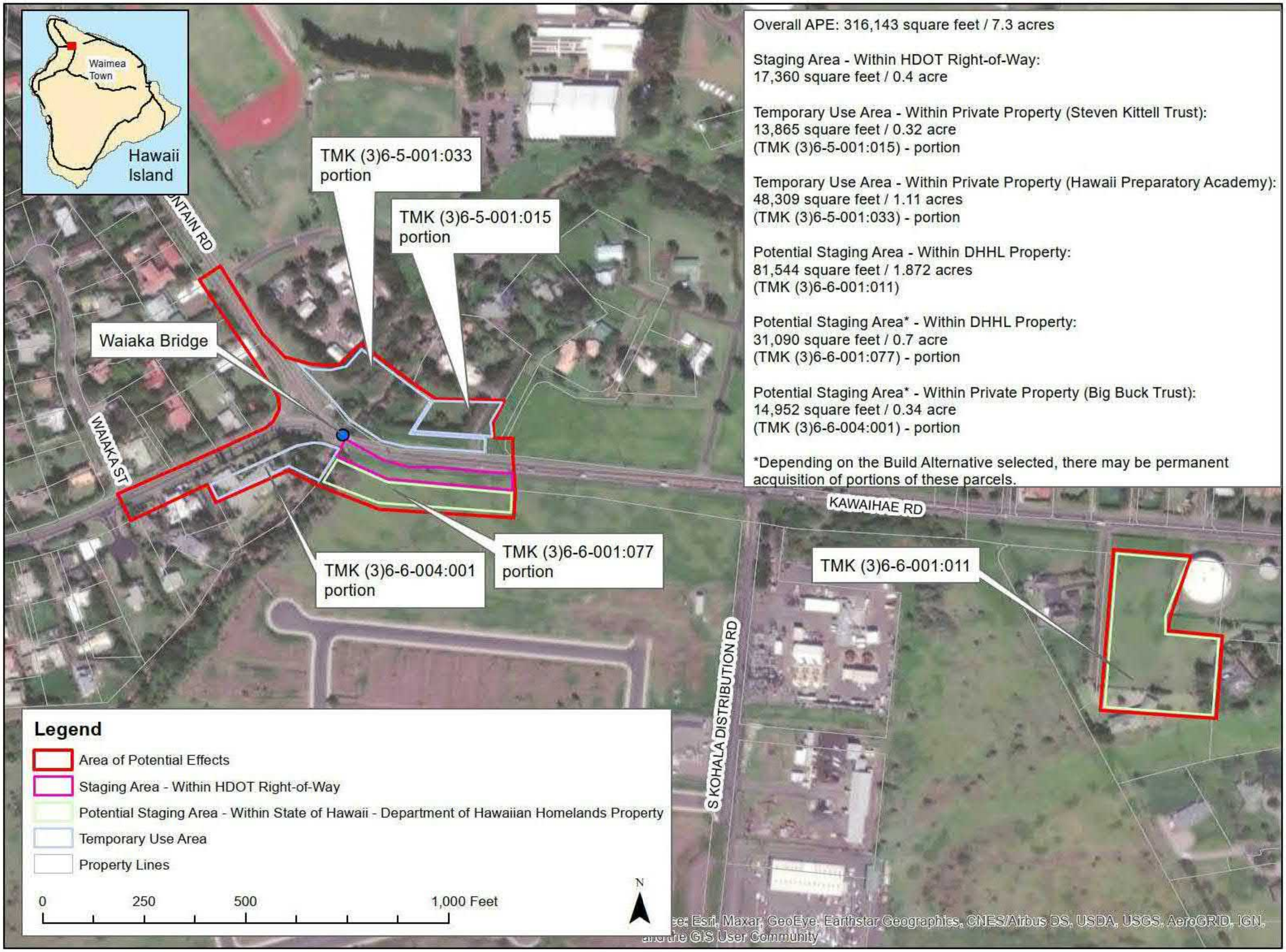
The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection and 2) a replacement bridge with a roundabout.

In addition to providing us with information regarding NHOs and other potential consulting parties, we ask for your concurrence on our proposed APE for the proposed project within 30 days from notification.

We would appreciate a written response within 30 days from date of receipt to the HDOT Project Manager, Mr. Andrew Hirano, via email at andrew.j.hirano@hawaii.gov. We look forward to working with you on this needed project.

Enclosure

c: Federal Highway Administration (Meesa Otani)
WSP USA Inc. (Darin Chinen)


Waimea Town
Hawaii Island
Overall APE: 316,143 square feet / 7.3 acres
Staging Area - Within HDOT Right-of-Way:
17,360 square feet / 0.4 acre
Temporary Use Area - Within Private Property (Steven Kittell Trust):
13,865 square feet / 0.32 acre
(TMK (3)6-5-001:015) - portion
Temporary Use Area - Within Private Property (Hawaii Preparatory Academy):
48,309 square feet / 1.11 acres
(TMK (3)6-5-001:033) - portion
Potential Staging Area - Within DHHL Property:
81,544 square feet / 1.872 acres
(TMK (3)6-6-001:011)
Potential Staging Area* - Within DHHL Property:
31,090 square feet / 0.7 acre
(TMK (3)6-6-001:077) - portion
Potential Staging Area* - Within Private Property (Big Buck Trust):
14,952 square feet / 0.34 acre
(TMK (3)6-6-004:001) - portion
*Depending on the Build Alternative selected, there may be permanent acquisition of portions of these parcels.
TMK (3)6-5-001:033 portion
TMK (3)6-5-001:015 portion
Waiaka Bridge
WAIAKA ST
KAWAIHAE RD
S KOHALA DISTRIBUTION RD
TMK (3)6-6-004:001 portion
TMK (3)6-6-001:077 portion
TMK (3)6-6-001:011
Legend
Area of Potential Effects
Staging Area - Within HDOT Right-of-Way
Potential Staging Area - Within State of Hawaii - Department of Hawaiian Homelands Property
Temporary Use Area
Property Lines
0
250
500
1,000 Feet
N
Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Waiaka Stream Bridge – Approach along Kawaihae Road, Leaving Waimea Town

Waiaka Stream Bridge – Approach along Kawaihae Road, Leaving Waimea Town

Waiaka Stream Bridge – Abutment

DAVID Y. IGE
GOVERNOR

HIGHWAY DESIGN BRANCH, ROOM 688A
BRIDGE DESIGN SECTION, ROOM 611
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STATE OF HAWAII
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JADE T. BUTAY
DIRECTOR

Deputy Directors
ROSS M. HIGASHI
EDUARDO P. MANGLALLAN
PATRICK H. MCCAIN
EDWIN H. SNIFFEN

IN REPLY REFER TO:
HWY-DS 2.7423

February 9, 2022

Subject: National Historic Preservation Act (NHPA) Section 106 Consultation
Kawaihae Road, Replacement of Waiaka Bridge and
Realignment of Approaches Ahupuaa of Lalamilo and Keanuiomano
District (Moku) of Kohala, Island of Hawaii, State of Hawaii
Project No. 19D-01-19
Tax Map Keys: (3) 6-5-001:015, :033; (3) 6-6-001:011, :077; (3) 6-6-004:001;
Kawaihae Road Right-of-Way (ROW) and Kohala Mountain Road ROW

On behalf of the Federal Highway Administration (FHWA), the State of Hawaii Department of Transportation (HDOT) is hereby notifying you that on July 21, 2021, Section 106 of the NHPA of 1966 (amended, 2006), was initiated with the Department of Land and Natural Resources, State Historic Preservation Office (SHPO) for the subject bridge replacement project.

This proposed project is currently state funded, but there is the potential for federal funds to be used, which would result in the project being a federal action and undertaking, as defined in Title 36 of the *Code of Federal Regulations (CFR),* Part 800.16(y). Effective May 1, 2016, FHWA has issued a Delegation of Authority allowing the HDOT and local public agencies to conduct NHPA Section 106 consultations with the SHPO, Native Hawaiian Organizations (NHO), and other consulting parties per 36 *CFR*, Part 800.2 (c) (4). The FHWA will remain responsible for all findings and determinations charged to the agency during the Section 106 process.

Overview of the Undertaking
The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are

two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection and 2) a replacement bridge with a roundabout.

Consultations
Consulting parties during the Section 106 process include the Advisory Council on Historic Preservation, SHPO, NHOs, and if applicable, local governments and applicants for federal assistance, permits, licenses and other approvals.

<u>NHO and/or Native Hawaiian Descendants</u>
NHO and Native Hawaiian descendants with ancestral, lineal or cultural ties to, cultural and historical property knowledge of and/or concerns for, and cultural or religious attachment to the proposed Area of Potential Effect (APE) are asked to provide a response to this letter within 30 days of notification.

<u>Other Individuals and Organizations</u>
Individuals and organizations with legal, economic, or historic preservation interest are requested to respond within 30 days of notification and demonstrate your interest in the proposed undertaking and provide intent to participate in the Section 106 process. Your participation is subject to FHWA approval.

Request for Comment on the Area of Potential Effect
We would like to invite you to comment on the proposed APE.

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. The proposed APE includes the existing highway ROW that encompasses this intersection and Waiaka Bridge (Mile Post 58.88), which carries Kawaihae Road over Keanuiomano Stream leaving Waimea Town.

The proposed APE encompasses those areas that would be directly and indirectly affected by the project. In addition to the locations where construction would occur, the APE includes the areas needed for construction staging, as well as the temporary roadway and bridge facility. Please refer to the enclosed APE map.

In all, the APE is approximately 6.6 acres. As measured from the center of the existing intersection, it includes:

- 450 feet along Kohala Mountain Road (roughly 130 feet wide).
- 500 feet along Kawaihae Road toward Kawaihae (roughly 105 feet wide at its widest point).
- 550 feet along Kawaihae Road, including Waiaka Bridge, approaching the intersection while leaving Waimea Town (roughly 190 feet wide).
- Privately-owned parcel, (3)6-5-001:015 – 13,865 square feet / 0.32 acre.

Identification of Historic Properties within the APE
We welcome any information you may have on historical and cultural sites that have been recorded or which you may have knowledge of within the proposed APE. In addition, if you are acquainted with any persons or organization that is knowledgeable about the proposed APE, or any descendants with ancestral, lineal or cultural ties to or cultural knowledge and/or historical properties information of or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information within 30 days of notice.

Conclusion
On behalf of FHWA, the HDOT, by way of this letter is notifying you of the proposed Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project. Should you want to participate in the Section 106 process, we request your written intent. In addition, please include your comments on the proposed APE. We also request any information you may have on the historic and cultural sites that have been recorded within the APE or any other historic or cultural sites nearby about which you may have knowledge. Lastly, should you know of any persons or organizations who may have cultural affiliations to the project area, we would appreciate receiving their names and contact information.

We would appreciate a written response within 30 days from date of receipt, to the HDOT Project Manager, Mr. Andrew Hirano, via email at andrew.j.hirano@hawaii.gov, Technical Design Services Section, Design Branch, Highways Division.

We look forward to working with you on this needed project.

Sincerely,

Karen Chun

KAREN CHUN
Engineering Program Manager
Design Branch, Highways Division

Enclosure

DAVID Y. IGE
GOVERNOR OF
HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

March 7, 2022

IN REPLY REFER TO:
Project No.: 2021PR00849
Doc No.: 2203SH05
Archaeology
Architecture

Karen Chun
Engineering Program Manager
Design Branch, Highways Division
State of Hawaiʻi Department of Transportation
601 Kamokila Boulevard
Kapolei, Hawaiʻi 96707
Email: Karen.Chun@hawaii.gov

Electronic Transmittal Only, No Hard Copy to Follow

Dear Karen Chun:

SUBJECT: **National Historic Preservation Act (NHPA) Section 106 Review –**
Continued Consultation, Request for Concurrence with the Revised Area of Potential Effects
Kawaihae Road, Replacement of Waiaka Stream Bridge and Realignment Approaches
Ref. No. HWY-DS 2.7423, Federal Aid Project No. 19D-01-19
Lālāmilo, Keanuʻiʻomanō Ahupuaʻa, Kohala District, Island of Hawaiʻi
TMK: (3) 6-5-001:015, (3) 6-5-001:033, (3) 6-6-001:011, (3) 6-6-001:077, (3) 6-6-004:001
Kawaihae Road Right-of-Way and Kohala Mountain Road Right-of-Way

The State Historic Preservation Division (SHPD) received a letter dated February 3, 2022 from the State of Hawai'i Department of Transportation (HDOT) on behalf of the Federal Highway Administration (FHWA) to continue the Section 106 historic preservation process for the Replacement of Waiaka Stream Bridge and Realignment Approaches project on Kawaihae Road on the island of Hawaiʻi. The SHPD received this submittal on February 7, 2022 (HICRIS Submission No. 2022PR00849.002).

The proposed HDOT project is currently only state funded but *may* receive funding from FHWA. At this time, the proposed project is subject to compliance with Hawaii Revised Statutes (HRS) §6E-8; should the proposed project receive federal funding it would also be subject to compliance with Section 106 of the NHPA. Pursuant to the Programmatic Delegation of Authority (May 2016), the FHWA has delegated Section 106 consultation to the Hawaiʻi Department of Transportation.

HDOT states the proposed project will bring Waiaka Stream Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection or 2) a replacement bridge with a roundabout.

The proposed project is located in South Kohala at the intersection of Kawihae Road and Kohala Mountain Road in the town of Waimea. HDOT has defined the Area of Potential Effects (APE) to include the existing highway right-of-way that encompasses this intersection and Waiaka Bridge (Mile Post 58.88), which carries Kawaihae Road over Keanuiomano Stream leaving Waimea Town. The proposed APE also includes areas for construction staging and a temporary roadway and bridge facilities.

The APE has been minimized since the start of Section 106 consultation for the proposed undertaking to avoid culturally sensitive areas (Personal Communication; March 7, 2022 Andrew Hirano [HDOT] and Stephanie Hacker

[SHPD]). The area of the APE has been revised from approximately 7.3 acres to approximately 6.6 acres. The APE includes the following, as measured from the center of the existing intersection:

- 450 feet along Kohala Mountain Road (roughly 130 feet wide);
- 500 feet along Kawaihae Road toward Kawaihae (roughly 105 feet wide at its widest point);
- 550 feet along Kawaihae Road, including Waiaka Bridge, approaching the intersection while leaving Waimea Town (roughly 190 feet wide); and
- Privately-owned parcel, (3)6-5-001:015 (13,865 square feet / 0.32 acres).

Based on the information received, the State Historic Preservation Officer (SHPO) has no objections to the revised APE as it is defined.

As stated previously in SHPD’s letter dated August 18, 2021 (SHPD Doc No. 2108SH06), there are two historic properties approximately 200 meters slightly northeast of TMK: (3) 6-5-001:015. One is State Inventory of Historic Places (SIHP) Site 50-10-06-19648, a Hawaiian habitation termed Wai‘Aka. The other is SIHP Site 50-10-06-19649, also termed Wai‘Aka and documented as a Hawaiian habitation and burial complex. North of these sites are a number of documented related sites assigned SIHP numbers. One can only assume this is a single cultural site assigned multiple SIHP numbers. Therefore, the subsurface of this area should be treated as culturally sensitive.

Additionally, according to HDOT’s 2013 Bridge Inventory Survey, the Waiaka Stream Bridge was built in 1932 and is eligible for listing in the National Register of Historic Places (NRHP) under Criterion C and is considered a good example of a 1930s reinforced concrete bridge. However, SHPD found discrepancies between the locational data provided by HDOT and the data within the 2013 Bridge Inventory Survey. The Bridge Inventory Survey states the Waiaka Stream Bridge (Bridge Number 001002500500053) is at Milepost 53 and carries Hawai‘i Belt Road over Waiaka Stream, not Keanuiomano Stream as stated by HDOT. It appears from the APE map provided by HDOT and the map illustrating the location of Bridge Number 001002500500053 in the 2013 Bridge Inventory Survey that this is the same bridge, however **the SHPD requests** clarification of these discrepancies from HDOT and further points out, Hawai‘i Belt Road is also considered a historic property eligible for listing in the NRHP.

Should the Waiaka Stream Bridge be a historic property, please provide HDOT’s assessment of how the proposed undertaking will, or will not, impact the character defining features of the Waiaka Stream Bridge, as well as of Hawai‘i Belt Road. Please provide a detailed assessment of the significance and integrity of these historic properties as well as a list of their character defining features.

In response to HDOT’s request for a contact list of potential consulting parties and based on the consulting parties listed in HDOT’s letter, the SHPD recommends HDOT expand consultation to interested parties such as civic clubs and historic preservation interest groups including Historic Hawai‘i Foundation and the National Trust for Historic Preservation. Contact information for Historic Hawai‘i Foundation and the National Trust for Historic Preservation are copied with this letter.

Per HDOT’s request, the SHPD is confirming its intent to participate in the Section 106 process for this project. The SHPD looks forward to continuing the Section 106 process for the proposed project.

Please submit all forthcoming information and correspondence related to the subject project to SHPD HICRIS Project No 2021PR00849 using the Project Supplement option.

The HDOT and FHWA are the offices of record for this undertaking. Please maintain a copy of this letter with your environmental review record for this undertaking.

Please contact Stephanie Hacker, Historic Preservation Archaeologist IV, at Stephanie.Hacker@hawaii.gov or at (808) 692-8046 for matters regarding archaeological resources or this letter.

Aloha,

Alan Downer

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

cc: Andrew Hirano, HDOT (Andrew.j.Hirano@hawaii.gov)
Meesa Otani, FHWA (Meesa.Otani@dot.gov)
Julia Flauaus, SHPD (Julia.Flauaus@hawaii.gov)
Darin Chinen, WSP USA Inc. (Darin.Chinen@wsp.com)
Kiersten Faulkner, Historic Hawaiʻi Foundation (Kiersten@historichawaii.org)
Elizabeth Merritt, National Trust for Historic Preservation (emerritt@savingplaces.org)

DAVID Y. IGE
GOVERNOR

HIGHWAY DESIGN BRANCH, ROOM 688A
BRIDGE DESIGN SECTION, ROOM 611
CADASTRAL DESIGN SECTION, ROOM 600
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JADE T. BUTAY
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Deputy Directors
LYNN A.S. ARAKI-REGAN
DEREK J. CHOW
ROSS M. HIGASHI
EDWIN H. SNIFFEN

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

IN REPLY REFER TO:
HWY-DS 2.4671

July 21, 2021

VIA EMAIL: DLNR.aquatics@hawaii.gov

TO: SUZANNE D. CASE, CHAIRPERSON AND
STATE HISTORIC PRESERVATION OFFICER
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: BRIAN NIELSON, ADMINISTRATOR
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES

FROM: KAREN CHUN Karen Chun
ENGINEERING PROGRAM MANAGER
DESIGN BRANCH, HIGHWAYS DIVISION

SUBJECT: CHAPTER 195D HAWAII REVISED STATUTES (HRS)
CONSULTATION KAWAIHAE ROAD, REPLACEMENT OF WAIAKA BRIDGE AND REALIGNMENT OF APPROACHES
WAIMEA, SOUTH KOHALA DISTRICT, ISLAND OF HAWAII,
PROJECT NO. 19D-01-19
TAX MAP KEYS: (3) 6-5-001:015, :033, (3) 6-6-001:011, :077; (3) 6-6-004:001, :999; (3) 6-6-009:999

The State of Hawaii Department of Transportation Highways Division (HDOT), is proposing to replace Waiaka Bridge, which carries Kawaihae Road over Keanuiomano Stream, in South Kohala on the island of Hawaii. In accordance with State guidelines for preparing environmental review documents, HDOT is consulting with the State of Hawaii Department of Land and Natural Resources Division of Aquatic Resources (DAR) under HRS Chapter 195D. Specifically, we are interested in (a) threatened and endangered species that may be present in or pass through the project area, (b) the presence of identified critical habitat for any species in the area, and (c) any other input or concerns you have regarding the proposed project. HDOT would like to request for a list of threatened and endangered plant and animal species and critical habitats within the vicinity of the project to enable an appropriate determination for this project under HRS Chapter 195D.

This project will be a federally funded HDOT project for construction and therefore is considered a federal action. As such, HDOT will also be consulting on behalf of the Federal

Highways Administration with the National Marine Fisheries Service under Section 7 of the Endangered Species Act.

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection and 2) a replacement bridge with a roundabout. The proposed project would also include the following:

- Construction of temporary road and bridge during construction
- Relocation of highway lighting and utility poles, and
- Roadway restriping.

It is anticipated that any partial road closures during construction would be limited to daytime hours. However, full road closures and night work may become necessary depending on site conditions and local traffic.

Work will be done in and above the water at Keanuiomano Stream. The Contractor will be required to maintain the stream's health and best management practices will be utilized to create isolated work areas as needed to minimize the potential for inappropriate discharge to the stream.

Furthermore, to assist us in our assessment, we also respectfully ask for DAR's opinion on the potential impact of the project to threatened and endangered species and associated critical habitat based on the project location as well as the proposed construction activities and schedule.

Should you have any questions, please contact Andrew Hirano, the HDOT Project Manager, Technical Design Services Section, Design Branch, Highways Division at (808) 692-7548, or by email at andrew.j.hirano@hawaii.gov and reference letter number HWY-DS 2.4671 as noted above.

Enclosure

c: WSP USA Inc. (Darin Chinen)

DAVID Y. IGE
GOVERNOR

HIGHWAY DESIGN BRANCH, ROOM 688A
BRIDGE DESIGN SECTION, ROOM 611
CADASTRAL DESIGN SECTION, ROOM 600
ENVIRONMENTAL DESIGN SECTION, ROOM 688A
HIGHWAY DESIGN SECTION, ROOM 609
HYDRAULIC DESIGN SECTION, ROOM 636
TECHNICAL DESIGN SECTION, ROOM 688

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

JADE T. BUTAY
DIRECTOR

Deputy Directors
LYNN A.S. ARAKI-REGAN
DEREK J. CHOW
ROSS M. HIGASHI
EDWIN H. SNIFFEN

IN REPLY REFER TO:
HWY-DS 2.4672

July 21, 2021

VIA EMAIL: DLNR.@hawaii.gov

TO: SUZANNE D. CASE, CHAIRPERSON AND
STATE HISTORIC PRESERVATION OFFICER
DEPARTMENT OF LAND AND NATURAL RESOURCES

ATTN: DAVID SMITH, ADMINISTRATOR
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE

FROM: KAREN CHUN *Karen Chun*
ENGINEERING PROGRAM MANAGER
DESIGN BRANCH, HIGHWAYS DIVISION

SUBJECT: CHAPTER 195D HAWAII REVISED STATUTES (HRS)
CONSULTATION KAWAIHAE ROAD, REPLACEMENT OF WAIAKA
BRIDGE AND REALIGNMENT OF APPROACHES
WAIMEA, SOUTH KOHALA DISTRICT, ISLAND OF HAWAII,
PROJECT NO. 19D-01-19
TAX MAP KEYS: (3) 6-5-001:015, :033, :054; (3) 6-6-001:011; (3) 6-6-004:999;
(3) 6-6-009:999

The State of Hawaii Department of Transportation Highways Division (HDOT), is proposing to replace Waiaka Bridge, which carries Kawaihae Road over Keanuiomano Stream, in South Kohala on the island of Hawaii. In accordance with State guidelines for preparing environmental review documents, HDOT is consulting with the State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) under HRS Chapter 195D. Specifically, we are interested in (a) threatened and endangered species that may be present in or pass through the project area, (b) the presence of identified critical habitat for any species in the area, and (c) any other input or concerns you have regarding the proposed project. HDOT would like to request for a list of threatened and endangered plant and animal species and critical habitats within the vicinity of the project to enable an appropriate determination for this project under HRS Chapter 195D.

This project will be a federally funded HDOT project for construction and therefore is considered a federal action. As such, HDOT will also be consulting on behalf of the Federal

Highways Administration with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act.

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection and 2) a replacement bridge with a roundabout. The proposed project would also include the following:

- Construction of temporary road and bridge during construction
- Relocation of highway lighting and utility poles, and
- Roadway restriping.

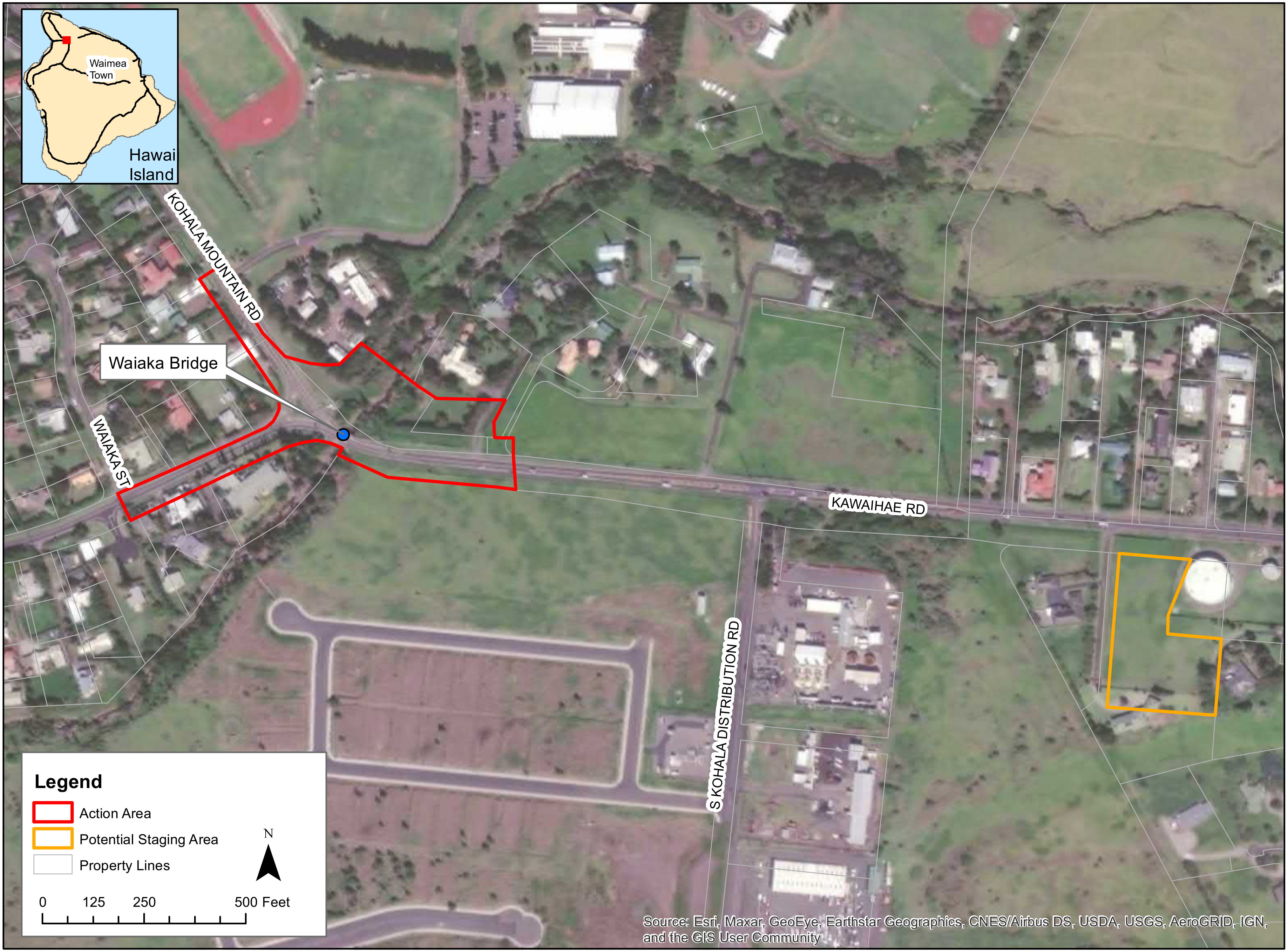
It is anticipated that any partial road closures during construction would be limited to daytime hours. However, full road closures and night work may become necessary depending on site conditions and local traffic.

Furthermore, to assist us in our assessment, we also respectfully ask for DOFAW's opinion on the potential impact of the project to threatened and endangered species and associated critical habitat based on the project location as well as the proposed construction activities and schedule.

Should you have any questions, please contact Andrew Hirano, the HDOT Project Manager, Technical Design Services Section, Design Branch, Highways Division at (808) 692-7548, or by email at andrew.j.hirano@hawaii.gov and reference letter number HWY-DS 2.4672 as noted above.

Enclosure

c: WSP USA Inc. (Darin Chinen)



Waimea Town
Hawai Island
KOHALA MOUNTAIN RD
Waiaka Bridge
WAIAKA ST
KAWAIHAE RD
S KOHALA DISTRIBUTION RD
Legend
Action Area
Potential Staging Area
Property Lines
N
0 125 250 500 Feet
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

September 28, 2021

MEMORANDUM

Log no. 3343
Reference HWY-DS 2.4672

TO: KAREN CHUN, Engineering Program Manager
Design Branch, Highways Division
Department of Transportation

FROM: DAVID G. SMITH, Administrator
Division of Forestry and Wildlife

SUBJECT: Division of Forestry and Wildlife Comments for the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your Chapter 195D consultation regarding the Kawaihae Road, replacement of Waiaka Bridge and realignment of approaches in Waimea on the Island of Hawaiʻi, TMKs: (3) 6-5-001:015, :033, :54; (3) 6-6-001:011; (3) 6-6-004:999; (3) 6-6-009:999. The proposed project consists of: replacing the existing bridge and realigning the roadway approaches toward the bridge; construction of a temporary road and bridge during construction; relocation of highway lighting and utility poles; and roadway restriping.

The State listed Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*) has the potential to occur in the vicinity of the project area and may roost in nearby trees. If any site clearing is required this should be timed to avoid disturbance during the bat birthing and pup rearing season (June 1 through September 15). If this cannot be avoided, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed without consulting DOFAW.

The State listed Hawaiian Hawk or ʻIo (*Buteo solitarius*) may occur in the project vicinity. DOFAW recommends surveying the area to ensure no Hawaiian Hawk nests are present if trees are to be cut. ʻIo nests may be present during the breeding season from March to September.

DOFAW recommends minimizing the movement of plant or soil material between worksites, such as in fill. Soil and plant material may contain invasive fungal pathogens (e.g. Rapid ʻŌhiʻa Death), vertebrate and invertebrate pests, or invasive plant parts that could harm our native species and ecosystems. We recommend consulting the Big Island Invasive Species Committee at (808) 933-3340 in planning, design, and construction of the project to learn of any high-risk invasive species in the area and ways to mitigate spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species. Gear that may contain soil, such as work boots and vehicles, should be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of Rapid ‘Ōhi‘a Death and other harmful fungal pathogens.

We note that artificial lighting can adversely impact seabirds that may pass through the area at night by causing disorientation. This disorientation can result in collision with manmade artifacts or grounding of birds. For nighttime lighting that might be required, DOFAW recommends that all lights be fully shielded to minimize impacts. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season from September 15 through December 15. This is the period when young seabirds take their maiden voyage to the open sea. This is the period when young seabirds take their maiden voyage to the open sea. For illustrations and guidance related to seabird-friendly light styles that also protect the dark, starry skies of Hawai‘i please visit: https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

The State listed Blackburn’s Sphinx Moth (BSM; *Manduca blackburni*) has a historic range that encompasses the project area. Larvae of BSM feed on many nonnative hostplants that include tree tobacco (*Nicotiana glauca*) which grows in disturbed soil. We recommend contacting our Hawai‘i Island DOFAW office at (808) 974-4226 for further information about where BSM may be present and whether a vegetation survey should be conducted to determine the presence of plants preferred by BSM. To avoid harm to BSM, DOFAW recommends removing plants less than one meter in height or during the dry time of the year. If you remove tree tobacco over one meter in height or disturb the ground around or within several meters of these plants they must be checked thoroughly for the presence of eggs and larvae.

We appreciate your efforts to work with our office for the conservation of our native species. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible. If you have any questions, please contact Paul Radley, Protected Species Habitat Conservation Planning Coordinator at (808) 587-0010 or paul.m.radley@hawaii.gov.

Sincerely,

DAVID G. SMITH
Administrator

DAVID Y. IGE
GOVERNOR

HIGHWAY DESIGN BRANCH, ROOM 688A
BRIDGE DESIGN SECTION, ROOM 611
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
601 KAMOKILA BOULEVARD
KAPOLEI, HAWAII 96707

IN REPLY REFER TO:
HWY-DS 2.4669

July 21, 2021

VIA EMAIL: pifwo_admin@fws.gov

Mary Abrams, Ph.D.
Acting Field Supervisor
Department of the Interior
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawaii 96850-5000

Dear Dr. Abrams:

Subject: Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches
Project No. 19D-01-19
Section 7, Endangered Species Act Consultation
Request for Species List

The State Department of Transportation, Highways Division (HDOT), in cooperation with Hawaii County and the Federal Highway Administration (FHWA) is proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches project in South Kohala on the Island of Hawaii. This project is located along Kawaihae Road at Waiaka Bridge (Mile Post 58.88), and includes the replacement of the existing bridge and the realignment of the roadway approaches toward the bridge.

This proposed project is currently state-funded, but there is the potential for federal funds to be used, which would result in the project being a federal action and undertaking, as defined by 36 Code of Federal Regulations Section 800.16(y). Therefore, the FHWA will require compliance with the National Environmental Policy Act, Section 7 of the Endangered Species Act (ESA) of 1973 (Section 7), as amended, and other federal requirements.

On behalf of the FHWA, the HDOT would like to request a list of threatened and endangered plant and animal species and critical habitats within the vicinity of the project to enable an appropriate determination for this project under Section 7 of the ESA.

Per the August 7, 1986 letter from the FHWA to United States Fish and Wildlife Service (USFWS) the FHWA has designated State Highway or Transportation Agencies as Non-Federal

Representatives to conduct informal Consultations. However, the FHWA remains responsible for all findings and determinations charged to the agency during the Section 7 process.

All official letters to the USFWS shall be transmitted under the HDOT letterhead. All determination letters regarding the findings will be transmitted under the FHWA letterhead.

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for the project: 1) a replacement bridge with a T-Intersection and 2) a replacement bridge with a roundabout.

The proposed project area includes the existing highway right-of-way that encompasses this intersection and Waiaka Bridge (Mile Post 58.88), which carries Kawaihae Road over Keanuiomano Stream leaving Waimea Town. The proposed project area also includes areas for construction staging and a temporary roadway and bridge facilities. A map of the project indicating the proposed action area and staging area is enclosed.

Should you have any questions, please contact our project manager, Andrew Hirano at (808) 692-7546 Technical Design Services Section, Design Branch, Highways Division, or email at andrew.j.hirano@hawaii.gov and reference letter number HWY-DS 2.4669 as noted above.

Sincerely,

Karen Chun

KAREN CHUN
Engineering Program Manager
Design Branch, Highways Division

Enclosure

c: Federal Highway Administration (Meesa Otani)
WSP USA, Inc. (Darin Chinen)

In Reply Refer To:
01EPIF00-2021-SL-0408

July 28, 2021

Karen Chun
Design Branch, Highways Division
Department of Transportation
601 Kamokila Boulevard
Kapolei, Hawaiʻi 96707

Subject: Species List to Replace Waiaka Bridge and Realign Roadway Approaches in Kawaihae, Island and County of Hawaiʻi

Dear Karen Chun:

The U.S. Fish and Wildlife Service (Service) received your correspondence on July 21, 2021, requesting a species list for the Replacement of Waiaka Bridge and Realignment of Approaches Project in Kawaihae, South Kohala (Project Number: 19D-01-19). The Service offers the following comments to assist you in your planning process so that impacts to trust resources can be avoided through site preparation, construction, and operation. Our comments are provided under the authorities of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C 1531 *et seq.*).

Project Description

The State Department of Transportation, Highways Division in cooperation with Hawaiʻi County and the Federal Highway Administration is proposing to replace the existing Waiaka Bridge and realign roadway approaches along Kawaihae Road in South Kohala on the island of Hawaiʻi. The project is located at mile post 55.88. The proposed project is currently State-funded, but there is a potential for federal funds to be used.

The purpose of the project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. There are two build alternatives being considered for the project: (1) replace the bridge with a T-intersection, and (2) replace the bridge with a roundabout.

The proposed project area includes the existing highway right-of-way that encompasses this intersection and Waiaka Bridge, which carries Kawaihae Road over Keanuʻiʻomanō Stream leaving Waimea town. The proposed project area also includes areas that will be used for construction staging, temporary roadway, and bridge facilities.

Based on information you provided and pertinent information in our files, including data compiled by the Hawaiʻi Biodiversity and Mapping Project, there are 13 listed species in the immediate vicinity of the project area: the federally endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the threatened Hawaiian goose (*Branta [Nesochen] sandvicensis*), the endangered Blackburn's sphinx moth (*Manduca blackburni*), the endangered Hawaiian stilt, (*Himantopus mexicanus knudseni*), the endangered Hawaiian coot (*Fulica alai*), the endangered Hawaiian duck (*Anas wyvilliana*), the endangered Pacific damselfly (*Megalagrion pacificum*), the orange-black damselfly (*Megalagrion xanthomelas*), the endangered *Chrysodracon hawaiiensis* (hala pepe), and the endangered *Achyranthes mutica*. Additionally, the endangered Hawaiian petrel (*Pterodroma sandwichensis*), the endangered Hawaiʻi Distinct Population Segment of the band-rumped storm-petrel (*Oceanodroma castro*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*) may transit the project area flying to upland breeding colonies. The Hawaiian petrel, band-rumped storm-petrel, and Newell's shearwater will hereafter, collectively be referred to as "Hawaiian seabirds," and the Hawaiian stilt and Hawaiian coot will be referred to as "Hawaiian waterbirds." There is no critical habitat for listed species in the vicinity of this proposed project.

To avoid and minimize potential project impacts to listed species, the following measures are recommended:

Hawaiian hoary bat: The Hawaiian hoary bat roosts in woody vegetation across all islands and will leave their young unattended in trees and shrubs when they forage. If trees or shrubs 15 feet (ft) or taller are cleared during the pupping season, there is a risk that young bats could inadvertently be harmed or killed since they are too young to fly or may not move away. Additionally, Hawaiian hoary bats forage for insects from as low as 3 ft to higher than 500 ft above the ground and can become entangled in barbed wire used for fencing.

To avoid and minimize impacts to the endangered Hawaiian hoary bat we recommend you incorporate the following applicable measures into your project description:

- Do not disturb, remove, or trim woody plants greater than 15 ft tall during the bat-birthing and pup-rearing season (June 1 through September 15).
- Do not use barbed wire for fencing.

Hawaiian goose: The Hawaiian goose are found on the islands of Hawaiʻi, Maui, Molokaʻi, and Kauaʻi. They are observed in a variety of habitats, but prefer open areas, such as pastures, golf courses, wetlands, natural grasslands and shrublands, and lava flows. Threats to the species include introduced mammalian and avian predators, wind facilities, and vehicle strikes.

To avoid and minimize potential project impacts to the Hawaiian goose we recommend you incorporate the following measures into your project description:

- Do not approach, feed, or disturb the Hawaiian goose.

- If a Hawaiian goose is observed loafing or foraging within the project area during the breeding season (September through April), have a biologist familiar with Hawaiian goose nesting behavior survey for nests in and around the project area prior to the resumption of any work. Repeat surveys after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest).
- Cease all work immediately and contact the Service for further guidance if a nest is discovered within a radius of 150 ft of proposed project, or a previously undiscovered nest is found within the 150-ft radius after work begins.
- In areas where Hawaiian goose are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.

Blackburn's sphinx moth: The adult Blackburn's sphinx moth feeds on nectar from native plants, including *Ipomoea pes-caprae* (beach morning glory), *Plumbago zeylanica* (ʻilieʻe), *Capparis sandwichiana* (maiapilo), and others. Blackburn's sphinx moth larvae feed on nonnative *Nicotiana glauca* (tree tobacco) and native, federally listed, *Nothocestrum* spp. (ʻaiea). To pupate, the larvae burrow into the soil and can remain in a state of torpor for a year or more before emerging from the soil. Soil disturbance can result in death of the pupae.

We offer the following survey recommendations to assess whether the Blackburn's sphinx moth occurs within the project area:

- A biologist familiar with the species should survey areas of proposed activities for Blackburn's sphinx moth and its larval host plants prior to work initiation.
    - Surveys should be conducted during the wettest portion of the year (usually November-to-April or several weeks after a significant rain) and within 4-to-6 weeks prior to construction.
    - Surveys should include searches for adults, eggs, larvae, and signs of larval feeding (i.e., chewed stems, frass, or leaf damage).
    - If moths, eggs, larvae, or native ʻaiea or tree tobacco over 3-ft tall, are found during the survey, please contact the Service for additional guidance to avoid impacts to this species.

If no Blackburn's sphinx moth, ʻaiea, or tree tobacco are found during surveys, it is imperative that measures be taken to avoid attraction of Blackburn's sphinx moth to the project location and prohibit tree tobacco from entering the site. Tree tobacco can grow greater than 3-ft tall in approximately 6 weeks. If it grows over 3 ft tall, the plants may become a host plant for Blackburn's sphinx moth. We therefore recommend that you:

- Remove any tree tobacco less than 3-ft tall.
- Monitor the site every 4-to-6 weeks for new tree tobacco growth before, during, and after the proposed ground-disturbing activity.
    - Monitoring for tree tobacco can be completed by any staff, such as groundskeeper or regular maintenance crew, provided with picture placards of tree tobacco at different life stages.

Hawaiian stilt, Hawaiian coot, Hawaiian duck: Hawaiian waterbirds are currently found in a variety of wetland habitats including freshwater marshes and ponds, coastal estuaries and ponds, artificial reservoirs, *Colocasia esculenta* (kalo or taro) lo‘i or patches, irrigation ditches, sewage treatment ponds, and in the case of the Hawaiian duck, montane streams and marshlands. Hawaiian stilts may also be found wherever ephemeral or persistent standing water may occur. Threats to these species include nonnative predators, habitat loss, and habitat degradation. Hawaiian ducks are also subject to threats from hybridization with introduced mallards.

Based on the project details provided, your project may result in the creation of standing water or open water that could attract Hawaiian waterbirds to the project site. In particular, the Hawaiian stilt is known to nest in sub-optimal locations (e.g., any ponding water), if water is present. Hawaiian waterbirds attracted to sub-optimal habitat may suffer adverse impacts, such as predation and reduced reproductive success, and thus the project may create an attractive nuisance. Therefore, we recommend you work with our office during project planning so that we may assist you in developing measures to avoid impacts to listed species (e.g., fencing, vegetation control, predator management).

To avoid and minimize potential project impacts to Hawaiian waterbirds we recommend you incorporate the following measures into your project description:

- In areas where waterbirds are known to be present, post and implement reduced speed limits, and inform project personnel and contractors about the presence of endangered species on-site.
- If water resources are located within or adjacent to the project site, incorporate applicable best management practices regarding work in aquatic environments into the project design (see enclosed Aquatic Best Management Practices).
- Have a biological monitor that is familiar with the species’ biology conduct Hawaiian waterbird nest surveys where appropriate habitat occurs within the vicinity of the proposed project site prior to project initiation. Repeat surveys again within 3 days of project initiation and after any subsequent delay of work of 3 or more days (during which the birds may attempt to nest). If a nest or active brood is found:
    - Contact the Service within 48 hours for further guidance.
    - Establish and maintain a 100-ft buffer around all active nests and/or broods until the chicks/ducklings have fledged. Do not conduct potentially disruptive activities or habitat alteration within this buffer.
    - Have a biological monitor that is familiar with the species’ biology present on the project site during all construction or earth moving activities until the chicks/ducklings fledge to ensure that Hawaiian waterbirds and nests are not adversely impacted.

***Chrysodracon hawaiiensis* and *Achyranthes mutica*:** Project activities may affect listed plant species by causing physical damage to plant parts (roots, stems, flowers, fruits, seeds, etc.) as well as impacts to other life requisite features of their habitat which may result in reduction of germination, growth, and/or reproduction. Cutting and removal of vegetation surrounding listed plants has the potential to alter microsite conditions (e.g., light, moisture, temperature), damaging or destroying the listed plants and also increasing the risk of invasion by nonnative plants which can result in higher incidence or intensity of fire. Activities such as grazing, use of construction equipment and vehicles, and increased human traffic (i.e., trails, visitation, monitoring), can cause ground disturbance, erosion, and/or soil compaction, which decrease absorption of water and nutrients and damage plant root systems and may result in reduced growth and/or mortality of listed plants. Soil disturbance or removal has the potential to negatively impact the soil seed bank of listed plant species if such species are present or historically occurred in the project area.

In order to avoid or minimize potential adverse effects to listed plants that may occur on the proposed project site, we recommend minimizing disturbance outside of existing developed or otherwise modified areas. When disturbance outside existing developed or modified sites is proposed, conduct a botanical survey for listed plant species within the project action area, defined as the area where direct and indirect effects are likely to occur. Surveys should be conducted by a knowledgeable botanist with documented experience in identifying native Hawaiian and Pacific Islands plants, including listed plant species. Botanical surveys should optimally be conducted during the wettest part of the year (typically October to April) when plants and identifying features are more likely to be visible, especially in drier areas. If surveys are conducted outside of the wet season, the Service may assume plant presence.

The boundary of the area occupied by listed plants should be marked with flagging by the surveyor. To avoid or minimize potential adverse effects to listed plants, we recommend adherence to buffer distances for the activities in the **Table below**. Where disturbed areas do not need to be maintained as an open area, restore disturbed areas using native plants as appropriate for the location. Whenever possible we recommend using native plants for landscaping purposes. The following websites are good resources to use when choosing landscaping plants: Landscape Industry Council of Hawaiʻi Native Plant Poster (http://hawaiiscape.wpengine.com/publications/), Native Hawaiian Plants for Landscaping, Conservation, and Reforestation (https://www.ctahr.hawaii.edu/oc/freepubs/pdf/of-30.pdf), and Best Native Plants for Landscapes (https://www.ctahr.hawaii.edu/oc/freepubs/pdf/OF-40.pdf).

If listed plants occur in a project area, the avoidance buffers are recommended to reduce direct and indirect impacts to listed plants from project activities. However, where project activities will occur within the recommended buffer distances, additional consultation is required. The impacts to the plants of concern within the buffer area may be reduced by placing temporary fencing or other barriers at the boundary of the disturbance, as far from the affected plants as practicable.

The above guidelines apply to areas outside of designated critical habitat. If project activities occur within designated critical habitat unit boundaries, additional consultation is required.

All activities, including site surveys, risk introducing nonnative species into project areas. Specific attention needs to be made to ensure that all equipment, personnel and supplies are properly checked and are free of contamination (weed seeds, organic matter, or other contaminants) before entering project areas. Quarantines and or management activities occurring on specific priority invasive species proximal to project areas need to be considered or adequately addressed. This information can be acquired by contacting local experts such as those on local invasive species committees (Hawaiʻi: https://www.biisc.org/).

Table 1. Recommended buffer distances to minimize and avoid potential adverse impacts to listed plants from activities listed below.

<table>
<tr><th colspan="2" rowspan="2">Action</th><th colspan="2">Buffer Distance (feet (meters)) - Keep Project Activity This Far Away from Listed Plant</th></tr>
<tr><th>Grasses/Herbs/Shrubs and Terrestrial Orchids</th><th>Trees and Arboreal Orchids</th></tr>
<tr><td colspan="2">Walking, hiking, surveys</td><td>3 ft (1 m)</td><td>3 ft (1 m)</td></tr>
<tr><td colspan="2">Cutting and Removing Vegetation By Hand or Hand Tools (e.g., weeding)</td><td>3 ft (1 m)</td><td>3 ft (1 m)</td></tr>
<tr><td colspan="2">Mechanical Removal of Individual Plants or Woody Vegetation (e.g., chainsaw, weed eater)</td><td>3 ft up to height of removed vegetation (whichever greater)</td><td>3 ft up to height of removed vegetation (whichever greater)</td></tr>
<tr><td colspan="2">Removal of Vegetation with Heavy Equipment (e.g., bulldozer, tractor, "bush hog")</td><td>2x width equipment + height of vegetation</td><td>820 ft (250 m)</td></tr>
<tr><td colspan="2">Ground/Soil Disturbance/Outplanting/Fencing (Hand tools, e.g., shovel, ‘ō‘ō; Small mechanized tools, e.g., auger)</td><td>20 ft (6 m)</td><td>2x crown diameter</td></tr>
<tr><td colspan="2">Ground/Soil Disturbance (Heavy Equipment)</td><td>328 ft (100 m)</td><td>820 ft (250 m)</td></tr>
<tr><td rowspan="2">Surface Hardening/Soil compaction</td><td>Trails (e.g., human, ungulates)</td><td>20 ft (6 m)</td><td>2x crown diameter</td></tr>
<tr><td>Roads/Utility Corridors, Buildings/Structures</td><td>328 ft (100 m)</td><td>820 ft (250 m)</td></tr>
</table>

Hawaiian petrel, Newell’s shearwater, and Hawai‘i Distinct Population Segment of the band-rumped storm petrel: Hawaiian seabirds may traverse the project area at night during the breeding, nesting, and fledging seasons (March 1 to December 15). Outdoor lighting could result in seabird disorientation, fallout, and injury or mortality. Seabirds are attracted to lights and after circling the lights they may become exhausted and collide with nearby wires, buildings, or other structures or they may land on the ground. Downed seabirds are subject to increased mortality due to collision with automobiles, starvation, and predation by dogs, cats, and other predators. Young birds (fledglings) traversing the project area between September 15 and December 15, in their first flights from their mountain nests to the sea, are particularly vulnerable to light attraction.

To avoid and minimize potential project impacts to seabirds we recommend you incorporate the following measures into your project description:

- Fully shield all outdoor lights so the bulb can only be seen from below.

- Install automatic motion sensor switches and controls on all outdoor lights or turn off lights when human activity is not occurring in the lighted area.
- Avoid nighttime construction during the seabird fledging period, September 15 through December 15.

If this potential project should receive federal funding, federal permits, or any federal authorization, it will require a Section 7 consultation with the Service. The Service only conducts Section 7 consultations with the federal action agency or their designated representative.

Thank you for participating with us in the protection of our endangered species. If you have any further questions or concerns regarding this consultation, please contact Eldridge Naboa, Fish and Wildlife Biologist, 808-284-0037, e-mail: eldridge_naboa@fws.gov. When referring to this project, please include this reference number: ***01EPIF00-2021-SL-0408***.

Sincerely,

Island Team Manager
Maui Nui and Hawai‘i Island

Enclosure (1): Aquatic Best Management Practices

cc: Andrew Hirano, Department of Transportation
Federal Highway Administration Administrative Staff

U.S. Fish and Wildlife Service
Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service (USFWS) recommends the following measures to be incorporated into project planning to avoid or minimize impacts to fish and wildlife resources. Best Management Practices (BMPs) include the incorporation of procedures or materials that may be used to reduce either direct or indirect negative impacts to aquatic habitats that result from project construction-related activities. These BMPs are recommended in addition to, and do not over-ride any terms, conditions, or other recommendations prepared by the USFWS, other federal, state or local agencies. If you have questions concerning these BMPs, please contact the USFWS Aquatic Ecosystems Conservation Program at 808-792-9400.

1. Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

2. Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods. Because these periods are variable throughout the Pacific islands, we recommend contacting the relevant local, state, or Federal fish and wildlife resource agency for site specific guidance.

3. Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. These BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.

4. All project construction-related materials and equipment (i.e., dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project-related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HACCP – see https://www.fws.gov/policy/A1750fw1.html) can help to prevent attraction and introduction of non-native species.

5. Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

6. Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.

7. All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

APPENDIX B
TRAFFIC IMPACT ANALYSIS

TRAFFIC IMPACT ANALYSIS

Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project No. 19D-01-19

South Kohala, Island of Hawaii, HAWAII

August 2021

TRAFFIC IMPACT ANALYSIS

Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches
Project No. 19D-01-19

South Kohala, Island of Hawaii, Hawaii

August 2021

Prepared For:
State of Hawaii Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

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WSP Reference Number:

193025A

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I. INTRODUCTION

The State Department of Transportation, Highways Division (HDOT), in cooperation with Hawaii County (County) and the Federal Highway Administration (FHWA) is proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project in South Kohala on the Island of Hawaii. This project is located along Kawaihae Road at Waiaka Bridge (Mile Post 58.88), and includes the replacement of the existing bridge and the realignment of the roadway approaches toward the bridge.

The proposed project is located in South Kohala, at the intersection of Kawaihae Road and Kohala Mountain Road in the town of Waimea. The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are three build alternatives being considered for the project, each of which replaces the bridge:

- Stop-controlled T-Intersection
- Signalized T-intersection
- Roundabout

This report examines and compares the traffic operations under the No Build alternative and three Build alternatives. The location map is shown in Figure 1.

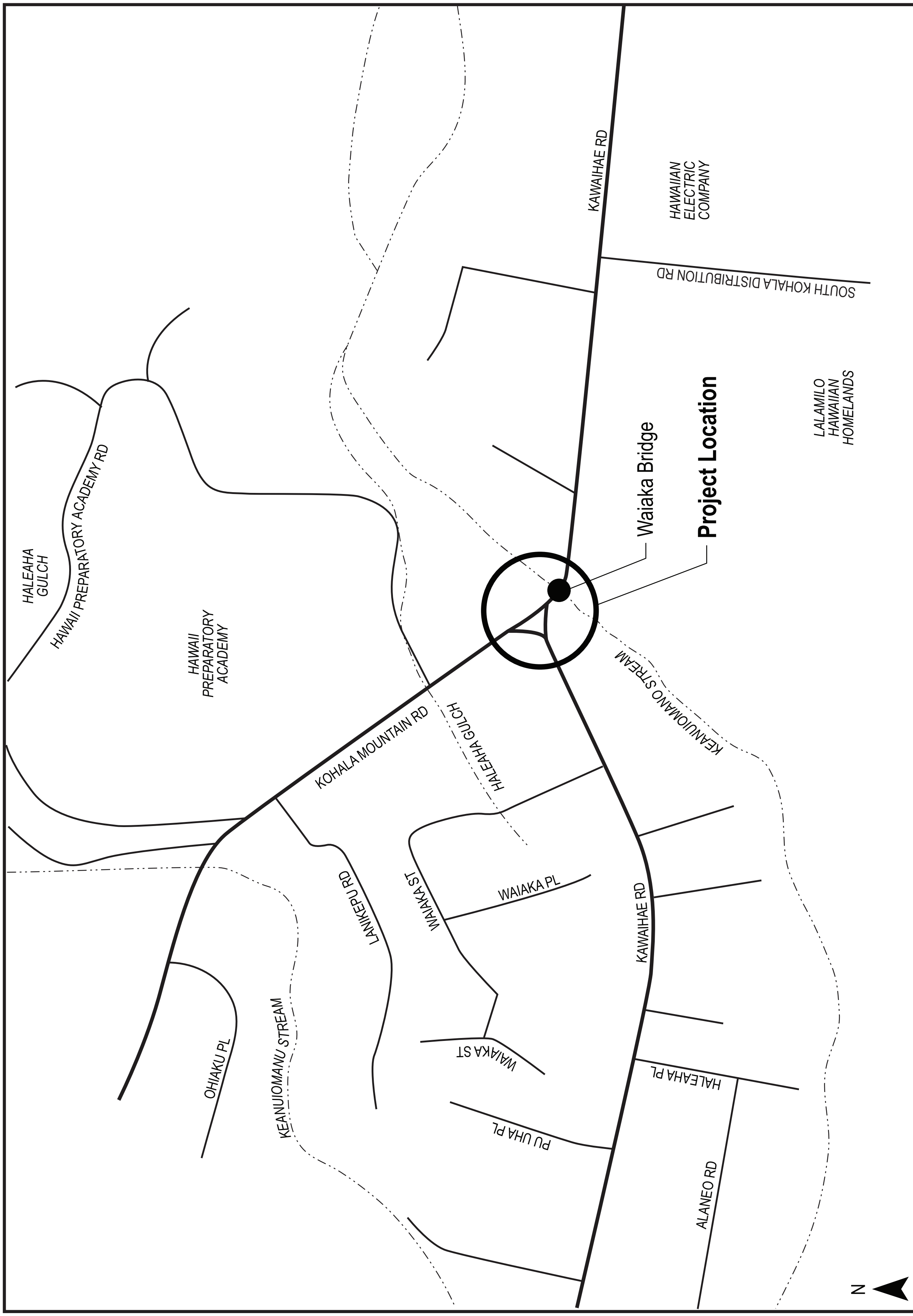


Figure 1

Location Map

II. EXISTING CONDITIONS

A. EXISTING ROADWAY SYSTEM

Kawaihae Road

Route 19 generally follows the coastline, connecting Kailua-Kona and Hilo through Waimea in the South Kohala area. Within the project area, Route 19 is called Kawaihae Road and is a two-lane, undivided principal arterial. Within the project area, the posted speed limit is 25 miles per hour (mph).

Kawaihae Road provides primary regional and sub-regional access within the project area.

Kohala Mountain Road

Kohala Mountain Road, or Route 250, is a two-lane, undivided major collector roadway which connects Waimea to the Kapaau area to the north. The posted speed limit is 25 mph in the immediate vicinity of Kawaihae Road.

B. EXISTING INTERSECTION GEOMETRY AND CONTROL

Existing traffic conditions were observed and documented, and operations of study area intersections were analyzed. The existing intersection operational characteristics established base conditions for comparison to future operations.

Traffic-related data was collected for each of the study intersections. Traffic turning movement counts, field observations of intersection operations, and general intersection characteristics were noted. Geometric lane configurations and intersection traffic control data were collected. Intersection geometry inventory included the following:

- Number of lanes and lane widths,
- Unsignalized intersection control, and
- Posted speed limits.

The existing lane configurations are shown in Figure 2. These data were used as inputs into the intersection analyses. Appendix A contains the traffic count data.

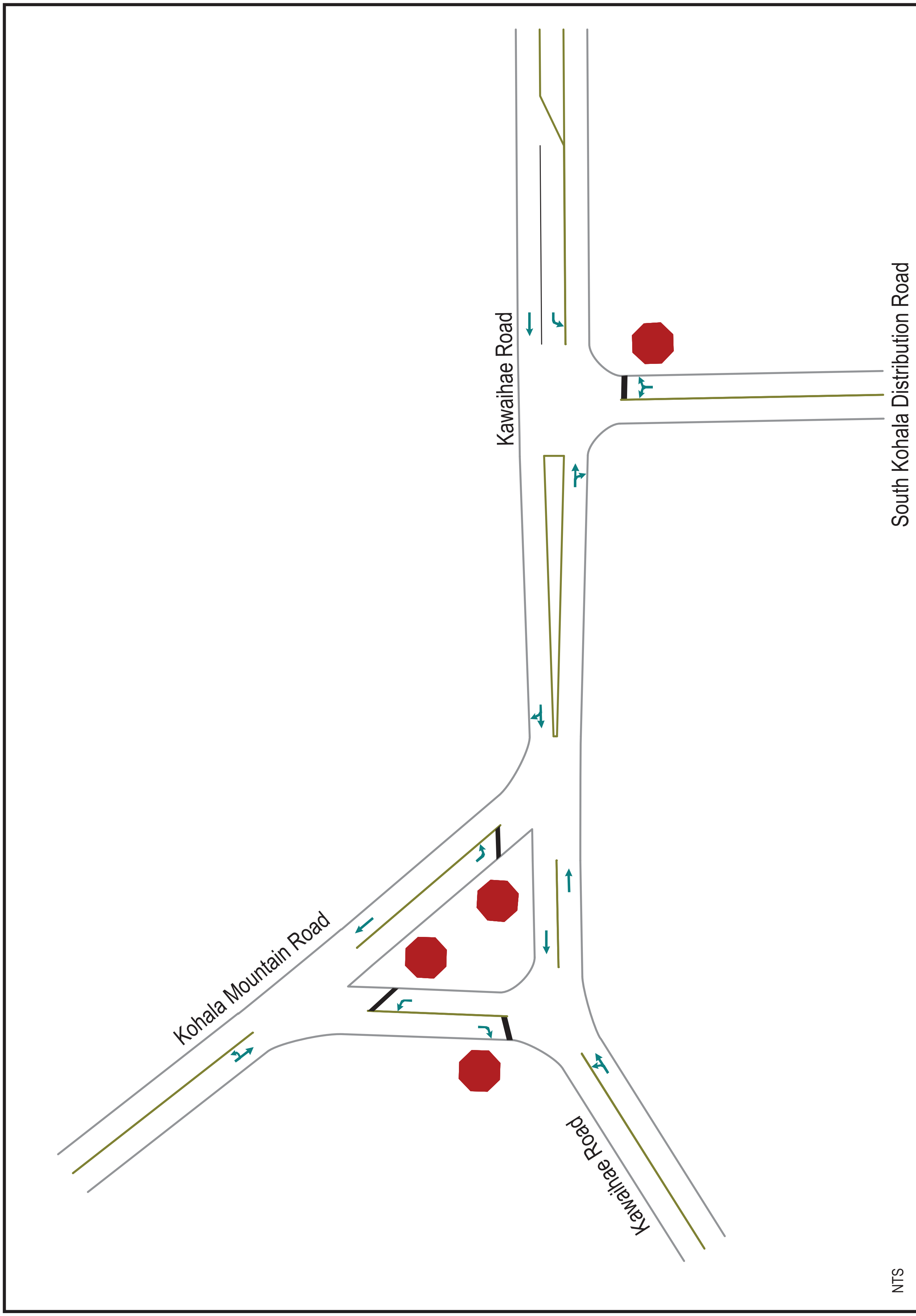


Figure 2

Existing Lane Configurations

C. EXISTING TRAFFIC VOLUMES

Traffic turning movement counts were conducted on Tuesday, January 19, 2021 during the AM and PM peak hours at the following intersections:

- Kawaihae Road/Kohala Mountain Road and
- Kawaihae Road/South Kohala Distribution Road

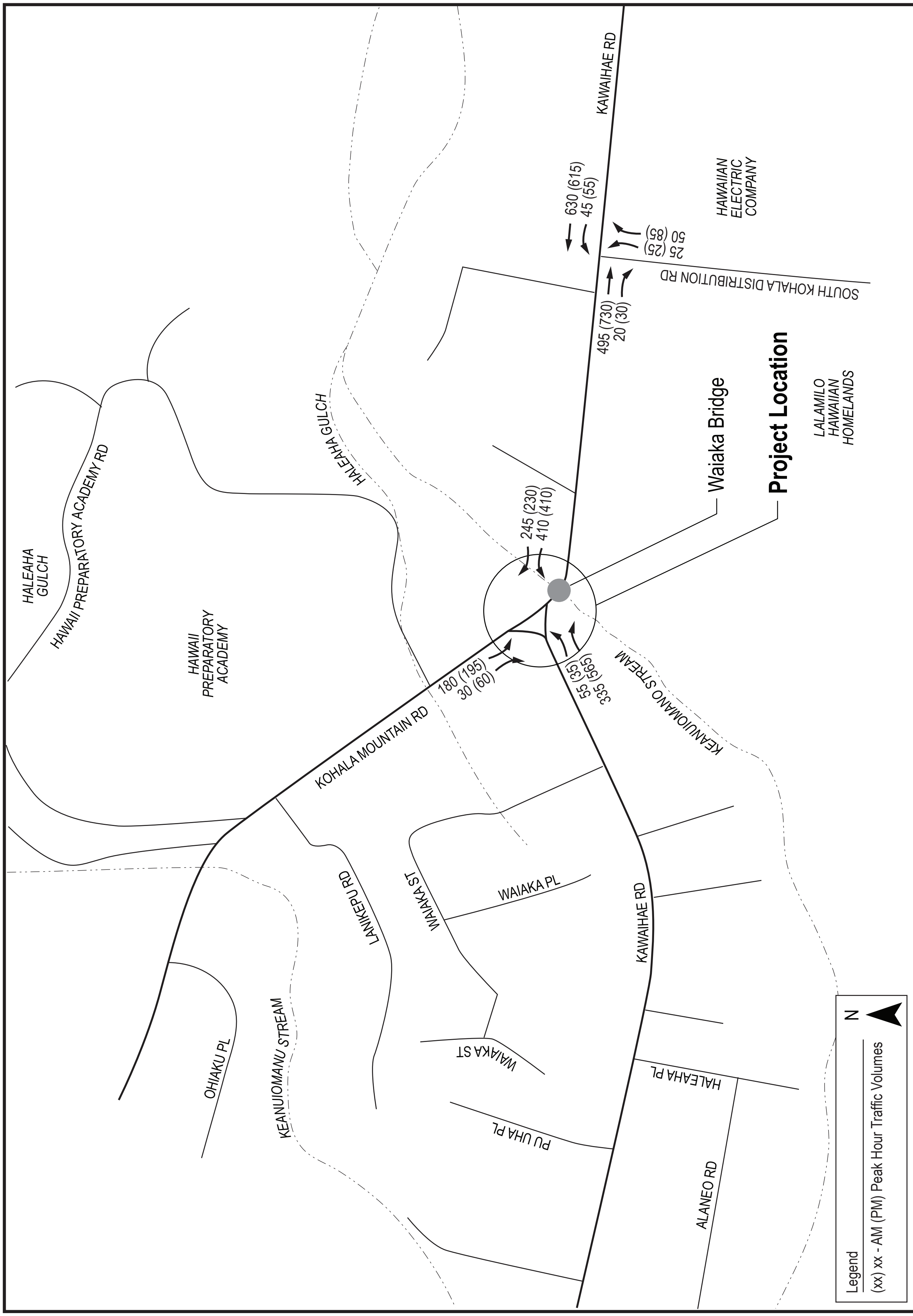
The AM and PM peak hours were found to occur from 7:30 AM to 8:30 AM and from 3:00 PM to 4:00 PM, respectively. Existing 2021 traffic counts were compared with pre-pandemic traffic counts in order to estimate 2021 volumes. These calculated existing traffic volumes are shown in Figure 3 at the study area intersections. Pedestrians and bicyclists were also counted. Zero peak hour crossing pedestrians were observed either intersection. At the Kawaihae Road/Kohala Mountain Road intersection, 4 total cyclists were counted during the AM peak hour and 6 were counted during the PM peak hour. At the Kawaihae Road/South Kohala Distribution Road intersection, 3 total cyclists were counted during the AM peak and 5 cyclists were counted during the PM peak hour.

Existing traffic count data can be found in Appendix A.

D. EXISTING TRAFFIC OPERATIONS

The intersections were analyzed in Synchro 10 using the methodologies for unsignalized intersections outlined in the *Highway Capacity Manual 6th Edition (HCM6).* Operating conditions at an intersection by approach are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. The overall intersection LOS is a weighted average of the LOS of individual traffic movement groups. Appendix B has more detailed definitions of intersection LOS. Appendix C contains the Synchro worksheets.

Field observations were performed at selected intersections to verify the results of the intersection analyses. Table 1 displays the existing conditions LOS for each intersection. The volume-to-capacity ratio (v/c), which represents the traffic volume divided by the available capacity, is included as well.



Existing Peak Hour Traffic Turning Movement Volumes

Figure 3

Table 1 Existing Level of Service

<table>
<tr><th colspan="4">Existing</th><th colspan="3">AM Peak Hour</th><th colspan="3">PM Peak Hour</th></tr>
<tr><th>Intersection</th><th colspan="2">Movement</th><th>Lane Config</th><th>v/c Ratio</th><th>Delay</th><th>LOS</th><th>v/c Ratio</th><th>Delay</th><th>LOS</th></tr>
<tr><td rowspan="5">Kawaihae Rd /Kohala Mountain Rd</td><td rowspan="2">Kawaihae Rd EB to Kohala Mountain Rd NB</td><td>Left from Kawaihae Rd</td><td>L/T</td><td>0.10</td><td>8.5</td><td>A</td><td>0.04</td><td>8.4</td><td>A</td></tr>
<tr><td>Left to Kohala Mountain Rd</td><td>L</td><td>0.13</td><td>13.0</td><td>B</td><td>0.08</td><td>12.6</td><td>B</td></tr>
<tr><td>Kohala Mountain Rd SB to Kawaihae Rd EB</td><td>Left to Kawaihae Rd</td><td>L</td><td>0.67</td><td>39.5</td><td>E</td><td>1.01</td><td>114.1</td><td>F</td></tr>
<tr><td>Kohala Mountain Rd SB to Kawaihae Rd WB</td><td>Right to Kawaihae Rd</td><td>R</td><td>0.06</td><td>11.6</td><td>B</td><td>0.12</td><td>11.9</td><td>B</td></tr>
<tr><td colspan="3">Overall</td><td colspan="3">Unsignalized</td><td colspan="3">Unsignalized</td></tr>
<tr><td rowspan="3">Kawaihae Rd /South Kohala Distribution Rd</td><td colspan="2">Kawaihae Rd WB to South Kohala Distribution Rd SB</td><td>L</td><td>0.05</td><td>8.8</td><td>A</td><td>0.08</td><td>9.9</td><td>A</td></tr>
<tr><td colspan="2">South Kohala Distribution Rd NB to Kawaihae Road WB</td><td>L/R</td><td>0.27</td><td>21.9</td><td>C</td><td>0.52</td><td>36.2</td><td>E</td></tr>
<tr><td colspan="3">Overall</td><td colspan="3">Unsignalized</td><td colspan="3">Unsignalized</td></tr>
</table>

Delay expressed in seconds per vehicle.

E. SUMMARY OF RESULTS

Overall the study area intersections operate better during the AM peak hour than during the PM peak hour under existing conditions. Several issues and discussion points were identified under the existing conditions:

- Kawaihae Road/Kohala Mountain Road
    - The eastbound Kawaihae Road left turn to Kohala Mountain Road is performed from a shared left/through lane on Kawaihae Road followed by a stop-controlled left turn to Kohala Mountain Road. During the AM and PM peak hours, the eastbound Kawaihae Road shared left/through movement operates at LOS A while the stop-controlled left turn to Kohala Mountain Road operates at LOS B.
    - The southbound left turn to Kawaihae Road operates at LOS E during the AM peak and at LOS F during the PM peak. In particular, significant queuing can occur between 3:45 PM and 4:00 PM.
    - The southbound right turn to Kawaihae Road operates at LOS B during both peak hours.
- Kawaihae Road/South Kohala Distribution Road
    - A 125’ storage lane is provided for the westbound left turn from Kawaihae Road to South Kohala Distribution Road. The left turn operates at LOS A during both peak hours.
    - The northbound South Kohala Distribution Road approach operates at LOS C during the AM peak hour and at LOS E during the PM peak hour.

III. FUTURE TRAFFIC CONDITIONS

The year 2024 was chosen as the future analysis year based on the anticipated completion of the project.

A. FUTURE TRAFFIC VOLUMES

No new development is anticipated in the vicinity of the project. An annual regional growth rate of 0.5% was used, which was based on Annual Average Daily Traffic (AADT) at Waiaka Bridge between 2012 and 2019. The growth rate was applied linearly to the existing 2021 traffic volumes to obtain projected 2021 traffic volumes at the two study area intersections. These projections are shown in Figure 4.

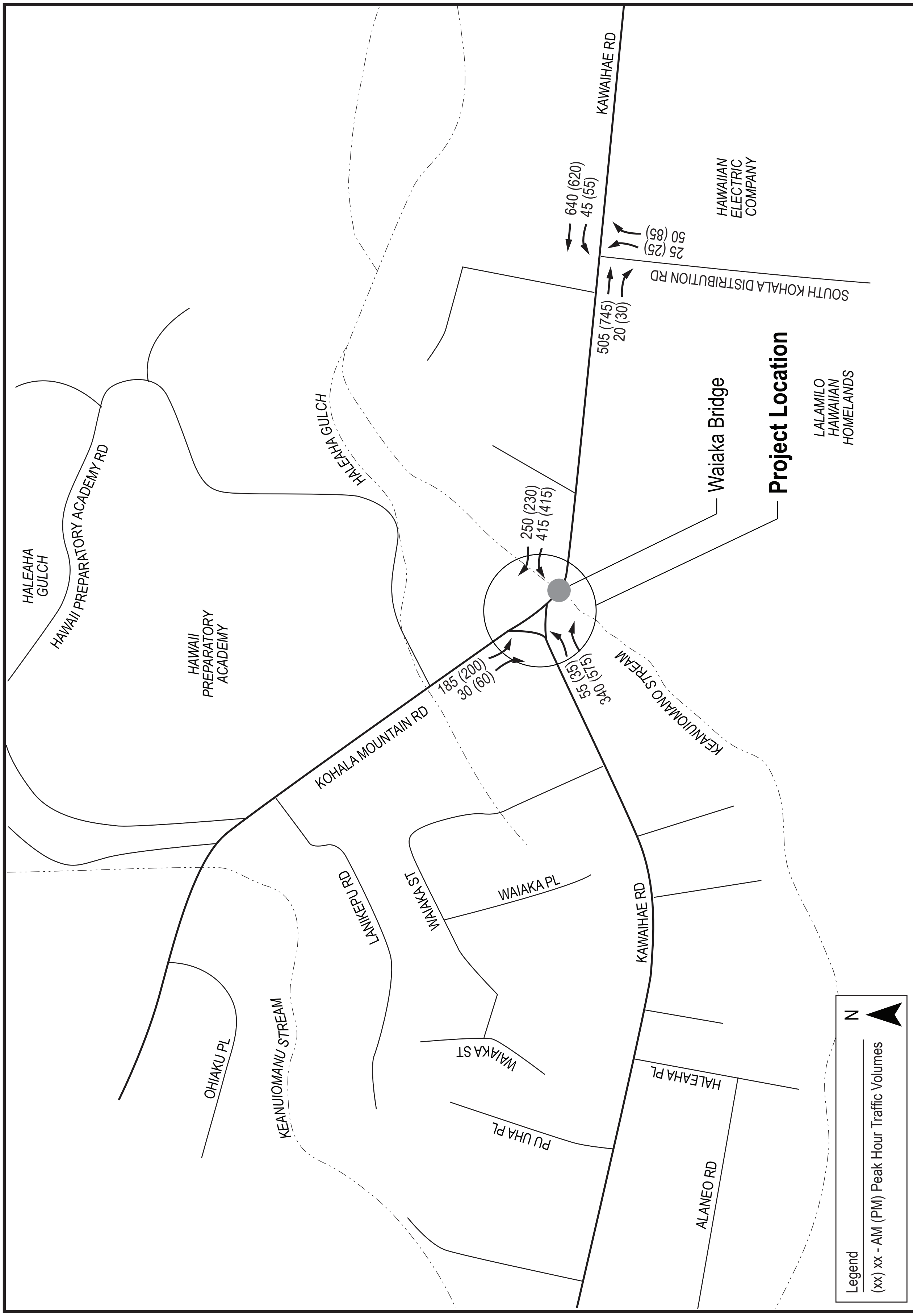
B. FUTURE TRAFFIC OPERATIONS

The AM and PM peak hours were analyzed for the 2024 analysis year for the No Build and Build scenarios.

1. No Build

The No Build scenario assumes that the configuration of the Kawaihae Road/Kohala Mountain Road intersection will remain the same as it currently exists. The projected LOS and delay are shown in Table 2. The projected future traffic volume is not expected to increase substantially so the delays and LOS are anticipated to remain similar to existing conditions.

- Kawaihae Road/Kohala Mountain Road
  - The eastbound Kawaihae Road left turn to Kohala Mountain Road will be performed from a shared left/through lane on Kawaihae Road followed by a stop-controlled left turn to Kohala Mountain Road. During the AM and PM peak hours, the eastbound Kawaihae Road shared left/through movement is projected to operate at LOS A and the stop-controlled left turn to Kohala Mountain Road is projected to operate at LOS B.
  - The southbound left turn to Kawaihae Road is projected to operate at LOS E during the AM peak and at LOS F during the PM peak.
  - The southbound right turn to Kawaihae Road is projected to operate at LOS B during both peak hours.



Projected 2024 Peak Hour Traffic Turning Movement Volumes

Figure 4

Table 2 Projected 2024 No Build Level of Service

Existing				AM Peak Hour			PM Peak Hour		
Intersection	Movement		Lane Config	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Kawaihae Rd /Kohala Mountain Rd	Kawaihae Rd EB to Kohala Mountain Rd NB	Left from Kawaihae Rd	L/T	0.06	8.6	A	0.04	8.5	A
		Left to Kohala Mountain Rd	L	0.13	13.1	B	0.08	12.7	B
	Kohala Mountain Rd SB to Kawaihae Rd EB	Left to Kawaihae Rd	L	0.70	42.7	E	1.07	130.6	F
	Kohala Mountain Rd SB to Kawaihae Rd WB	Right to Kawaihae Rd	R	0.06	11.7	B	0.12	11.9	B
	Overall			Unsignalized			Unsignalized		
Kawaihae Rd /South Kohala Distribution Road	Kawaihae Rd WB to South Kohala Distribution Rd SB		L	0.05	8.8	A	0.08	10.0	B
	South Kohala Distribution Rd NB to Kawaihae Road WB		L/R	0.28	22.5	C	0.53	37.8	E
	Overall			Unsignalized			Unsignalized		

Delay expressed in seconds per vehicle.

- Kawaihae Road/South Kohala Distribution Road
  - The westbound Kawaihae Road left turn is projected to operate at LOS A during the AM peak hour and at LOS B during the PM peak hour.
  - The northbound South Kohala Distribution Road approach is projected to operate at LOS C during the AM peak hour and at LOS E during the PM peak hour.

2. Build

The Build scenario assumes that the Kawaihae Road/Kohala Mountain Road intersection will be modified. Three alternatives are being considered:

- Stop-controlled T-intersection – The intersection would be shifted south and reconfigured as a T-intersection with stop control at the Kohala Mountain Road approach. It was assumed that a left turn storage lane would be provided for the eastbound Kawaihae Road left turn movement.

- Signalized T-intersection – The intersection would be reconfigured as a T-intersection with a traffic signal. It was assumed that a left turn storage lane would be provided for the eastbound Kawaihae left turn movement.
- Roundabout – The intersection would be configured as a roundabout.

The T-intersection configurations are shown in Figure 5. The roundabout configuration is shown in Figure 6.

a) Stop-Controlled T-Intersection

This scenario examines the Kawaihae Road/Kohala Mountain Road intersection being reconfigured to a stop-controlled T-intersection. A left turn storage lane would be provided for eastbound Kawaihae Road left turns. The southbound Kohala Mountain Road approach was assumed to be a single lane due to the low number of right-turning vehicles.

The projected LOS and delay are shown in Table 3.

Table 3 Projected 2024 Stop-Control Level of Service

Existing			AM Peak Hour			PM Peak Hour		
Intersection	Movement	Lane Config	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Kawaihae Rd /Kohala Mountain Rd	Kawaihae Rd EB Left	L	0.08	9.7	A	0.05	9.4	A
	Kohala Mountain Rd SB Left/Right	L/R	1.17	>50.0	F	1.65	>50.0	F
	Overall		Unsignalized			Unsignalized		

Delay expressed in seconds per vehicle.

- Kawaihae Road/Kohala Mountain Road
    - It is assumed that a left turn storage lane will be provided for the eastbound Kawaihae Road left turn. During the AM and PM peak hours, the eastbound Kawaihae Road left turn movement is projected to operate at LOS A.

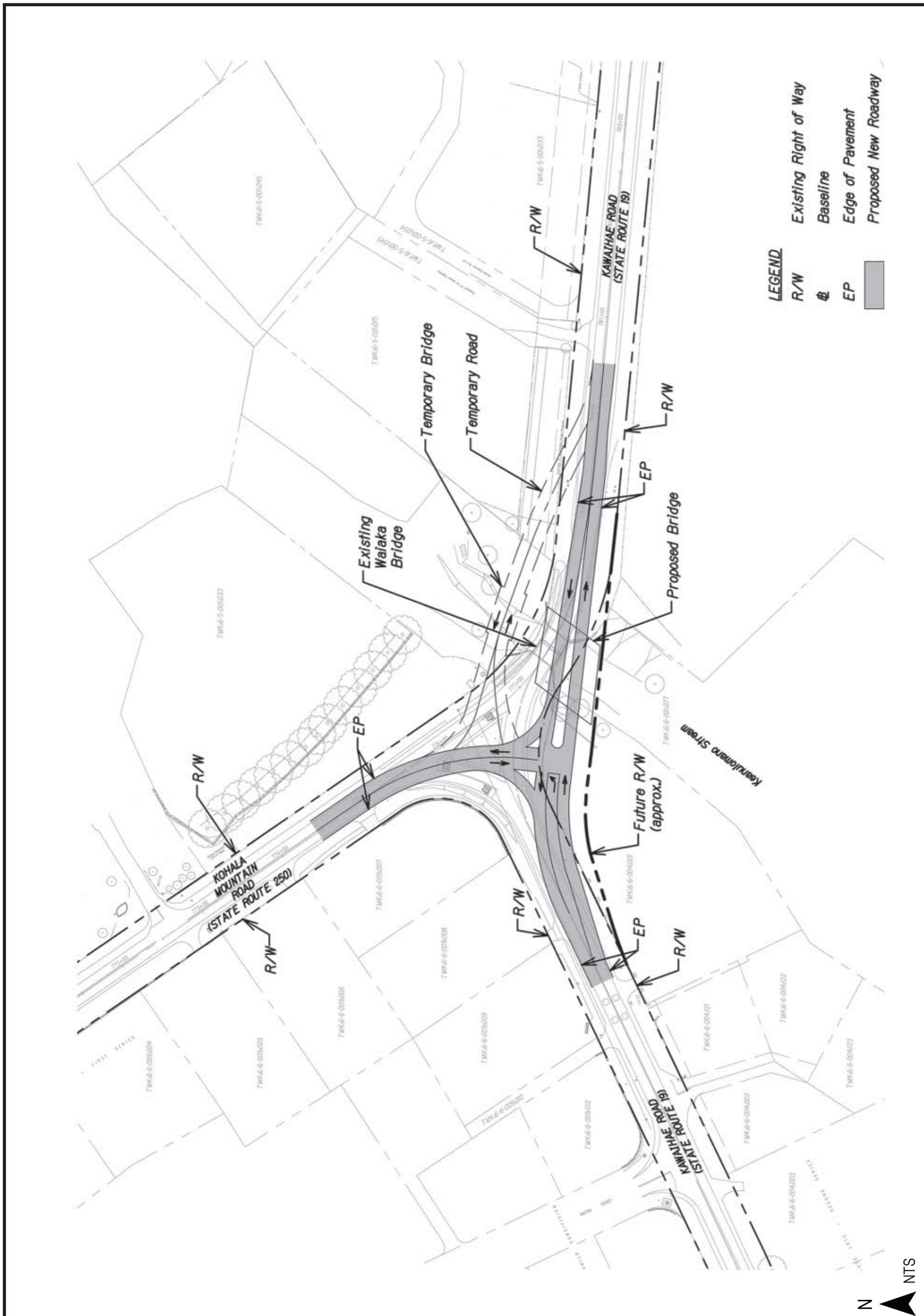


Figure
5

Projected T-Intersection Configuration

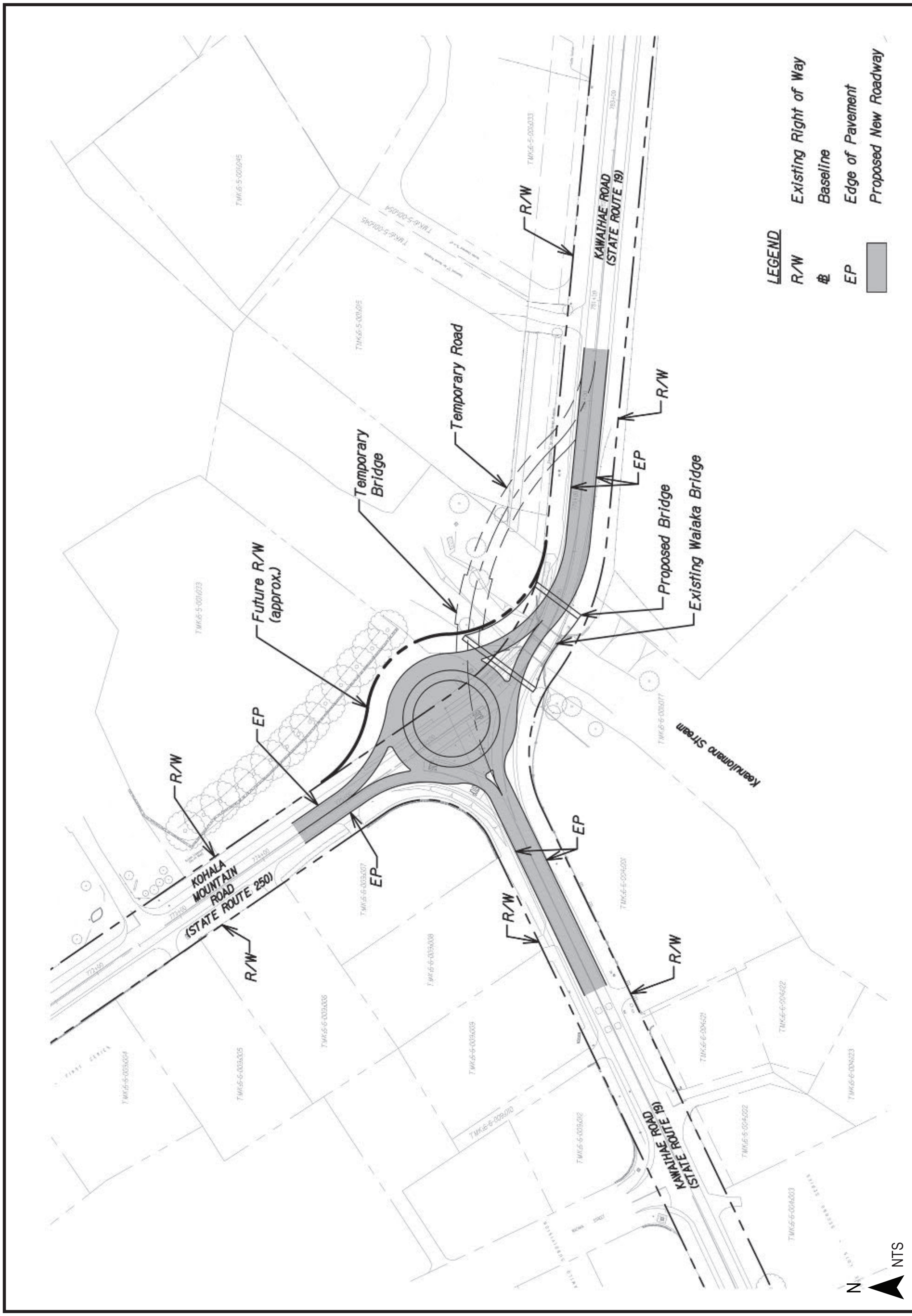


Figure 6

Projected Roundabout Configuration

- The southbound Kohala Mountain Road approach is projected to operate at LOS F during both peak hours with a higher v/c ratio and delay during the PM peak.

b) <u>Signalized T-Intersection</u>

This scenario examines the Kawaihae Road/Kohala Mountain Road intersection being reconfigured to a signalized T-intersection. A left turn storage lane would be provided for eastbound Kawaihae Road left turns. The southbound Kohala Mountain Road approach was assumed to be a single lane due to the low number of right-turning vehicles.

The projected LOS and delay are shown in Table 4.

Table 4 Projected 2024 Signalized Level of Service

Existing		AM Peak Hour			PM Peak Hour		
Intersection	Movement	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Kawaihae Rd /Kohala Mountain Rd	Kawaihae Rd EB Left	0.30	27.7	C	0.16	22.1	C
	Kawaihae Rd EB Through	0.40	9.3	A	0.69	14.2	B
	Kawaihae Rd WB Through/Right	0.86	22.1	C	0.80	18.3	B
	Kohala Mountain Rd SB Left/Right	0.47	19.7	B	0.57	21.8	C
	Overall		18.5	B		17.4	B

Delay expressed in seconds per vehicle.

- Kawaihae Road/Kohala Mountain Road
  - Overall the intersection is projected to operate at LOS B during the AM and PM peak hours.
  - It is assumed that a left turn storage lane will be provided for the eastbound Kawaihae Road left turn. During the AM and PM peak hours, the eastbound Kawaihae Road left turn movement is projected to operate at LOS C.
  - The southbound Kohala Mountain Road approach is projected to operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

c) Roundabout

This scenario examines the Kawaihae Road/Kohala Mountain Road intersection being reconfigured to a roundabout. A single approach lane would be provided for each leg of the roundabout and no bypass lanes are assumed.

The intersection was analyzed in SIDRA 9 using the methodologies for roundabouts outlined in the *HCM6.* Appendix D contains the SIDRA worksheets. The projected LOS and delay are shown in Table 5.

Table 5 Projected 2024 Roundabout Level of Service

Existing			AM Peak Hour			PM Peak Hour		
Intersection	Movement	Lane Config	v/c Ratio	Delay	LOS	v/c Ratio	Delay	LOS
Kawaihae Rd /Kohala Mountain Rd	Kawaihae Rd EB Approach	L/R	0.36	6.9	A	0.59	11.2	A
	Kawaihae Rd WB Approach	L/R	0.54	9.0	A	0.50	8.0	A
	Kohala Mountain Rd SB Approach	L/R	0.25	6.8	A	0.30	7.4	A
	Overall		0.54	8.0	A	0.59	9.2	A

Delay expressed in seconds per vehicle.
HCM6 delay shown.

- Kawaihae Road/Kohala Mountain Road
  - Overall, the intersection is projected to operate at LOS A overall during both peak hours.
  - All approaches are projected to operate at LOS A during both the AM and PM peak hours.

IV. CONCLUSIONS & RECOMMENDATIONS

A. CONCLUSIONS

The following are concluded:

- Under existing conditions, the left turn from southbound Kohala Mountain Road to eastbound Kawaihae Road at the Kawaihae Road/Kohala Mountain Road intersection experiences LOS E conditions during the AM peak hour and LOS F conditions during the PM peak hour with significant queuing. At the Kawaihae Road/South Kohala Distribution Road intersection, the South Kohala Distribution Road approach operates at LOS E during the PM peak hour.
- In the 2024 analysis year, the No Build is expected to experience the same delays for the aforementioned left turn. The South Kohala Distribution Road approach is projected to operate at LOS E during the PM peak hour.
- In the Build scenario where the intersection is reconfigured to a stop-controlled T-intersection, the Kohala Mountain Road approach is projected to experience high delay and queuing.
- In the Build scenario where the intersection is reconfigured as a signalized T-intersection, the intersection is projected to operate at LOS B overall.
- In the Build scenario where the intersection is reconfigured as a roundabout, the intersection is projected to operate at LOS A overall.

B. RECOMMENDATIONS

Based on the intersection operational analyses, it is recommended that the following transportation improvements be constructed:

1. Kawaihae Road/Kohala Mountain Road
    a. Reconstruct the intersection as a roundabout. Provide single lane approaches with no bypass lanes.
2. Kawaihae Road/South Kohala Distribution Road
    a. Consider providing a refuge lane for left turn from northbound South Kohala Distribution Road to westbound Kawaihae Road in the event that the land southwest of the intersection is developed.

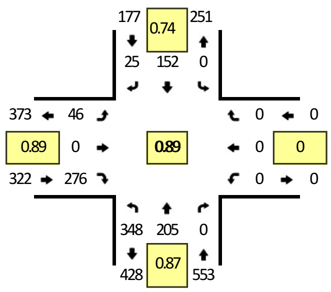
Appendix A Traffic Count Data

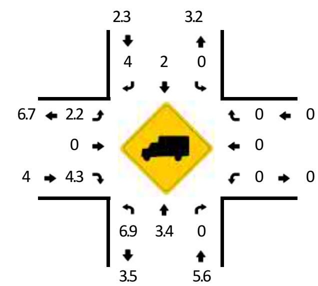
LOCATION: Kohala Mountain Rd -- Kawaihae Rd | **QC JOB #:** 15329601

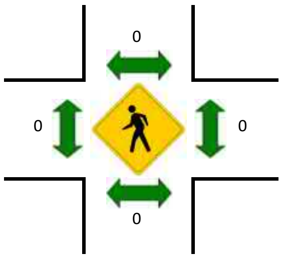
CITY/STATE: Waimea, HI | **DATE:** Tue, Jan 19 2021

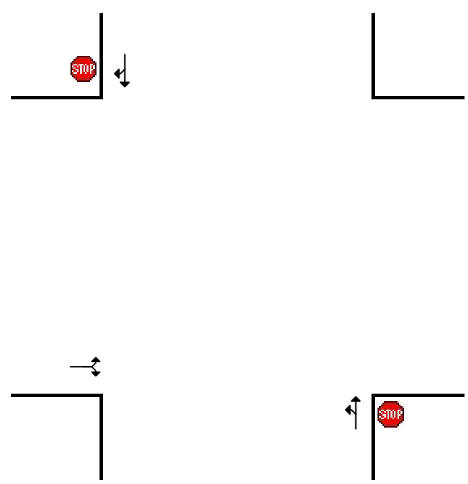
Peak-Hour: 7:30 AM -- 8:30 AM

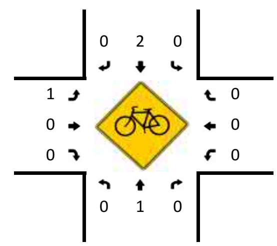
Peak 15-Min: 8:15 AM -- 8:30 AM

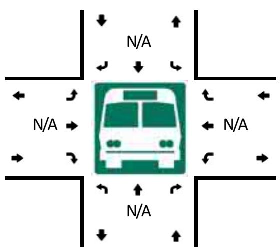


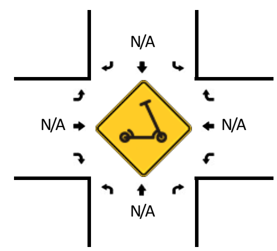












15-Min Count Period Beginning At	Kohala Mountain Rd (Northbound)				Kohala Mountain Rd (Southbound)				Kawaihae Rd (Eastbound)				Kawaihae Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	89	9	0	0	0	10	2	0	0	0	15	0	0	0	0	0	125	
6:15 AM	81	6	0	0	0	13	3	0	2	0	22	0	0	0	0	0	127	
6:30 AM	96	14	0	0	0	14	0	0	0	0	17	0	0	0	0	0	141	
6:45 AM	70	8	0	0	0	17	1	0	1	0	41	0	0	0	0	0	138	531
7:00 AM	82	19	0	0	0	10	1	0	0	0	36	0	0	0	0	0	148	554
7:15 AM	79	14	0	0	0	20	3	0	2	0	49	0	0	0	0	0	167	594
7:30 AM	90	26	0	0	0	36	4	0	5	0	85	0	0	0	0	0	246	699
7:45 AM	83	41	0	0	0	31	0	0	2	0	81	0	0	0	0	0	238	799
8:00 AM	88	66	0	0	0	36	10	0	20	0	51	0	0	0	0	0	271	922
8:15 AM	87	72	0	0	0	49	11	0	19	0	59	0	0	0	0	0	297	1052
8:30 AM	70	20	0	0	0	24	6	0	8	0	54	0	0	0	0	0	182	988
8:45 AM	83	12	0	0	0	16	2	0	4	0	77	0	0	0	0	0	194	944

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	348	288	0	0	0	196	44	0	76	0	236	0	0	0	0	0	1188
Heavy Trucks	20	20	0		0	4	4		0	0	16		0	0	0		64
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		4	0	0		0	0	0		4
Scooters																	

Comments:

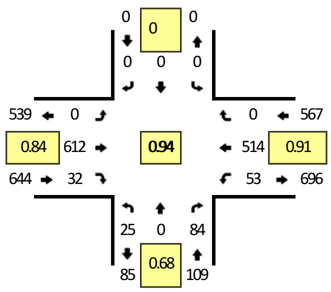
Report generated on 1/25/2021 7:27 AM

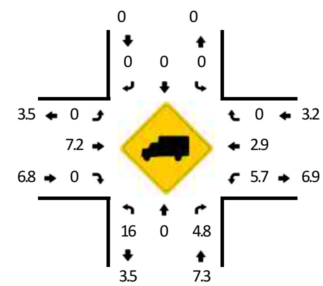
SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

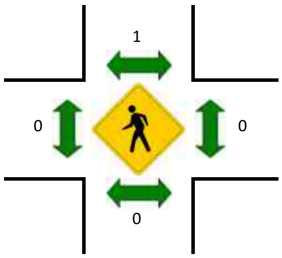
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

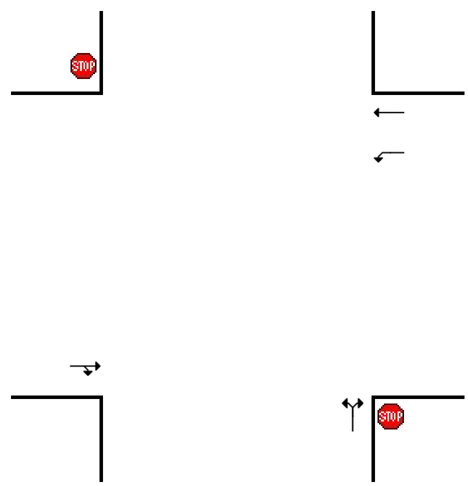
LOCATION: Waimea Solid Waste Transfer Station Dwy -- Kawaihae Rd | **QC JOB #:** 15329604
CITY/STATE: Waimea, HI | **DATE:** Tue, Jan 19 2021

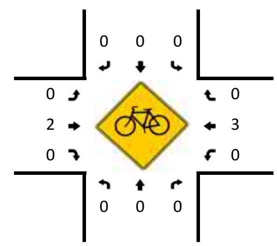
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM

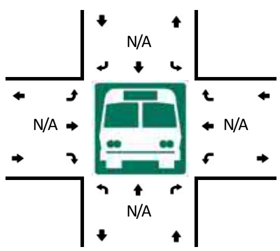


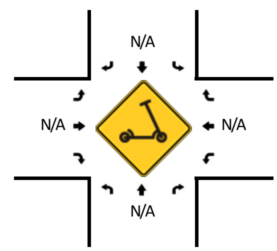












15-Min Count Period Beginning At	Waimea Solid Waste Transfer Station Dwy (Northbound)				Waimea Solid Waste Transfer Station Dwy (Southbound)				Kawaihae Rd (Eastbound)				Kawaihae Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	12	0	28	0	0	0	0	0	0	148	11	0	15	111	0	0	325	
3:15 PM	4	0	21	0	0	0	0	0	0	108	6	0	18	137	0	0	294	
3:30 PM	4	0	12	0	0	0	0	0	0	171	9	0	11	145	0	0	352	
3:45 PM	5	0	23	0	0	0	0	0	0	185	6	0	9	121	0	0	349	1320
4:00 PM	3	0	17	0	0	0	0	0	0	107	3	0	7	107	0	0	244	1239
4:15 PM	5	0	13	0	0	0	0	0	0	162	9	0	11	89	0	0	289	1234
4:30 PM	5	0	14	0	0	0	0	0	0	130	8	0	8	87	0	0	252	1134
4:45 PM	5	0	16	0	0	0	0	0	0	87	7	0	14	89	0	0	218	1003
5:00 PM	3	0	11	0	0	0	0	0	0	96	6	0	9	97	0	0	222	981
5:15 PM	4	0	11	0	0	0	0	0	0	93	6	0	8	109	0	0	231	923
5:30 PM	4	0	13	0	0	0	0	0	0	106	11	0	7	67	0	0	208	879
5:45 PM	6	0	14	0	0	0	0	0	0	96	5	0	10	70	0	0	201	862

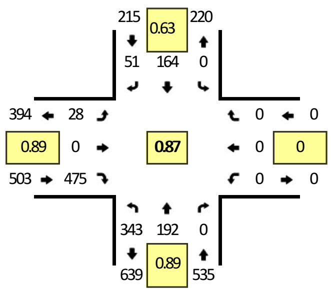
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	16	0	48	0	0	0	0	0	0	684	36	0	44	580	0	0	1408
Heavy Trucks	0	0	0		0	0	0		0	52	0		4	16	0		72
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	12	0		12
Scooters																	

Comments:

Report generated on 1/25/2021 7:27 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

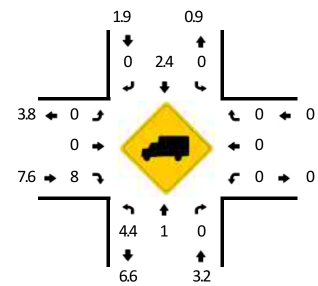
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

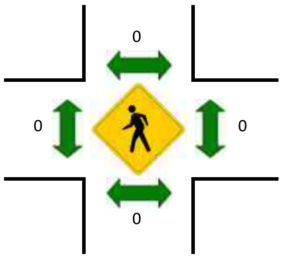
LOCATION: Kohala Mountain Rd -- Kawaihae Rd | **QC JOB #:** 15329602
CITY/STATE: Waimea, HI | **DATE:** Tue, Jan 19 2021

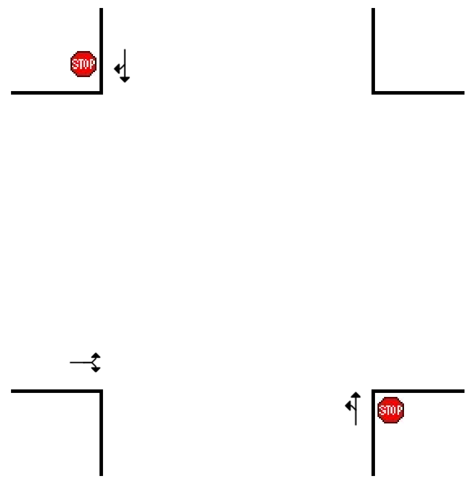


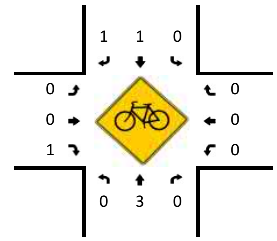
Peak-Hour: 3:00 PM -- 4:00 PM
Peak 15-Min: 3:30 PM -- 3:45 PM

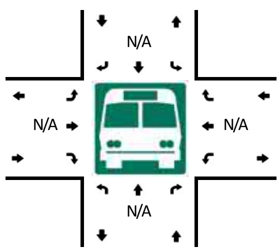
Quality Counts
DATA THAT DRIVES COMMUNITIES

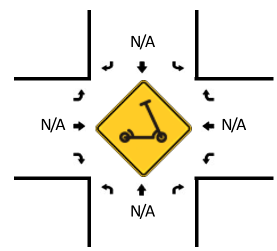












15-Min Count Period Beginning At	Kohala Mountain Rd (Northbound)				Kohala Mountain Rd (Southbound)				Kawaihae Rd (Eastbound)				Kawaihae Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	74	31	0	0	0	33	3	0	3	0	119	0	0	0	0	0	263	
3:15 PM	93	55	0	0	0	19	4	0	6	0	97	0	0	0	0	0	274	
3:30 PM	84	66	0	0	0	50	20	0	14	0	128	0	0	0	0	0	362	
3:45 PM	92	40	0	0	0	62	24	0	5	0	131	0	0	0	0	0	354	1253
4:00 PM	86	22	0	0	0	51	5	0	2	0	71	0	0	0	0	0	237	1227
4:15 PM	73	27	0	0	0	20	8	0	2	0	143	0	0	0	0	0	273	1226
4:30 PM	71	20	0	0	0	20	7	0	3	0	127	0	0	0	0	0	248	1112
4:45 PM	62	25	0	0	0	16	6	0	2	0	75	0	0	0	0	0	186	944
5:00 PM	75	26	0	0	0	16	4	0	4	0	87	0	0	0	0	0	212	919
5:15 PM	75	42	0	0	0	38	9	0	7	0	50	0	0	0	0	0	221	867
5:30 PM	49	25	0	0	0	36	13	0	5	0	92	0	0	0	0	0	220	839
5:45 PM	53	22	0	0	0	17	1	0	1	0	79	0	0	0	0	0	173	826

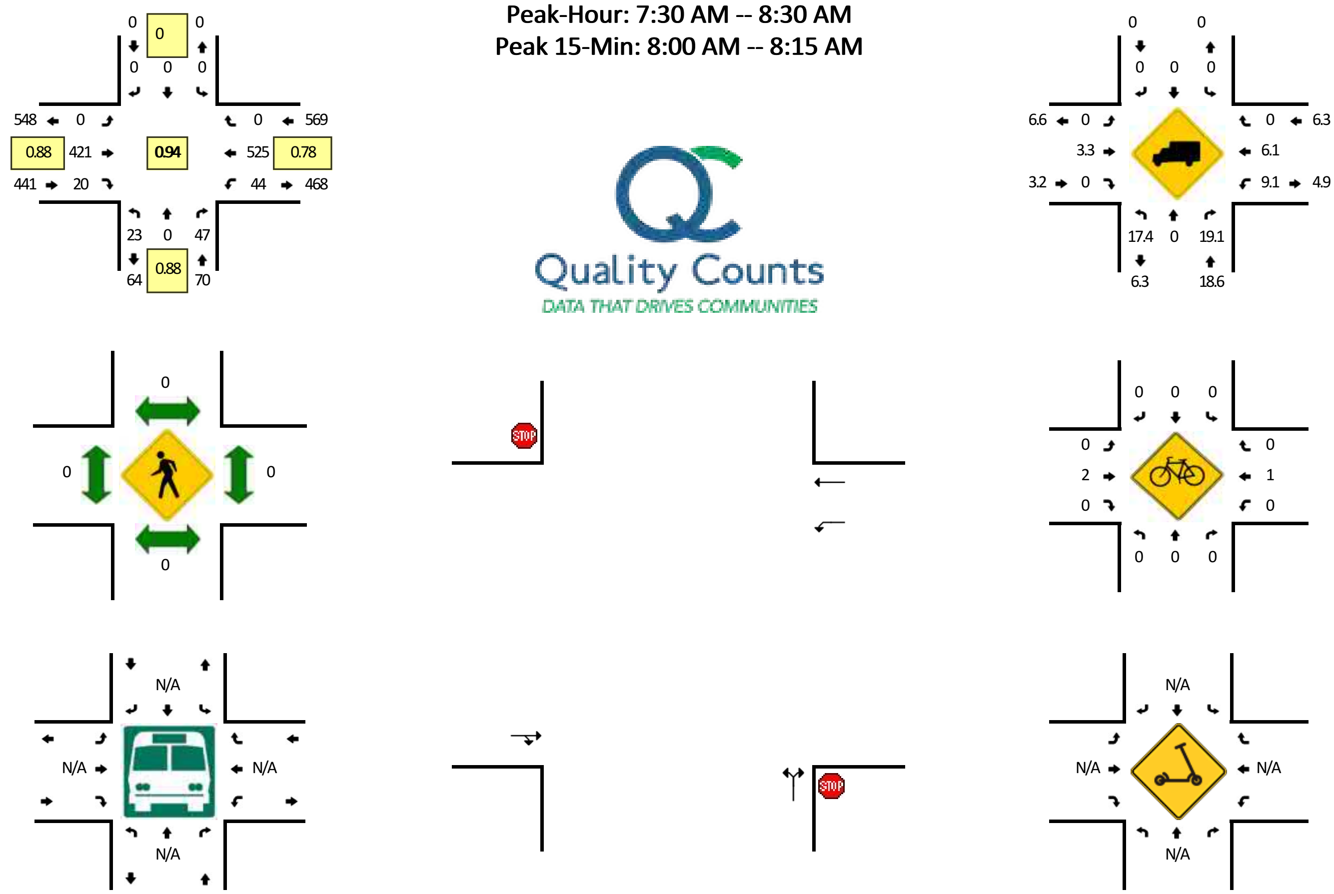
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	336	264	0	0	0	200	80	0	56	0	512	0	0	0	0	0	1448
Heavy Trucks	12	0	0		0	0	0		0	0	48		0	0	0		60
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	12	0		0	0	0		0	0	0		0	0	0		12
Scooters																	

Comments:

Report generated on 1/25/2021 7:27 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: Waimea Solid Waste Transfer Station Dwy -- Kawaihae Rd | **QC JOB #:** 15329603
CITY/STATE: Waimea, HI | **DATE:** Tue, Jan 19 2021

Peak-Hour: 7:30 AM -- 8:30 AM
Peak 15-Min: 8:00 AM -- 8:15 AM



15-Min Count Period Beginning At	Waimea Solid Waste Transfer Station Dwy (Northbound)				Waimea Solid Waste Transfer Station Dwy (Southbound)				Kawaihae Rd (Eastbound)				Kawaihae Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	4	0	1	0	0	0	0	0	0	26	3	0	9	85	0	0	128	
6:15 AM	0	0	5	0	0	0	0	0	0	31	4	0	12	93	0	0	145	
6:30 AM	4	0	4	0	0	0	0	0	0	31	1	0	12	99	0	0	151	
6:45 AM	5	0	5	0	0	0	0	0	0	52	4	0	11	78	0	0	155	579
7:00 AM	5	0	6	0	0	0	0	0	0	45	2	0	5	94	0	0	157	608
7:15 AM	4	0	2	0	0	0	0	0	0	71	3	0	5	97	0	0	182	645
7:30 AM	5	0	15	0	0	0	0	0	0	122	4	0	5	106	0	0	257	751
7:45 AM	6	0	6	0	0	0	0	0	0	107	5	0	8	121	0	0	253	849
8:00 AM	5	0	13	0	0	0	0	0	0	85	3	0	16	166	0	0	288	980
8:15 AM	7	0	13	0	0	0	0	0	0	107	8	0	15	132	0	0	282	1080
8:30 AM	4	0	15	0	0	0	0	0	0	66	7	0	7	89	0	0	188	1011
8:45 AM	6	0	20	0	0	0	0	0	0	79	12	0	13	86	0	0	216	974

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	0	52	0	0	0	0	0	0	340	12	0	64	664	0	0	1152
Heavy Trucks	4	0	4		0	0	0		0	8	0		4	32	0		52
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments:

Report generated on 1/25/2021 7:27 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Appendix B Level of Service Definitions

The *Highway Capacity Manual* defines six Intersection Levels of Service (LOS), labeled A through F, from free flow to congested conditions.

Levels of Service for signalized intersections is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions: in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

LEVEL-OF-SERVICE A: Low control delay, up to 10 s/veh. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

LEVEL-OF-SERVICE B: Control delay greater than 10 and up to 20 s/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

LEVEL-OF-SERVICE C: Control delay greater than 20 and up to 35 s/veh. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LEVEL-OF-SERVICE D: Control delay greater than 35 and up to 55 s/veh. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LEVEL-OF-SERVICE E: Control delay greater than 55 and up to 80 s/veh. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

LEVEL-OF-SERVICE F: Control delay in excess of 80 s/veh. This level, considered unacceptable to most drivers, often occurs with oversaturation, that is when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

For unsignalized intersections, the *Highway Capacity Manual* evaluates gaps in the major street traffic flow and calculates available gaps for left-turns across oncoming traffic and for the left and right-turns onto the major roadway from the minor street. Average control delay, based on these factors, is still used to define the levels of service.

LEVEL-OF-SERVICE A: Low control delay, up to 10 s/veh.

LEVEL-OF-SERVICE B: Control delay greater than 10 and up to 15 s/veh.

LEVEL-OF-SERVICE C: Control delay greater than 15 and up to 25 s/veh.

LEVEL-OF-SERVICE D: Control delay greater than 25 and up to 35 s/veh.

LEVEL-OF-SERVICE E: Control delay greater than 35 and up to 50 s/veh.

LEVEL-OF-SERVICE F: Control delay in excess of 50 s/veh.

Appendix C Synchro Reports

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	495	20	45	630	25	50
Future Vol, veh/h	495	20	45	630	25	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	3	0	6	9	17	19
Mvmt Flow	527	21	48	670	27	53

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	548	0	1304	538
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	766	-
Critical Hdwy	-	-	4.16	-	6.57	6.39
Critical Hdwy Stg 1	-	-	-	-	5.57	-
Critical Hdwy Stg 2	-	-	-	-	5.57	-
Follow-up Hdwy	-	-	2.254	-	3.653	3.471
Pot Cap-1 Maneuver	-	-	1002	-	165	512
Stage 1	-	-	-	-	556	-
Stage 2	-	-	-	-	433	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1002	-	157	512
Mov Cap-2 Maneuver	-	-	-	-	157	-
Stage 1	-	-	-	-	556	-
Stage 2	-	-	-	-	412	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	21.9
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	292	-	-	1002	-
HCM Lane V/C Ratio	0.273	-	-	0.048	-
HCM Control Delay (s)	21.9	-	-	8.8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.1	-	-	0.1	-

Intersection						
Int Delay, s/veh	1.4					

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	55	0	180	30	0	245
Future Vol, veh/h	55	0	180	30	0	245
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	3	2	2	4	2	6
Mvmt Flow	65	0	212	35	0	288

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	518	-	0	0	-	-
Stage 1	230	-	-	-	-	-
Stage 2	288	-	-	-	-	-
Critical Hdwy	6.43	-	-	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	-	-	-	-	-
Pot Cap-1 Maneuver	516	0	-	-	0	-
Stage 1	806	0	-	-	0	-
Stage 2	759	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	516	-	-	-	-	-
Mov Cap-2 Maneuver	516	-	-	-	-	-
Stage 1	806	-	-	-	-	-
Stage 2	759	-	-	-	-	-

Approach	NB	SE	NW
HCM Control Delay, s	13	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBLn1	NWT	SET	SER
Capacity (veh/h)	516	-	-	-
HCM Lane V/C Ratio	0.125	-	-	-
HCM Control Delay (s)	13	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.4	-	-	-

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	55	335	410	0	0	30
Future Vol, veh/h	55	335	410	0	0	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	4	7	3	2	4
Mvmt Flow	65	394	482	0	0	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	482	0	-	0	-	482
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	-	-	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	2.218	-	-	-	-	3.336
Pot Cap-1 Maneuver	1081	-	-	0	0	580
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	0	0	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1081	-	-	-	-	580
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	1.2	0	11.6
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1
Capacity (veh/h)	1081	-	-	580
HCM Lane V/C Ratio	0.06	-	-	0.061
HCM Control Delay (s)	8.5	0	-	11.6
HCM Lane LOS	A	A	-	B
HCM 95th %tile Q(veh)	0.2	-	-	0.2

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	0	335	410	245	180	0
Future Vol, veh/h	0	335	410	245	180	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	4	7	3	2	2
Mvmt Flow	0	364	446	266	196	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	943	-
Stage 1	-	-	-	-	579	-
Stage 2	-	-	-	-	364	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	0	-	-	-	291	0
Stage 1	0	-	-	-	560	0
Stage 2	0	-	-	-	703	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	291	-
Mov Cap-2 Maneuver	-	-	-	-	291	-
Stage 1	-	-	-	-	560	-
Stage 2	-	-	-	-	703	-

Approach	EB	WB	SE
HCM Control Delay, s	0	0	39.5
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	-	-	291
HCM Lane V/C Ratio	-	-	-	0.672
HCM Control Delay (s)	-	-	-	39.5
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	4.5

Intersection						
Int Delay, s/veh	2.9					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	730	30	55	615	25	85
Future Vol, veh/h	730	30	55	615	25	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	6	3	16	5
Mvmt Flow	793	33	60	668	27	92

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	826	0	1598	810
Stage 1	-	-	-	-	810	-
Stage 2	-	-	-	-	788	-
Critical Hdwy	-	-	4.16	-	6.56	6.25
Critical Hdwy Stg 1	-	-	-	-	5.56	-
Critical Hdwy Stg 2	-	-	-	-	5.56	-
Follow-up Hdwy	-	-	2.254	-	3.644	3.345
Pot Cap-1 Maneuver	-	-	788	-	108	375
Stage 1	-	-	-	-	414	-
Stage 2	-	-	-	-	425	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	788	-	100	375
Mov Cap-2 Maneuver	-	-	-	-	100	-
Stage 1	-	-	-	-	414	-
Stage 2	-	-	-	-	393	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	36.2
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	231	-	-	788	-
HCM Lane V/C Ratio	0.518	-	-	0.076	-
HCM Control Delay (s)	36.2	-	-	9.9	-
HCM Lane LOS	E	-	-	A	-
HCM 95th %tile Q(veh)	2.7	-	-	0.2	-

Intersection	
Int Delay, s/veh	0.8

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	35	0	195	60	0	230
Future Vol, veh/h	35	0	195	60	0	230
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	0	2	2	0	2	1
Mvmt Flow	41	0	227	70	0	267

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	529	-	0	0	-	-
Stage 1	262	-	-	-	-	-
Stage 2	267	-	-	-	-	-
Critical Hdwy	6.4	-	-	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	-	-	-	-	-
Pot Cap-1 Maneuver	514	0	-	-	0	-
Stage 1	786	0	-	-	0	-
Stage 2	782	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	514	-	-	-	-	-
Mov Cap-2 Maneuver	514	-	-	-	-	-
Stage 1	786	-	-	-	-	-
Stage 2	782	-	-	-	-	-

Approach	NB	SE	NW
HCM Control Delay, s	12.6	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBLn1	NWT	SET	SER
Capacity (veh/h)	514	-	-	-
HCM Lane V/C Ratio	0.079	-	-	-
HCM Control Delay (s)	12.6	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	565	410	0	0	60
Future Vol, veh/h	35	565	410	0	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	8	4	3	2	0
Mvmt Flow	41	657	477	0	0	70

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	477	0	-	0	-	477
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	2.218	-	-	-	-	3.3
Pot Cap-1 Maneuver	1085	-	-	0	0	592
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	0	0	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1085	-	-	-	-	592
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1
Capacity (veh/h)	1085	-	-	592
HCM Lane V/C Ratio	0.038	-	-	0.118
HCM Control Delay (s)	8.4	0	-	11.9
HCM Lane LOS	A	A	-	B
HCM 95th %tile Q(veh)	0.1	-	-	0.4

Intersection	
Int Delay, s/veh	15.9

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	0	565	410	230	195	0
Future Vol, veh/h	0	565	410	230	195	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	8	4	1	2	2
Mvmt Flow	0	614	446	250	212	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	1185	-
Stage 1	-	-	-	-	571	-
Stage 2	-	-	-	-	614	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	0	-	-	-	~ 209	0
Stage 1	0	-	-	-	565	0
Stage 2	0	-	-	-	540	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	~ 209	-
Mov Cap-2 Maneuver	-	-	-	-	~ 209	-
Stage 1	-	-	-	-	565	-
Stage 2	-	-	-	-	540	-

Approach	EB	WB	SE
HCM Control Delay, s	0	0	114.1
HCM LOS			F

Minor Lane/Major Mvmt	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	-	-	209
HCM Lane V/C Ratio	-	-	-	1.014
HCM Control Delay (s)	-	-	-	114.1
HCM Lane LOS	-	-	-	F
HCM 95th %tile Q(veh)	-	-	-	9.1

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	1.6					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	505	20	45	640	25	50
Future Vol, veh/h	505	20	45	640	25	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	3	0	6	9	17	19
Mvmt Flow	537	21	48	681	27	53

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	558	0	1325	548
Stage 1	-	-	-	-	548	-
Stage 2	-	-	-	-	777	-
Critical Hdwy	-	-	4.16	-	6.57	6.39
Critical Hdwy Stg 1	-	-	-	-	5.57	-
Critical Hdwy Stg 2	-	-	-	-	5.57	-
Follow-up Hdwy	-	-	2.254	-	3.653	3.471
Pot Cap-1 Maneuver	-	-	993	-	160	505
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	428	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	993	-	152	505
Mov Cap-2 Maneuver	-	-	-	-	152	-
Stage 1	-	-	-	-	550	-
Stage 2	-	-	-	-	407	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	22.5
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	285	-	-	993	-
HCM Lane V/C Ratio	0.28	-	-	0.048	-
HCM Control Delay (s)	22.5	-	-	8.8	-
HCM Lane LOS	C	-	-	A	-
HCM 95th %tile Q(veh)	1.1	-	-	0.2	-

Intersection						
Int Delay, s/veh	1.4					

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	55	0	185	30	0	250
Future Vol, veh/h	55	0	185	30	0	250
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	3	2	2	4	2	6
Mvmt Flow	65	0	218	35	0	294

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	530	-	0	0	-	-
Stage 1	236	-	-	-	-	-
Stage 2	294	-	-	-	-	-
Critical Hdwy	6.43	-	-	-	-	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.43	-	-	-	-	-
Follow-up Hdwy	3.527	-	-	-	-	-
Pot Cap-1 Maneuver	508	0	-	-	0	-
Stage 1	801	0	-	-	0	-
Stage 2	754	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	508	-	-	-	-	-
Mov Cap-2 Maneuver	508	-	-	-	-	-
Stage 1	801	-	-	-	-	-
Stage 2	754	-	-	-	-	-

Approach	NB	SE	NW
HCM Control Delay, s	13.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBLn1	NWT	SET	SER
Capacity (veh/h)	508	-	-	-
HCM Lane V/C Ratio	0.127	-	-	-
HCM Control Delay (s)	13.1	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.4	-	-	-

Intersection						
Int Delay, s/veh	1					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	55	340	415	0	0	30
Future Vol, veh/h	55	340	415	0	0	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	4	7	3	2	4
Mvmt Flow	65	400	488	0	0	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	488	0	-	0	-	488
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	-	-	6.24
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	2.218	-	-	-	-	3.336
Pot Cap-1 Maneuver	1075	-	-	0	0	576
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	0	0	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1075	-	-	-	-	576
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	1.2	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1
Capacity (veh/h)	1075	-	-	576
HCM Lane V/C Ratio	0.06	-	-	0.061
HCM Control Delay (s)	8.6	0	-	11.7
HCM Lane LOS	A	A	-	B
HCM 95th %tile Q(veh)	0.2	-	-	0.2

Intersection						
Int Delay, s/veh	6.6					

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations						
Traffic Vol, veh/h	0	340	415	250	185	0
Future Vol, veh/h	0	340	415	250	185	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	4	7	3	2	2
Mvmt Flow	0	370	451	272	201	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	957	-
Stage 1	-	-	-	-	587	-
Stage 2	-	-	-	-	370	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	0	-	-	-	286	0
Stage 1	0	-	-	-	556	0
Stage 2	0	-	-	-	699	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	286	-
Mov Cap-2 Maneuver	-	-	-	-	286	-
Stage 1	-	-	-	-	556	-
Stage 2	-	-	-	-	699	-

Approach	EB	WB	SE
HCM Control Delay, s	0	0	42.7
HCM LOS			E

Minor Lane/Major Mvmt	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	-	-	286
HCM Lane V/C Ratio	-	-	-	0.703
HCM Control Delay (s)	-	-	-	42.7
HCM Lane LOS	-	-	-	E
HCM 95th %tile Q(veh)	-	-	-	4.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	55	340	415	250	185	30
Future Volume (veh/h)	55	340	415	250	185	30
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	1870	1841	1796	1856	1870	1841
Adj Flow Rate, veh/h	65	400	488	294	218	35
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Percent Heavy Veh, %	2	4	7	3	2	4
Cap, veh/h	219	997	569	343	464	74
Arrive On Green	0.54	0.54	0.54	0.54	0.31	0.31
Sat Flow, veh/h	691	1841	1050	633	1503	241
Grp Volume(v), veh/h	65	400	0	782	254	0
Grp Sat Flow(s),veh/h/ln	691	1841	0	1682	1752	0
Q Serve(g_s), s	5.3	7.6	0.0	23.9	7.0	0.0
Cycle Q Clear(g_c), s	29.2	7.6	0.0	23.9	7.0	0.0
Prop In Lane	1.00			0.38	0.86	0.14
Lane Grp Cap(c), veh/h	219	997	0	911	540	0
V/C Ratio(X)	0.30	0.40	0.00	0.86	0.47	0.00
Avail Cap(c_a), veh/h	219	997	0	911	540	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	24.3	8.1	0.0	11.8	16.8	0.0
Incr Delay (d2), s/veh	3.4	1.2	0.0	10.3	2.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	2.8	0.0	9.5	3.0	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	27.7	9.3	0.0	22.1	19.7	0.0
LnGrp LOS	C	A	A	C	B	A
Approach Vol, veh/h		465	782		254	
Approach Delay, s/veh		11.8	22.1		19.7	
Approach LOS		B	C		B	

Timer - Assigned Phs	4	6	8
Phs Duration (G+Y+Rc), s	37.0	23.0	37.0
Change Period (Y+Rc), s	4.5	4.5	4.5
Max Green Setting (Gmax), s	32.5	18.5	32.5
Max Q Clear Time (g_c+I1), s	31.2	9.0	25.9
Green Ext Time (p_c), s	0.4	0.5	3.1

Intersection Summary	
HCM 6th Ctrl Delay	18.5
HCM 6th LOS	B

Intersection	
Int Delay, s/veh	27.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	55	340	415	250	185	30
Future Vol, veh/h	55	340	415	250	185	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	85	85	85	85	85	85
Heavy Vehicles, %	2	4	7	3	2	4
Mvmt Flow	65	400	488	294	218	35

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	782	0	-	0	1165	635
Stage 1	-	-	-	-	635	-
Stage 2	-	-	-	-	530	-
Critical Hdwy	4.12	-	-	-	6.42	6.24
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.336
Pot Cap-1 Maneuver	836	-	-	-	~ 215	475
Stage 1	-	-	-	-	528	-
Stage 2	-	-	-	-	590	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	836	-	-	-	~ 198	475
Mov Cap-2 Maneuver	-	-	-	-	~ 198	-
Stage 1	-	-	-	-	487	-
Stage 2	-	-	-	-	590	-

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	161.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	836	-	-	-	216
HCM Lane V/C Ratio	0.077	-	-	-	1.171
HCM Control Delay (s)	9.7	-	-	-	161.5
HCM Lane LOS	A	-	-	-	F
HCM 95th %tile Q(veh)	0.3	-	-	-	12.3

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Intersection						
Int Delay, s/veh	3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	745	30	55	620	25	85
Future Vol, veh/h	745	30	55	620	25	85
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	200	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	7	0	6	3	16	5
Mvmt Flow	810	33	60	674	27	92

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	843	0	1621	827
Stage 1	-	-	-	-	827	-
Stage 2	-	-	-	-	794	-
Critical Hdwy	-	-	4.16	-	6.56	6.25
Critical Hdwy Stg 1	-	-	-	-	5.56	-
Critical Hdwy Stg 2	-	-	-	-	5.56	-
Follow-up Hdwy	-	-	2.254	-	3.644	3.345
Pot Cap-1 Maneuver	-	-	776	-	105	367
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	422	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	776	-	97	367
Mov Cap-2 Maneuver	-	-	-	-	97	-
Stage 1	-	-	-	-	407	-
Stage 2	-	-	-	-	390	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.8	37.8
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	225	-	-	776	-
HCM Lane V/C Ratio	0.531	-	-	0.077	-
HCM Control Delay (s)	37.8	-	-	10	-
HCM Lane LOS	E	-	-	B	-
HCM 95th %tile Q(veh)	2.8	-	-	0.2	-

Intersection						
Int Delay, s/veh	0.8					

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	35	0	200	60	0	230
Future Vol, veh/h	35	0	200	60	0	230
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	0	2	2	0	2	1
Mvmt Flow	41	0	233	70	0	267

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	535	-	0	0	-	-
Stage 1	268	-	-	-	-	-
Stage 2	267	-	-	-	-	-
Critical Hdwy	6.4	-	-	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	-	-	-	-	-
Pot Cap-1 Maneuver	510	0	-	-	0	-
Stage 1	782	0	-	-	0	-
Stage 2	782	0	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	510	-	-	-	-	-
Mov Cap-2 Maneuver	510	-	-	-	-	-
Stage 1	782	-	-	-	-	-
Stage 2	782	-	-	-	-	-

Approach	NB	SE	NW
HCM Control Delay, s	12.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBLn1	NWT	SET	SER
Capacity (veh/h)	510	-	-	-
HCM Lane V/C Ratio	0.08	-	-	-
HCM Control Delay (s)	12.7	-	-	-
HCM Lane LOS	B	-	-	-
HCM 95th %tile Q(veh)	0.3	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	575	415	0	0	60
Future Vol, veh/h	35	575	415	0	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	2	8	4	3	2	0
Mvmt Flow	41	669	483	0	0	70

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	483	0	-	0	-	483
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	4.12	-	-	-	-	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	2.218	-	-	-	-	3.3
Pot Cap-1 Maneuver	1080	-	-	0	0	588
Stage 1	-	-	-	0	0	-
Stage 2	-	-	-	0	0	-
Platoon blocked, %		-	-			
Mov Cap-1 Maneuver	1080	-	-	-	-	588
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	11.9
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	SBLn1
Capacity (veh/h)	1080	-	-	588
HCM Lane V/C Ratio	0.038	-	-	0.119
HCM Control Delay (s)	8.5	0	-	11.9
HCM Lane LOS	A	A	-	B
HCM 95th %tile Q(veh)	0.1	-	-	0.4

Intersection						
Int Delay, s/veh	18.4					

Movement	EBL	EBT	WBT	WBR	SEL	SER
Lane Configurations		↑	↱		↰	
Traffic Vol, veh/h	0	575	415	230	200	0
Future Vol, veh/h	0	575	415	230	200	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	8	4	1	2	2
Mvmt Flow	0	625	451	250	217	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	-	0	-	0	1201	-
Stage 1	-	-	-	-	576	-
Stage 2	-	-	-	-	625	-
Critical Hdwy	-	-	-	-	6.42	-
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	-	-	3.518	-
Pot Cap-1 Maneuver	0	-	-	-	~ 204	0
Stage 1	0	-	-	-	562	0
Stage 2	0	-	-	-	534	0
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	-	-	-	-	~ 204	-
Mov Cap-2 Maneuver	-	-	-	-	~ 204	-
Stage 1	-	-	-	-	562	-
Stage 2	-	-	-	-	534	-

Approach	EB	WB	SE
HCM Control Delay, s	0	0	130.6
HCM LOS			F

Minor Lane/Major Mvmt	EBT	WBT	WBR	SELn1
Capacity (veh/h)	-	-	-	204
HCM Lane V/C Ratio	-	-	-	1.066
HCM Control Delay (s)	-	-	-	130.6
HCM Lane LOS	-	-	-	F
HCM 95th %tile Q(veh)	-	-	-	9.9

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	35	575	415	230	200	60
Future Volume (veh/h)	35	575	415	230	200	60
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	1900	1781	1841	1885	1870	1900
Adj Flow Rate, veh/h	41	669	483	267	233	70
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Percent Heavy Veh, %	0	8	4	1	2	0
Cap, veh/h	258	965	603	334	409	123
Arrive On Green	0.54	0.54	0.54	0.54	0.31	0.31
Sat Flow, veh/h	723	1781	1114	616	1328	399
Grp Volume(v), veh/h	41	669	0	750	304	0
Grp Sat Flow(s),veh/h/ln	723	1781	0	1730	1732	0
Q Serve(g_s), s	2.9	16.5	0.0	21.0	8.8	0.0
Cycle Q Clear(g_c), s	24.0	16.5	0.0	21.0	8.8	0.0
Prop In Lane	1.00			0.36	0.77	0.23
Lane Grp Cap(c), veh/h	258	965	0	937	534	0
V/C Ratio(X)	0.16	0.69	0.00	0.80	0.57	0.00
Avail Cap(c_a), veh/h	258	965	0	937	534	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	0.00
Uniform Delay (d), s/veh	20.8	10.1	0.0	11.1	17.4	0.0
Incr Delay (d2), s/veh	1.3	4.1	0.0	7.1	4.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	6.2	0.0	8.1	3.8	0.0
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	22.1	14.2	0.0	18.3	21.8	0.0
LnGrp LOS	C	B	A	B	C	A
Approach Vol, veh/h		710	750		304	
Approach Delay, s/veh		14.6	18.3		21.8	
Approach LOS		B	B		C	

Timer - Assigned Phs				4		6		8
Phs Duration (G+Y+Rc), s				37.0		23.0		37.0
Change Period (Y+Rc), s				4.5		4.5		4.5
Max Green Setting (Gmax), s				32.5		18.5		32.5
Max Q Clear Time (g_c+I1), s				26.0		10.8		23.0
Green Ext Time (p_c), s				2.6		0.6		3.8

Intersection Summary			
HCM 6th Ctrl Delay			17.4
HCM 6th LOS			B

Intersection						
Int Delay, s/veh	62.2					

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	35	575	415	230	200	60
Future Vol, veh/h	35	575	415	230	200	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	86	86	86	86	86	86
Heavy Vehicles, %	0	8	4	1	2	0
Mvmt Flow	41	669	483	267	233	70

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	750	0	-	0	1368	617
Stage 1	-	-	-	-	617	-
Stage 2	-	-	-	-	751	-
Critical Hdwy	4.1	-	-	-	6.42	6.2
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.2	-	-	-	3.518	3.3
Pot Cap-1 Maneuver	868	-	-	-	~ 162	494
Stage 1	-	-	-	-	538	-
Stage 2	-	-	-	-	466	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	868	-	-	-	~ 154	494
Mov Cap-2 Maneuver	-	-	-	-	~ 154	-
Stage 1	-	-	-	-	513	-
Stage 2	-	-	-	-	466	-

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	$ 361.5
HCM LOS			F

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	868	-	-	-	183
HCM Lane V/C Ratio	0.047	-	-	-	1.652
HCM Control Delay (s)	9.4	-	-	-	$ 361.5
HCM Lane LOS	A	-	-	-	F
HCM 95th %tile Q(veh)	0.1	-	-	-	20.5

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Appendix D SIDRA Reports

Kawaihae Rd/Kohala Mountain Rd
2024 Roundabout AM

MOVEMENT SUMMARY

Site: 1 [Kawaihae/Kohala Mountain (Site Folder: General)]

Kawaihae/Kohala Mountain
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Kawaihae Rd														
3	L2	415	6.9	415	6.9	0.539	9.0	LOS A	4.1	107.1	0.30	0.14	0.30	26.3
8	T1	250	3.4	250	3.4	0.539	8.9	LOS A	4.1	107.1	0.30	0.14	0.30	25.9
Approach		665	5.6	665	5.6	0.539	9.0	LOS A	4.1	107.1	0.30	0.14	0.30	26.1
North: Kohala Mountain														
4	T1	185	2.0	185	2.0	0.251	6.8	LOS A	1.1	28.9	0.56	0.50	0.56	27.2
14	R2	30	4.0	30	4.0	0.251	6.9	LOS A	1.1	28.9	0.56	0.50	0.56	26.0
Approach		215	2.3	215	2.3	0.251	6.8	LOS A	1.1	28.9	0.56	0.50	0.56	27.0
West: Kawaihae														
5	L2	55	2.2	55	2.2	0.361	6.9	LOS A	2.0	51.2	0.44	0.30	0.44	26.6
12	R2	340	4.3	340	4.3	0.361	6.9	LOS A	2.0	51.2	0.44	0.30	0.44	25.1
Approach		395	4.0	395	4.0	0.361	6.9	LOS A	2.0	51.2	0.44	0.30	0.44	25.3
All Vehicles		1275	4.5	1275	4.5	0.539	8.0	LOS A	4.1	107.1	0.39	0.25	0.39	26.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Kawaihae Rd/Kohala Mountain Rd
2024 Roundabout PM

Site: 1 [Kawaihae/Kohala Mountain (Site Folder: General)]

Kawaihae/Kohala Mountain
Site Category: (None)
Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] ft	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed mph
South: Kawaihae														
3	L2	415	4.0	415	4.0	0.499	8.0	LOS A	3.8	97.2	0.22	0.08	0.22	26.5
8	T1	230	1.0	230	1.0	0.499	8.0	LOS A	3.8	97.2	0.22	0.08	0.22	26.1
Approach		645	2.9	645	2.9	0.499	8.0	LOS A	3.8	97.2	0.22	0.08	0.22	26.4
North: Kohala Mountain														
4	T1	200	2.4	200	2.4	0.298	7.4	LOS A	1.4	35.9	0.58	0.52	0.58	26.9
14	R2	60	0.0	60	0.0	0.298	7.3	LOS A	1.4	35.9	0.58	0.52	0.58	25.8
Approach		260	1.8	260	1.8	0.298	7.4	LOS A	1.4	35.9	0.58	0.52	0.58	26.7
West: Kawaihae														
5	L2	35	0.0	35	0.0	0.586	10.9	LOS B	4.0	105.3	0.58	0.43	0.58	25.4
12	R2	575	8.0	575	8.0	0.586	11.2	LOS B	4.0	105.3	0.58	0.43	0.58	23.9
Approach		610	7.5	610	7.5	0.586	11.2	LOS B	4.0	105.3	0.58	0.43	0.58	24.0
All Vehicles		1515	4.6	1515	4.6	0.586	9.2	LOS A	4.0	105.3	0.43	0.30	0.43	25.4

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
Delay Model: HCM Delay Formula (Geometric Delay is not included).
Queue Model: HCM Queue Formula.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

December 21, 2021

Mr. Ken Tatsuguchi
Hawaii Department of Transportation (HDOT)
Highways Division, Planning Branch
869 Punchbowl Street, Room 202
Honolulu, HI 96813

Re: Update to Traffic Signal Warrant Study for the intersection of Kawaihae Road at Kohala Mountain Road

Dear Mr. Tatsuguchi:

The purpose of this memo is to update the March 2009 *Traffic Signal Warrant Study for the Intersection of Kawaihae Road at Kohala Mountain Road* by Wilson Okamoto Corporation. The location of the intersection is shown in **Figure 1** (attached). The Kawaihae Road/Kohala Mountain Road intersection lane configuration and traffic control are shown in **Figure 2** (attached).

For this analysis, the intersection was examined as a tee-intersection with Kawaihae Road being a two-lane roadway with single lane approaches and an east-west orientation and Kohala Mountain Road being a two-lane roadway with single lane approaches and a north-south orientation. Furthermore, according the 2020 U.S. Census, the Waimea Census Designated Place (CDP) has a population of 9,904 (see attachment). Because the intersection is located in an isolated community having a population of fewer than 10,000, lower traffic volume thresholds were used in the analysis.

Manual turning movement counts were conducted on Tuesday, October 26, 2021 at the study area intersection between 5:00 AM and 9:00 PM. Hawaii Preparatory Academy, located off of Kohala Mountain Road, was in session at the time. The updated data was used to perform the traffic volume-related traffic signal warrant analyses.

The following three traffic signal warrants, standards for which are outlined in the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD), were analyzed in the 2009 study:

WSP USA
Suite 2400
1001 Bishop Street
Honolulu, HI 96813

Tel.: +1 808 531-7094
Fax: +1 808 528-2368
wsp.com

- Warrant 1, Eight-Hour Vehicular Volume
- Warrant 2, Four-Hour Vehicular Volume
- Warrant 7, Crash Experience

The following traffic signal warrants were not applicable or not analyzed:

- Warrant 3, Peak Hour – not applicable due MUTCD standard stating that the peak hour warrant should only be used in unusual cases such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.
- Warrant 4, Pedestrian Volume – not applicable due to existing low pedestrian volumes, see attached pedestrian data.
- Warrant 5, School Crossing – not applicable due to no school crossing and low pedestrian volume.
- Warrant 6, Coordinated Signal System – not applicable, intersection is isolated (approximately 2 miles away from nearest signalized intersection).
- Warrant 8, Roadway Network – not analyzed.
- Warrant 9, Intersection Near a Grade Crossing – not applicable, no railway crossing nearby.

The three applicable warrants were analyzed. For this analysis, the intersection was examined as a tee-intersection with Kawaihae Road being a two-lane roadway with single lane approaches and an east-west orientation and Kohala Mountain Road being a two-lane roadway with single lane approaches and a north-south orientation. Furthermore, according the 2020 U.S. Census, the Waimea Census Designated Place (CDP) has a population of 9,904 (see attachment). Because the intersection is located in an isolated community having a population of fewer than 10,000, lower traffic volume thresholds were used in the analysis.

<u>Warrant 1, Eight-Hour Vehicular Volume</u>

Support: The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.
If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

Waimea is an isolated community with a population <10,000; therefore the 70% values in Table 4C-1 were used. The Condition A thresholds were satisfied for six hours. Therefore Condition A is not satisfied. The Condition B thresholds were satisfied thirteen hours. Therefore Condition B is satisfied and Warrant 1 is satisfied.

<u>Warrant 2, Four-Hour Vehicular Volume</u>
Support: The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only)

all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.
If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

As shown in the Figure 4C-1 markup, a total of thirteen data points fall above the applicable single-lane approach curves. Therefore, Warrant 2 is satisfied.

Warrant 7, Crash Experience

Support: The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard: The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Although criterion C is satisfied, the condition A has not been studied and condition B is not satisfied (see attached Traffic Accident Analysis). Therefore, Warrant 7 is not satisfied.

Conclusion

The Kawaihae Road/Kohala Mountain Road intersection satisfies Warrants 1 and 2 outlined in the 2009 MUTCD based on existing 2021 traffic volumes. While satisfying one or more traffic signal warrants justifies the installation of a traffic signal at the study intersection, the satisfaction of the warrants does not in itself require the installation of a traffic control signal.

If you have any questions, please call me at 808-566-2256 or email phillip.matsunaga@wsp.com.

Very truly yours,
WSP USA

Phillip Matsunaga
Senior Transportation Engineer

APPENDIX C
HISTORIC PROPERTIES ASSESSMENT

Historic Properties Assessment in Support of NHPA Section 106 and HRS Chapter 6E-8 Review of the Waiaka Bridge Replacement and Roadway Realignment Project

TMK: (3) 6-5-001:015 and 033 por., (3) 6-6-001:077 por., (3) 6-6-001:011; (3) 6-6-004:001 por.

Kauniho, Lālāmilo, and Wai‘aka 1st and 2nd *ahupua‘a*
South Kohala District
Island of Hawai‘i

DRAFT VERSION

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October 2021

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Historic Properties Assessment in Support of NHPA Section 106 and HRS Chapter 6E-8 Review of the Waiaka Bridge Replacement and Roadway Realignment Project

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Kauniho, Lālāmilo, and Waiʻaka 1st and 2nd *ahupuaʻa*
South Kohala District
Island of Hawaiʻi

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ASM affiliates

EXECUTIVE SUMMARY

At the request of WSP USA, Inc. on behalf of the State of Hawai‘i, Department of Transportation (HDOT), ASM Affiliates (ASM) conducted a historic properties assessment for the proposed Waiaka Bridge Replacement and Roadway Realignment project. The purpose of the study is to aid HDOT in their efforts to identify historic properties in compliance with Section 106 of the National Historic Preservation Act (NHPA) and Hawai‘i Revised Statutes (HRS) Chapter 6E-8 for the proposed project. The project, which is located along Kawaihae Road and the Kohala Mountain Road in the South Kohala District, Island of Hawai‘i, involves replacing the existing Waiaka Bridge and realigning the approaches to create a smooth transition to the replacement bridge and the Kawaihae Road-Kohala Mountain Road intersection. The project has been determined to be an Undertaking subject to Section 106 of the NHPA of 1966 as amended (2006) and its implementing regulations (36 CFR 800) due to the use of funding from the United States Department of Transportation Federal Highway Administration. As a project to be conducted by the HDOT as a State Agency, the project is also subject to review under HRS Chapter 6E-8. The Section 106 Area of Potential Effect (APE) and the HRS Chapter 6E-8 Project Area are coterminous. The APE comprises 316,143 square feet (7.3 acres) and contains a portion of Kawaihae Road, portions of surrounding parcels where equipment and materials storage will take place, portions of surrounding parcels that will be used temporarily during the project.

The current APE was included in five prior archaeological studies (Corbin 2007; Haun et al. 2002, 2003; Sinoto 1998; Thompson and Rosendahl 1992). Within the current APE, Haun et al. (2002) identified three features of a large Precontact agricultural complex (SIHP 50-10-06-22632), a “concrete foundation” (SIHP 50-10-06-23313), and the Waiaka Bridge (SIHP 50-10-06-29221). The three features of Site 22632 are terraces (Features XN and XO) and a ditch (Feature XR). Site 23313 was identified as a concrete foundation located in Keanu‘i‘omanō Stream. Site 29221 is the Waiaka Bridge. No other sites were documented in the current APE in any of the prior archaeological studies. Consultation conducted in 2012 for an earlier iteration of the current Undertaking found that the portion of Keanu‘i‘omanō Stream in the current APE is unlikely to contain concealed *iwi* or archaeological resources.

Fieldwork for the current study was conducted on August 26, 2020, by Johnny Dudoit, B.A., and Benjamin Barna, Ph. D. (Principal Investigator), with follow-up field visits on October 14, 2020, by Dr. Barna. And on August 4, 2021, by Brooke Kauoa under supervision of Dr. Barna. A total of nine person-hours were expended during the fieldwork. During the current fieldwork, the three previously identified sites were identified, and no previously unidentifived sites were found. Portions of the three features of Site 22632 (Features XO, XP, and XR) were identified within the current APE. The northern ends of the features extend between 12.6 and 18.0 meters into the current APE. South of the current APE boundary, these features have been disturbed by the partial development of the Department of Hawaiian Homelands residential lots project. Site 23313 was also identified, and its current condition noted. Additional research found that Site 23313 is the Keanu‘i‘omanō Stream Gage (USGS 16756500) and that the concrete “foundation” is actually a small weir built for the gage. During the current fieldwork, Site 29221 was visited, and its current condition was compared with the description provided by Haun et al. (2002). Overall, the condition of Site 29221 (at least cosmetically) does not appear to have degraded much since the 2002 fieldwork.

Site 22632 was previously determined eligible for the National Register of Historic Places (NRHP) under Criteria A, C, and D and significant under HRS Chapter 6E under Criteria a, c, and d. Nothing observed within the APE during the current study suggests that the features of the site have experienced a sufficient loss of integrity to change the NRHP eligibility or HRS Chapter 6E significance of the site as a whole. Therefore, Site 22632 remains recommended eligible for the NRHP under Criteria A, C, and D and significant under Criteria a, c, and d. Site 23313, now identified as the USGS Keanu‘i‘omanō Stream gaging station, was previously evaluated as NRHP eligible under Criterion D and HRS Chapter 6E significant under Criterion d. Based on the additional information obtained during the current study the site is no longer recommended NRHP eligible or significant under HRS Chapter 6E-8. Site 29221, the Waiaka Bridge, was previously determined to be NRHP eligible Criteria C and D and HRS Chapter 6E significant under Criteria c and d. Based on the observations made during the current study, the Site 29221 continues to be recommended NRHP eligible under Criteria C and D and HRS Chapter 6e significant under Criteria c and d.

The Undertaking would result in the demolition of the Waiaka Bridge (Site 29221). The use of staging/potential staging areas located on TMK: (3) 6-6-001:077 may result in the physical damage to Site 22632 (Features XO, XP, and XR). The recommended determination of effect for the Undertaking is “Adverse effect” under 36 CFR 800.5 and “Effect, with proposed mitigation commitments” under HAR §13-275-7. It is recommended that HDOT consult further to resolve the adverse effect pursuant to 36 CFR 800.6. Recommneded mitigation measures include data recovery at Site 22632 (e.g., high-resolution mapping of the the site using LiDAR and/or the recovery of macro- and microbotanical remains from within the fields and field ridges) and architectural recordation (HAER Level I or II) of Site 29221.

CHAPTERS

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1. INTRODUCTION

At the request of WSP USA, Inc. on behalf of the State of Hawai‘i, Department of Transportation (HDOT; referred to hereafter as the Agency), ASM Affiliates (ASM) conducted a historic properties assessment for the proposed Waiaka Bridge Replacement and Roadway Realignment project. The purpose of the current study is to aid the Agency in their efforts to identify historic properties in compliance with Section 106 of the National Historic Preservation Act (NHPA) and Hawai‘i Revised Statutes (HRS) Chapter 6E-8 for the proposed project. The project, which is located along Kawaihae Road and the Kohala Mountain Road in the South Kohala District, Island of Hawai‘i (Figures 1, 2, and 3), involves replacing the existing Waiaka Bridge and realigning the approaches to create a smooth transition to the replacement bridge and the Kawaihae Road-Kohala Mountain Road intersection. The Agency has been awarded funds by the United States Department of Transportation Federal Highway Administration (FHWA) for this project. As such, the project has been determined to be an Undertaking subject to Section 106 of the NHPA of 1966, as amended (2006), and its implementing regulations (36 CFR 800). As a project to be conducted by the HDOT as a State Agency, the project is also subject to review under HRS Chapter 6E-8. The scope of the Section 106 Undertaking and the HRS Chapter 6E-8 project are identical and for simplicity the two projects are referred to as “the Undertaking” in the remainder of this report, except where statute-specific language is required. Similarly, the Section 106 Area of Potential Effect (APE) and the HRS Chapter 6E-8 Project Area are coterminous and are referred to collectively as “the APE” except where statute-specific language is required. A detailed description of the Undertakinga and the APE is provided in the following section.

The current study was conducted in partial compliance with 36 CFR 800 and in compliance with Hawai‘i Administrative Rules (HAR) §13-275. This report is divided into six chapters. Chapter 1 includes a description of the Undertaking and the APE. Chapter 2 provides background information for the APE, including a culture-historical context followed by a summary of relevant archaeological, cultural, and prior consultation conducted within the APE and surrounding area. Chapter three summarizes archaeological expectations for APE. Chapter 4 presents a description of the archaeological fieldwork methods and results. Chapter 5 presents recommended National Register of Historic Places and HRS Chapter 6E significance evaluations. Chapter 6 discusses the recommended determination of effect under both applicable statutes. Chapter 7 presents recommended mitigation measures for the project.

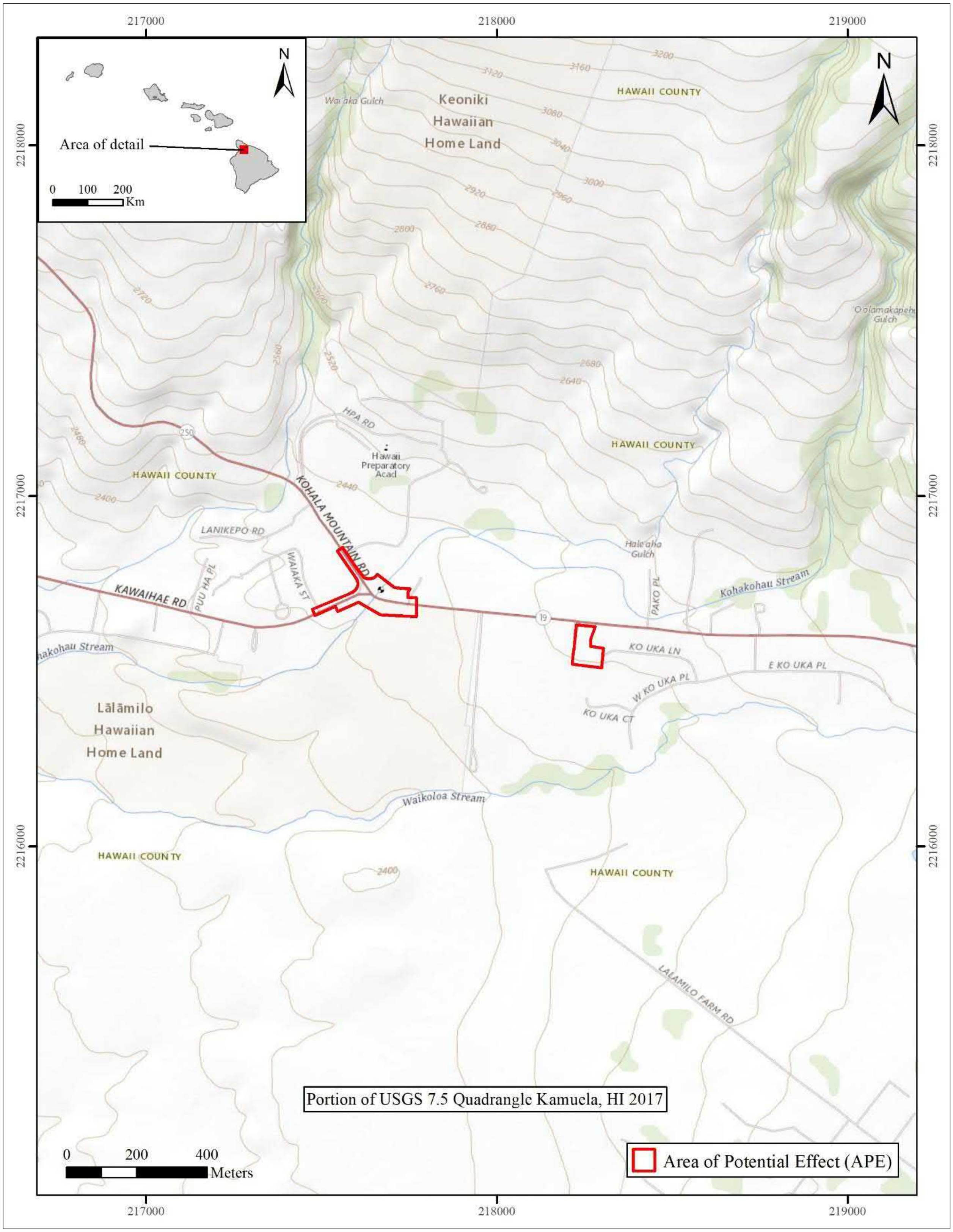


Figure 1. Area of Potential Effect.

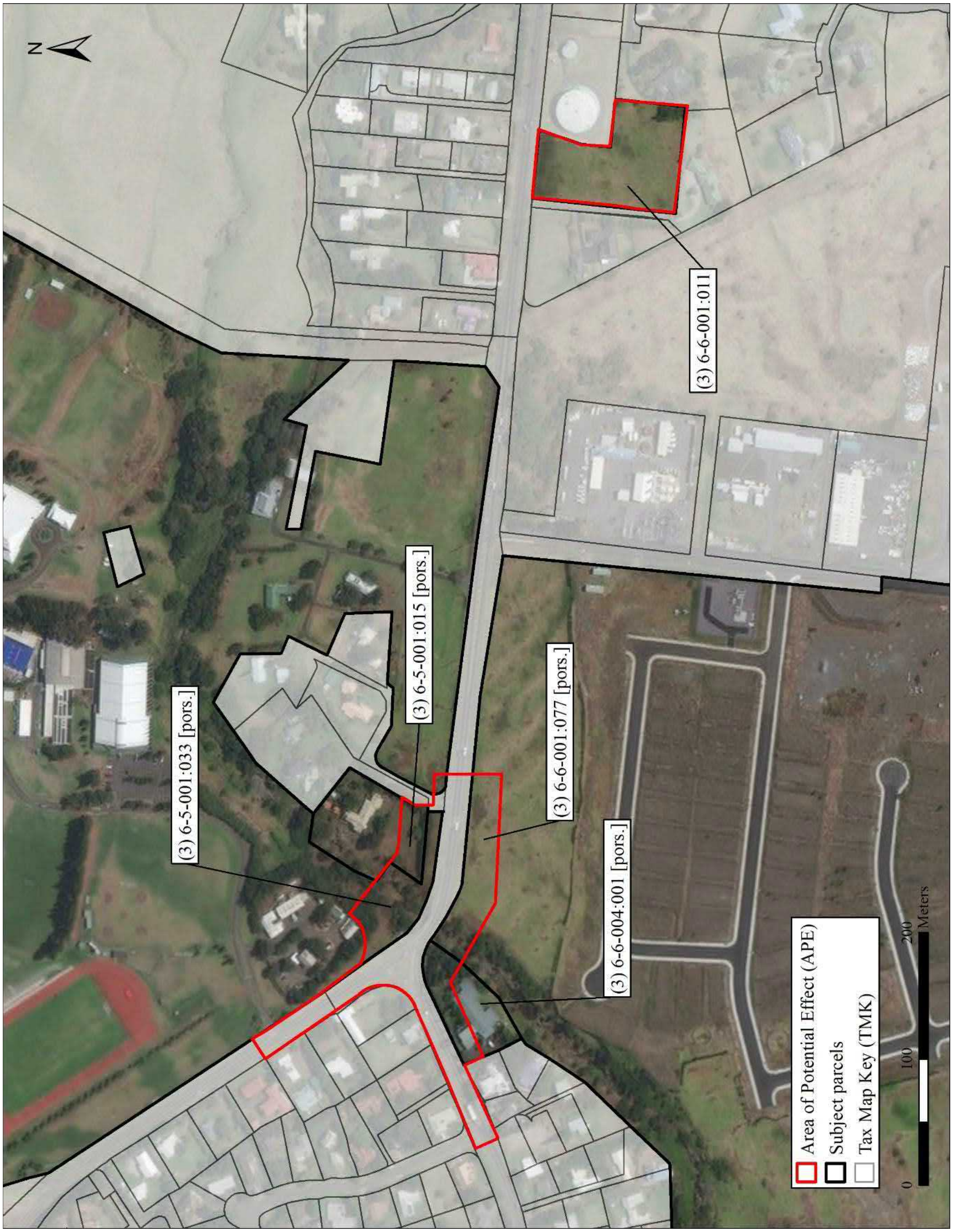


Figure 2. Tax Map Key showing the location of the Area of Potential Effect.

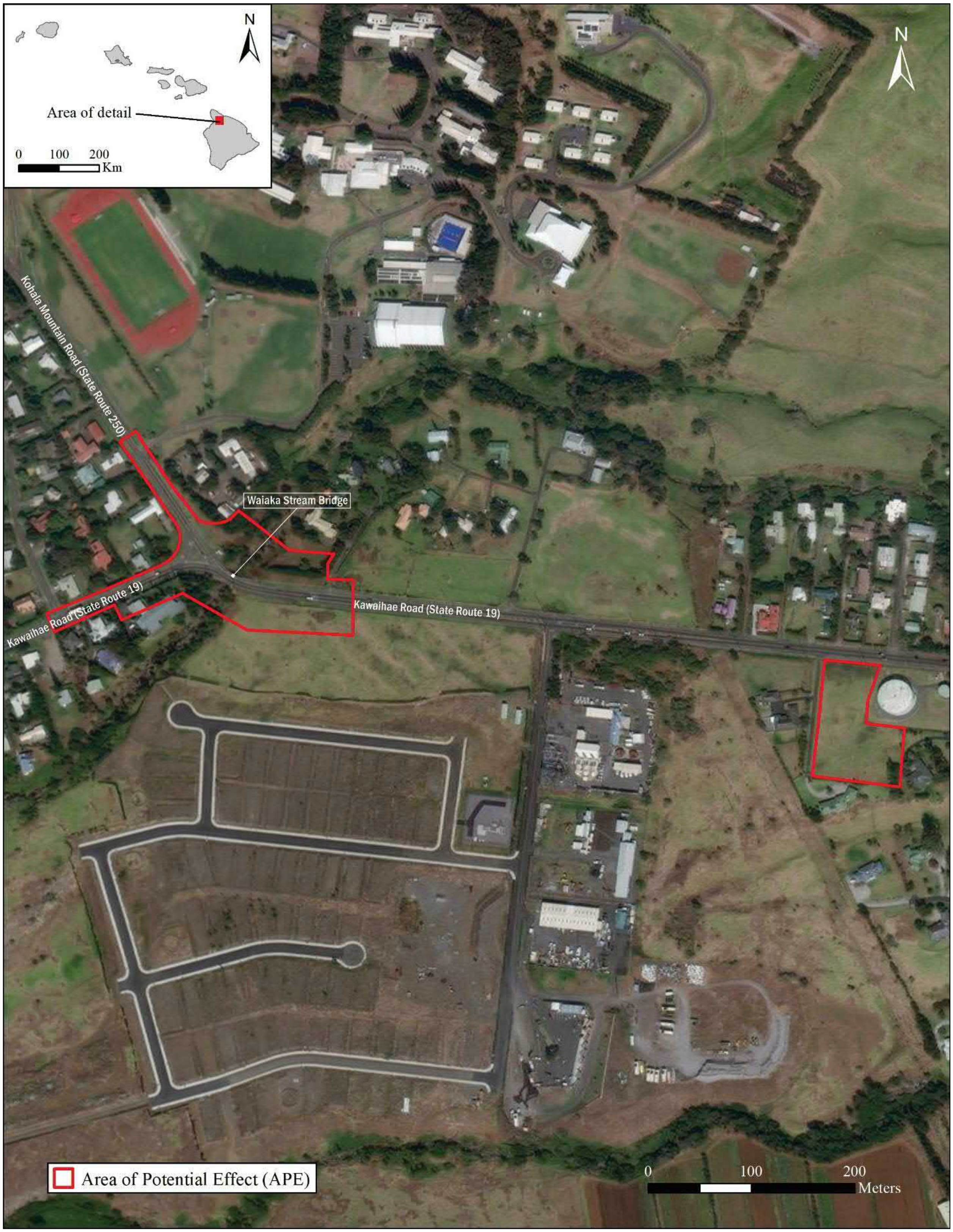


Figure 3. Satellite image showing the Area of Potential Effect.

DESCRIPTION OF THE UNDERTAKING

The Undertaking will consist of replacing the existing Waiaka Bridge (Figure 4), constructed in 1932, with an approximately 53-foot wide by approximately 80-foot-long replacement bridge to accommodate two travel lanes, one in each direction, a shoulder/bike lane, and raised sidewalk. Additionally, the three approaches (ranging in distance from roughly 415-600 feet; see Figures 3) leading to the Waiaka Bridge will be realigned to create a smooth transition to the replacement bridge. The Kawaihae Road (State Route 19) and Kohala Mountain Road (State Route 250) intersection (see Figure 3) would be reconfigured to include a traffic signal or a roundabout. The APE (further defined below) is intended to accommodate the construction of either alternative. The project limits will extend to the west, east, and north for a sufficient distance to achieve a smooth transition. The objectives of the Undertaking are to replace the aging Waiaka Bridge, improve sight distances and intersection operations, and improving hydraulic conditions for Keanuʻiʻomanō Stream beneath the Waiaka Bridge.

The primary objective of the Undertaking is to replace the Waiaka Bridge with one that will conform to the guidelines set forth by the American Association of State Highways and Transportation Officials' (AASHTO) *A Policy on Geometric Design for Highways and Streets*. The AASHTO guidelines were adopted by the Agency for the planning and engineering of highway projects in Hawaiʻi. The bridge design will follow current State planning and design guidelines for bridges encompassing lane widths, shoulders, pedestrian access, and railing heights. Additionally, the planning and engineering will need to conform to the *Hawaii Statewide Uniform Design Manual for Streets and Highways* (1980) and the guidelines related to the Americans with Disabilities (ADA) Act.

Figure 4. The Waiaka Bridge, view to the southwest.

AREA OF POTENTIAL EFFECT

The APE (Figure 5) comprises 316,143 square feet (7.3 acres) located adjacent to Kawaihae Road roughly 2 miles west of Waimea Town and 10 miles southeast of Kawaihae Harbor and contains portions of the Tax Map Keys listed below in Table 1 and shown in Figure 2 above. This area includes portions of four traditional *ahupua‘a*: Kauniho, Wai‘aka 1st, Wai‘aka 2nd, and Lālāmilo, all of which are located within the South Kohala District, Island of Hawai‘i. The APE is located at elevations ranging from 732 meters (2,401 feet) to 741 meters (2,431 feet) above sea level along the southwestern slope of the Kohala Mountains (see Figure 1), approximately 13.2 kilometers (8.24 miles) from the South Kohala coast. Terrain in the APE slopes very gently to the southwest. Surface geology in the APE is mapped in Figure 6 as “Qhm” described as Hamakua Volcanics dating between 64,000-300,000 years ago (Sherrod et al. 2007). Two soil units (Figure 7) have been mapped in the APE (Soil Survey Staff 2020). In the portion of the APE located east of Keanu‘i‘omanō Stream, soils are mapped as Waimea medial very fine sandy loam, 0 to 6 percent slope (mapped in Figure 7 as “383”). In the portion located west of Keanu‘i‘omanō Stream, soils are mapped as rock outcrop-Kamakoa complex with a 6 to 20 percent slope (mapped in Figure 7 as “379”). The climate in the APE is generally cool and dry. Mean annual temperatures range between 62 and 71 degrees Fahrenheit (Giambelluca et al. 2014). The mean annual rainfall within the APE is 41 inches (1,054 millimeters) with most of the precipitation occurring between the months of December through April (Giambelluca et al. 2013). A portion of portion of Keanu‘i‘omanō Stream (Figure 8) passes through the APE. This stream is the dominant hydrological feature in the APE vicinity. It extends through the APE from the northeast, passing beneath Waiaka Bridge (see Figure 8). The streambed is *pāhoehoe* bedrock, and banks are cut through the surrounding soil to *pāhoehoe* in several places.

Within the APE, there are seven smaller areas designated by their proposed use during the Undertaking (Table 2, see Figure 5). Approximately 2.9 acres of the APE includes Kawaihae Road (Figure 9), which is paved with asphaltic concrete and has unpaved shoulders. The “HDOT staging area” that is outlined in pink in Figure 5 is located within the HDOT-managed county road right of way on the southern side of Kawaihae Road (Figure 10). Immediately to the south of this area is the “West DHHL potential staging area,” which is outlined in green in Figure 5. This area is located on the DHHL-managed parcel located south of Kawaihae Road (Figure 12). The “DHHL potential staging area” comprises an isolated parcel (Figure 11) near Sandalwood Estates. This is also outlined in green in Figure 5. Both of these areas are vegetated with a mix of introduced grasses and other forage dominated by kikuyu grass (*Pennisetum clandestinum*). There are three “temporary use areas,” two located on the north side of Kawaihae Road and one on the south side. On the north side of Kawaihae Road, one area is owned by the Steven Kittel Trust is vegetated with thick stands of Russian olive (*Elaeagnus angustifolia*) fronting an open grassy area (Figure 13). The second area is owned by Hawai‘i Preparatory Academy and includes a roadside swale with well-maintained grass cover (Figure 14), along with ironwood and introduced brushy vegetation near the banks of Keanu‘i‘omanō Stream. On the south side of Kawaihae Road, the temporary use area comprises a portion of a developed residential parcel owned by Big Buck Trust (right of entry was not available at the time of the current study).

Table 1. Tax Map Key parcels containing the APE.

Tax Map Key	*Acres*	*Square Footage (ft^2)*	*Current Owner*	*County of Hawaii Zoning*
(3) 6-5-001:015	0.32	13,865 ft^2	Steven Kittell Trust	A-1a/Agriculture
(3) 6-5-001:033	1.11	48,309 ft^2	Hawaii Preparatory Academy	RS-10/Residential
(3) 6-6-001:011	1.872	81,544 ft^2	Department of Hawaiian Home Lands	RS-10/Residential
(3) 6-6-001:077	0.7	31,090 ft^2	Department of Hawaiian Home Lands	RS-10/Residential
(3) 6-6-004:001	0.34	14,952 ft^2	Big Buck Trust	RS-10/Residential
Kawaihae Road	2.958	126,653	County of Hawai‘i	n/a

Table 2. APE use areas.

Area name	*Tax Map Key*	*Acres*	*Project actions’*
Kawaihae Road	-	2.9	Repaving, realignment
HDOT staging area	-	0.4	Equipment and material staging
Steven Kittel Trust temporary use area	(3) 6-5-001:015	0.32	Temporary bridge
Hawai‘i Preparatory Academy temporary use area	(3) 6-5-001:033	1.11	Temporary bridge
Big Buck Trust potential staging area	(3) 6-6-004:001	0.34	Equipment and material staging
West DHHL potential staging area	(3) 6-6-001:077	0.7	Equipment and material staging
East DHHL potential staging area	(3) 6-6-001:011	1.872	Equipment and material staging

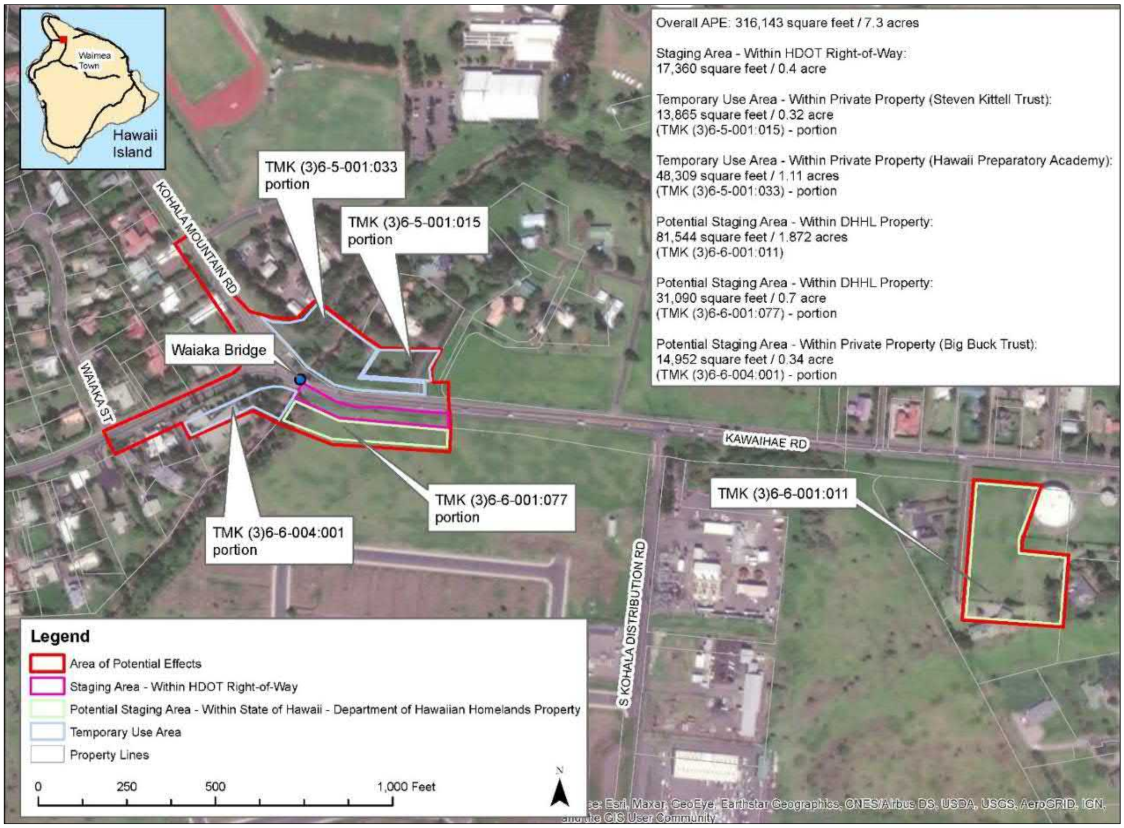


Figure 5. Area of Potential Effect shown along with staging and temporary use areas.

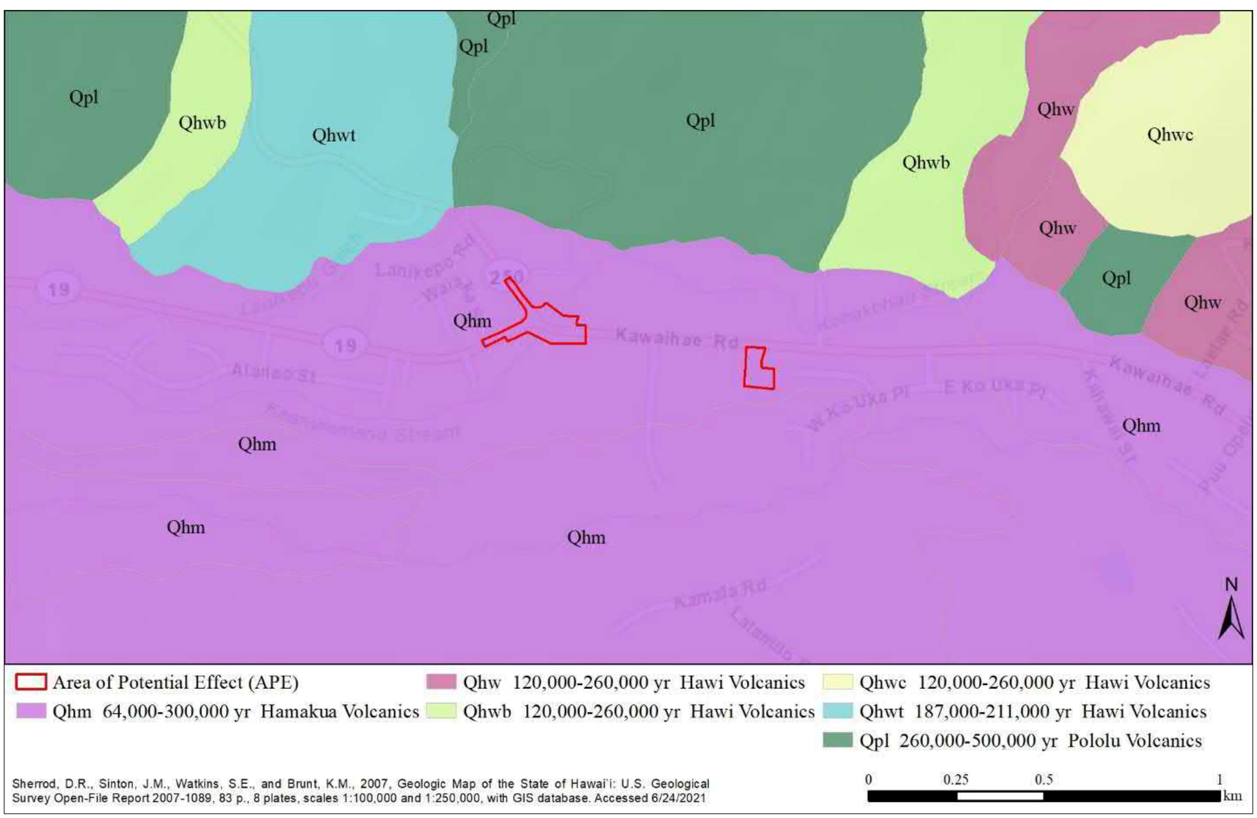


Figure 6. Geology in the Area of Potential Effect.

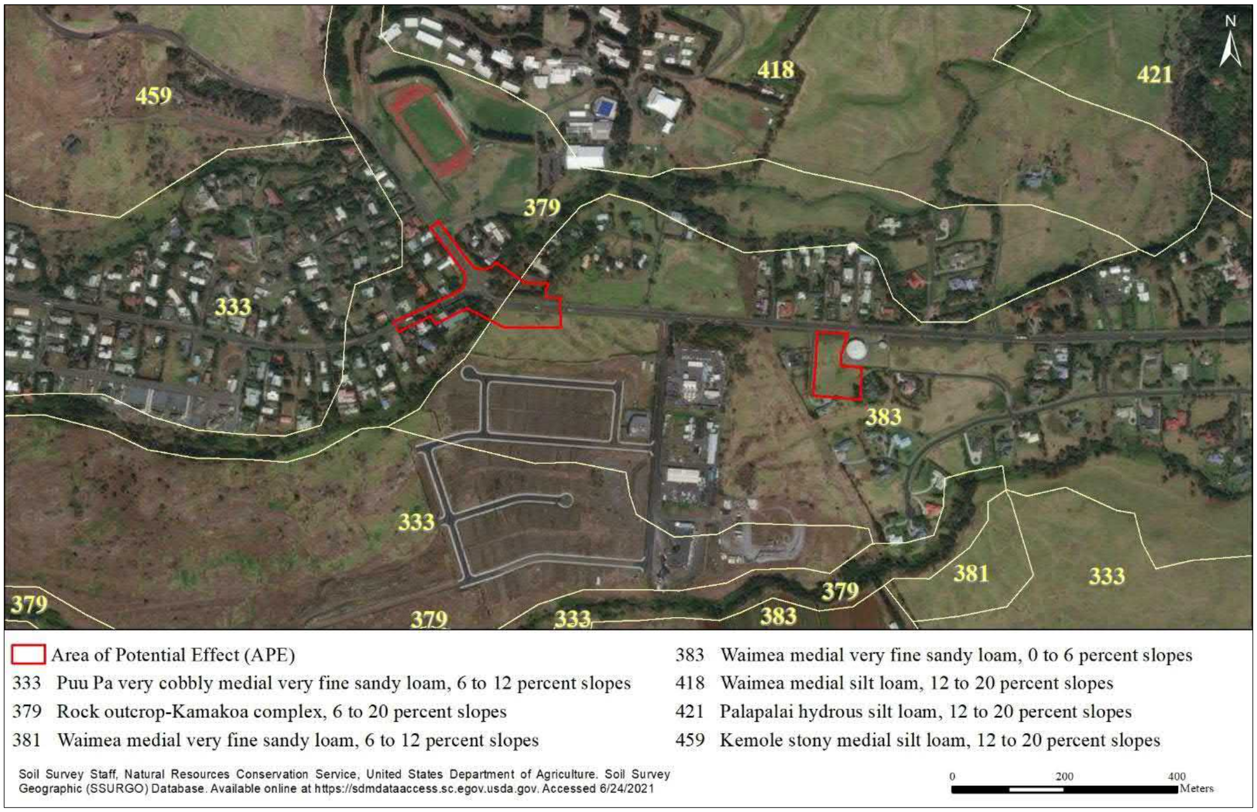


Figure 7. Soils in the Area of Potential Effect.

Figure 8. Keanuʻiʻomanō Stream looking downstream toward the Waiaka Bridge, view to the southwest.

Figure 9. Intersection of Kawaihae Road and Kohala Mountain Road, view to the west.

Figure 10. HDOT staging area, view to the east.

Figure 11. Eastern DHHL potential staging area, view to the southwest.

Figure 12. Western DHHL potential staging area, view to the southwest.

Figure 13. Temporary use area owned by Steven Kittel Trust, view to the west.

Figure 14. Temporary use area owned by Hawai‘i Preparatory Academy, view to the northwest.

2. BACKGROUND

To generate a set of expectations regarding the nature of historic properties that might be encountered within the current APE, and to establish a context in which to assess the significance of any such resources, a general culture-historical context for the South Kohala region is presented that includes specific information regarding the documented history of Kauniho, Lālāmilo, Waiʻaka 1st and 2nd Ahupuaʻa and the APE. This is followed by a presentation of relevant prior archaeological studies conducted in the APE.

CULTURE-HISTORICAL BACKGROUND

The bridge and the staging area of the APE are both situated within the northwestern portion of Lālāmilo Ahupuaʻa. The bridge APE also falls in the southern portion of the *ahupuaʻa* (land division spanning from the mountain to the sea) of Kauniho, Waiʻaka 1st, and Waiʻaka 2nd. In the *moku* (district) of Kohala, the long ridge of the Kohala Mountains extends perpendicular to the predominant northeasterly trade winds, creating an orographic rainfall pattern that separates the district into two distinct environmental zones, a wetter windward zone on the eastern side distinguished by its lush green valleys, and a drier leeward zone on the western side. Traditional poetical expressions for this district also identify other geographical divisions of the district. Once such saying derived from an ancient chant titled *Kū e hoʻopiʻo ka lā* states:

ʻo Kohala-iki, ʻo Kohala-nui	lesser Kohala, greater Kohala
ʻo Kohala-loko, ʻo Kohala-waho…	inner Kohala, outer Kohala…
(Pukui and Korn 1973:188)	(Pukui and Korn 1973:190)

Although Lesser-, Greater-, Inner-, and Outer Kohala cannot be found on historical maps, Maly (1999:25) explains that “the lands from Kawaihae to ʻAnaehoʻomalu are within the region called Kohala waho (outer Kohala) or Kohala makani ʻĀpaʻapaʻa (Kohala of the ʻĀpaʻapaʻa wind)”. Another Hawaiian proverb recorded by Pukui (1983:196) specifies the extent of the Kohala District, “*Kohala, mai Honokeʻā a Keahuolono*,” which she translated as “Kohala, from Honokeʻā [a valley in the northeast of the district] to Keahualono [an altar constructed on the district’s southern boundary near ʻAnaehoʻomalu].” Handy et al. (1991) provide the following description of Kohala:

> The district of Kohala is the northernmost land area of the island of Hawaii. ʻUpolu Point, the northwesterly projection, fronts boldly out into the Alanuihaha [*sic*] Channel towards the southeastern coast of Maui, and is the nearest point of communication between the two islands. To the south, along Hawaii’s western coast, lies Kona; to the east the rough coast of Hamakua District unprotected from the northerly winds and sea. Kohala was the chiefdom of Kamehameha the Great, and from this feudal seat he gradually extended his power to embrace the whole of the island, eventually gaining suzerainty of all the Hawaiian Islands. (Handy et al. 1991:528)
>
> The rugged central area of the district is formed by the mountainous remains (elevation 5,505 feet) of the Kohala dome, the oldest of the island’s volcanoes, now long regarded as extinct. The high table land between Mt. Kohala and the vast northern slopes of Mauna Kea, known as Waimea, has one of the finest and most salubrious mountain climates in the Hawaiian Islands, and also offers excellent grazing for cattle. In post-European times it became the seat of the Parker Ranch, one of the largest ranches in the world. (Handy et al. 1991:528)

Like the other districts, Kohala contains multiple land divisions, one of which includes the subject ahupuaʻa of Lālāmilowhose name Pukui et al (1974:128) translates literally to mean the “*milo* tree branch.” Maly (1999:27) offers a different etymology based on information which he gathered from the *moʻolelo* (account) *Kaʻao Hoʻoniua Puʻuwai no Ka-Miki*:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert *lawaiʻa hī-ʻahi* (deep sea tuna lure fisherman) and Piliamoʻo, a powerful priestess and *ʻōlohe*. Kanakanaka and Piliamoʻo were the parents of Nēʻula (a fishing goddess), and she married Puʻu-hīnaʻi a chief of the inlands. Nēʻula and Puʻu-hīnaʻi were the parents of Lālāmilo.

While Lālāmilo is currently referred to as an *ahupuaʻa*, traditionally it was one of several *ʻili* that made up the *kalana* of Waimea. Pukui et al. (1974:226) translate the place name to mean “Reddish Water.” As a *kalana*, Waimea was treated as a subdistrict of the greater *moku* of Kohala and contained several other lands divisions (Maly and Maly 2002). The lands subject to the *kalana* of Waimea were those that form the southern limits of the present-day South

Kohala District including the lands of ʻŌuli, Waiʻaka, Lālāmilo, Puakō, Kalāhuipuaʻa (Lāhuipuaʻa), ʻAnaehoʻomalu, Kanakanaka, Alaʻōhiʻa, Paulama, Puʻukalani (Pukalani), Puʻukapu, and Waikōloa. Additionally, Puakō, the coastal portion of Lālāmilo, was also identified as an *ʻili* of Waimea. In ancient times, Lālāmilo was referred to as Waikōloa Iki (literally, little Waikōloa), while Waikōloa Ahupuaʻa proper was known as Waikōloa Nui (literally, great Waikōloa) (Maly 1999). Bernice Judd, a former librarian at the Hawaiian Mission Children's Society, describes the extent of the *kalana* of Waimea:

> In the early days Waimea meant all the plateau between the Kohala Mountains and Mauna Kea, inland from Kawaihae. This area is from eight to ten miles long and from three to five miles wide. There was no running water on Mauna Kea, so the inhabitants lived at the base of the Kohala Mountains, where three streams touched the plain on their way towards the sea. . . The middle stream, which was famous for wild ducks, was named Waikoloa, or Duckwater. This and the most westerly stream, called Kahakohau, went towards Kawaihae, but neither reached the sea, except in times of flood. (Judd 1932:14)

While the traditional name of this region is Waimea, the name Kamuela (Samuel) has been used since the United States post office in Waimea was renamed in 1901 (The Hawaiian Star 1901). Although originally named after the town, it shared this name with the Waimea post office on Kauaʻi. The post office's practice was to avoid duplicate names within a state or territory to avoid confusion. However, as the office's cashier Kenake said at the time, "Letters come here marked 'Waimea, Hawaii.' Under the old system this would be understood, but now it produces untold trouble on account of the fact that mainland people cannot conceive of two offices of the same name in a Territory" (The Hawaiian Star 1901). The new name, Kamuela, is said to have referred to the postmaster Samuel Spencer or the famed rancher Samuel Parker (Pukui et al. 1974). For whomever this area is named after, most of the references describing the Precontact history and the celebrated cultural landscape refer to this area as Waimea.

Celebrated Cultural Landscape

Nestled between the plateau of two shield volcanoes (Kohala Mountains and Mauna Kea), Lālāmilo Ahupuaʻa along with the greater South Kohala region boasts stunning views of its wind-swept landscape dotted with rolling and jutting *puʻu* (hills). As noted by Plunkett (2018:76), "More than just aesthetically pleasing, the puʻu of Waimea[,] as landscape fabric, functions culturally as definers of place." Three such *puʻu* located at the base of the Kohala Mountains are visible from the APE. These area Puʻu ʻOwāʻowaka, Puʻu Kī, and Hōkūʻula. Hōkūʻula is noted as the battle site between Lonoikamakahiki and Kamalālāwalu, and the name given to the *kānoa* (*ʻawa* mixing bowl) of Laninuikuʻiamamaoloa (Wilkinson et al. 2012). The *kānoa* of Hōkūʻula is also said to belong to Lono and is associated with rituals connected to the agricultural god (Wilkinson et al. 2012). Souza et al. (2003:7) explain:

> The association of the bowl, or *kānoa* of the god Lono (a provider of abundant crops and rain-laden clouds) with Hōkūʻula may refer to the agricultural lands of the region; i.e., (1) the bowl or container could symbolize a land of agricultural abundance; (b) the sprinkling of waters from the bowl could refer to the waters of the streams that flow from the uplands and spread across the plains; and (c) the importance of the rituals of Lono in agricultural endeavors, particularly in the areas of Kohala where large field systems have been archaeologically documented.

While these *puʻu* are a culturally-celebrated natural feature of Waimea, so too are the winds. The variety of winds found in Kohala are numerous and several Hawaiian proverbs recorded by Pukui (1983) capture their names and characteristics. Of the famous *ʻāpaʻapaʻa* winds, she records:

> *Ka makani ʻāpaʻapaʻa o Kohala.*
>
> The ʻāpaʻapaʻa wind of Kohala.
>
> Kohala was famed in song a story for the ʻāpaʻapaʻa wind of that district. (Pukui 1983:157)
>
> *Kahilipulu Kohala na ka makani.*
>
> Kohala is swept, mulch and all, by the wind.
>
> Kohala is a windy place. (Pukui 1983:143)
>
> ʻo*peʻope Kohala i ka makani.*
>
> Kohala is buffeted by the wind. (Pukui 1983:277)

Other winds in Kohala, such as the one that sent clouds racing across the sky, were seen as omens that foretold impending trouble.

> *Makani luna ka lele ʻino mai lā ke ao.*

> There is wind from the upland, for the clouds are set a-flying.
>
> Signs of trouble are seen. This saying originated shortly after the completion of Puʻukoholā heiau by Kamehameha I. He sent Keaweahuulu to Kaʻū to invite Keōuakūʻahuʻula to Kawaihae for a peace conference between them. Against the advice of his own high priest, Keōuakūʻahuʻula went, taking his best warriors along with him. When outside Māhukona, he saw canoes come out of Kawaihae and realized that treachery awaited him. It was then that he uttered the words of this saying. His navigator pleaded with him to go back, but he refused. Arriving in Kawaihae, Keōuakūʻahuʻula stepped off the canoe while uttering a chant in honor of Kamehameha. One of the latter's war leaders stepped up from behind and killed him. All of his followers were slaughtered except for Kuakahela, who hid a later found his way home, where he wailed the sad story. (Pukui 1983:228)

The many rains of Waimea are another important natural feature celebrated in traditional Hawaiian text. The rain named *ʻĀpuʻupuʻu*—also as *Kīpū*, *Kīpuʻu*, and *Kīpuʻupuʻu*—is a cold wind-driven rain that creates bumps on the skin (Akana and Gonzalez 2015), and the name may include a play on the word *puʻu* (hill) to refer to the hilly land of the Waimea area (Akana and Gonzalez 2015). Pukui (1983) adds that when the *aliʻi* Kamehameha of Kohala organized his army of spear fighters and runners from Waimea, they referred to themselves as the *Kīpuʻupuʻu* after the cold rain of their homeland. Pukui (1983:188) documented the following poetical expression for the Kīpuʻupuʻu rain "*Ke Kipuʻupuʻu hoʻanu ʻili o Waimea*," literally translated as "The Kipuʻupuʻu rain of Waimea that chills the skin of people." Doyle's (1953:44) description of the *kīpuʻupuʻu* relates it to a certain wind, "This is the piercing wind that suddenly meets the traveler who makes his upward way from the heat of Kawaihae; and as he nears Waimea he comes upon a region once held sacred."

Another rain, the *ʻEʻelekoa*—also knows as *Mālana, Mālanalana*, and *Mālanaʻeʻelekoa*—is associated with storms. According to Akana and Gonzalez (2015), the *ʻEʻelekoa* is also a wind name of Waimea. The *Kokoʻula* and *Leikokoʻula* rain of Waimea which accompanies a red-hued rainbow is said to be associated with royalty. Sweeping down from the cliffs of Kapaliloa is the *Paliloa* rain and the *Peʻepākaiaulu* is a fierce rain squall that arises suddenly giving the area residents little time to take shelter, thus forcing them to *peʻe* (hide) to prevent from getting soaked. Other rain names for this area include the *ʻĀkōlea*, *Kīnehelehua*, *Kulaʻikanaka*, and the *Leihaʻakolo* rain (Akana and Gonzalez 2015). The account of Kāmiki also identifies the *Nāulu* rain which sweeps across the land between Kawaihae and Puʻu Waʻawaʻa (Maly 1999).

Select *Moʻolelo* for the Lālāmilo-Waimea Area

The history of ancient Hawaiʻi was transmitted orally from one generation to the next, but after the arrival of the first missionaries in 1820, one of the major transformations to Hawaiian culture was the creation of a written Hawaiian language. Although oral traditions were still maintained, many natives and foreigners began inscribing generations' worth of knowledge onto paper. As such, these writings provide us with invaluable insight into Hawaiʻi's past as they describe elements of Hawaiian culture such as historical figures, beliefs, traditions, *wahi pana* (legendary places), *inoa ʻāina* (place names), and *moʻolelo* (legendary accounts, stories, and myths), *mele* and *oli* (songs and chants), and *ʻōlelo noʻeau* (proverbs and sayings); all of which contribute to an in-depth understanding of the people, their culture, and their relationship to place. One of the hallmarks of traditional legendary accounts is their ability to transcend place and time, all while bringing cohesion to landscapes that have been subjected to artificial divisions and boundaries. Summaries of two accounts with connections to Lālāmilo and the APE are presented below.

Kaʻao Hoʻoniua Puʻuwai No Ka-Miki (The Heart Stirring Story of Ka-Miki),

One account that refers explicitly to Lālāmilo is told in the narrative *Kaʻao Hoʻoniua Puʻuwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki), which originally appeared in the Hawaiian language newspaper *Ka Hōkū O Hawaiʻi* between 1914 and 1917. This *moʻolelo* was likely authored during the late 1800s through the early 1900s by noted Hawaiian scholars John Wise and J.W.H.I Kihe. Maly, who translated their story noted*:*

> While "Ka-Miki" is not an ancient account, the authors used a mixture of local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations…While the personification of all the identified individuals and their associated place names may not be entirely "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (Maly 1999:23-24)

The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe,* and their travels around Hawaiʻi Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other

ʻōlohe. The two brothers were born to Pōhaku-o-Kāne (male) and Kapaʻihilani (female), who were the *aliʻi* of the lands of Kohanaiki and Kaloko, North Kona. Upon the mysterious and premature birth of Ka-miki, he was placed in the cave of Pōnahanaha and given up for death. He was eventually saved and raised by his ancestress, Ka-uluhe-nui-hihi-kolo-i-uka, a manifestation of the goddess Haumea, at Kalamaʻula, an area located on Hualālai. Ka-miki was later joined by his elder brother Makaʻiole where their ancestress Ka-uluhe-nui trained her grandsons into *ʻōlohe,* or experts skilled in fighting, wrestling, debating, riddle solving, and running, and taught them how to use their supernatural powers. Portions of the story that explicitly refer to Lālāmilo, the surrounding lands, and their natural features including *puʻu* (hills) and the coastline are discussed below.

As previously noted, the Ka-Miki story states that the land of Lālāmilo was named in honor of the chief by the same name. Lālāmilo's grandfather was Kanakanaka, an expert *ʻahi* fisherman and his grandmother was Piliamoʻo, a powerful priestess and *ʻōlohe*. To this pair was born Nēʻula, a fishing goddess who later married Puʻu-hīnaʻi, chief of the uplands. From this union was born Lālāmilo. Maly continues thusly:

> Kanakanaka was an expert *lawaiʻa hī-ʻahi* (deep sea tuna lure fisherman), and his sister was the windgoddess Waikōloa. Lālāmilo also gained famed as an expert *ʻōlohe* and fisherman. Through his wife Puakō, Lālāmilo came to possess the supernatural *leho* (cowrie octopus lure) which had been an *ʻōnohi* (cherished) possession of Haʻaluea, a goddess with an octopus form…How this octopus lure came to rest on the reefs fronting this land remains a mystery. (Maly 1999:27)
>
> The *leho* was so powerful that if it was only shown to the *heʻe* (octopus), they would climb upon the canoe and be caught. Lālāmilo carefully guarded this lure and even slept with it. When Lālāmilo did leave the lure, he stored it in the *hōkeo aho hī-ʻahi* (tuna lure and *olonā line storage gourd*) of his grandfather Kanakanaka, and this was hidden, tied to the ridge pole of his house. (Maly 1999:27)

The story of how Lālāmilo came into possession of this magical lure is further described. The day after Lālāmilo wed Puakō, the young maiden from Puna who had an insatiable appetite for *heʻe* (octopus), she traveled to the shore at Waimā to gather fish and seaweeds. The tide was low and she walked about the reef flats where she came upon a large *heʻe* (octopus) spread about the reef. She speared it and struggled to carry it ashore. Nēʻula, her mother-in-law saw her carrying the enormous *heʻe* and asked who had given it to her, to which Puakō replied that she had indeed caught the large *heʻe*. With a sense of suspicion, Nēʻula replied that as a native of this place, she had never seen such an octopus in this area. As the two women were talking, Lālāmilo approached them and saw Puakō holding a large octopus. Assuming that another man had given the octopus to his wife, Lālāmilo asked where she got the octopus from and she proceeded to relate the events to him. Accusing his wife of lying, Lālāmilo struck Puakō with a hard blow causing her skin to darken. Nēʻula interjected and suggested that the couple go look about the reef to see for themselves the place where Puakō had retrieved the large *heʻe*.

As Lālāmilo walked intently about the reef, he investigated the site where Puakō had found the massive *heʻe*, to which he discovered a small hole with something red hidden within. Peering into the hole, he saw a beautiful *leho* (cowrie) tucked within, which had attracted the *heʻe*. Without hesitation, Lālāmilo broke the reef and retrieved the *leho* and it is said that after he had taken this *leho,* no more *heʻe* appeared on the reef flats of this area. Lālāmilo took the *leho* home, cleaned it, and prepared himself a lure, which he kept a close watch over. He kept the lure in a container and when he went out to the *heʻe* fishing grounds he would retrieve the lure from the container and hold it in his hand. Without delay, *heʻe* would climb into his canoe and within a short time, he would be able to retrieve several hundred with little effort. Lālāmilo, however, noticed that when his lure was covered in the container, the *heʻe* stopped climbing into the canoe. Amazed at his catch, Lālāmilo showed his wife Puakō and mother Nēʻula, to which the latter recommended that he take the lure and an offering of *heʻe* to Piliamoʻo, his grandmother. When Piliamoʻo had seen what Lālāmilo had brought she explained to her grandson:

> …that this was no ordinary cowrie lure, but a god, the *ʻōnohi* (favorite or cherished one) of Haʻaluea the mysterious supernatural octopus being of the ocean depths. Haʻaluea and her family came from Kāne-hūnā-moku (The hidden land of Kāne) and settled at Makaīwa in the land of Kapaʻa, Kauaʻi. Haʻaluea was the wife of the wind and ocean god Halulu-koʻakoʻa, and grandmother of ʻIwa-nui-kīlou-moku (Great ʻIwa the island catcher). (Maly 1999:30)

Piliamoʻo consecrated the *leho* and the *heʻe,* which it attracted and instructed Lālāmilo to always bring the first *heʻe* that he caught to her as an offering. Having learned that her grandson had this magical lure, Piliamoʻo instructed Lālāmilo to extinguish anyone who inquired about the lure. Because of its mystical powers, rumors about the cowrie lure quickly spread throughout Hawaiʻi and soon caught the ear of Pili-a-Kaʻaiea, the chief of Kona, who had a great love for octopus fishing. Pili-a-Kaʻaiea sent messengers to inquire about the lure and each was killed by Lālāmilo and Piliamoʻo. While engaged in a contest at Hinakahua, a playing field in Puapuaʻa, North Kona, the young and adept

Ka-Miki agreed to fetch the lure for Pili-a-Ka‘aiea with the hopes of becoming the foremost favorite of the Kona chief. One day, Lālāmilo decided to visit his father Pu‘u-hīna‘i, his sister Pu‘u‘iwa‘iwa, and his grand-aunt Waikōloa, who was the guardian of Pu‘u‘iwa‘iwa.

> Lālāmilo arose and told his wife Puakō, and his mother Nē‘ula that he was going to the uplands to visit his father, sister, and the people who worked the upland plantations. Lālāmilo desired to eat the sugar cane and bananas, and drink the *‘awa* which grew on the hill of Po‘opo‘o. Po‘opo‘o was also the name of a seer (*makāula*) who saw to the continued peaceful dwelling of the people. Lālāmilo placed the lure in Kanakanaka’s gourd and secured it near the ridge pole of his house. Lālāmilo then asked Puakō and Nē‘ula to go and look after the gourd in which the *‘ōnohi* (eyeball or cherished possession) of Ha‘aluea was kept. (Maly 1999:38)

Lālāmilo left his home and headed for the settlements and agricultural lands of Pu‘u-hīna‘i, however, as he got closer to his intended destination, his thoughts became consumed by his precious lure. Unable to curb his thoughts, Lālāmilo returned to the coast without paying a visit to his father and sister. In the meantime, while Lālāmilo was on his journey to the uplands, the adept Ka-Miki traveled to Lālāmilo’s home and met with a man from the area, Nīheu. Ka-Miki inquired about the whereabouts of Lālāmilo only to find that he was not at home. Ka-Miki gazed into the home of Lālāmilo and confirmed that it was unoccupied, however, a gourd container caught his eye and Ka-Miki proceeded to fetch the container tucked away in the rafters of the house. Without incident, Ka-Miki lowered the gourd and departed with the magical lure.

Because of his premonition, Lālāmilo returned home to find that his prized *leho* had been stolen. Lālāmilo then went to visit his grandmother and upon seeing that her grandson had arrived empty-handed, she paid him no attention. The saddened Lālāmilo then called out in chant to his grandmother to inform her of the stolen lure. After hearing the cries of her grandson, Piliamo‘o commanded that Lālāmilo retrieve a white rooster, *‘awa* from Po‘opo‘o; an *‘āhuluhulu* fish; and a red *malo* (loincloth) before the setting of the sun. Lālāmilo quickly retrieved all of the prescribed items and returned to his grandmother’s home which overlooked the shore of Kauna‘oa.

> Pili-a-mo‘o told Lālāmilo to release the pig and chicken, and both of them entered the canoe which Pili-a-mo‘o had prepared as the path on which Lālāmilo would travel to Kaua‘i-o-Kamāwaelualani, where he could find ‘Iwa at Makaīwa, Kapa‘a. (Maly 1999:31-32)
>
> Pili-a-mo‘o called to Lālāmilo saying, “The gods have approved your offerings, and here is your path (canoe) to present the offerings to ‘Iwa, the mysterious cascal of the land which snares the sun, ‘Iwa the sacred ward of Halulu-ko‘ako‘a.” With the offerings set in the canoe, and the sail raised, Pili-a-mo‘o then prepared, an *‘awa* ceremony.
>
> The pig was at the mast, the *‘awa* and fish were set on the platform, the rooster sat on the outrigger end, and the *malo* was placed at the stern of the canoe. After Pili-a-mo‘o and Lālāmilo drank *‘awa* they slept and when half the night passed the rooster crowed. Pili-a-mo‘o arose and went out of the house where she saw the navigator’s star high above. Pili-a-mo‘o then called to Lālāmilo, :”Arise great shark of the sea, o offspring of Hulihia-ka-lani, o flippers of the turtle Kamilo-holu-o-Waiākea. Awaken for the light of the star Hīki‘i-maka-o-Unulau, the *Kualau* (shower bearing wind) blows and the traveler will touch Kaua‘i.” Lālāmilo arose, entered the canoe and prepared to sail to Kaua‘i. [August 2, 1917]. (Maly 1999:32)

Piliamo‘o then gave specific instructions to her grandson on how to find and how to use the various items to solicit the help of ‘Iwa, the rascal lad of Kaua‘i. Heeding the instruction of Piliamo‘o, Lālāmilo sailed to Kaua‘i and just as his grandmother had described, Lālāmilo found the young ‘Iwa. After an exchange, ‘Iwa consented to Lālāmilo’s request and the two men set sail for Kohala, passing along the north side of the Hawaiian Islands, before turning south along the Kohala coast and sailing to Pālau‘eka in Hōlualoa, Kona. Here they met with Ka‘aha‘aha and Kapakapaka, the two fishermen for the chief Pili-a-Ka‘aiea. After a brief exchange of words, ‘Iwa asked the fishermen “…what fish the chief was after today, and Kapakapaka said *he‘e*” (Maly 1999:34). Having learned of this, ‘Iwa set in motion a plan to retrieve the prized cowrie lure of Lālāmilo and described the nature of retrieving the largest octopus that dwelled in the deep sea to the two fishermen. While Kapakapaka did not believe ‘Iwa, Ka‘aha‘aha was more than willing to investigate the claims made by ‘Iwa.

Together, the four men sailed in the fishing canoe into the deep sea, passing the *‘ōpelu*, and *kāhala* fishing grounds. ‘Iwa took his prized cowrie lure, Mulali-nui-makakai, and tossed it overboard and called out in chant to his grandmother, Ha‘aluea, asking for her assistance. As ‘Iwa closed his chant, he felt a tug on his lure line. He quickly pulled the fishing line up and a large *he‘e* slipped into the canoe. Amazed at the sight of the large *he‘e*, ‘Iwa proceeded to kill it then turned to the two fishermen and told them this is not the biggest octopus. He again cast his lure into the deep sea but this time, the lure held fast in the ocean, as though it was stuck. At this time, the chief Pili-a-Kaʻaiea drew near the men in his large double-hauled canoe.

> ʻIwa suggested that Kapakapaka *mā* asked Pili to use his lure at this site, so he could secure the largest octopus. Pili's lure was set into the water and ʻIwa called once again to Haʻaluea…
>
> A large *heʻe* rose and embraced Pili's canoe, this *heʻe* was killed and Pili set the lure into the ocean again. This time the goddess Haʻaluea rose in her octopus form and held tight to the canoe and lure. ʻIwa dove into the ocean and swam along Haʻaluea's tentacles, he found the lure and secured it in the folds of his *malo*. ʻIwa then tied the chiefs' line to a coral outcropping and returned to the surface where he joined Lālāmilo. Haʻaluea let go of Pili's canoe, and ʻIwa told Lālāmilo to paddle the canoe towards Maui. In a short time, they arrived along the shore of Waimea (also called Kaunaʻoa), where they were greeted by Pili-a-moʻo. (Maly 1999:35)

Pleased with the outcome of their journey, ʻIwa, Lālāmilo, and Piliamoʻo feasted on food and *ʻawa* and ʻIwa returned to his home on Kauaʻi. As this portion of the story concludes, it is said that Lālāmilo divided his lure with his brother-in-law Pualaʻa who arrived from the Puna District. It is said that because the divided lure resembled baked taro, the lure came to be known as Kalo-kunu (broiled taro). This is how Lālāmailo reclaimed his prized lure.

The Epic Tale of Hiʻiakaikapoliopele

The ancient saga details Pele's migration to Kīlauea and quest for her lover, Lohiʻauipo, then details the travels of her younger sister, Hiʻiakaikapoliopele, to find him. The *moʻolelo* was published daily in the Hawaiian language newspaper, *Ka Naʻi Aupuni*, which ran from 1905 to 1906 and was orated by Hoʻoulumāhiehie. A portion of the story discusses two places within the Waimea region: Mahiki, a mystical forest in the area; and Waiʻaka, where the forest of Mahiki seems to be located. Mahiki was likely located north of the current APE

Hiʻiaka and her traveling companions stopped in the forest known as Mahiki located in the Waimea region, which was also the residence of Mahiki, a male demigod who had extraordinary powers and great strength (Hoʻoulumāhiehie 2006:107). When Hiʻiaka saw the being, she knew he was ready to battle her and she had no desire to fight Mahiki but he was determined to defeat her. Hiʻiaka said to Wahineʻōmaʻo, "Get behind me. Wherever I move, you move with me. I shall fight in my womanly fashion against the shameless one. He, the male, may inflict injury upon us, but you and I, the women, shall inflict such injury that he will end up laid out like the fishes of Hīlia that lie still in the water in easy reach" (Hoʻoulumāhiehie 2006:107).

As Mahiki darkened the forest and commanded a fierce rain upon the two women, Hiʻiaka asked her companion to "make your body forms into a shelter above us, so we are not blinded by the eye-piercing rain of Mahiki Forest" (Hoʻoulumāhiehie 2006:108). As *palaʻā* (lace fern; *Sphenomeris chinensis syn. chusana*) and *ʻamaʻu* (*Sadleria*) ferns sheltered the women as the icy Kīpuʻupuʻu rain pelted down. Mahiki was sure that the conditions he employed would affect the women advancing through the forest, to his dismay, that was not the case.

Mahiki furious with Hiʻiaka unleashed all of is plant forms to imprison her and her companions. As various plants began to coil around them, Hiʻiaka struck a blow and all foliage turned into ash instantly (ibid.). Still furious but now tinged with fear and worry, Mahiki stated, "And so it is. You may have escaped death from my plant forms, but you will never escape the throngs and legions of spirits here in Mahiki" (Hoʻoulumāhiehie 2006:109). Mahiki began to summon the spirits of the forest and area. Wahineʻōmaʻo felt the rush of the wind followed by the voices calling out the group and surrounding them. Suddenly Mahiki and his band of spirits pounced on Hiʻiaka and her cohort attacking them from all sides until she struck her "lightning skirt" causing a frenzy with the spirits who began to shriek and cry. As the spirits ceased and the chaos cleared, Mahiki found Hiʻiaka and her friends unfazed. Hoʻoulumāhiehie includes the following lyrics:

> Mahiki is garlanded with rain and wind
> The buffeting gusts of the Kipuʻupuʻu strut like billows
> Waves adorned by Kawelowelo
> Appreciated by Kawiliwahine, there
> There we two shared the chilling cold
> Enduring the Kīpuʻupuʻu rain
> Along with my fellow flotsam in the storm
> We warmed ourselves against the cold and wind
> A familiar wind from Waihaka

Ornamenting the blossom of the koʻokoʻolau

The forest of Waiʻaka is radiant in its verdure, ah, there. (Hoʻoulumāhiehie 2006:109)

Later in the story, Waiʻaka is the setting of a fight between ʻĀinakō, the strongest fighter of Waimea, and Kauakahiapaoa, the fighting champion of Kauaʻi. When ʻĀinakō heard of his future opponent, he uttered this taunt:

This is Waimea

Of the pummeling Kīpuʻupuʻu rain

With ʻĀinako's fiery fists

Waiʻaleʻale will be humbled. (Hoʻoulumāhiehie 2006:375)

Once the fight was set, the chiefess of Waimea suggested to Kauakahiapaoa that he should go to the men's eating house. Refusing the invitation he stated, "I shall wait to eat until Waimea beholds the man-smiting moss of Manuʻakepa, and you, O Chiefess, see how truly fine Kauaʻi can be, with Waiʻaleʻale's peak breaking through on high, piercing the storm clouds" (Hoʻoulumāhiehie 2006:375).

As Kauakahiapaoa made his way to the wrestling grounds at Waiʻaka, the locals' eyes were drawn to his features and physique, and they did not take notice of their own champion, ʻĀinakō. The two men observed each other and hurled boasts at each other until ʻĀinakō threw a punch so violent that a blast of air burned Kauakahiapaoa's eyes. But ʻĀinako did not land his punch. Instead, Kauakahiapaoa struck the giant man's hand sending him spinning in the air. As ʻĀinako lay and groaned in pain, Kauakahiapaoa lifted him and threw him *makai* of Waiʻaka. Where ʻĀinakō's body fell is now called Puʻuʻāinakō—the reason that place is named today (Hoʻoulumāhiehie 2006:377). Puʻuʻāinakō is located where the three *ahupuaʻa* of Kawaihae 2nd, ʻŌuli, and Puʻuwaiwai meet about 5 miles (8.2kilometers) west of the current APE.

Brief Account of a Several *Heiau* in Waimea with Reference to Hōkūʻula

In Emma Doyle's (1953) book *Makua Laiana The Story of Lorenzo Lyons*, she provides a brief account describing some *heiau*, including their uses and origins that were located along the Kohala Mountains slopes in the area east of the current APE. Doyle did not know the name of these *heiau*, but includes them as the setting of a story that tells how the Akua Makuakua met the beautiful Wao and how they settled on Hōkūʻula after their marriage:

> Vivid were the rainbows of the Lanikepu hills, and red the rain, uakoko, that fell upon their slopes, for in the forest that was then their background was a heiau—a women's heiau, the only one; and by these lovely tinted tokens the gods honored it, and signified their approval.
>
> Founded, dedicated and consecrated by the very high chiefess Hoapiliahae, it was attended exclusively by young virgins. There, in the sanctity of the cool highland forest, they performed the sacred ceremonies, learning also the science of healing so that they might eventually minister to others. And the names of the five rains of the heiau were given to the five children of Hoapiliahae.
>
> On a nearby ridge stood another heiau, builded there by the great Akua Makuakua who had come from far off Kahiki. He it was who, flying to a hillside to watch the rainbows, found there the beautiful goddess Wao, clad only in her long, silky hair. Love came swiftly and was mutual, and after glorious wedding festivities the couple went to live at Hokuula, the hill of the red planet.
>
> But to bear each of her children Wao returned to the Waimea hills, thereby made sacred. On these occasions a tabu was proclaimed, the forbidden ground extending down across the plains to whatever place a stone happened to stop rolling when started above by her servants. Stones they were themselves, these retainers, all through the night hours, for so Wao transformed them until daylight, when they became human again. (Doyle 1953:44)

Hoopiliahae was a wife of Keawenuiaʻumi, the grandson of the *aliʻi nui* Līloa, and she herself was the daughter of Līloa's *kahuna* (priest), Paeamolemole (Clark and Kirch 1983). The earliest recorded chiefs of Waimea descended from the Ulu-Hema genealogical line that led to Līloa, whom Clark and Kirch (1983:23) describe as "the founder of the island dynasty."

Chiefly Rule in South Kohala

During the late 16th century, Kohala and Kona were ruled together by an *aliʻi* named Kūāiwa (Cordy 2000). The other four *moku* on Hawaiʻi Island were ruled by an independent chief: Kulukuluʻā in Hilo, Huaʻā in Puna, ʻĪmaikalani in Kaʻū, and it is believed that Līloa ruled over Hāmākua (Cordy 2000). Kūāiwa appointed his son ʻEhuinuikaimalino (also referred to as ʻEhu) to rule over Kona and a junior son, Hukulani, to rule Kohala. Kūāiwa had two other sons from a previous wife, Kahoukapu and Manauea, and all of his sons became the heads of Hawaiʻi's aristocratic families (Fornander 1880). It was Līloa's son, ʻUmi-a-līloa, however, who would come to rule the entire island.

In Kona, the ʻEhu line of chiefs grew to be somewhat powerful, but ʻEhu was ranked second to Līloa, the ruler of Hāmākua (Kelly 1983). According to Kamakau (1992), ʻEhu placed his son, Laea-nui-kau-manamana in Līloa's royal court and for some time they both resided in Waipiʻo in the Hāmākua District, where Laea-nui assisted with the construction of the sacred stone slab named *Ka paepae kapu o Līloa*. When Līloa died, his eldest son Hākau was given the kingdom. Hākau mistreated his people, and Līloa's second son, ʻUmi-a-līloa, seized the kingdom from his brother. The chiefs of Hilo, Puna, Kaʻū, and Kona, however, withheld their allegiance to ʻUmi. One by one, ʻUmi and his army conquered these *moku.* Kamakau (1992) notes that when ʻUmi marched on Kona and Kohala, ʻEhu was of old age, and his lands were easily seized. ʻUmi eventually moved his royal court to Kailua in Kona, and took the daughter of ʻEhu, Moku-a-hua-lei-akea as his wife. She bore ʻUmi a daughter named ʻAkahi-ʻili-kapu.

ʻUmi's reign is one that is often celebrated as it marked a time of peace and increased productivity and a move towards craft specialization. According to Kamakau:

> There was no kingdom like his. He took care of the old men, the old women, the fatherless, and the common people. Murder and thievery were prohibited. He was a religious chief, just in his rule…
>
> During ʻUmi-a-Liloa's reign, he selected workers and set them in various positions in the kingdom. He separated those of the chiefly class (*papa aliʻi*), of the priestly class, of the readers of omens (*papa kilo*), those skilled in the affairs of the land (*poʻe akamai o ka ʻaina*), farmers, fishermen, canoe builders, warriors, and other skilled artisan (*poʻe pale ʻike*) in the work they were best suited for; and each one applied himself to his own task. . . (1992:19)

Kamakau (1992) adds that ʻUmi was a skilled fisherman, who often fished for *aku* (his favorite fish), *ʻahi*, and *kālā* from beaches of Kalāhuipuaʻa to Makaula in South Kohala.

ʻUmi's reign lasted until around A.D. 1620. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawaiʻi for more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). Upon his death, ʻUmi was succeeded by his son, Keawenui a ʻUmi, who ruled over Kohala, Kona, and Kaʻū, and then his grandson, Lonoikamakahiki (Cordy 2000; Kamakau 1992). During this time, wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *aliʻi*. By the late 17th century, large areas of Hawaiʻi Island were controlled by a few powerful *aliʻi ʻai moku* (district chiefs). There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level.

The Reign of Lonoikamakahiki (ca. A.D. 1640) to Kalaniʻōpuʻu (late 1700s)

Lonoikamakahiki, the son of Keawenui a ʻUmi, and the grandson of celebrated *aliʻi nui* ʻUmi a Līloa, was recognized as an accomplished and dexterous warrior. During his reign, a major battle was fought between Lonoikamakahiki and his insurgent older brother, Kanaloakuaʻana. According to Fornander (1880) Kanaloakuaʻana and his rebel forces fought and pursued each other across Kohala, including the Waimea Plain. The battle began at:

> . . . Anaehoomalu [ʻAnaehoʻomalu], near the boundaries of Kohala and Kona. The rebel chiefs were encamped seaward of this along the shore. The next day Lono marched down and met the rebels at a place called Wailea, not far from Wainanalii, where in those days a watercourse appears to have been flowing. Lono won the battle, and the rebel chiefs fled northward with their forces. At Kaunaoa [Kaunaʻoa], between Puako and Kawaihae, they made another stand, but were again routed by Lono, and retreated to Nakikiaianihau, where they fell in with reinforcements from Kohala and Hamakua. Two other engagements were fought at Puupa [Puʻupā; on the plain southwest of the APE] and Puukohola [Puʻukoholā], near the Heiau of that name, in both of which Lono was victorious. His brother Kanaloakapulehu was taken prisoner, slain, and sacrificed at the Heiau, but Kanaloakuakawaiea escaped with the scattered remnant of the rebel forces. The rebels now fled into Kohala, and were hotly pursued by Lonoikamakahiki. Several skirmishes were fought during the pursuit; at Kaiopae, where Kanaloakuakawaiea was slain; at Kaiopihi, and finally at Puumaneo [Puʻumaneʻo], on the high lands above Pololu [Pololū], where the last remnant of the rebel force was conquered and slain, and the island returned to its allegiance to Lono and Kaikilani. (Fornander 1880:120-121)

Later in Lonoikamakahiki's reign, Kamalālāwalu, the *aliʻi nui* of Maui invaded the island and led a series of attacks in South Kohala that culminated in the battle at Puoaoaka (Puʻu ʻOwāʻowaka) just northeast of the APE (Fornander 1916-1917). The fighting began at Wailea, moved north to Kaunaʻoa, and then to Puakō (the coastal section of Lālāmilo), where Lonoikamakahiki's brother, the high chief Kanaloakuaʻana, was brutally tortured and slaughtered. Kamalālāwalu and his army then proceeded to the *puʻu* named Hōkūʻula just east of the current APE, to prepare for the next battle.

The battle at Puʻu ʻOwāʻowaka is described in detail by Fornander (1916-1917, 1959) and (Kamakau 1992). Once he reached Waimea, Kamalālāwalu positioned himself on Hōkūʻula, the hill that he was told would serve as a refuge for him and his men (Fornander 1959). He had been advised to meet Lonoikamakahiki's forces on the Waimea Plain by two members of his camp named Kauhipaewa and Kihapaewa. Unbeknownst to Kanaloakuaʻana, these two men were secretly working for Lonoikamakahiki. The Maui chief assumed, having positioned his army on the Waimea Plan and stationed himself on Hōkūʻula to direct his forces, an easy victory, however:

> Kamalalawalu, upon arrival thereon, found on reconnoitering that there were neither stones nor trees, but only dirt [on Hōkūʻula]. While they were engaged in a conversation with Kumaikeau together with Kumakaia, at that time messengers were sent to summon Lonoikamakahiki and Pupuakea. At Kealakekua, in Kona, was the place where Lonoikamakahiki lived. When the messenger appeared before him, he said to Lonoikamakahiki: "Kamalalawalu and Makakuikalani have come to give battle to you both…When Lonoikamakahiki heard these things, he questioned the messenger: "Where is the battle to take place?" The messenger replied: "There, at Waimea, on top of that hill, Hokuula, where Kamalalawalu and all Maui are stationed." (Fornander 1959:188)

Upon awakening the next morning, however, Kamalālāwalu was stunned to discover that a great constellation of men had amassed near the coast. What seemed like thousands of warriors from all of Hawaiʻi Island had gathered as far as the eye could see and were prepared to savagely wage war upon the intruder Maui chief. According to Fornander (1916–1917:344), "the Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia, while those of Kohala guarded from Momoualoa to Waihaka." Realizing that he was vastly outnumbered, Kamalālāwalu attempted to reconcile differences but was denied, as the Hawaiʻi chief was enraged at how his ally Kanaloakuaʻana had been slain. Lonoikamakahiki held the advantage with superior numbers, and knowledge of the battleground. The battle commended:

> After Kama-lala-walu's warriors reached the grassy plain, they looked seaward on the left and beheld the men of Kona advancing toward them. The lava bed of Kaniku and all the land up to Huʻehuʻe was covered with the men of Kona. Those of Kau and Puna were coming down from Mauna Kea, and those of Waimea and Kohala were on the level plain of Waimea. The men covered the whole of the grassy plain of Waimea like locusts. Kama-lala-walu with his warriors dared to fight. The battle of Puoaoaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger for the slinging of stones that would fall like raindrops from the sky. The stones would fall about with a force like lightening, breaking the bones into pieces and causing sudden death as if by bullets.
>
> Maui almost won in the first battle because of Hawaii's lack of a strong champion. Maka-ku-i-ka-lani [representing Maui] was first on the field and defied any man on Hawaii to match strength with him. Maka-ku-i-ka-lani tore Hawaii's champion apart. When Puapua-kea arrived later by way of Mauna Kea, those of Hawaii rejoiced at having their champion. Maka-ku-i-ka-lani and Puapua-kea matched their strength in club fighting on the battle site before the two sides plunged into the fight. (Kamakau 1992:58-59)

Although well-matched, Puapuakea overpowered Makakiakalani, and the warriors of Maui were put to flight. After three days of fighting, Lonoikamakahiki emerged victorious and Kamalālāwalu and nearly all the invaders, except his son Kauhiakama, were executed. Lonoikamakahiki died without an heir, and the next four rules of Hawaiʻi were descendants of his older brother (Cordy 2000). Through their reigns, the Ī lineage of Hilo and the Mahi lineage of Kona grew in power. The resulting political friction culminated in the marriage of Keawe (the fourth of these chiefs) and Lonomaʻaikanaka of the Ī line.

In about A.D. 1740, following the death of Keawe, Hawaiʻi was invaded by Alapaʻinui, the son of a former Kona war chief of the Mahi lineage, who had been living on Maui since the death of his father (Kamakau 1992). Alapaʻinui waged war against the chiefs of Kona and Kohala and was eventually victorious, proclaiming those lands as his own (he also later gained control of the Hilo and Kaʻū Districts). After gaining control of the Island, Alapaʻinnui is said to have lived in Waimea for a time:

> Alapaʻi dwelt in Hilo for a year and then went to live in Waipiʻo. Shortly after, he and the chiefs moved to Waimea and others went by canoe to Kawaihae. From Waimea, he went to Lanimaomao, where he fell ill. (Kamakau 1992:77)

It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupuaʻa* of Kokoiki, near Moʻokini Heiau (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (Kamakau 1992:67-68) places the birth event sometime between A.D. 1736 and 1758, and probably nearer to the later date. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning signified the night before by a very bright, ominous star, thought by some to be Halley's Comet (this is also controversial). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1918).

Many of the chiefs who had been deprived of their lands by Alapaʻinui battled against Keaweʻōpala, and he was soon defeated in South Kona by Kalaniʻōpuʻu, who then became the ruler of Hawaiʻi Island (Kamakau 1992). Kalaniʻōpuʻu's reign was marked by near-constant warfare as he invaded Maui and defended himself from rebellions by Maui and Hawaiʻi *aliʻi* (Kamakau 1992). In A.D. 1775 Kalaniʻōpuʻu and his forces from Hāna, Maui, raided and destroyed the neighboring district of Kaupō, and then launched several more raids on Molokaʻi, Lānaʻi, Kahoʻolawe, and parts of West Maui. It was at the battle of Kalaeokaʻīlio that Kamehameha, a favorite of Kalaniʻōpuʻu, was first recognized as a great warrior and given the name of Paiʻea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi (Kamakau 1992). Kalaniʻōpuʻu was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

The Arrival of Europeans, Missionaries, and the Reign of Kamehameha

The arrival of foreigners in the Hawaiian Islands marked the beginning of drastic changes in Hawaiʻi's culture and political-economy. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas due to war and disease, yet an increase in others, with relatively little change in material culture. Some of the work of the *makaʻāinana* shifted from subsistence agriculture to the production of foods and goods which could be traded with foreign ships. There was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influences were already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui, and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983).

Captain James Cook and his crew onboard the ships the *H.M.S. Resolution* and *Discovery* first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniʻōpuʻu, who was still at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting but chose not to participate (Jarves 1847). Although the expedition did not explore inland to Waimea while sailing up the Kohala coast, Lt. King recorded his observations of that part of the countryside:

> Koaara [Kohala] extends from the Westernmost point to the Northern extremity of the island; the whole coast between them forming an extensive bay, called Toe-yah-yah [Kawaihae], which is bounded to the North by two very conspicuous hills. Toward the bottom of this bay there is foul, corally ground, extending upward of a mile from the shore, without which the soundings are regular, with good anchorage, in twenty fathoms. The country, as far as the eye could reach, seemed fruitful and well inhabited, the soil being in appearance of the same kind with the district of Kaoo [Kaʻū]; but no fresh water is to be got here. (King 1784:106)

After the death of Captain Cook and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck the district and Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized. He set out on a circuit of the island. While in Kohala, Kalaniʻōpuʻu proclaimed that his son Kīwalaʻō would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to his nephew Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kīwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication, Kalaniʻōpuʻu went to Hilo to quell a rebellion by a Puna chief named ʻĪmakakoloʻa.

In 1790, John Young and Isaac Davis, sailors on board the ships *Eleanora* and *Fair American*, which were trading in Hawaiian waters, were detained by Kamehameha I and made his advisors. The story of their detention begins when the crew of the *Eleanora* massacred more than 100 natives at Olowalu, on the island of Maui, in retaliation for the theft of a skiff and the murder of a sailor. The *Eleanora* then sailed to Hawai‘i Island, where John Young went ashore and was detained by Kamehameha’s warriors. The other vessel, the *Fair American*, was captured off the Kona coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named “Lopaka,” were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1992). Kamehameha, with the aid of Young and Davis and their knowledge of the newly acquired foreign arms, then succeeded in conquering all the island kingdoms except Kaua‘i by 1796. It was only in 1810, after two unsuccessful invasion attempts, that Kamehameha received the Kaumuali‘i of Kaua‘i, unifying the Hawaiian Islands under one ruler (Kuykendall and Day 1976).

Soon after the arrival of foreigners, the landscape of Waimea also began to change dramatically. This began with deforestation caused by the harvesting of sandalwood, and then by the introduction of cattle (Rechtman and Prasad 2006). In 1792, Captain George Vancouver, who had sailed with Cook during his 1778-1779 voyages, arrived at Kealakekua Bay with a small fleet of British ships, where he met with Kamehameha. Vancouver stayed only a few days on this first visit but returned again in 1793 and 1794 to take on supplies. Vancouver introduced cattle to the Island of Hawai‘i at Kealakekua during these latter two visits, gifting seventeen heads of steer to Kamehameha I, who at the request of Vancouver, immediately made the cattle *kapu*, thus preventing them from being killed and allowing their numbers to increase (Barrère 1983; Kamakau 1992; Vancouver 1984). Some of the offspring of these animals escaped the initial attempts to contain them and spread throughout Kohala, Kona, and the saddle region. In agricultural areas, they wrought havoc on crops and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes (Barrère 1983; Henke 1929).

Hawai‘i’s culture and the economy continued to change drastically during Kamehameha’s rule as capitalism and industry established a firm foothold in the Islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810. Kamehameha, who resided on the Island of O‘ahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food, and fish (Kamakau 1992). This new burden contributed to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau (1992:204) indicates that “this rush of labor to the mountains brought about a scarcity of cultivated food … The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ‘Ama‘u, or Hapu‘u, from the wild plants resorted to.” Once Kamehameha realized that his people were suffering, he “declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land” (Kamakau 1992:202). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua-Kona, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade but also continued to enforce the *kapu* system.

When Kamehameha I died on May 8, 1819, the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate (Kamakau 1992). Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha’s death, a period of *‘ai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history, traditional customs were altered (Kamakau 1992). Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu, and rather than re-establish the *kapu*:

> Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief’s tabu and the freeing of the eating tabu. The *kahu* said to the chief, “Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!” and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali‘i consented to the free eating and it was accepted on Kauai (Kamakau 1992:225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house, and did whatever he desired it was still during a time when he had not reinstituted the *ʻai kapu* (eating taboo), but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kūkāʻilimoku, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was ultimately defeated in the battle of Kuamoʻo in the North Kona District (Kamakau 1992). With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawaiʻi to Kauaʻi, and the arrival of Christian missionaries shortly thereafter, Hawaiʻi's culture and their spiritual beliefs continued to be transformed. By December of 1819, Liholiho had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *ʻaumakua* worship, to continue (Kamakau 1992; Oliver 1961). With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

In October of 1819, seventeen Protestant missionaries had set sail from Boston to Hawaiʻi. They arrived in Kailua-Kona on March 30, 1820, to a society whose spiritual system has just been overturned. Many of the *aliʻi*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western-style and adopted their dress and religion. As missionaries began to introduce Christian concepts and beliefs they also set forth the process of rendering a once purely oral language into written form, and literacy was quickly taken up as a national endeavor (Nogelmeier 2010; Schütz 1994). Soon many *aliʻi* were rewarding these early missionaries with land and positions in the Hawaiian government. During this period, the demands of the *aliʻi* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *aliʻi* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade soon led to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian economy was well on its way toward integration into global trade networks as its focus shifted from the sandalwood trade to a short-lived whaling industry, then to the to the more lucrative but environmentally destructive sugar industry.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, the missionary William Ellis described Waimea as a fertile, well-watered land "capable of sustaining many thousands of inhabitants" (Ellis 1831:399). The population was concentrated in three villages, Keaalii, Waikōloa, and Puʻukapu, each located where major streams reached the plain. Ellis noted that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. In the time since Kamehameha I's death, the harvesting of sandalwood had once again been forced upon the *makaʻāinana*. During his travels along the coast of Kohala, Ellis noted that most of the villages were empty as the men of the region had been ordered to the mountains by the King to collect sandalwood. He wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young… Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 1831:396-397)

Agricultural Practices of the Lālāmilo-Waimea Area

The wind-swept landscape dotted with rolling and jutting *puʻu* found in the upper Lālāmilo-Waimea, described in the *moʻolelo* summarized above, allowed for highly productive agricultural development during the Precontact and early Historic periods. As described by Kirch (1985:215), "Hawaiians were first and foremost cultivators of the land," and over the generations, they adapted and intensified their agricultural production to levels unseen elsewhere in greater Oceania. Evidence of their adaptive agricultural endeavors is still visible today in Kohala. The uplands of the Waimea-Lālāmilo area, at elevations ranging from roughly 750 and 900 meters (2,460 to 2,950 feet) above sea level, fertile soil and adequate rainfall allowed for the extensive cultivation of sweet potatoes, taro, and other crops (Kirch 1985). Early archaeological investigations conducted by Barrera and Kelly (1974) identified a dense concentration of sites in the uplands of Lālāmilo. Subsequent studies conducted by Bishop Museum staff (Clark 1981b, 1983) identified remnants of an agricultural field system in the Lālāmilo-Waimea area. These early investigations ultimately concluded, "that the present town of Waimea was at the center of a large and intensively cultivated field system, which was in operation by at least the seventeenth century…" (c.f. Kirch 1985:177).

Concerning the Precontact use of the Waimea area, including the APE, Clark (1987) proposed a regional settlement pattern model that includes four elevational delineated environmental zones. The Coastal Zone extends up to about 150 feet elevation and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with the associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops and was a locus for the collection of wild floral and faunal resources. The current APE, situated at elevations ranging from 732 meters (2,401 feet) to 741 meters (2,431 feet) is Clark's (1987) Kula Zone.

Ultimately the increased upland population resulted in the creation of what archaeologists have dubbed the Waimea Field System found at elevations ranging from roughly 2,460 to 2,950 feet (750 and 900 meters) above sea level. The Waimea Field System is at least one of two major field agricultural field systems in the Kohala District. Each field system is vastly different in size and has its own distinguishing feature composition, however, unlike the expansive Kohala Field System, found along the leeward slopes of the Kohala Mountains, that relied almost exclusively on rainfall, the Waimea Agricultural System was also supported by small irrigation channels (*ʻauwai*) that may have intermittently carried water across the sloping landscape (Kirch 1985). Subsequent archaeological studies conducted on the Waimea Agricultural System throughout the 1990s and early 2000s yielded additional information about the agricultural system. Burtchard and Tomonari-Tuggles' (2005:iii) study of the field system concluded that:

> …short-term, temporary, agriculturally supported residence began on the upper Waimea Plain, possibly as early as the AD 1400s. The agricultural system, however, appears to have been substantially smaller than previously believed, and was limited to non-irrigated cultivation. Elongated earthen ridges are most plausibly remnant dunes that formed at the base of floral windbreaks sheltering fields. Limited irrigation may have begun in the late AD 1700s in support of military undertakings by Kamehameha at Kawaihae on the leeward Hawaiʻi coast. Most of the extensive irrigation system on the upper Waimea Plain was developed in the 19th century in association with commercial agriculture. In more recent times, the project area was used for the cultivation of corn and hay, a World War II military camp, and pasture for livestock.

At these elevations in Clark's (1987) Kula Zone, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Clark and Kirch (1983) identified four field complexes in the Waimea area (Figure 15), each containing an extensive network of fields fed by a system of irrigation ditches that drew water from the Waikōloa and Kahakohau streams. The APE is situated near Field Complex 2. Kirch (1985:231) surmises that the fields were perhaps intermittently irrigated with "simple furrows" that were used to "direct water across the sloping field surfaces." Recent modelling of water flow in a portion of Field Complex 3 (located west of the current APE) by McIvor and Ladefoged (2018) suggests that intermittent irrigation there may have been used to grow a variety of crops. In addition to staple crops such as *ʻuala* (sweet potatoes) and *kalo* (taro), crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, *maiʻa* (bananas), *kō* (sugarcane), *niu* (coconuts), and *hala* (pandanus) (Haun et al. 2003). According to Barrère (1983:27), "the cultivating places at Waimea were first expanded to supply the chiefs' needs while sojourned there and at Kawaihae".

In addition to sweet potatoes and taro, crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, bananas, sugarcane, coconuts, and *hala* (Haun et al. 2003). While most of the taro and sweet potato fields of South Kohala were located in the rainier uplands near the present-day town of Waimea (where there was also a sizeable permanent population). Handy et al. (1991:532) relate that "the coastal section of Waimea, now called South Kohala, has a number of small bays with sandy shores where fishermen used to live, and where they probably cultivated potatoes in small patches . . . Puako near the Kona border was a sizable fishing village at one time where there were undoubtedly many sweet potato patches." The name of the village of Puakō, which literally translates as "sugarcane blossom" (Pukui et al. 1974:191), suggests that sugarcane was grown there. In fact, it was the A.D. 1880 discovery of wild sugarcane growing near the village of Puakō that would eventually lead to the establishment of the short-lived Puakō Sugar Plantation (Puakō Historical Society 2000).

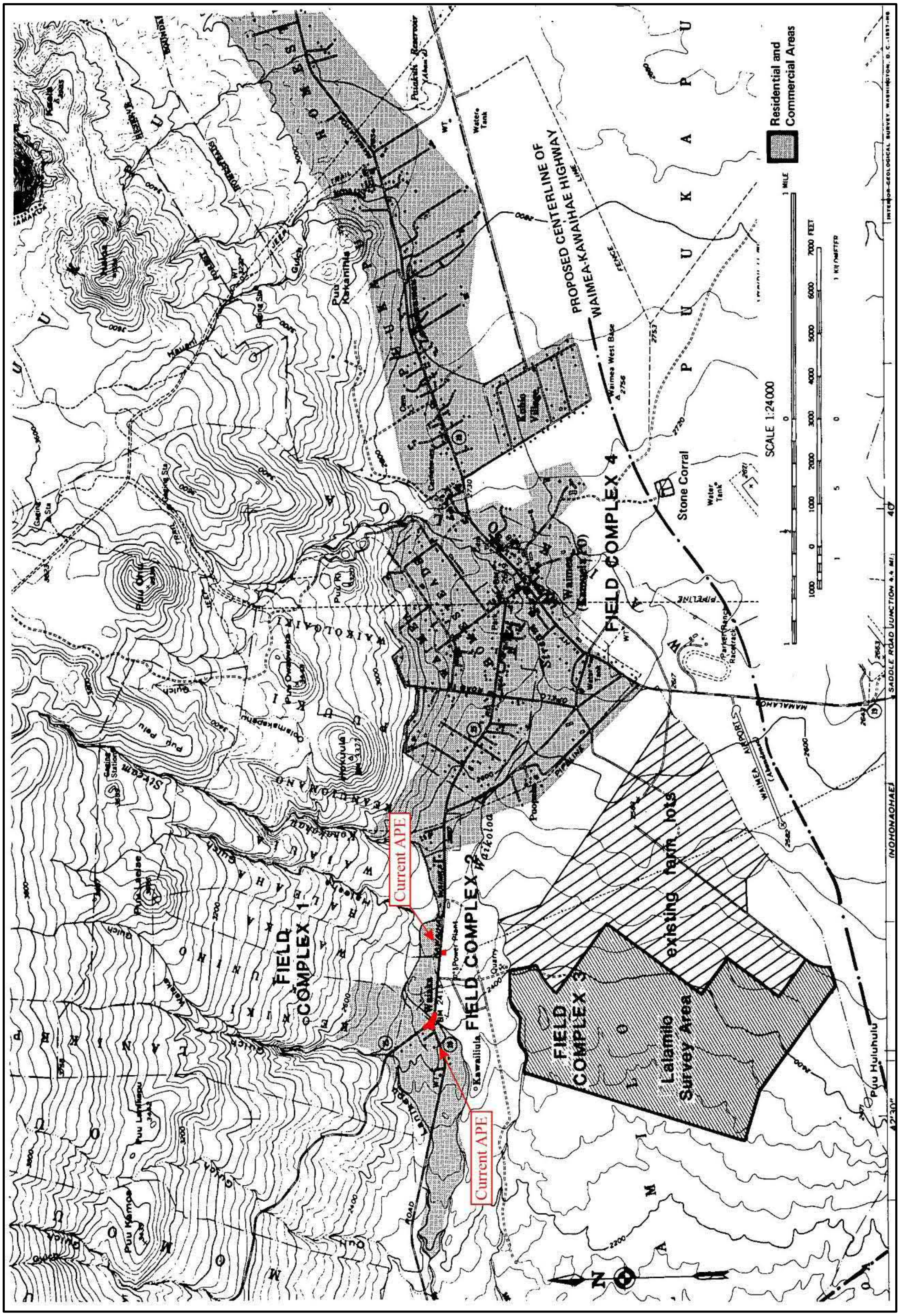


Figure 15. Location of Field Complexes 1-4 of the Waimea Agrictultural System with the current APE indicated (Clark and Kirch 1983:294).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction that served a variety of important uses. The *kō kea,* or white cane, was the most common and was usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy et al. 1991). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy et al. 1991). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903). Pukui (1983) records two proverbs that liken the toughness of sugarcane to the warriors of Kohala, one of which derives from the battle of Puʻu Owaokoa:

> *I ʻike ʻia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.*
>
> One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.
>
> When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong. (Pukui 1983:127)
>
> *He pāʻā kō kea no Kohala, e kole ai ka waha ke ʻai.*
>
> A resistant white sugar cane of Kohala that injures the mouth when eaten.
>
> A person that one does not tamper with. This was the retort of Pupukea, a Hawaiʻi chief, when the Maui chief Makakūikalani made fun of his small stature. Later used in praise of the warriors of Kohala, who were known for valor.(Pukui 1983:95)

Early European explorers who visited the Waimea area also described extensive agricultural fields, plantations, and a sizable population. In 1793, after landing at Kawaihae, Scottish surgeon and botanist Archibald Menzies, accompanied by two native guides traveled inland towards Waimea and recorded the following observation:

> A little higher up, however, than I had time to penetrate. I saw in the verge of the woods several fine plantations, and my guides took great pains to inform me that the inland country was very fertile and numerously inhabited. Indeed, I could readily believe the truth of these assertions, from the number of people I met loaded with the produce of their plantations and bringing it down to the water side to market, for the consumption was now great, not only by the ship, but by the concourse of people which curiosity brought into the vicinity of the bay. (Menzies 1920:56)

Nearly thirty years after Menzies' visit, the early missionary, William Ellis penned his version of the journey taken by fellow missionaries Messrs. Bishop and Goodrich, both of whom passed through Waimea on their way to Kawaihae. Ellis reported that after leaving:

> Kapulena, and, taking an inland direction, [Bishop and Goodrich] passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, through but few inhabitants.
>
> About noon they reached the valley of Waimea, lying at the foot of Mouna-Kea [sic], on the northwest side. Here a number of villages appeared on each side of the path, surrounded with plantations, in which plantains, sugar-cane, and taro, were seen growing unusually large. (Ellis 1917:265)

Between the 1820s and 1860s, agricultural endeavors in Waimea began to shift to accommodate the growing market economy. In the late 1820s, Lau Ki and Aiko, two Chinese immigrants opened a sugar mill in the Līhuʻe area in upper Lālāmilo and although their mill was not commercially successful, sugar production continued in the Waimea area (Barrera and Kelly 1974). Productive sugarcane cultivation in Lālāmilo required an extensive network of irrigation ditches that would transport water from the nearby Waikōloa and Lanimaomao streams to the fields. According to Burtchard and Tomonari-Tuggle (2005:26):

> Despite poor irrigation qualities of the Waimea Plain sediments, the network extended 8 km (5 miles) west and south of Waimea town, providing drinking water, mill power, and supplemental field irrigation. Two irrgation canals, Akona's ʻAuwai from Waikoloa Stream and Lanimaumau Ditch in Pukalani, appear to have been early constructs in the system. Lyons' ʻAuwai, on the other hand, seems to have been built around 1850; this ditch, which also came from Waikoloa Stream, was named for its point of origin near Reverend Lyons' houselot at Pele Gulch. Akona's ʻAuwai and Lyons' ʻAuwai were specificcally for the purpose of irrigating sugarcane and supplying the Līhuʻe sugar mill. Lanimaumau Ditch irrigated cane fields that lay on higher ground above the Waikoloa ditches, including fields at Kamaloʻo.

The Early Development of Cattle Ranching in Waimea

After being introduced to the Island of Hawai‘i in 1793 and 1794 by Captain George Vancouver, cattle populations quickly grew and spread throughout the Kohala, Kona, and the saddle region of the island. Ellis (1831:402) describes a journey by one of his traveling companions to Mauna Kea and the feral cattle herds roaming the mountainside:

> Although there are immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the native vessels. But this is attended with great labour and expense. They first carry all the salt to the mountains. When they have killed the animals, the flesh is cut off their bones, salted immediately, and afterwards put into small barrels, which are brought on men’s shoulders ten to fifteen miles to the sea-shore.

In 1822, John P. Parker, originally of Newton, Massachusetts, was among the early foreigners granted permission to hunt wild cattle for the Crown (Brennan 1974). The wild cattle were often captured in bullock pits dug seven to eight feet long by four feet deep that were covered over with sticks and a thin layer of dirt; they were also hunted with guns (Frost and Frost 1977; Wilkes 1845). By the 1830s, the unregulated population of livestock was cause for concern and under the administration of Kauikeaouli (Kamehameha III), *vaqueros* (cowboys of Mexican, Indian, and Spanish descent) from Central and South America were brought to the islands to train Hawaiians in the handling of both horses and wild cattle (Bergin 2004). It was out of these early interactions among the *vaqueros* and Hawaiians that the Hawai‘i *paniolo* (cowboy) culture developed.

In about 1830, Parker began to establish his own private cattle herd and the business that became Parker Ranch, which would eventually grow into the largest cattle ranch on the island (Henke 1929). That same year, the governor of Hawai‘i Island, John Adams Kuakini, moved to the town of Waimea to oversee and improve the government cattle industry. He ordered the construction of corrals and had a twelve-mile stretch of trail between Waimea and Kawaihae widened (Escott 2008). In his annual report for 1834, Lorenzo Lyons (1834), the resident missionary in Kohala, reported that a road between Waimea and Hāmākua had been completed. The 1835 missionary census lists 6,175 people living in Kohala and another 1,396 people, including 500 men, 510 women, and 386 children, living in Waimea (Schmitt 1977). Despite the eventual prominence of ranching in Waimea, at the time Lorenzo Lyons (1837:1) reported that “The beef establishment has lost some of its charms; & the attention of the people is more directed to the cultivation of the soil - a great portion of Waimea is being surrounded by a stone wall – to form an extensive garden from which all graminivorous animals are to be excluded & which is to be cultivated by the people for their own benefit as well as that of the chiefs.” Foreigners appear to have been somewhat transient during this period, as Lyons notes:

> There was a time when the foreign population numbered about 70 - & their children 30. But the number has considerably diminished & it is always fluctuating - sometimes more & sometimes less. They belong to 6 or 7 different nations & are variously employed – beefcatchers - sugar manufacturers - shoemakers, merchants - tanners - lawyers - blacksmiths - -combmakers - masons - doctors - saddlers - farmers & what not. (Lyons 1841:13-14)

By 1840, bullock hunting had drastically reduced the population of wild cattle on Hawai‘i Island, so much so that a five-year *kapu* was placed on hunting them solely for their hides and tallow (Bergin 2004). This led to further efforts to tame, brand, fence, and herd privately-owned cattle (Wilkes 1845). For a while, agricultural products from Waimea replenished the cargo ships at Kawaihae Harbor, and in the late 1840s many of the potatoes grown in the Waimea area were shipped to California to help feed those involved in the gold rush (Haun et al. 2003), but the decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, ultimately led to a period of economic hardship and population decline in the Waimea area (Escott 2008).

At about this time, a Honolulu merchant named William French constructed his residence, currently known as the historic Spencer House, at Pu‘uloa to the northeast the Lindsey Road-Māmalahoa Highway. French operated a store in Kawaihae and another, a “thatched hut” at Pu‘uloa where he “employed a saddle-maker and operated a tannery” under the management of Parker, who “kept busy supervising this operation and collecting beef tallow, and leather to supply the needs of French’s growing business” (Wellmon 1973:50). Despite a lack of money in Waimea at the time, the store did well for both French and Parker, as Wellmon (1973:50-51) explains:

> There was no surplus of currency in Waimea at this time, and most of the business at the Puuloa store consisted of bartering for goods and services. Long-term credit and buying on time was the rule rather than the exception in these transactions. . . French supplied Parker with different goods

> in exchange for his services and produce. Parker used these goods himself or exchanged them with those who worked for French and those who paid the store in money or goods.

Francis Allyn Olmsted (1841:230), an American author, journeyed to Waimea in 1840 and described French's storefront and the colorful *vaqueros* and bullock hunters who frequented the store:

> About eight o'clock, we came up with a collection of thatched houses, towards the principal of one which we directed our steps, which was a store belonging to Mr. French of Honolulu. Here a novel scene presented itself to us. In front of the door, a bright fire was blazing in a cavity in the earthern floor, displaying in strong light the dark features of the natives congregated around it in their grotesque attitudes. Immediately back of these, a group of fine looking men, in a peculiar costume, were leaning against the counter of the store. Some of them were Spaniards from California, and they were all attired in the poncho, an oblong blanket of various brilliant colors, having a hole in the middle through which the head is thrust. The pantaloons are open from the knee downwards on the outside seam. A pair of boots armed with prodigiously long spurs completed their costume. They were bullock hunters, employed in capturing the wild bullocks that roam the mountains, and had just returned from an expedition of eight or ten days, in which they had been very successful.

As the decade wore on, however, the population of Kohala began to decline, and settlement patterns changed significantly. Leeward inhabitants relocated to the wetter windward slopes of North Kohala and the Waimea plain, abandoning their agriculturally marginal areas in favor of wetter sugarcane lands more productive farmland. According to Tomonari-Tuggle (1988), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. Tomonari-Tuggle clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali'i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment. (Tomonari-Tuggle 1988:33)

These population shifts were accompanied by an overall decline in the number of people living in Kohala. Contemporary observers and modern scholars (Burtchard and Tomonari-Tuggle 2005) offer several explanations, including the decline of the whaling industry, a *kapu* on killing wild cattle (Wilkes 1845), dissatisfaction with William Beckley's (also known as Wilama Bekele) appointment as *konohiki* (Doyle 1953), and disease (HSA 1848), and epidemics that raged through the islands in 1848 and 1849. The population reduction in Waimea as documented by missionaries was tremendous, as the Rev. Lorenzo Lyons expressed, "if the decrease of local people continues the same, how many years before they are all dead, without any left?" (Schmitt 1973:29). Similarly, an 1848 description of the Waimea population cited by McEldowney (1983:432) laments that "it can scarcely be said that there is any native population at all."

The 1848 *Māhele ʻĀina* and Land Commission Awards

By the mid-19th century, the Hawaiian Kingdom was an established center of commerce and trade in the Pacific, and recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. This change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. *Mōʻī* (King) Kauikeaouli (Kamehameha III), through deliberations with his high-ranking chiefs and political advisors, defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī*, the *aliʻi* and *konohiki*, and the native tenants known as *hoaʻāina*. In 1846, King Kauikeaouli formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire *ahupuaʻa* or *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupua'a*), or by *hoa'āina* for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. This deadline was extended several times for chiefs and *konohiki*, but not for native tenants (Soehren 2005).

The *Mō'ī* and some 245 *ali'i* spent nearly two years trying unsuccessfully to divide all the lands of Hawai'i amongst themselves before the matter was discussed in the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once the *Mō'ī* and his *ali'i* accepted the principles of the Privy Council, the *Māhele 'āina* (Land Division) was completed in just forty days (on March 7, 1848). The names of all of the *ahupua'a* and *'ili kūpono* of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the *Buke Māhele* (*Māhele* Book) (Buke Māhele 1848). As this process unfolded, the *Mō'ī*, Kauikeaouli, received roughly one-third of the lands of Hawai'i, realizing in the process the importance of setting aside public lands that could be sold to raise money for the government and also purchased for fee simple title by his subjects. Accordingly, the day after the division when the name of the last chief was recorded in the *Buke Māhele*, the *Mō'ī* commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kauikeaouli, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land." The lands personally retained by the King became known as "Crown Land." Lastly, the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). For all land designations, whether to the *Mō'ī*, *konohiki*, or Government, the rights of the native tenants were expressly reserved. (Garovoy 2005). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed.

During the *Māhele*, *hoa'āina* (native tenants) residing on lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to parcels that they actively lived on or farmed. The parcels awarded to *hoa'āina* were and still are referred to as *kuleana*, using the Hawaiian term to describe the relationship of rights and responsibilities held among tenants, *konohiki*, and the land. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848, to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly and Maly 2002). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and further defined the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly and Maly 2002).

The Disposition of Lands in Waimea and Lālāmilo at the time of the Māhele 'Āina

The disposition and distribution of the lands of Waimea was a complicated issue and was a matter of much testimony and debate among Commissioners, *kama'āina* informants, and land petitioners. Waimea was a discrete land unit but considered by some to not be an *ahupua'a*; rather it was considered to be a *kalana* or *'okana*, a unit larger than an *ahupua'a*. To further complicate the issue, some of the land units within Waimea were considered *ahupua'a* and others *'ili kupono*. As a result of the *Māhele* testimony and decisions rendered by the Boundary Commission, many smaller *ahupua'a* names were dropped and the relatively independent *'ili kupono* were given *ahupua'a* status, and except for a portion of the Waikōloa Ahupua'a (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. Almost all of the smaller *'ili 'āina* located on the southern slope of Kohala Mountain became Government Land, with two exceptions. The lands of Wai'aka 1st and 2nd, located northwest of the APE, were awarded to M. Kamaikui (LCAw. 8516-B:1) and G. Lahilahi (LCAw. 8520-B:2), respectively. The two *'ili* of Pauahi and Lanikepu were given to Lunalilo, who relinquished them to the Government. The rest of the land, including the large *ahupua'a* of Lālāmilo, in which the current APE is located, also became government land. Which of the *ali'i* relinquished these lands were not recorded in the *Buke Māhele* (Soehren 2005).

Over 140 claims for Land Commission Awards (*LCAw.*) were made by native tenants within the Waimea area (Office of Hawaiian Affairs 2018; Waihona Aina 2020). Awards in Waimea, however, are described in the Land Commission records as being located in Waimea, with each *ʻili* specified. Thus, for example, "Waiʻaka" does not appear in these records as an *ahupuaʻa*, but rather as an *ʻili* of Waimea. Table 3 lists awards located near the current APE. Five *kuleana* parcels were claimed in Waiʻaka (three in Waiʻaka 1st and one in Waiʻaka 2nd), and three of these were awarded. Two claims not awarded were Claim 3984 by Hano for sugarcane land in Waikoloa and Claim 4148 by Kupa for a houselot. One claim in Kauniho was awarded. In Lālāmilo, thirteen *kuleana* parcels were awarded to the south, east, and west of the current APE. Of the Lālālmilo awards, four were located at the coast at Puakō, and nine were located in the uplands near the current APE (Haun et al. 2003). Nearly all of these claims were for house lots or cultivated sections, and as Haun et al. (2003) note, the average size of awards excluding small house lots was about 23 acres. Of these, the most proximate awards are LCAw. 8520B tp Gini Lahilahi

Table 3. *LCAw.* in the vicinity of the current APE.

LCAw. No.	*Name*	*Acres*	*ʻIli*	*Description*
976:1	William Beckley	29.59	Waikani	House lot and farm
989	John Davis	4.83	Napooakolu	Enclosed house lot, 2 houses, 3 fields
3202B	Jose Bowers	7.6	Puuopelu	House lot, 3 fields
3760	Iese Aa	14.0	Waiaka	2 houses
3762	Auwae	26.00	Keanuiomano	Taro farm
3828	I. A. Palea and wife	48.00	Waikōloa	House lot, partially enclosed
3832	Poolipi	1.6	Kauniho	Lot for cultivation, house
4127	Kuahine	2.4	Waiaka	1 house
4195	Kanehailua	35.20	Kaluaana	1 house, 45 gardens
4885	William French	21.90	None listed [Ahuli]	House, slaughterhouse with enclosure, grass houses, cookhouse
8513B	Hoolulu	29.44	Napooakolu	field
8516B:1	Kamaikui	24.0	Waiaka	-
8520B:1	Lahilahi, G.		Waiaka 2	-

Government Land Grant Program and the Expansion of Ranching in Waimea

In conjunction with the *Kuleana Act*, the King authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the *Māhele ʻĀina*. These Land Grants were generally larger than those awarded by the Land Commission. The Act resolved that portions of Government Lands should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of the program was to enable native tenants, many of whom were insufficiently awarded or not awarded land through the *Kuleana Act* to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of Government lands. Land Grant 662, covering 93 1/5 acres, including a portion of the current APE located to the east of the bridge, was sold to Kamaikui in 1851. The Land Grant was awarded to Kamaikui in 1851 and encompasses 93.20-acres in "Waiakanui" or Waiʻaka 1st. A relatively large land grant (Grant 1157), totaling 258 acres at Līhuʻe to the southeast of the current APE, was sold to George Macey and James Louzada in 1853. A 71-acre parcel (Grant 2129) located south of the current APE was purchased by George K. Lindsey in 1856.

During the middle to late 1800s, Western businessmen established a number of diverse industries on these newly available lands. Letters written at the time of the *Māhele* indicate that by 1848 George Davis Hūʻeu had already established a cattle corral, a goat corral, and house lots on lands adjacent to his roughly 95,000-acre Waikōloa award (Maly and Maly 2002). By 1848, John Palmer Parker, founder of the Parker Ranch, had received two acres of land at Mānā where he built a family house and the first ranch buildings (Bergin 2004). In 1850 Parker purchased 640 acres surrounding his Mānā lands, and in 1851 he purchased another 1,000 acres. The next year, Kamehameha III granted Parker a lease on the lands of Waikōloa (presumably Lālāmilo and neighboring lands to the north and east), some of which would eventually be deeded to the ranch by outright purchase. By the middle of the decade, Parker had turned most of the day-to-day operations of Parker Ranch over to his son, John Palmer Parker II. When John Palmer Parker, died on August 20, 1868, the ranch controlled about 47,000 acres of land in the region (Bergin 2004). These lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr.

The decades following the *Māhele ʻāina* of 1848 were characterized by a growing detraction from traditional subsistence activities as the population along the Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up and converted to pastures. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements or into dispersed upland habitations where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect their homes and gardens from cattle and other free-ranging animals but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. The economy also transitioned, becoming cash-based, and taxes were collected. Foreigners controlled much of the land and most of the businesses, and the native population was largely dependent on these foreigners for food and money (Haun et al. 2003). The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region (McEldowney 1983). Parker Ranch continued to expand its operations in the Waimea area throughout the 1870s and 80s, eventually acquiring the lease to roughly 95,000 acres of Waikōloa that had formerly belonged to the Waimea Agricultural and Grazing Company. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship, new managers were brought in to oversee the day-to-day operations at the ranch.

By the early 1900s, the Parker Ranch headquarters were located near what is now the corner of Lindsey Road and Māmalahoa Highway, in the same building as the old store, post office, and restaurant (Maly and Maly 2005). The ethnic makeup of Waimea at this time was primarily of Hawaiian and part-Hawaiian, Japanese, Portuguese, Chinese, and a small number of *haole* (Euro-American descent); and most of the residents were employed by Parker Ranch or were independent farmers (Paniolo House Committee Friends of the Future 2005). At this time, Parker Ranch was under the direction of Alfred W. Carter, who had been chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. By this time, Parker Ranch was operating on several large leased parcels, but the fee simple holdings amounted to only 34,000 acres (Bergin 2004). Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. In 1903, with only a short period left on its lease, Carter acquired nine-tenths interest in the Waikōloa lands from Ms. Lucy Peabody for $112,000, securing important grazing lands for the ranch (Bergin 2004). Soon thereafter, Carter purchased the adjacent lands of ʻōuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines *makai* of Waimea Town. He also acquired the Puʻuloa Sheep and Stock Company, encompassing over 3,700 acres and including the Keʻāmuku Sheep station in Waikōloa, which he converted to cattle ranching over the next decade. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humuʻula, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

A Brief History of USGS Stream Gaging in Hawaiʻi

The measurement of stream flows by the United States Geological Survey (USGS) began in 1888 as result of the efforts of John Wesley Powell, the second director of the USGS, to "reclaim" arid lands in the American West through irrigation (Frazier and Heckler 1972). The Hawaiʻi office of the USGS began collecting surface-water data in 1909 (Matsuoka et al. 1985). The first stations established were operated primarily to evaluate the potential of streams for supplyin water to the sugar industry. From the initial 12 gages installed in 1909, the program rapidly expanded to 87 gaging stations in 1914, and then to 143 by 1940. Between 1941 and 1950 the number of gaging stations was reduced slightly, but after 1950 more gages were added, and by 1964 the USGS was operating 240 daily flow surface-water gaging stations within the Hawaiʻi District (which included the islands of Guam, American Sāmoa, and Okinawa). Within the current APE, the USGS installed a stream gage just above the Waika Bridge in Keanuʻiʻomanō Stream in 1955 during its post-war expansion of gaging stations, and that gage is in operation today (USGS 2021).

PREVIOUS ARCHAEOLOGIAL STUDIES

The APE is situated within a portion of what has been designated Field Complex 2 of the Waimea Agrictultural System (Figure 15). The agricultural system was identified based on the analysis of aerial photographs conducted in 1981 in advance of fieldwork for the Mudlane-Waimea-Kawaihae Road Corrdior survey conducted by the B. P. Bishop Museum (Clark and Kirch 1983). The Waimea Agricultural System, and the large system of agricultural fields in Lālāmilo to the southwest of the current APE have been investigated by several studies, beginning with work for the Mudlane-Waimea-Kawaihae Road Corrdior and then as part of other compliance-based studies (Barrera and Kelly 1974; Barrera 1993; Ching 1979; Clark 1981a, 1981b; Clark and Kirch 1983; Clark 1987; Clark et al. 1990; Hammatt and Shideler 1989; Haun et al. 2003; Rechtman 2000). As described by Clark (1983:293), the Waimea Agrictultural System:

> …comprises the remains of an extensive series of agricultural features, throughout which are scattered multiple residential structures. The system forms a large arc to the W and S of the present-day village of Waimea. Beginning on the S flank of Kohala Mountain, a short distance below Puʻu Laʻelaʻe, this system extends down the slope and onto the Waimea plain W of town. It then bends to the E, fading out just S of Waimea and W of Kuhio Village. For descriptive convenience, the system was subdivided into four field complexes, each with its own characteristic attributes.

Field Complex 2 was described as the area:

> … bounded on the N by Keanuʻiʻomanō and Kohākōhau Streams, and on the S by Waikoloa Stream. It is characterized by a set of agricultural fields that are demarcated by low terrace retaining faces or ridges of soil and/or stone. The long axes of the fields are oriented NW by SE, or perpendicular to the prevailing winds. Associated with the fields is a set of *ʻauwai*, the main channels of which divert from the Kohākōhau Stream and angle to the SE, eventually draining into the Waikoloa Stream. Other agricultural and residential features are scattered throughout the area. (Clark 1983:293)

The Field Complex 2 area has been included in seven prior studies, and other nearby work has documented portions of neighboring Precontact agricultural and habitation sites as well as Historic ranching and habitation sites (Table 4, Figure 16). In general, these studies have identified field ridges, terraces, fields, and ditches associated with Field Complex 2, but have also documented areas near Kahwaihae Road that have been disturbed. The following discussion of prior archaeological studies begins with a summary of an AIS conducted by Haun et al. (2002) in support of two previous attempts to replace Waiaka Bridge. This is followed by summaries of the other studies that have included portions of the APE.

In addition to the archaeological studies described below, the Hawaiʻi State Historic Bridge Inventory (MKE and Fung 2013) documented the Waiaka Bridge , which was designated Bridge Number 001002500500053. The inventory fieldwork did not substantially add to the description of the bridge that was included in the Haun et al. (2002) AIS. MKE and Fung (2013) noted that the bridge is eligible for the NRHP under Criterion C as a good example of a 1930's reinforced concrete bridge that is typical of its period in its use of materials, method of construction, craftsmanship and design.

Table 4. Previous archaeological studies conducted in the vicinity of the current study area.

Year	*Author(s)*	*Type of Study*	*Location*	*Relevant Findings**
1985	Rosendahl	Reconnaissance	East of APE	No archaeological features
1986	Hammatt and Borthwick	AIS	West of APE	Site 11097 Keanuʻiʻomanō Pondfields Site 11098 Wall & Midden scatter Site 11099 Rectangular Enclosure Site 11100 Historic Pipeline Site 11101 Mounds Site 11102 Wall Site 11103 Rectangular Enclosure Site 11104 Lanikepu Agricultural Terraces
1988	Hammatt et al.	AIS	West of APE	Site 11105 Enclosure Site 11106 Terrace wall Site 11107 Habitation enclosure Site 11108 Stone alignment Backhoe trenching at these sites and sites identified in Hamamatt and Borthwick 1986
1989	Bonk	Reconnaissance	North of APE	Site 19644 Field Complex 1 features
1989	Hammatt and Shideler	AIS	West of APE	Additional trenching at Sites 11,097 and 11,107
1992	Thompson and Rosendahl	AIS	HDOT staging, DHHL west potential staging	Site 18054 agricultural fields. No ʻauwai. Subsurface testing negative.
1993	Barrera	AIS	Surrounds DHHL east potential staging.	Site 14948 portion of Field Complex 2
1994	Franklin et al.	AIS	North of APE	Site 19644 Field Complex 1 features
1998	Sinoto	AIS	DHHL east potential staging	Subsurface testing, no archaeological features.
2000	Rechtman	Supplemental AIS	27-acre parcel north of current APE	13 sites, including agricultural and habitation. Sites 18569, 18579, 18580, 18580, 18581, 18587, 18588, 18589, 18590, 18591, 18592, 48593, 18595, 18596.
2002 (2012)	Haun et al.	AIS	HDOT staging, DHHL potential staging, North temporary use	Site 22632: seven soil terraces (Features XI, XN, XO, XP, XQ, XS, and XU) and fields, two irrigation ditches (Features TS and XR) and two field boundaries (Feature XT and XV). Site 23312 ditch segments northeast of APE. Site 23313 concrete foundation. Site 29221 Waiaka Stream Bridge.
2003	Haun et al.	AIS	HDOT staging, DHHL west potential staging	Same results as Haun et al. 2002
2005	Haun et al.	Data Recovery	West of APE	Trenching of Site 22632 terrace and field boundary features found no artifact, one hearth feature. C14 dates mid-1400s to the mid-1600s or later.
2005	Corbin	AIS	North of current APE	Trenching in Site 19646
2007a	Corbin	AIS	North temporary use areas	No features in current APE. Site 25867, 25868, 25870 walls Site 25868 modified boulder Site 25871 *kuaiwi* Site 25872 mound Site 25873 vault with canoe and reported burial Site 25874, 25875 rectangular ditches
2007b	Corbin	AIS	North of current APE	Historic boundary or ranching walls
2013	MKE and Fung	Inventory	Waiaka Bridge	NRHP eligible under Criterion C.

*Site numbers preceded by SIHP-50-10-06-

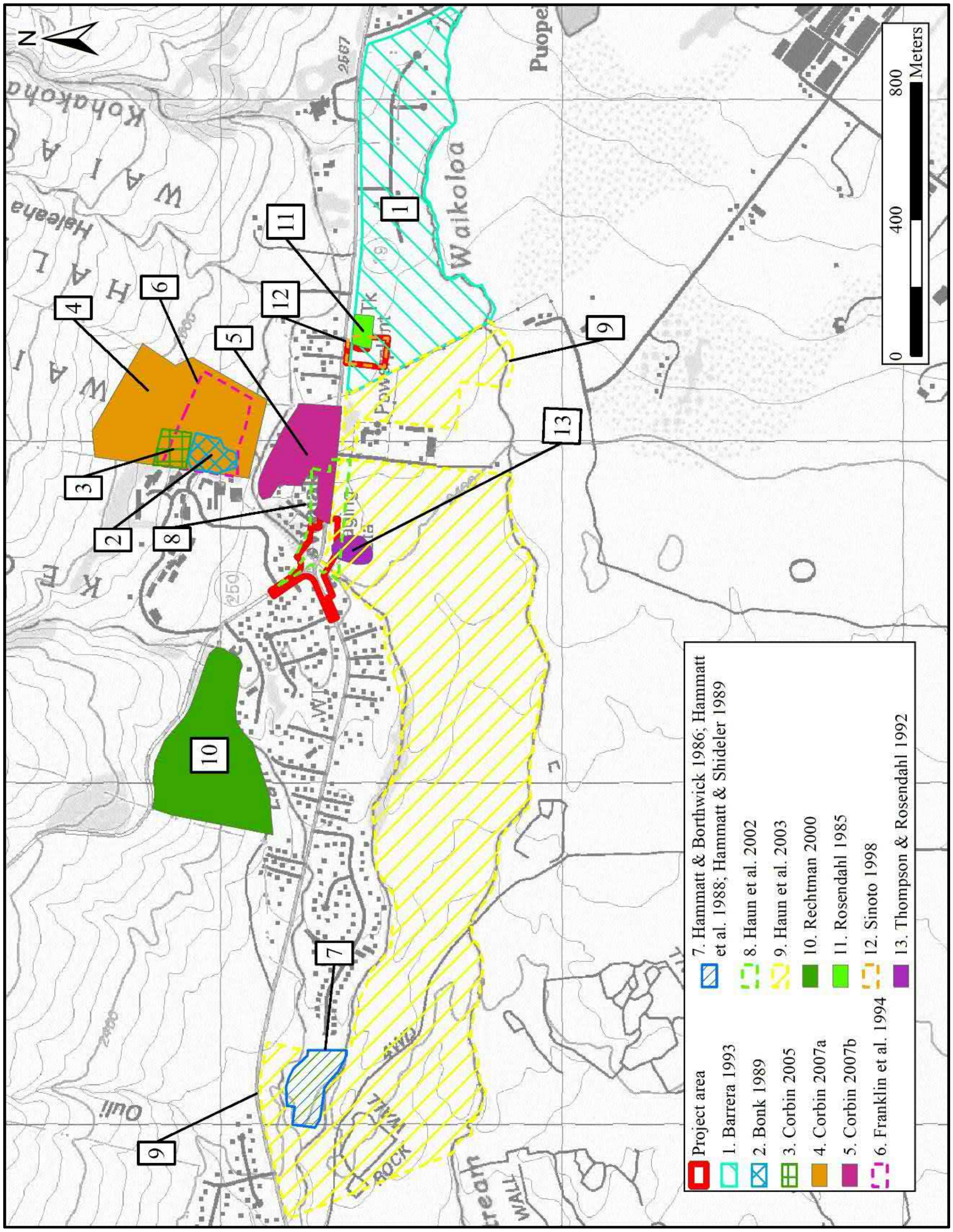


Figure 16. Previous archaeological studies in the vicinity of the current study area.

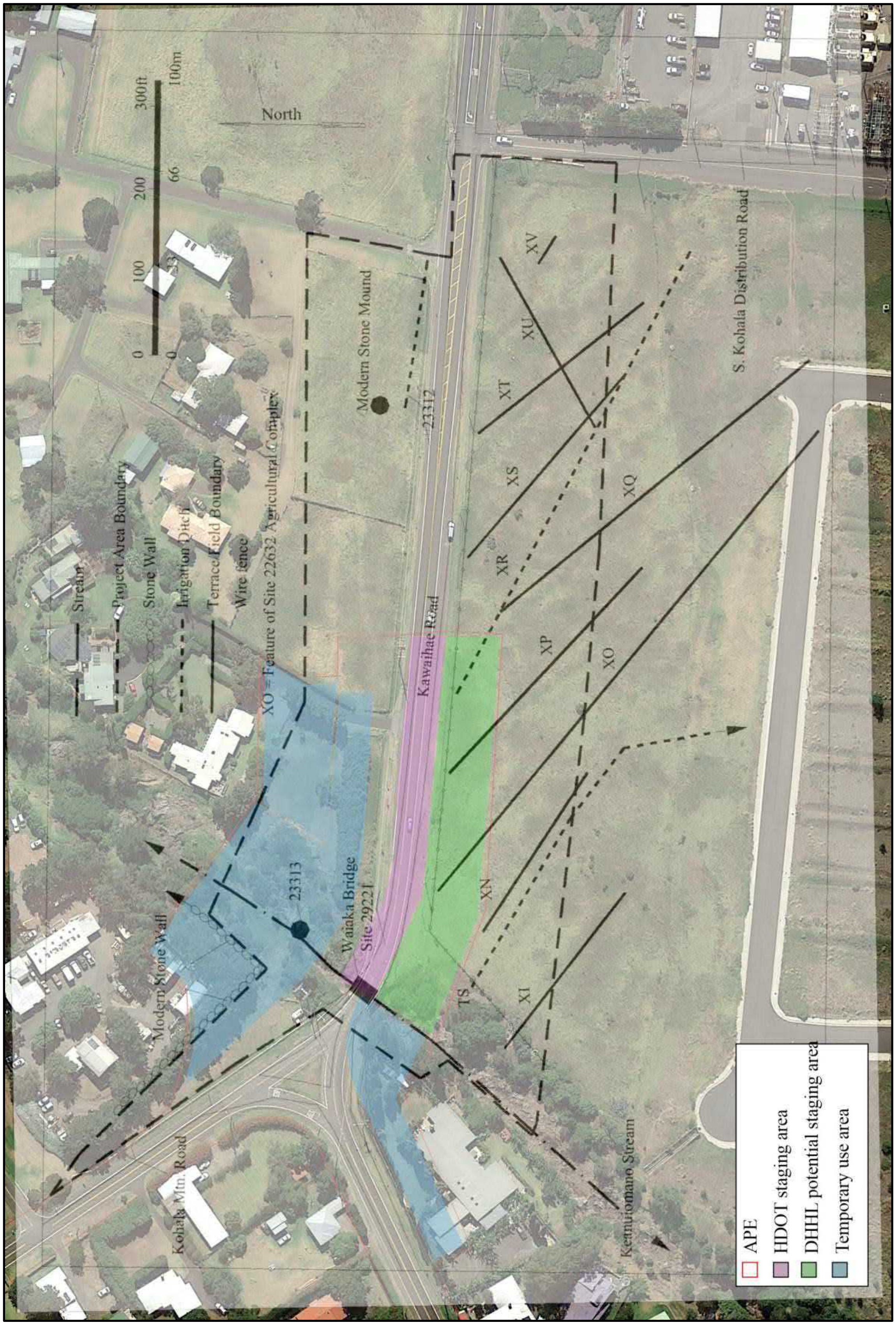
Waiaka Bridge Replacement (2002 and 2012) AIS and Section 106 consultation (Haun et al. 2002)

In 2002, Haun & Associates conducted an archaeological inventory survey (Haun et al. 2002) in support of an earlier iteration of the current Undertaking. The AIS investigated a 9.8-acre APE comprising portions of TMKs: (3) 6-5-01: por. 033, 6-6-01: por. 077 and 6-6-04:por. 001 (Figure17). This area includes the majority of the current APE. The AIS was conducted in 2002, but the replacement of the bridge did not occur at that time. In 2011, during a revived attempt to replace the bridge, the AIS was updated and a revised report (Haun et al. 2002) was resubmitted in support of the Section 106 and HRS 6E-8 review of the project. That report was accepted by DLNR-SHPD (Letter May 15, 2012, Log No. 2012.1353, Doc. No. 1205MV04), who noted that it met the requirements of HAR 13-276 as well as the Secretary of the Interior’s Standards (see Appendix A). In partial fulfilment of the Section 106 and HRS 6E-8 requirements, the study included an archaeological survey and consultation with Native Hawaiian Organizations (NHOs) and other consulting parties. Haun et al. (2002) identified 4 sites (SIHP 50-10-06-22632, 23312, 23313, 29221) with the 2002/2012 APE (see Figure 17). These sites are summarized below.

Site 22632 is a large (>700 acres) agricultural complex, and several projects conducted before the Haun et al. (2002) AIS documented portions it, but under differend SIHP numbers. It was designated as Site 22632 during fieldwork conducted for an AIS of the DHHL Residential Development at Lālāmilo by Haun et al. (2003), which is discussed below. Within the 2002 and 2012 Waiaka Bridge replacement project APE, Haun et al. (2002) documented eleven features of Site 22632. These features included seven soil terraces (Features XI, XN, XO, XP, XQ, XS, and XU), two linear mounds of soil interpreted as field boundaries (Features XT and XV), and two irrigation ditches (Features TS and XR). These features generally extend northwest to southeast across the 2002/2012 APE, with the exception of Feature XU, which was roughly perpendicular to the others. The features are all subtle in appearance because they are much wider than they are tall (or deep, in the case of the two ditches), and tend to be obscured when grass covering the ground surface is thick. The soil terraces range between 2.75 and 4.1 meters wide, standing an average of 18 centimeters tall on their upslope sides and an average of 61 centimeters tall on their downslope sides. The longer of the two field boundaries, Feature XT, was 1.7 meters wide by 41 centimeters tall; the shorter, Feature XV, was 1 meter wide and 50 centimeters tall. The ditch desginated Feature TS was 1.8 meters wide and 40 centimeter deep, while the other ditch, Feature XR, was 3.5 meters wide and 65 centimeters deep. During a review of a draft version of the AIS report, DLNR-SHPD commented that they believed that the features of the site “extend all the way to and were truncated by the construction of the Kawaihae Road. This is significant because even small changes to the road alignment may impact these sites” (Log No. 2011.2213, Doc. No. 1111MV03). Haun et al. (2002) responded by re-inspecting the site and concurring that the features extend closer to the road, as depicted in the final version of their AIS (Haun & Associates letter to Theresa K. Donham of March 03, 2012). In this final version of the report, the features are shown abruptly ending at the barbed wire fence adjacent to the road.

North of Kawaihae Road, to the east of the proposed temporary use areas, Haun et al. (2002) identified a segment of an irrigation ditch (Site 23312) extending roughly parallel to Kahwaihae Road. Within Keanuʻiʻomanō Stream, Haun et al. (2002) idenfied a concrete foundation as Site 23313, suggesting that it was built to support a pump used to raise water from the stream. The study also documented Waiaka Bridge (Site 29221), but not to Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) requirements. This modest reinforced concrete slab bridge with a center pier was identified as the first bridge built with Federal Aid funds on Hawaiʻi Island.

In addition to the archaeological study, Section 106 consultation was conducted for the Waiaka Bridge replacement project in 2011 and 2012 (FHWA 2012). This included public notices in the *Honolulu Star-Advertiser*, *West Hawaii Today*, and *Hawaii Tribune*. Groups and idividuals consulted included Pua Aiu, Administrator of DLNR-SHPD; Kimo Lee, Chair of the Hawaii Island Burial Council (HIBC); Keola Lindsey of the Office of Hawaiian Affairs (OHA); Jeffrey Fujimoto of the DHHL; Katie Kissling of the Hawaii Historic Foundation (HHF); Halealoha Ayau of Hui Malama I Na Kupuna O Hawaii; Mr Hugh “Buttons” Lovell and Ms Leimana Damate of the Aha Kiole Advisory Committee, Aha Moku; Waimea Hawaiian Civic Club (WHCC), Kaena Peterson and Maulili Dickson of the South Kohala Civic Club (SKCC) ;and Ms. Nicole Lui. Among the information shared by consulting parties was a perception that Waiaka Bridge appears to span a portion of Keanuʻiʻomanō Stream that is not ideal for the concealment of *iwi* and that *iwi* are located further *mauka* above Hawaii Preparatory Academy and further south. Generally, Keola Lindsey (OHA) commented that OHA was comfortable with the level of effort taken to identify historic properties of significance to the Hawaiian People within the 2012 APE. With respect to the proposed replacement of Waiaka Bridge, some respondents were in favor of replacment. Kiersten Faulkner of the Historic Hawaii Foundation concurred with the NRHP eligibility determination and the “adverse effect” determination for the replacement project


North
0 100 200 300ft
0 33 66 100m
Stream
Project Area Boundary
Stone Wall
Irrigation Ditch
Terrace Field Boundary
Wire fence
XO = Feature of Site 22632 Agricultural Complex
Modern Stone Mound
23312
Kawaihae Road
S. Kohala Distribution Road
XV
XU
XT
XS
XR
XQ
XP
XO
XN
XI
TS
23313
Waiaka Bridge
Site 29221
Modern Stone Wall
Kohala Mtn. Road
Keanuiomano Stream
APE
HDOT staging area
DHHL potential staging area
Temporary use area

Figure

As a result of the Haun et al. (2003) study and the Section 106 consultation, all four documented sites were determined eligible for listing in the National Register of Historic Places (NRHP) and also significant under HRS 6E-8. Site 22632 was determined eligible for the NRHP under Criterion A for its association with the broad pattern of traditional and early historic agricultural intensification in Hawai‘i, under Criterion C as awell-preserved example of an agricultural field complex, and Criterion D for the information yielded relative to late prehistoric to historic land use in the project area. Under HRS 6E-8, it was assessed significant under Criterion a, Criterion c, and Criterion d for Haun et al. (2002:53) recommended data recovery for the features of Site 22632 located in the Waiaka Bridge APE “if the sites are to be impacted by the proposed road improvements.”

Site 23312, the ditch segment located outside of the current APE, was assessed to be eligible for the National Register of Historic Places under Criterion D for the information yielded relative to historic land use in the project area, and under HRS 6E-8 it was assessed significant under Criterion d for the information yielded relative to historic land use in the project area. Data recovery was recommended if the site were to be impacted by the proposed project.

Site 23313 was assessed to be eligible for the National Register of Historic Places under Criterion D for the information yielded relative to historic land use in the project area, and under HRS 6E-8 it was assessed significant under Criterion d for the information yielded relative to historic land use in the project area. The mapping, written descriptions, and photography conducted at Site 23313 was considered to have adequately documented the site and no further mitigation or preservation was recommended.

Site 29221 was determined by DLNR-SHPD to be eligible for the National Register of Historic Places under Criterion C as a good example of a modest reinforced concrete slab bridge that embodies the distinctive characteristics of a type, period, or method of construction (Log No. 2011.2731, Doc. No. 1108MA05). Although not explicitly stated, the Haun et al. (2002:53) report appears to conclude that the bridge is also HRS 6E-8 significant under Criterion c for the same reason. The proposed replacement or widending of the bridge was determined to have an adverse effect on the historic property. Data recovery in the form of Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) Level I or Level II documentation. Based on information provided by HDOT and DLNR-SHPD, it appears that the project was abandoned before a memorandum of agreement concerning the mitigation of adverse effects could be prepared.

Other archaeological studies conducted within the current APE and its vicinity.

Five other prior archaeological studies have included portions of the current APE, and several others have occurred on adjacent parcels (see Figure 16). Within the current APE, these studies documented features of the large agricultural field system (Site 22632) on the south side of Kawaihae Road, but not on the north side. Areas of prior ground disturbance were also reported. Results of these studies are summarized below. In addition to these archaeological studies, the Hawai‘i Statewide Historic Bridge Inventory (MKE and Fung 2013) includes Waiaka Bridge.

In 1985, Paul H. Rosendahl, Inc. (PHRI) conducted an archaeological reconnaissance (Rosendahl 1985) of a 32,000 square foot parcel located immediately east of the eastern potential staging area in the current APE (see Figure 16). Although that study area is not located in the current APE, it is similar in its topography and degree of prior surface disturbance. During a pedestrian survey of the pacel, no archaeological remains of any kind were identified, including no surface structural archaeological features, portable artifacts, or midden. No subsurface testing was conducted.

In 1992, PHRI conducted an Archaeological Inventory Survey (Thompson and Rosendahl 1992) of seven potential locations of the North Hawai‘i Community Hospital. The location designated “Parcel 7” comprises a roughly 250 meter by 130 area that includes a portion of the current APE (see Figure 16). A series of at least six agricultural fields were documented as SIHP 50-10-06-18054 (Figure 18). The fields are described as:

> The edges of the fields were demarcated by low soil retaining faces constructed of soil with no obvious inclusion of rock. The ridges were less than 50 cm high and the width of the fields was 20-30 m each. The lengths varied from 60-80 m and several of the ridges appear to have been truncated on the northwest in the past by the existing Waimea-Kawaihae road. The ridges all paralleled one another and were oriented perpendicular to the prevailing wind (NW to SE). No *‘auwai* were apparent during the inventory. The parcel is currently being used as a cattle pasture and modem field traffic has cut paths across some of the fields, creating the illusion of ditches in some cases. There was nothing apparent that was as distinct as the ditches noted in Parcels 1, 3, and 4. (Thompson and Rosendahl 1992:10-11)

Seven backhoe trenches (see Appendix B) were excavated in Parcel 7. Thompson and Rosendahl (1992:12) identified a buried agricultural soil horizon in portions off all seven trenches:

> The trenches were placed across the parcel in order to cross section the agricultural fields noted during the surface inventory. The trenches were placed such that a representative sample of the soils present within the parcel were revealed. A buried agricultural soil termed Stratum II was identified intermittently in all seven trenches. The stratum was apparent as a darkly stained soil, sometimes containing flecks of charcoal. The boundaries were wavy and the distribution was sporadic, across the site.

Based on these results, Thompson and Rosendahl (1992:16) concluded that:

> The site (18054) identified within Parcel 7 is an agricultural field complex. It is typical of other field systems identified in the region on earlier projects (Clark 1981, Clark and Kirch 1983). The size of the fields and the construction techniques are consistent with other field complexes identified within the Waimea-Lalamilo agricultural system, specifically, Field Complex 2 as defined by Clark (1981). No samples suitable for age determination were collected during the current project. However, based on similarity to other sites in the region, an age range of AD 1600 to AD 1800 is speculated, a time frame when the usage of the area for agricultural purposes is documented. The further work in the parcel should most definitely include the location of suitable samples for dating to confirm or dispute this estimate so as to better define the settlement and land usage patterns of the region over time.

Overlaying the Thompson and Rosendahl (1992) site location map (see Figure 18) on recent satellite imagery suggests that there are some inaccuracies in their site location map that make it difficult to correlate their findings with those reported by (Haun et al. 2002). In particular, the orientation of the roads and Keanuʻiʻomanō Stream appear to be skewed, and the distance between the fence on the project boundary and Kawaihae Road may not have been measured in the field. The overlay showin in Figure 18 represents the best effort made without distorting the representation of the archaeological features, as their orientation and length would likely have been directly measured. The discrepancies in the map are undoubtedly what led Haun et al. (2002) to state that they were unable to positively re-identify individual field ridges based on this map.

Despite the potential mapping inaccuracies, the Thompson and Rosendahl (1992) report provides information about conditions within their project area and beneath the field ridges in the immediate vicinity of the current APE. One detail worth noting is that Thompson and Rosendahl (1992) did not observe the field ridges extending all the way to Kawaihae Road (contra Haun et al. 2002). They documented no ditches and only five field ridges, of which two appear to extend into the current APE. Two test trenches appear to have been located within the Western Potential Staging Area portion of the current APE. Trench BT-4 examined a field ridge that might be Feature XO of Site 22632. This test trench did not contain anything other than the buried agricultural soil (Stratum II). Test trench BT-5 was located in a field area possibly located between FeatureS XP and XQ. This trench appears to have cut through an area with a relatively higher concentration of cobbles within all layers but no constructed rock subfeatures. That information suggests that the field ridges are composed of accumulated wind-blown soil with no rock construction associated with the fields or ridges, and that artifacts or other cultural material is unlikely to be present beneath the surface.

In 1993, Chiniago, Inc. conducted an inventory survey (Barrera 1993) of a 50-acre property that became the Sandalwood Estates subdivision. During that survey, thirty-three earthen field ridges were recorded as Site 50-10-06-14948 (Figure 19), which Barrera associated with Field Complex 2 of the Waimea Agricultural System. None of these field ridges were noted to extend into the current APE. Ten test trenches were excavated by backhoe to examine cross-sections of the field ridges, sample open space between ridges, and investigate potential archaeological features. Three basin-shaped hearth features and four charcoal deposits were identified. Radiocarbon dates obtained from charcoal recovered from these features were interpreted to indicate that the earliest usage of the fields may have post-dated A.D. 1430, and more certainly after the sixteenth century.

In 1998, Aki Sinoto Consulting conducted an AIS of a (Sinoto 1998) of the 2.33 acre parcel that contains the eastern DHHL potential staging area portion of the current APE (see Figure 16). The portion of the parcel adjacent to Kawaihae Road was found to be levelled and cleared of stones, and a bulldozed road extended along the southern boundary. No archaeological sites or deposits were identified. Subsurface testing near the southern parcel boundary found culturally sterile soils, and a test pit near the northern boundary found culturally sterile gravelly silt loam that was interpreted as fill material.

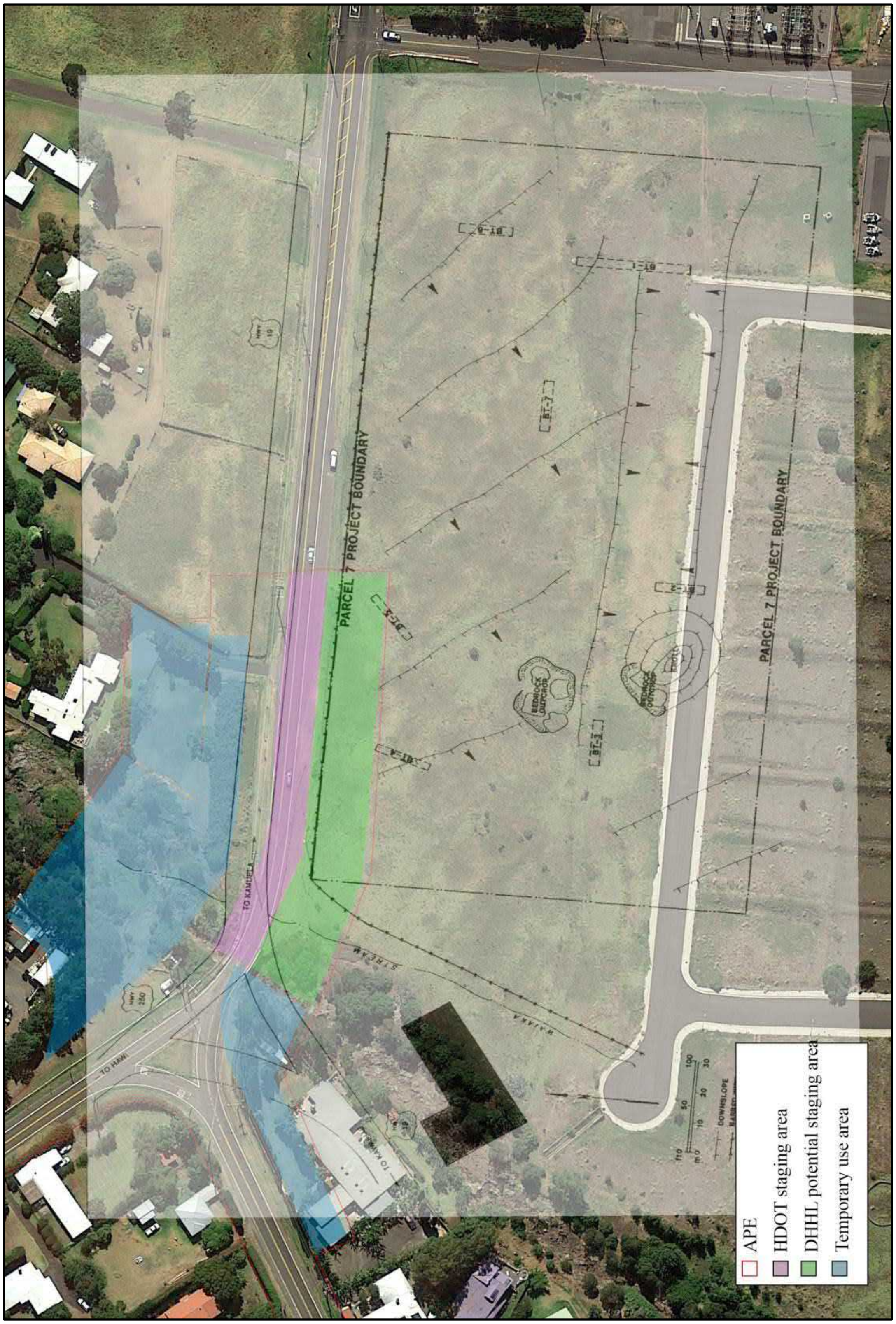
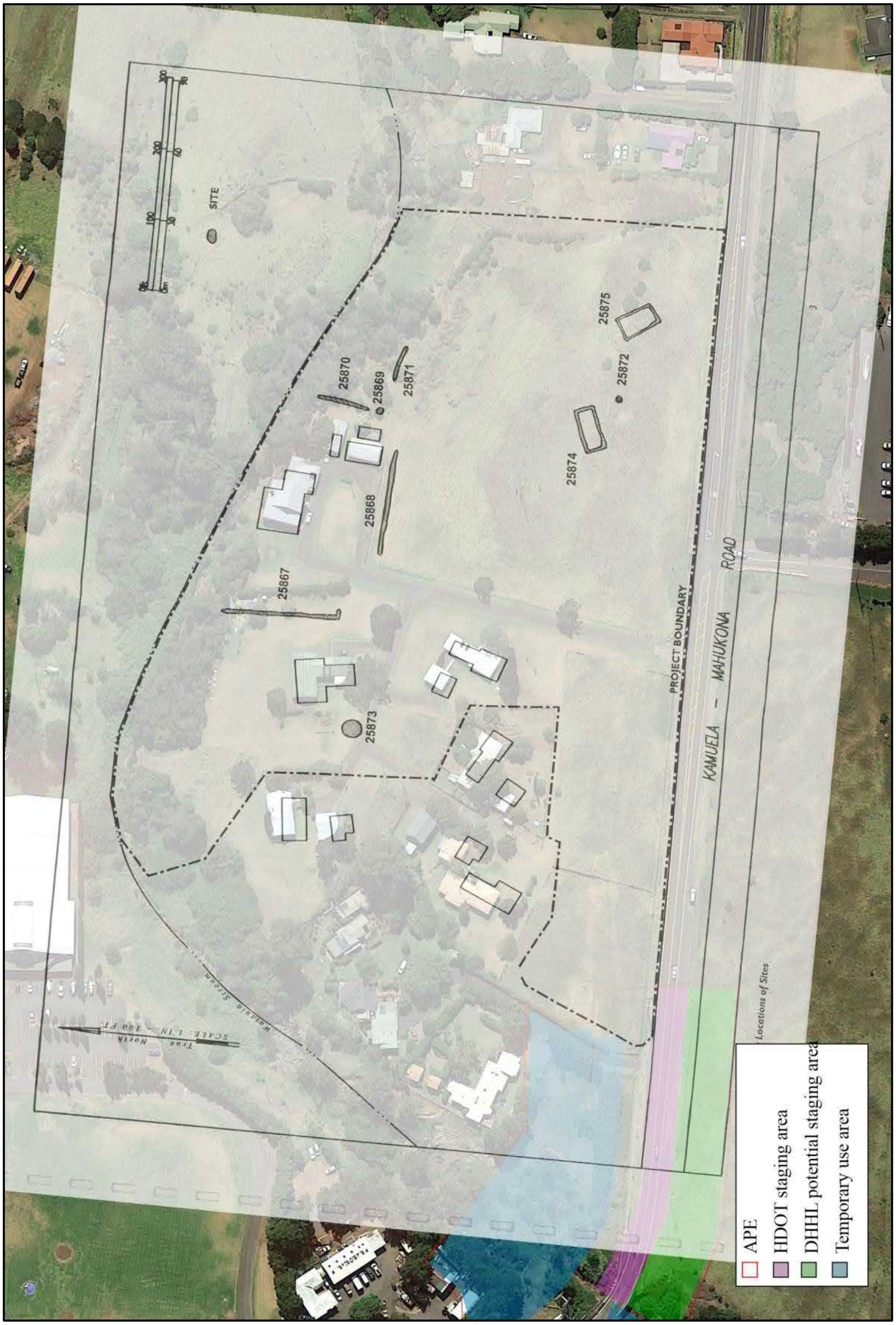


Figure 18. Thompson and Rosendahl (1992:14) project area and subsurface testing location map overlaid on recent aerial imagery (Google Earth 2019) with current APE indicated.

Figure 19. Barrera (1993) site location map overlaid on recent aerial imagery (Google Earth 2019) with current APE indicated


APE
HDOT staging area
DHHL potential staging area
Temporary use area
Locations of Sites
SITE
25867
25868
25869
25870
25871
25872
25873
25874
25875
PROJECT BOUNDARY
KAMUELA – MAHUKONA ROAD

Figure

In 2001, Haun & Associates conducted an AIS (Haun et al. 2003) of a roughly 266-acre Department of Hawaiian Home Lands (DHHL) parcel for the DHHL Residential Development at Lālāmilo (Figure 21). Their study area included portions of the current APE (the HDOT staging area and West DHHL potential staging area) but extended more than two kilometers to the west and nearly one kilometer to the south. It also included two smaller areas that were subject to earlier survey and data recovery projects (Hammatt and Borthwick 1986; Hammatt et al. 1988; Hammatt and Shideler 1989). The agricultural features of Site 22632 located in the current APE were documented as part of 76 archaeological sites containing 819 features within the larger project area. Formal feature types identified during fieldwork included terraces, mounds, enclosures, field boundaries, stone walls, irrigation ditches, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, concrete piers, and a small number of isolated objects. Terraces were the most predominant of the identified features, followed by mounds. The sites were interpreted to primarily date to the Precontact Period, with only six possibly dating to the Historic Period. Feature functions varied considerably; however, Haun et al. (2003) noted that features relating to agriculture were the most common in the project area, followed closely by permanent habitation features. More than 300 discrete agricultural fields covering 28.7 hectares (70.93 acres) were identified, along with clusters of mounds of stones cleared from cultivation plots and two probable pondfields that suggested the limited cultivation of wet taro. Nearly three miles of irrigation ditches were documented. The walls that were documented formed large enclosures that appear to have been built to keep cattle out of the fields. Iighteen burials were identified, seven of them within an existing Historic cemetery. The remaining eleven burials were identified during subsurface testing at features thought to have a high potential for yielding human remains. Further work was not recommended for seven of the sites encountered during the study, as they were deemed to have been adequately documented. Data recovery was recommended for the remainder of the sites, excluding the burials and a portion of the large agricultural complex (Site 22632), which were recommended to be preserved in place. During the follow-on data recovery for Phase I of the DHHL Residential Development project (Haun et al. 2005), none of the features in the current APE were investigated. Seven terrace and field boundary features (Site 22632 Features HH, HI, HK, HN, HP, AAA, and AAB) located west of the current APE were sectioned with backhoe trenches. Most of the trenches contained no cultural material, and the few faunal remains that were recovered (e.g., rat bone) were not related to subsistence. A trench excavated through Feature AAB (a linear terrace) exposed a conical subfeature containing carbon-stained silt with patches of ash and charcoal fragments that was interpreted to be a hearth. A trench through Feature HI (a linear terrace) exposed a deposit of grayish brown to light brownish gray ash with sparse charcoal fragments, which was also interpreted to be a hearth. A radiocarbon sample was taken from inside these subfeatures, along with samples recovered from soil matrix in other trenches interpreted to be buried agricultural soils. All of these samples appear to have been submitted without wood identification (Haun et al. 2005:Appendix A). Calibrated 2σ calendric age ranges for these samples generally span the mid-1400s to the mid-1600s, although a few samples returned more recent dates (including those taken from Features HK, HP, AAA, and the hearth feature in AAB). In general, these results were interpreted to mean that the terraces and field boundaries ridges dated to the mid-fifteenth century but saw continued use into the early historic period. Subsequent data recovery for Phase II of the DHHL Residential Development project (Escott 2019) focused on habitation features and did not excavate agricultural features such as those found in the current APE.

In 2006, PHRI conducted an AIS (Corbin 2007a) of a an approximately 16-acre project area located on the north side of Kawaihae Road to assist planning for the development of a new K-8 Campus at Hawaiʻi Preparatory Academy. The project area included a small portion of which includes a potential staging area within the current APE (see Figure 16). During the surface survey of the project area, nine sites were identified, none of which were located in the current APE (Figure 20). Three of the sites (SIHP 50-10-06-25867, -25868, and -25870) are historic boundary or ranching walls. The remaining sites include a boulder used as a sharpening station (SIHP 50-10-06-25868), a low *kuaiwi* wall (SIHP 50-10-06-25871), a large mound composed of earth and rocks (SIHP 50-10-06-25872), a buried vault confirmed to contain a canoe and said by informants to contain a human burial (SIHP 50-10-06-25873), and two rectangular ditches with unknown functions (SIHP 50-10-06-25874 and -25875). All of these sites were assessed to significant under HRS 6E-42 as significant under Criterion d for information content. In addition, Site 25873 was assessed as also significant under Criterion c as an excellent example of a site type and Criterion e for its cultural value. Site 25873 was recommended for preservation. No further archaeological work was recommended for the remaining sites. The Corbin (2007a) AIS was among four other studies (Bonk 1989; Corbin 2005, 2007b; Franklin et al. 1994) conducted for planning and development of the Hawaiʻi Preparatory Academy campus. These other studies were all located north of the current APE. They documented the presence of Waimea Agricultural System features associated with Field Complex 1, along with historic boundary or ranching walls. Backhoe trenching was used to investigate field ridges and terraces, which resulted in the recovery of radiocarbon samples (identified only as charcoal) from soil layer contexts. The 2σ calibrated date ranges for these samples generally post-dated the the mid-17th century, although one sample may have been as old as the mid-fifteenth century.

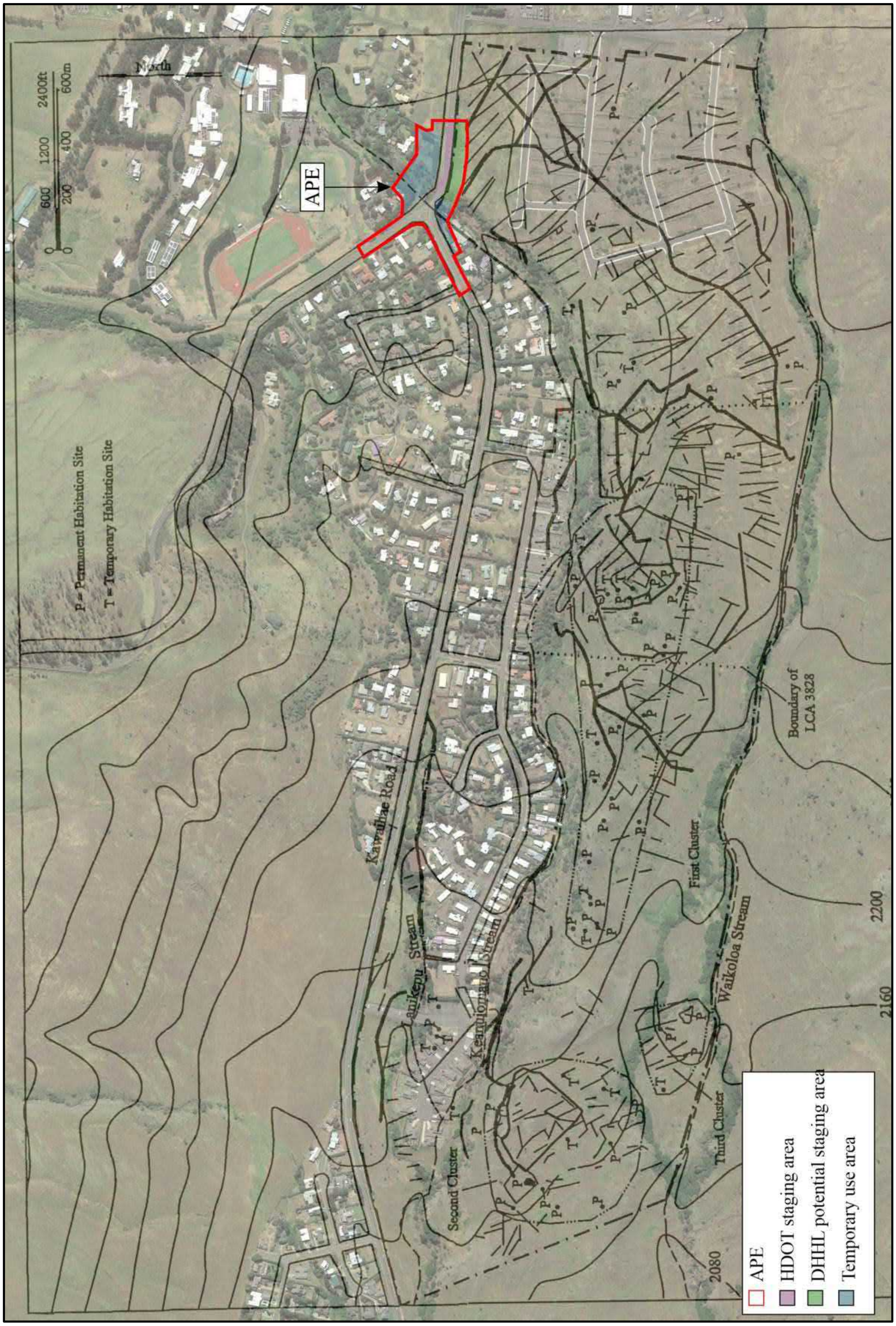


Figure 21. Site 22632 features overlain on recent aerial imagery (Haun et al. 2003).

3. APE EXPECTATIONS

The current APE has been included in five prior archaeological studies, which provide a substantial amount of information about the potential to encounter historic properties and archaeological resources. Haun et al. (2002) identified two sites (Site 23313 and 29221) and three features of another site (Site 22632) within the current APE. Site 23313 is a concrete foundation located in Keanuʻiʻomanō Stream. Site 29221 is Waiaka Bridge. The three features of Site 22632 are terraces (Features XN, XO, and XP) and two ditches (Features TN and XR) are located on the he DHHL-owned parcel south of Kawaihae Road. No other sites have been documented in the APE. The other studies all reported no archaeological resources in the current APE. Based on the prior Section 106 consultation, the portion of Keanuʻiʻomanō Stream located in the current APE is unlikely to contain concealed *iwi* or archaeological resources. The remainder of the APE appears to be disturbed and or cleared for pasture. Given these conditions, the likelihood of encountering previously undocumented archaeological sites appears to be low.

4. FIELDWORK

Fieldwork for the current study was conducted on August 26, 2020, by Johnny Dudoit, B.A., and Benjamin Barna, Ph. D. (Principal Investigator), with a follow-up field visit on October 14, 2020, by Dr. Barna. Additional field photographs were taken on August 4, 2021, by Brooke Kauoa under supervision of Dr. Barna. A total of nine person-hours were expended during the fieldwork.

FIELD METHODS

During the archaeological field survey, the entire (100%) ground surface of study area was visually inspected. Field archaeologists walked transects spaced at no more than 5 meters apart oriented parallel to Kawaihae Road. In Keanuʻiʻomanō Stream, field archaeologists walked a parallel to the stream along its upper banks and inside the stream immediately below its banks. When archaeological features were encountered, their positions were plotted on a map of the current study area using using a handheld tablet computer running ESRI's Collector application connected to an EOS Arrow 100 GNSS receiver with sub-meter accuracy (set to the UTM NAD 83 datum, Zone 5N North. Additionally, areas of previous disturbance, conspicuous landforms, and vegetation patterns were mapped. Identified features located within the current study area were then cleared of vegetation (with the exception of the Site 22632 field ridges, which were covered with kikuyu grass), photographed (both with and without a meter stick for scale), depicted on a scaled drafted plan map, and described using standardized feature record forms.

No subsurface testing was conducted in previously disturbed areas (e.g., HDOT staging area, eastern DHHL potential staging area), or in areas where prior subsurface testing by Thompson and Rosendahl (1992) suggests a low likelihood of buried archaeological deposits.

FINDINGS

As a result of the fieldwork for the current study, one previously recorded archaeological site and two previously recorded structures were identified in the APE (Table 5). The locations of these sites relative to the current APE is presented in Figure 22. The sites are described below.

Table 5. Properties recorded during the current study.

SIHP Site Number	*Property type*	*Status*	*Type*	*Function*	*Age*
22632	Site	Previously documented	Complex	Agriculture	Precontact
23313	Structure	Previously documented	Concrete foundation	Stream monitoring	Historic
29221	Structure	Previously documented	Waiaka Bridge	Transportation	Historic

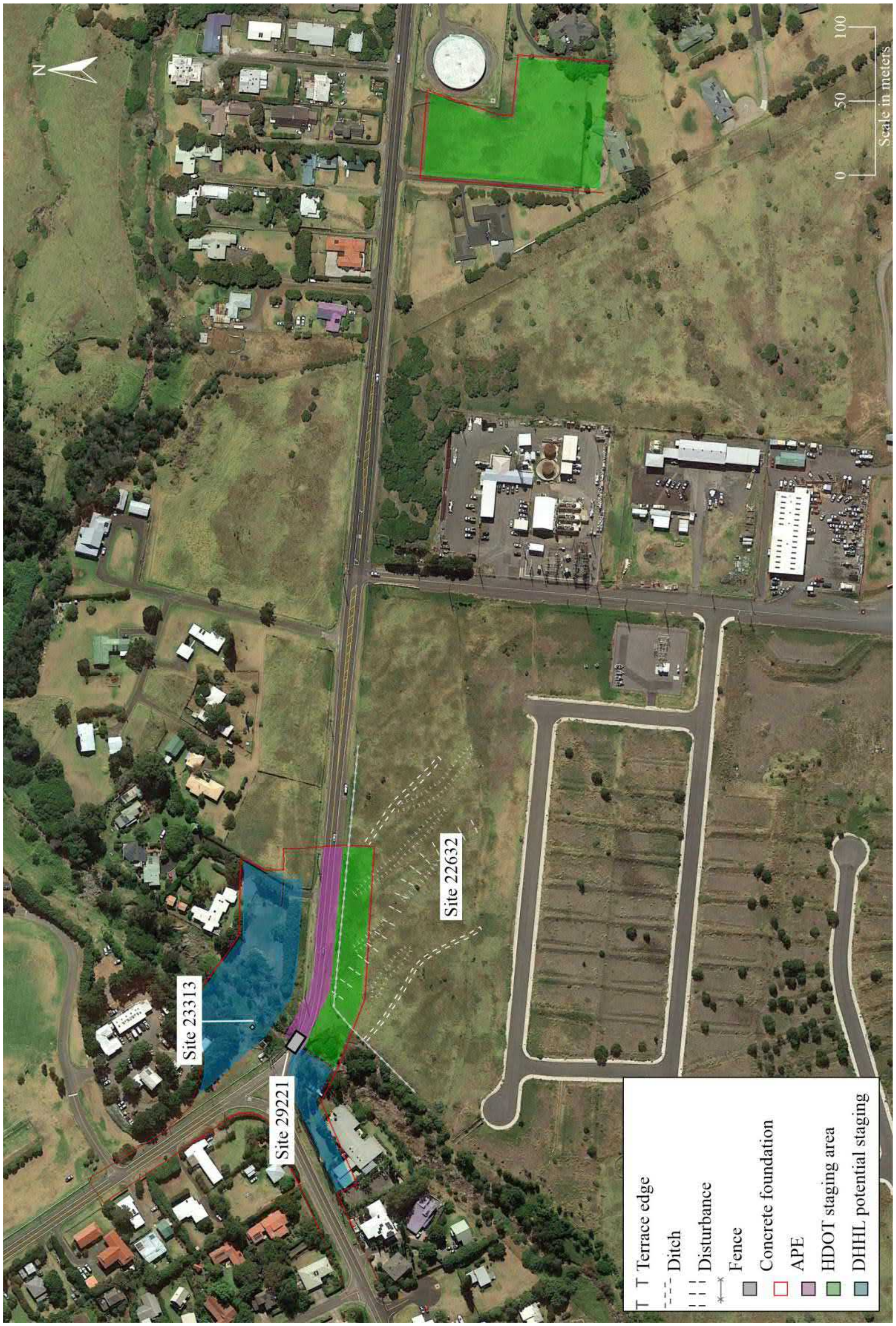


Figure 22. Site location map.

Site 22632: Features XO, XP, and TR

Site 22632 is a complex of 700 agricultural features previously documented during the (Haun et al. 2003). These features included 368 terraces and field boundaries, 280 agricultural clearing piles, 21 irrigation ditches, 26 walls, three enclosures and two pond fields (see Figure 21). More than 300 agricultural fields, defined as space bordered by terraces and field boundary features, were also identified, but these do not appear to be treated as archaeological features. The identified features were interpreted as agricultural elements based on their formal type, informal construction, and lack of habitation debris. Eleven features of Site 22632 (see Figure 17) were identified within the 2002/2011 Waiaka Bridge replacement APE (Haun et al. 2002). These features consist of seven soil terraces (Features XI, XN, XO, XP, XQ, XS, and XU), two irrigation ditches (Features TS and XR) and two field boundaries (Feature XT and XV). No cultural remains were observed on the ground surface in association with any of the Site 22632 features. Prior to these two studies, Thompson and Rosendahl (1992) documented a portion of the site within the current project area as Site 50-10-06-18054 and tested at least one feature located in the current project area.

During the current fieldwork, portions of three features of Site 22632 were identified within the current APE (Figure 22). Two are terraces (Features XO and XP) and one is a ditch (Features XR). Figure 22 also shows the locations of two other terraces (Features XN and XQ) and a ditch (Feature TS) located outside of the current APE. These features, being outside the APE and previously documented by Haun et al. (2002), are not described further.

Feature XO is a linear terrace that extends approximately 15.8 meters into the western DHHL potential staging area (see Figure 22). This portion of the feature is the northern end of the extant terrace. The terrace measures3.5 meters wide and stands 8 centimeters tall on its upslope (northeast) side and 65 centimeters tall on the downslope (southwest) side. The feature is obscured by kikuyu grass and during the current fieldwork appeared as a subtle undulation in the ground surface (Figure 25). The terrace continues toward the southeast for an additional 105 meters beyond the APE boundary before reaching the disturbed northern boundary of the DHHL residential lots development. The northern end of the terrace is located 2 meters south of the barbed wire fence that is located along Kawaihae Road.

Feature XP is a linear terrace that extends approximately 18.0 meters into the western DHHL potential staging area (see Figure 22). This portion of the feature is the northern end of the extant terrace. The terrace measures 2.7 meters wide and stands 25 centimeters tall on its upslope (northeast) side and 70 centimeters tall on the downslope (southwest) side. The feature is obscured by kikuyu grass and during the current fieldwork appeared as a subtle undulation in the ground surface (Figure 26). The terrace continues toward the southeast for an additional 65 meters beyond the APE boundary before becoming indistinct. The northern end of the terrace is located 2 meters south of the barbed wire fence that is located along Kawaihae Road.

Feature XR was recorded by Haun et al. (2002) as a ditch extending approximately 12.6 meters through the western DHHL potential staging area (see Figure 22). This portion of the feature is the northern end of the extant ditch. The shallow, earthen ditch measures 3.5 meters wide and approximately 40 centimeters deep. The feature is obscured by kikuyu grass and during the current fieldwork appeared as a subtle linear depression in the ground surface (Figure 27). The ditch continues toward the southeast for an additional 155 meters beyond the APE boundary. Haun et al. (2002) noted that this ditch is oriented perpendicular to Keanuʻiʻomanō Stream, indicating that it drew water from the stream to feed agricultural fields to the southeast.

The portions of these features that are located in the current APE represent only a small part of each individual feature (see Figures 22 and 17). As Figure 21 shows, they also represent a very small fraction of the entire agricultural complex documented as Site 22632. Field ridges documented by Haun et al. (2003) are represented in that figure by the the northwest to southeast oriented straight lines located throughout their project area. Ditches are represented by thicker black lines. Thus, the ability of the current study to assess the condition and integrity of Site 22632 is limited. The small portion of the three features of Site 22632 within the current APE appear to be in fair condition, and so do the remainder of the features that are in close proximity. As with similar field ridge features throughout the Lālāmilo and Waimea area, they are difficult to see without the raking light of the morning or afternoon. The northern ends of the field ridges (and the agricultural fields that they define) appear to have been truncated by the development of Kawaihae Road. Other than that, there are no obvious signs of disturbance within the APE. South of the current APE boundary, these features have been disturbed by the partial development of the DHLL residential lots (visible in the lower left corner of Figure 21). Other disturbance includes equipment tracks that cut through the current APE and bisect Feature XO south of the APE boundary (see Figure 24). These equipment tracks were not readily visible on the ground due to the ground cover but are visible in aerial imagery from 2013 (Figure 23).

Figure 23. Aerial imagery from 2013 showing extent of Site 22632 features and disturbance within the current APE (Google Earth).

Figure 24. Overview of Site 22632 within the current APE, view to the west.

Figure 25. Site 22632 Feature XO, view to the southeast.

Figure 26. Site 22632 Feature XP, view to the southeast.

Figure 27. Site 22632 Feature XR, view to the northwest.

The site was previously determined to be eligible for the NRHP under under Criterion A for its association with the broad pattern of traditional and early historic agricultural intensification in Hawaiʻi, under Criterion C as a well-preserved example of an agricultural field complex, and Criterion D for the information yielded relative to late prehistoric to historic land use in the project area. It was previously determined to be HRS Chapter 6E significant under the corresponding criteria and for the same reasons. These determinations were made prior to the data recovery fieldwork that was conducted on multiple features of the complex elsewhere in the site (Haun et al. 2003). They were also made before the partial build-out of Phase I of the DHHL Residential Lots development. Data recovery excavations on features located outside of the current APE were used to mitigate adverse effects to the site caused by the DHHL Residential Lots Phase I development. The data recovery report, however, does not address changes to eligibility resulting from the mitigation work. Based on the information obtained during the current study, which did not examine any features of the site that were not at least partially located in the current APE, Site 22632 continues to be recommended eiligble for the NRHP and HRS chapter 6E significant under the same Criteria as before.

Site 23313

Site 23313 (Figure 28) is the Keanuʻiʻomanō Stream Gage (USGS 16756500) located within Keanuʻiʻomanō Stream, on the eastern side of the stream approximately 38.5 meters upstream from the Waiaka Bridge. The site was documented as a "concrete foundation" by Haun et al. (2002:46):

> Site 23313 is a concrete foundation located within the Keanuiomano Stream drainage, on the eastern side of the stream. The site is situated 38.5 m upstream to the north from Waiaka Bridge. The foundation consists of two concrete slabs and a concrete curb located on the eastern side of the stream [Figure 29, see Figure 28]. The main slab is 4.18 m long (east-west) and 1.25 m wide. The western portion of the slab is built on a bedrock outcrop situated adjacent to the stream, with the eastern portion constructed on the stream bank. The southern half of the slab is buried beneath a soil mound. The slab is 0.47 to 0.51 m in height on the north side.
>
> A low, irregularly-shaped slab is located adjacent to the main slab, 0.2 m to the west. This slab has been poured onto the surface of the outcrop, possible to level a depressed area. This slab is 0.73 m long (north-south) and 0.65 m wide. The surface of this slab is level with outcrop. There is a rectangular-shaped curb situated adjacent to the smaller slab to the west. This curb is 1.15 m long (north-south), 0.22 m wide at the top and 0.4 m wide at the base. The top of the curb is 0.38 m in height above the stream on the west side, and 0.21 m in height above the outcrop on the east side.
>
> A metal bolt is imbedded in the outcrop to the north of the north of the curb. The bolt has been cut off level with the surface of the outcrop and is 0.02 m in diameter. There is a 2" galvanized metal pipe set vertically in the ground 0.7 m north of the northeastern corner of the main slab. A threaded pipe cap has been screwed onto the top of the pipe. A circular brass United States Geologic Survey benchmark is located on the top of the outcrop to the south of the site. No cultural remains were found in association with the site.
>
> Site 23313 is unaltered and in fair condition. The nature of the slab and its location within the stream drainage suggests it potentially functioned as the foundation for a pump used to obtain water from the stream. The concrete used in the construction of the foundation is weathered and does not appear recent. However, the galvanized pipe is modern suggesting that a pump may have existed here.

During the fieldwork for the current study, Site 23313 was located and its current condition noted. The site's condition is as described by Haun et al. (2002), with the addition of stream gauge equipment and metal support braces that have been attached to the galvanized pipe (see Figure 29). This stream gauge is the Keanuiomano Stream gauging station (USGS 16756500). Available records from the United States Geological Survey (USGS) indicate that this gauging station has been in operation since 1955 (USGS 2021). While Haun et al. (2002) interpreted the foundation as the base for a water pump, its form and location at the stream gage station indicate that it is a weir built for the stream gage. At stream gaging stations, a weir is used to pond water above the gage so that changes in the height of the ponded water can be used to calculate stream flow (Reinhart and Pierce 1964). The site was previously evaluated as eligible for listing in the NHRP under Criterion D for information yielded relative to historic land use, and as HRS Chapter 6E significant under Criterion d fo the same reason. Based on the identification of the site as a USGS stream gaging station dating to 1955, the site is no longer recommended eligible for inclusion in the NRHP, and no longer assessed as significant under HRS Chapter 6E-8.

Figure 28. Site 23313, view to the east.

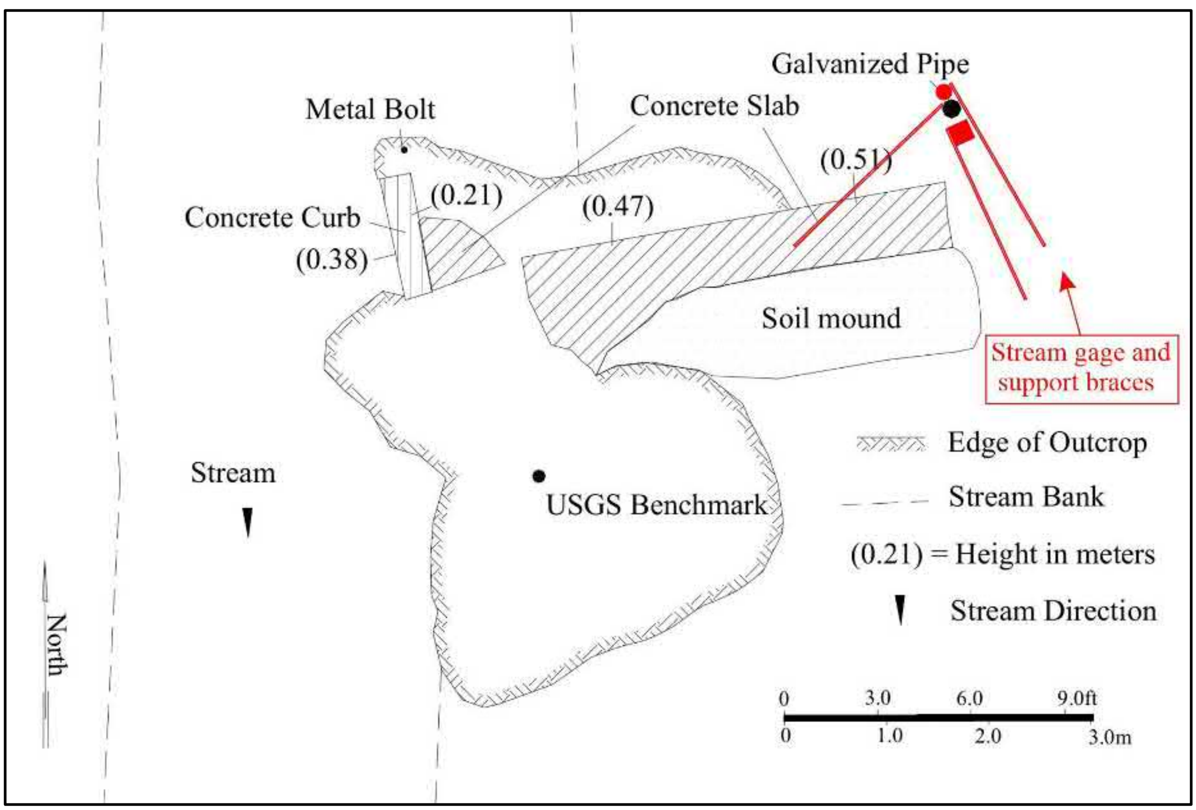


Figure 29. Site 23313 plan view map showing current conditions (after Haun et al. 2002:47).

Site 29221

Site 29221is the Waiaka Bridge (Figures 30 and 31), located at the intersection of Kawaihae Road (State Route 19) and Kohala Mountain Road (State Route 250). The bridge was previously documented by . Haun et al. (2002), and their description is quoted at length below and supplemented with photographs of the bridge's current condition. DLNR-SHPD's architecture branch has noted that the bridge was constructed in 1932 by Mr. Charles H. Will and was the first bridge funded by federal money on Hawai‘i Island (Log No. 2011.2731, Doc. No. 1108MA05). The bridge spans Keanu‘i‘omanō Stream about 2 miles west of Waimea Town. Haun et al. (2002) described the bridge as:

> …a concrete slab structure that is paved with asphalt and is rectangular in shape, measuring 11.2 m in length (northwest by southeast) and 8.4 m wide [Figure 32]. The surface of the bridge is supported by concrete retaining walls along the northwest and southeast sides of the stream drainage walls and a vertical, free-standing wall located in the center of the stream [Figure 33]. The retaining walls have wing walls at each end that angle away from the main wall. The end of each of the wing wall sections are comprised of mortared stone. The sides of the bridge are bordered by formed concrete walls, slightly curved and have decorated recessed areas on each side with metal guard rails. A partial inscription remains that include the date "1932" and the letters "KA," that likely reads "Waiaka".
>
> There are two horizontal metal pipes that are suspended along the southwestern exteriuor side of hte bridge by metal brackets. These pipes are 10" in daiamter and are joined by metal bolted couplings. A pressure valve is present on the outside pipe at the southwestern end of the bridge. These pipes extend to the northwest and southeast from the bridge an undetermined distance.
>
> A wooden foot bridge is present along the northeastern side of the bridge for pedestrian traffic [Figure]. The foot bridge is supported by a framework of wooden beams that rest on top of the retaining walls and the free-standing wall located in the center of the stream. The surface of the bridge is comprised of 2" by 10" wooden planks and there is a vertical railing that extends along the northeast side. This railing is built of vertical 4" by 4" posts with five horizontal 2" by 10" planks nailed to them.

During the current fieldwork, Site 29221 was visited, and its current condition was compared with the description provided by Haun et al. (2002). The Waiaka Bridge is a flat concrete slab bridge with two spans (see Figures 30 and 31). It is supported by concrete abutment walls (Figure 34) and a concrete wall pier between the two spans. The abutment walls area solid with basalt masonry wing walls (Figure 35) extending both upstream and downstream. The central wall pier (see Figure 33) is constructed with two solid arches centered on its length. The bridge's parapet design is concrete solid panel with cap (Figure 36). There are four panels per side with additional concrete pilasters installed asymmetrically on each parapet. The pilasters on the southern parapet have steel bolts and/or bolt scars (both filled with concrete and unrepaired) that indicate that pipes or other utilities were formerly suspended from the bridge parapet. The parapet cap has beveled edges and the parapets flare outward at each end. The parapets show signs of their age such as cracks and impact damage. The parapets for each span are connected to each other by large bolts and strapping. On the northern side of the bridge, the wooden footbridge (Figure 37) is also supported by steel girders directly attached to the abutments and central wall pier. Minor cosemetic damage to the bridge includes graffiti on the abutments and central wall pier. As Haun et al. (2002) noted, the installation of thrie beams (guardrails) has obscured the inscriptions reading "Waiaka" and "1932" on the parapets. Overall, the condition of Site 29221 (at least cosmetically) does not appear to have degraded much since the 2002 fieldwork. Additional damage to the parapets has been minimal, and surprisingly, many of the graffiti designs observed appear in Haun et al.'s (2002) report.

The Waiaka Bridge (Site 29221) was previously determined to be eligible for the National Register of Historic Places under Criterion C at the local level of significance as a good example of a modest reinforced concrete slab bridge that embodies "[t]he distinctive characteristics of a type, period, or method of construction" and as the first Federal Aid bridge constructed on Hawai‘i Island (Log No. 2011.2731, Doc. No. 1108MA05). It was also determined eligible under Criterion D for yielding information important for understanding land use (Haun et al. 2002). DLNR-SHPD determined that replacing or widening the bridge would result in an adverse effect to historic properties (Log No. 20112011.2731, Doc No. 1108MA05). DLNR-SHPD recommended Site 29221 for data recovery to consist of documenting the bridge following Historic American Building Survey (HABS) guidelines.

Based on the observations made during the current study, the Waiaka Bridge (Site 29221) continues to be considered eligible for the National Register of Historic Places under Criterion C as described above. With respect to HRS Chapter 6E significance, the bridge is considered significant under Criteria c and d for the same reasons listed above. A more detailed discussion of NRHP eligibility and 6E significance is provided in Chapter 5 below.

Figure 30. Site 29221 the Waiaka Bridge, north elevation.

Figure 31. Site 29221 the Waiaka Bridge, south elevation.

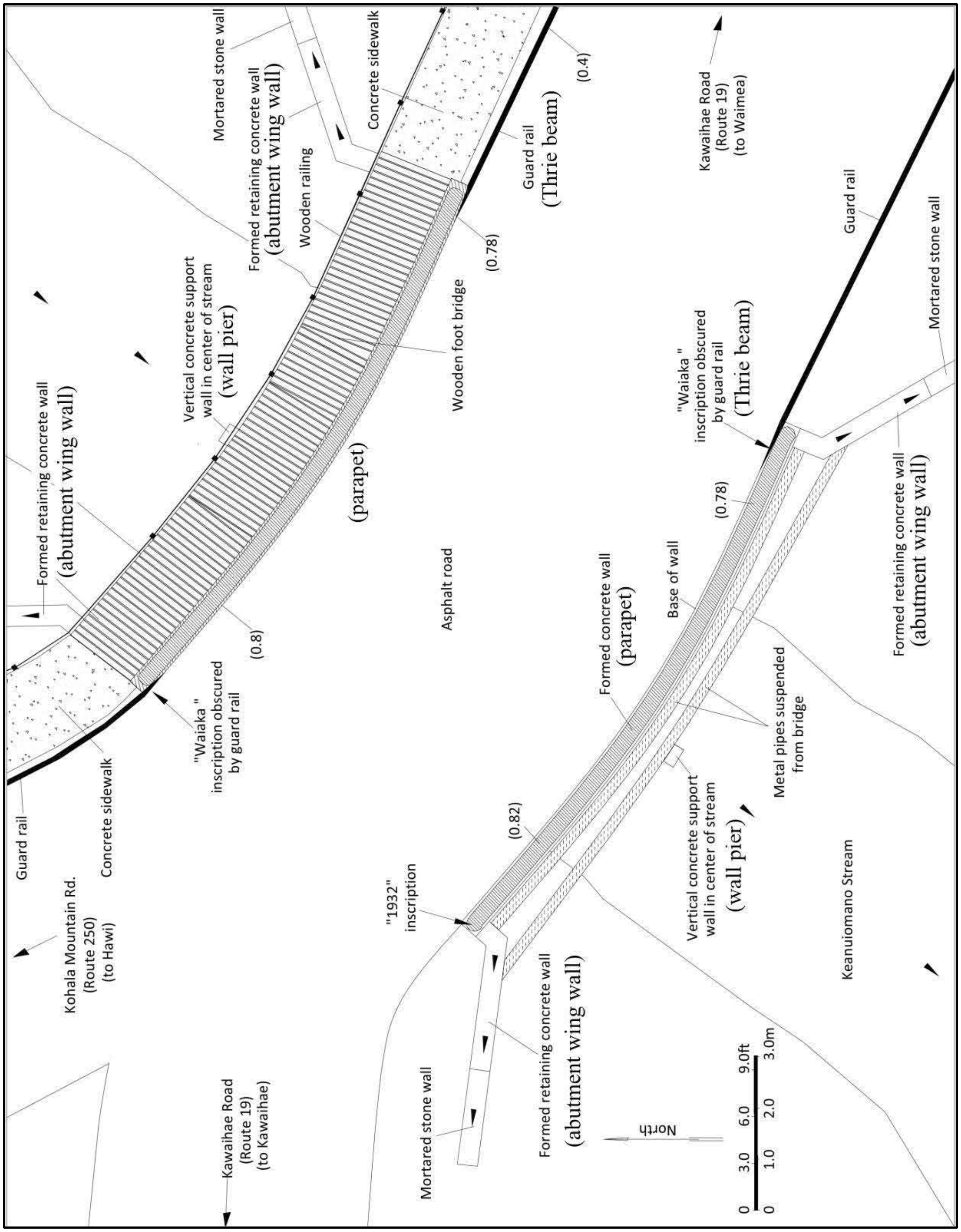


Figure 32. Site 29221 Waiaka Bridge plan view (after Haun et al. 2002:48).

Figure 33. Site 29221 Waiaka Bridge wall pier, view to the southeast.

Figure 34. Site 29221 Waiaka Bridge detail of concrete abutment wall, view to the northwest.

Figure 35. Site 29221 Waiaka Bridge detail of concrete and masonry abutment wing walls, view to the northwest.

Figure 36. Site 29221 Waiaka Bridge detail of parapet, view to the northeast.

Figure 37. Site 29221 Waiaka Bridge wooden foot bridge, view to the east.

5. NRHP ELIGIBILITY AND HRS CHAPTER 6E SIGNIFICANCE RECOMMENDATIONS

The recorded properties are assessed for eligibility for inclusion in the National Register of Historic Places (NRHP) and for their HRS Chapter 6E significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawaiʻi Administrative Rules 13§13-275-6.

To be eligible for listing in the NHRP, properties must meet one of the National Register Criteria for Evaluation by being associated with an important historic context and retainig historic integrity of those features necessary to convey its significance. The criteria, as defined in 36 CFR §60.4, state:

> The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or
>
> C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. That have yielded, or may be likely to yield, information important in prehistory or history.

Under HRS Chapter 6E, for a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and 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;
- e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional 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.

Recommendations for NRHP eligibility and HRS Chapter 6E significance for the three recorded properties are presented in Table 6 and discussed below.

Table 6. NRHP eligibility and HRS 6E significance recommendations.

*SIHP Site no.**	*Property*	*Temporal Affiliation*	*NRHP eligibility*	*HRS 6E significance*
22632	Agricultural complex	Precontact	A, C, D	a, c, d
23313	Keanuʻiʻomanō Stream gage	1955	Not eligible	Not signficant
29221	Waiaka Bridge	1932	C, D	c, d

*SIHP numbers include prefix 50-10-06-

SITE 22632

Site 22632 is a large agricultural complex consisting of around 700 agricultural features located south of Kawaihae Road within the lands owned by the State of Hawaii Department of Hawaiian Home Lands. The site was determined eligible for the NRHP as a result of the (Haun et al. 2003) study under Criteria A, C, and D. Under Criterion A, it was considered eligible because it is associated with the broad pattern of traditional and early historic agricultural intensification in Hawaiʻi. Under Criterion C, the site was considered eligible as well-preserved example site type of an agricultural field complex. Under Criterion D, the site was considered eligible for having yielded information important for understanding late prehistoric to historic land use in the project area. The site extends beyond the current Project Area, and so an updated evaluation of the entire site is beyond the scope of the current project.

Within the current APE, the portions of the three features appear to retain sufficient integrity in all categories to convey that significance; however, it should be noted that south of the APE these features have been disturbed by construction activities associated with the partial build-out of the DHHL Residential Lots. Nothing observed during the current study suggests that the features of the site within the APE have experienced a sufficient loss of integrity to change its eligibility status. Therefore, Site 22632 remains recommended eligible for the NRHP under Criteria A, C, and D for the reasons listed above.

With respect to HRS Chapter 6E significance, Site 22632 was assessed significant under Criteria a, c, and d by Haun et al. (2003). Under Criterion a, it was considered eligible because it is associated with the broad pattern of traditional and early historic agricultural intensification in Hawaiʻi. Under Criterion c, the site was considered eligible as well-preserved example site type of an agricultural field complex. Under Criterion d, the site was considered eligible for having yielded information important for understanding late prehistoric to historic land use in the project area.

Within the current project area, the portions of the three features appear to retain sufficient integrity in all categories to convey that significance; however, it should be noted that south of the current project area these features have been disturbed by construction activities associated with the partial build-out of the DHHL Residential Lots. Nothing observed during the current study suggests that that the features of the site within the current project area have experienced a sufficient loss of integrity to change its eligibility status. Therefore, Site 22632 remains recommended significant under Criteria a, c, and d for the reasons listed above

SITE 23313

Site 23313 is the USGS Keanuʻiʻomanō Stream gaging station, located in Keanuʻiʻomanō Stream. Based on available USGS records, the gaging station was established in 1955, as one of around 100 gaging stations installed between 1950 and 1964. With respect to its eligibility for inclusion in the NRHP, the site was previously evaluated by Haun et al. (2002) to be eligible under Criterion D for having yielded informaton important for understanding late prehistoric to historic land use in the project area.

Additional information about Site 23313 obtained during the current study allows for a re-evalutation of its eligibility for the NRHP. Based on this new information, the site is re-evaluated within the historical context of USGS Stream Gaging in Hawaiʻi, with a period of significance of 1909-1964. The Keanuʻiʻomanō Stream gaging station (Site 23313) was established late in the period of significice . It was one of approximately 100 new gages added between 1950 and 1964. A search of historic newspapers and other sources did not identify any specific events in which the Keanuʻiʻomanō Stream gaging station played an important role (not eligible under Criterion A), and no person or persons of historic importance could be directly associated with the gage (not eligible under Criterion B). It is of a simple, utilitarian, and non-descript design that cannot be said to embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction (not eligible under Criterion C). The information obtained during the current and prior studies has not yielded information that can be said to be important in prehistory or history, nor does the site appear to be likely to yield such information through further archictectural or archaeological research (not eligible under Criterion D.) Therefore, Site 23313 is now recommended *not eligible* for inclusion in the NRHP under any criterion.

With respect to HRS Chapte 6E significance, the site retains sufficient integrity in all categories to be evaluated. A described above, a search of historic newspapers and other sources did not identify any specific events in which the Keanuʻiʻomanō Stream gaging station played an important role (not eligible under Criterion a), and no individual of historic importance could be directly associated with the gage (not eligible under Criterion b). It is of a simple, utilitarian, and non-descript design that cannot be said to embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction (not eligible under Criterion c). The information obtained during the current and prior studies has not yielded information that can be said to be important in prehistory or history, nor does the site appear to be likely to yield such information through further archictectural or archaeological research (not eligible under Criterion d.) Consultation conducted for previous iterations of this project and other projects in the Waimea area did not identify this site as having an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts. Therefore, Site 23313 is now recommended *not significant* under any criterion.

SITE 29221

Site 29221, the Waiaka Bridge, was previoulsy determined eligible for inclusion in the NHRP under Criterion C and D (Haun et al. 2002; MKE and Fung 2013). Under Criterion C, the bridge was considered for its eligibility for the NRHP within the context of “Bridge Construction and the Federal Aid Program (1925-1941)” as detailed by MKE and Fung (2013:2-11). The bridge was constructed in 1932 by Charles H. Will as the first bridge funded by federal money on Hawaiʻi Island. It is also a good example of a simple 1930s reinforced concrete bridge. In addition to the NRHP eligibility and HRS Chapter 6E significance evaluations conducted by Haun et al. (2002), the bridge was previously evaluated for NHRP eligiblility in the *Hawaiʻi State Historic Bridge Inventory and Evluation* (MKE and Fung 2013). In that study, the bridge was evaluated as NRHP eligible under Criterion C as “a good example of a 1930’s reinforced concrete bridge that is typical of its period in its use of materials, method of construction, craftsmanship and design” (MKE and Fung 2013:6-174). Haun et al. (2002:53) also evaluated the bridge to be eligible under Criterion D for having “yielded information important for understanding late prehistoric to historic land use in the project area,” which is presumed to refer to a period of significance beginning in the 1930s in the case of this bridge.

The results of the current study indicate that the bridge retains sufficient integrity of all categories to convey its significance under Criteria C and D. Therefore, Site 29221 continues to be recommended eligible for the NRHP at the local level of significance under that category.

With respect to significance under HRS Chapter 6E, Site 29221 was previoulsy assessed as significant under Criterion c (Log No. 2011.2731, Doc. No. 1108MA05) and Criterion d (Haun et al. 2002). Under Criterion c, it was noted by DLNR-SHPD to be a good example of a modest reinforced concrete slab bridge that embodies the distinctive characteristics of a type, period, or method of construction. Under Criterion d, Haun et al. (2002) stated that the bridge “yielded information important for understanding late prehistoric to historic land use in the project area,” which is presumed to refer to a period of significance beginning in the 1930s in the case of this bridge.

The results of the current study indicate that the bridge retains sufficient integrity of all categories to convey its significance under Criteria c and d. Therefore, Site 29221 continues to be recommended significant under those categories.

6. RECOMMENDED DETERMINATION OF EFFECT

Under 36 CFR 800.5, the agency shall apply the criteria of adverse effect to historic properties. An adverse effect is found:

> when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. [36 CFR 800.5(a)(1)]

The Undertaking would include the demolition of Waiaka Bridge (Site 29221), which would result in the physical destruction of all or part of the property. The use of the HDOT staging area and the DHHL Potential Staging area located on TMK: (3) 6-6-001:077 may result in the physical damage to part of the three identified features of Site 22632 (Features XO, XP, and XR).

The recommended determination of effect under 36 CFR 800.5 for the Undertaking is therefore “Adverse effect.” It is recommended that HDOT consult further to resolve the adverse effect pursuant to 36 CFR 800.6.

Under HAR §13-275-7(a), the effects or impacts of a project on significant properties shall be determined by the agency. The proposed project would include the demolition of Waiaka Bridge (Site 23221), which would result in the physical destruction of all or part of the property.The use of the HDOT staging area and the DHHL Potential Staging area located on TMK: (3) 6-6-001:077 may result in the physical damage to part of the three identified features of Site 22632 (Features XO, XP, and XR).

The recommended determination of effect under HAR §13-275-7 for the proposed project is therefore “Effect, with proposed mitigation commitments.” Proposed mitigation commitments are discussed in Chapter 7.

7. MITIGATION RECOMMENDATIONS

The recommended effect determinations under Section 106 and HRS Chapter 6E would require mitigation of adverse effects to Sites 22632 and 29221. To resolve adverse effects under Section 106, procedures outlined in 36 CFR 600.6 would need to be followed, ultimately resulting in the execution and implementation of a memorandum of agreement (MOA) that would evidence the agency official's compliance with Section 106 and 36 CFR 600.6 and govern the Undertaking and all of its parts. Under HRS Chapter 6E, the procedures outlined in HAR §13-275-8 and 13-275-9 would be followed to propose, implement, and verify the completion of mitigation commitments. Recommended mitigation measures are discussed and proposed below.

Table 7. Proposed mitigation commitments

SIHP Site Number	***Site Type***	***NRHP eligibility***	***HRS 6E significance***	***Proposed mitigation***
22632	Agricultural complex	A, C, D	a, c, d	Data recovery
29221	Waiaka Bridge	C	c	Architectural recordation

*SIHP numbers include prefix 50-10-06-

SITE 22632

Features XO, XP, and XR of Site 22632 extend into portions of the current project area where planned project activities include the staging of equipment and vehicles. Potential adverse effects to these features could include physical damage caused by heavy equipment driving on them, which would diminish their integrity of design, workmanship, feeling, and association that allows them to convey their significance under Criteria A, C, and D (for their NRHP eligibility) and Criteria a, c, and d (for their HRS Chapter 6E significance). Data recovery is recommended to mitigate these adverse effects.

Past data recovery projects have therefore obtained information about morphology and chronology in representative features of Site 22632. Archaeological data has already been recovered from one field ridge (Feature XO) and one field (the one between Feature XP and XQ) within the current APE. This data was obtained by Thompson and Rosendahl (1992), whose backhoe trenches yielded little information other than details of the physical construction of the field ridges (see Appendix B). Data recovery has also been conducted on other similar features of Site 22632 by Haun et al. (2005) and by Escott (2019). Both of these studies produced radiocarbon dates that were interpreted to represent the age of these features. Data recovery by Haun et al. (2005) conducted at other features of the site resulted in the identification of a buried *ʻauwai* (Feature ZZ, located about 800 meters west of the current project area). Charcoal (unidentified in the report) was obtained from an *in-situ* deposit adjacent to the basal level of a boulder alignment interpreted as a down-slope reinforcement of the ditch bank. Accelerator Mass-Spectroscopy (AMS) dating of the charcoal returned a 2σ calibrated date range of A.D. 1430 to 1630 (Beta 195991), which was interpreted to be a *terminus post quem* for the construction of the *ʻauwai*. Terraces and field boundary features of Site 22632 were interpreted by Haun et al. (2005) to represent traditional Hawaiian agricultural features that post-date A.D. 1450. This interpretation was based on several AMS dates on unidentified charcoal with 2σ calibrated date ranges falling mostly within ca. A.D. 1440 to 1660 (Beta 195988, 195989, 195986), but also some that edged into the modern period (Beta 195990, 195987, 195993, 195992). Data recovery by Escott (2019) within *ʻauwai* features located west of the current project area documented their construction and morphology. Two radiocarbon dates recovered from *ʻauwai* Feature JM returned two bi-modal 2σ calibrated date range probabilities. One of them (Beta 292600) returned ranges of A.D. 1670 to 1780 and 1790 to 1960, and the other (Beta 292601) returned A.D. 1500 to 1600 and 1610 to 1660. Escott (2019) interpreted these dates to mean that the *ʻauwai* was constructed during to the first half of the seventeenth century and was still in use until the early Historic era, which suggests that the 1790-1960 portion of the first date range was discarded without explanation. Although both of these sets of radiocarbon dates do not follow the currently recognized best practices for radiocarbon dating (Allen and Huebert 2014; Rieth and Athens 2013), they appear to concur with previously proposed models of the development of the Lālāmilo Field System.

Thus, while past data recovery projects have focused on morphology and chronology, two other data recovery goals could be used to mitigate the adverse effects of the current Undertaking. One goal could be the creation of a high-resolution map of the remaining features using LIDAR. Another goal could be the recovery of macro- and microbotanical remains from within the fields and field ridges in search of direct physical evidence of crops that were cultivated in the fields.

SITE 29221

The Undertaking would demolish the Waiaka Bridge, which is by definition an adverse effect. The bridge is eligible for inclusion in the NRHP under Criterion C and HRS Chapter 6E significant under Criterion c as a good example of a 1930's reinforced concrete bridge that is typical of its period in its use of materials, method of construction, craftsmanship and design, and also under NRHP Criterion D and HRS Chapter 6E Criterion d for information it yielded about land use in the historic period. To mitigate adverse effects caused by its demolition, architectural recordation is recommended. This recordation could take the form of Historic American Engineering Record Level I or II documentation of the bridge.

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APPENDIX A.
(HAUN ET AL. 2002) AIS ACCEPTANCE LETTER

030 Rec'd 5/17/12

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
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COMMISSION ON WATER RESOURCE MANAGEMENT

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AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
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CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

May 15, 2012

Dr. Alan Haun
Haun and Associates
73-1168 Kahuna A'o Road
Kailua Kona, Hawai'i 96740

LOG NO: 2012.1353
DOC NO: 1205MV04
Archaeology

Dear Dr. Haun:

SUBJECT: Chapter 6E-8 and Section 106 Historic Preservation Review - Revised Archaeological Inventory Survey, Waiaka Bridge Replacement and Realignment of Approaches
Waimea Ahupua'a, South Kohala District, Island of Hawai'i
TMK (3) 6-6-001:033, :040 & :077 (portion)

Thank you for the opportunity to review the revised draft report titled *Archaeological Inventory Survey Waiaka Bridge Replacement and Realignment of Approaches Lands of Lalamilo Keoniki, Kauniho and Waiaka 1, South Kohala District, Island of Hawai'i TMK (3) 6-6-001:033, :040 & :077 (portion)*. A. Haun, D. Henry and Ka'ohulani McGuire (February 2012). This document was received by our office on March 6, 2012. We apologize for the delayed review and thank you for your patience. This report presents the findings of an archeological inventory survey that was conducted on 9.8 acres in the surrounding the intersection of Kawaehae Road and Kohala Mountain Road. The report was prepared at the request of The State Department of Transportation, who proposes to replace the Waiaka Bridge and realign the roads that lead into this intersection. Field work for this study consisted of a 100% pedestrian survey of the surface environment with no subsurface investigation. According to the report, four historic sites, one previously identified and three newly identified were located within this survey area. These sites include an agricultural field complex previously described by Haun et. al. 2002 (SIHP Site 50-10-6-22632); a water diversion ditch (Site 22312); a concrete foundation located within Keanuiomano Stream (Site 22313); and the Waiaka Bridge (Site 29221).

The revisions made to this report are the result of the SHPD review of a previous draft (Log 2011.2213, Doc 1111MV03); questions raised in our prior correspondence have been addressed. The report now contains an excellent description of the project alternatives and indicates the potential for these alternatives to impact Site 22632. We concur with your site evaluations and proposed mitigation commitments for these sites, including data recovery for Sites 22632 and 23312; no further work for Site 23313, and HABS documentation for Site 29221We also concur with your recommendation for onsite archaeological monitoring during ground disturbing activities associated with this project. We look forward to the opportunity to review and accept archaeological data recovery and monitoring plans prior to the commencement of ground disturbing activities.

This report meets the requirements of HAR 13-276 as well as the secretary of the interiors standards, and is accepted by SHPD. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Theresa K. Donham, Archaeology Branch Chief

APPENDIX B. THOMPSON AND ROSENDAHL (1992) BACKHOE TRENCH PROFILES

During their AIS of "Parcel 7," Thompson and Rosendahl (1992) documented seven soil profiles within backhoe trenches excavated across agricultural fields and field ridges in Site 18054. Stratigraphic profile descriptions are from those trenches are reproduced below, along with the profile drawings included in the Thompson and Rosendahl (1992) report.

PARCEL 7, BT-1

Layer	Description
I	0-10 cmbs; dark reddish brown (5YR 3/2 moist); silty clay loam; reddish brown (5YR 4/2 dry); moderate, medium crumb structure; slightly hard, friable, slightly sticky, slightly plastic;
II	30-40 cmbs; dark reddish brown (5YR 3/3 moist); silt loam; dark reddish brown (5YR 3/4 dry); structureless; loose, loose, slightly sticky, slightly plastic;
III	80-90 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; yellowish red (5YR 4/6 dry) moderate, coarse, crumb structure; soft, very friable, sticky, plastic;
IV	135-145 cmbs; dark reddish brown (2.5 YR 2.5/4 moist); silty clay loam; yellowish red (5YR 5/8 dry); weak, fine crumb structure; soft, very friable, sticky, plastic.

PARCEL 7, BT-2

Layer	Description
I	0-30 cmbs; dark reddish brown (5YR 3/3 moist); clay loam; reddish brown (5 YR 4/4 dry); moderate, fine crumb structure; hard, friable, slightly sticky, slightly plastic;
II	10-45 cmbs; dark reddish brown (5YR 3/4 moist); silty clay loam; yellowish red (5YR 4/6 dry); structureless; soft, loose, slightly sticky, slightly plastic;
III	35-115 cmbs; dark brown (7.5YR 3/3 moist); silty clay loam; strong brown (7.5YR 4/6 dry); weak; very coarse crumb structure; soft, very friable, sticky, plastic;
IV	100-115 cmbs; dark reddish brown (2.5YR 2.5/4 moist); silty clay loam; strong brown (7.5YR 5/8 dry); weak, coarse crumb structure; soft, very friable, sticky, plastic.

PARCEL 7, BT-3

Layer	Description
I	0-10 cmbs; dark reddish brown (SYR 2.5/2 moist); silty clay loam; dark reddish brown (5YR 3/4 dry); moderate fine crumb structure; hard, friable, slightly sticky, slightly plastic;
II	30-40 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; reddish brown (5YR 4/4 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, slightly plastic;
III	90-100 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; yellowish red (5YR 5/6 dry); weak, fine to coarse crumb structure; soft very friable, slightly sticky, plastic;
IV	150-160 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; yellowish red (5YR 4/6 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, plastic.

PARCEL 7, BT-4

Layer	Description
I	10-20 cmbs; dark brown (7.5YR 3/3 moist); silty clay loam; dark brown (75YR 3/4 dry); moderate, fine crumb structure; hard, friable, slightly sticky plastic
II	25-35 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; dark reddish brown (5YR 3/4 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, slightly plastic
III	65-75 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; strong brown (7 .5YR 4/6 dry); weak, fine to coarse, crumb structure; soft, very friable, slightly sticky, slightly plastic;
IV	90-100 cmbs; dark reddish brown (SYR 3/3 moist); silty clay loam; strong brown (7.5YR5/8 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, plastic.

PARCEL 7, BT-5

Layer	Description
I	0-35 cmbs; dark brown (7.5YR 3/3 moist); clay loam; dark brown (7 .5YR 3/4 dry); moderate fine crumb structure; hard, friable, slightly sticky, slightly plastic;
II	30-45 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; dark reddish brown (5YR 3/4 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, plastic;
III	30-150 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; strong (7 .5YR dry); weak, fine to medium crumb structure; soft, very friable, slightly sticky, plastic;
IV	80-105 cmbs; dark reddish brown (2.5YR 2.5/4 moist); clay loam; strong brown (7.5YR 5/8 dry); weak, fine to medium crumb structure; soft, very friable, sticky, plastic.

PARCEL 7, BT-6

Layer	Description
I	0-35 cmbs; dark brown (7 .5YR 3/3 moist); clay loam; dark brown (7.5YR 3/4 dry); moderate fine crumb
II	20-45 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; dark reddish brown (5YR 3/4 dry); weak, fine to coarse crumb structure; soft, very friable, slightly sticky, plastic
III	25-65 cmbs; dark reddish brown (5YR 3/3 moist); silty clay loam; strong (7 .5YR dry); weak, fine to medium crumb structure; soft, very friable, slightly sticky, plastic
IV	60-90 cmbs; darkreddish brown (2.5YR2.5/4 moist); clay loam; strong brown (7.5YR 5/8 dry); weak, fine to medium crumb structure; soft, very friable, sticky, plastic;
V	100-120 cmbs; dark brown (7.5YR 3/2 moist); clay loam; dark brown (7 .5YR 3/3 dry); moderate, fine to medium crumb structure; hard, friable, sticky, plastic

PARCEL 7, BT-7

Layer	Description
I	0-30 cmbs; dark reddish brown (5YR 3/3 moist); clay loam; dark brown (7.5 YR 3/4 dry); moderate, medium crumb structure; hard, friable, slightly sticky, slightly plastic;
II	10-00cmbs;darkreddishbrown(2.5YR2.5/4moist); siltyclayloam;strongbrown(7.5YR4/6dry);weak, medium crumb structure; soft, very friable, slightly sticky, plastic;
III	30-125 cmbs; dark reddish brown (2.5YR 2.5/4 moist); clay loam; strong brown (7.5YR 4/6 dry); moderate, fine to medium crumb structure; hard, very friable, slightly sticky, plastic;

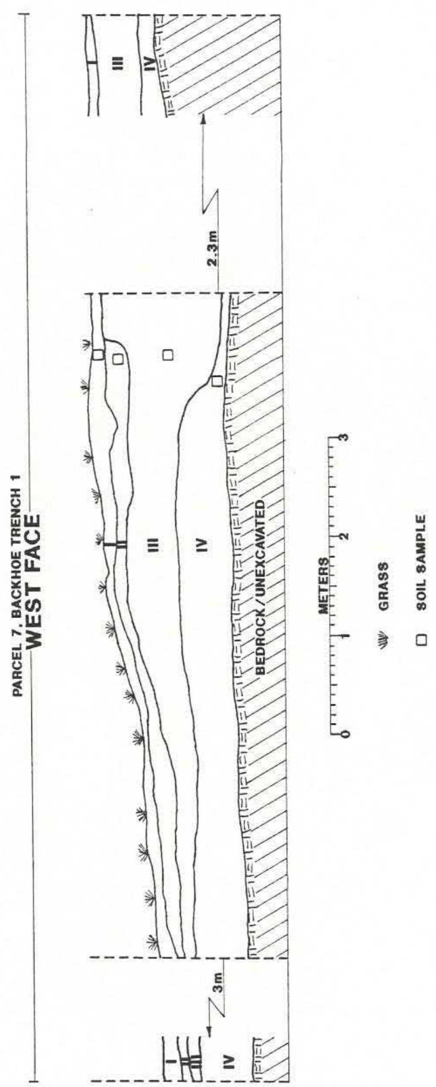

Figure B-6. Stratigraphic Sequence, BT-1, Parcel 7.

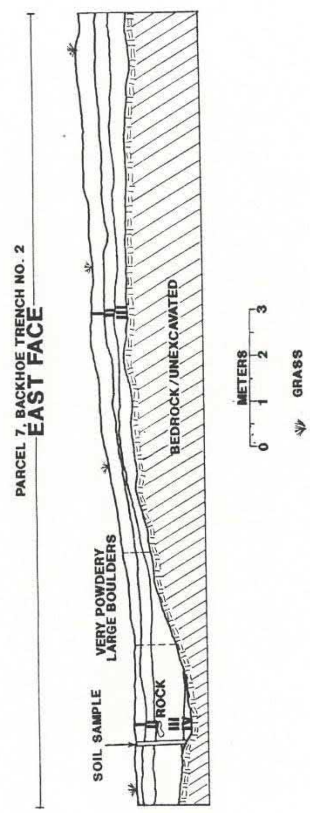

Figure B-7. Stratigraphic Sequence, BT-2, Parcel 7

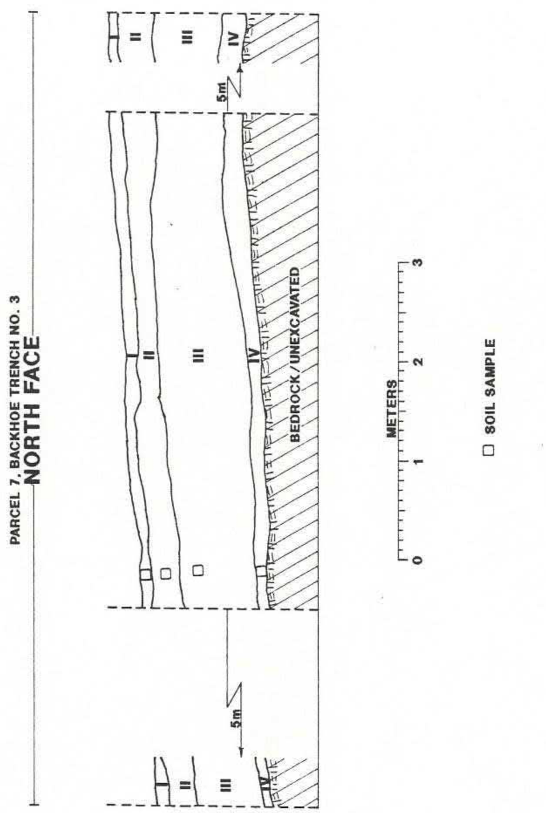

Figure B-8. Stratigraphic Sequence, BT-3, Parcel 7

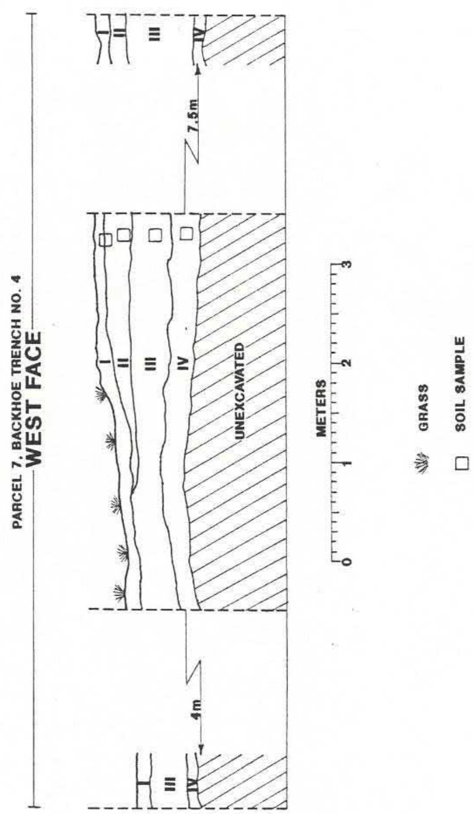

Figure B-9. Stratigraphic Sequence, BT-4, Parcel 7

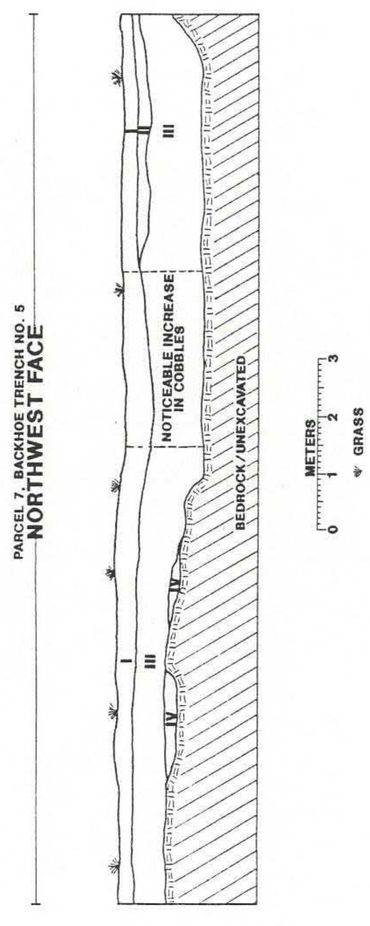

Figure B-10. Stratigraphic Sequence, BT-5, Parcel 7

905-092391 APPENDIX B 50

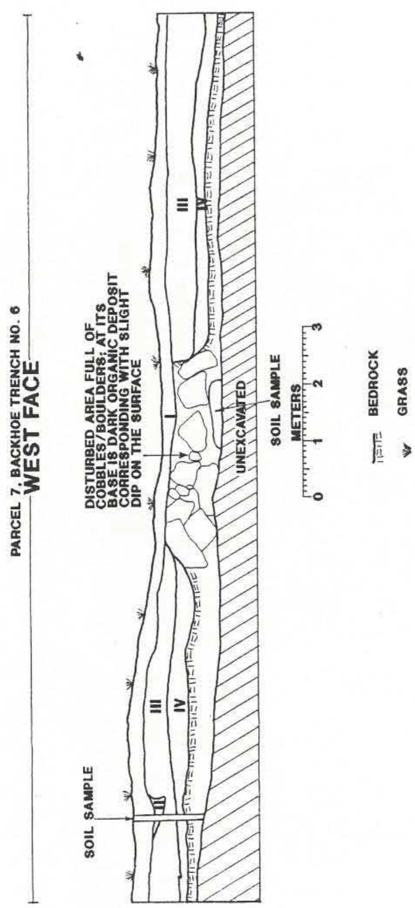

Figure B-11. Stratigraphic Sequence, BT-6, Parcel 7

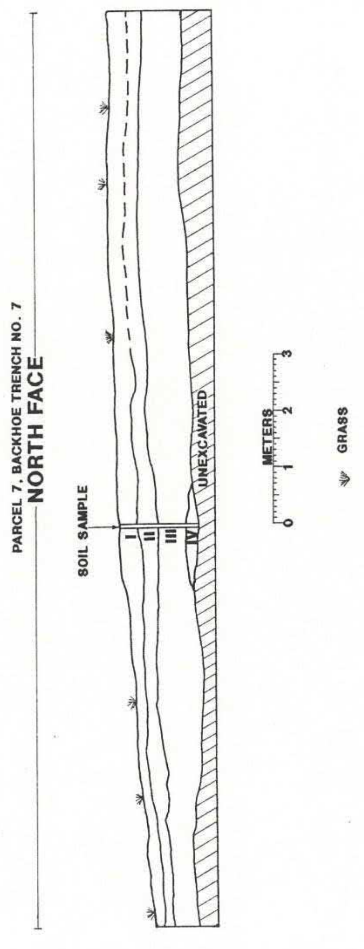

Figure B-12. Stratigraphic Sequence, BT-7, Parcel 7

APPENDIX D
CULTURAL IMPACT ASSESSMENT

A Cultural Impact Assessment for the Waiaka Bridge Replacement and Road Realignment

(3) 6-6-001:011, 6-5-001:033, 6-5-001:015, 6-6-004:001, 6-6-001:077.

Kauniho, Lālāmilo, Waiaka 1st and 2nd Ahupuaʻa
Kalana of Waimea
South Kohala District
Island of Hawaiʻi

DRAFT VERSION

Prepared By:
Nicole Ishihara, B.A.
and
Robert Rechtman, Ph.D.

Prepared For:

WSP USA, Inc.

December 2021

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ASM Project Number 35580.00

A Cultural Impact Assessment for for the Waiaka Bridge Replacement and Road Realignment

(3) 6-6-001:011, 6-5-001:033, 6-5-001:015, 6-6-004:001, 6-6-001:077.

Kauniho, Lālāmilo, Waiaka 1st and 2nd Ahupuaʻa

Kalana of Waimea

South Kohala District

Island of Hawaiʻi

ASM affiliates

CHAPTERS

FIGURES

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1. INTRODUCTION

At the request of WSP USA Inc., on behalf of the United States Department of Transportation Federal Highway Administration (FHWA) and the State of Hawai‘i Department of Transportation (HDOT), ASM Affiliates (ASM) prepared this Cultural Impact Assessment (CIA) for the proposed replacement of the Waiaka Bridge and realignment of roadway approaches (referred to hereafter as the ‘proposed project’). The proposed project encompasses several Tax Map Key (TMK) parcel, all of which are located in the City of Kamuela and extend across the *ahupua‘a* of Kauniho, Lālāmilo, Waiaka 1st and 2nd, Kalana of Waimea; South Kohala District; Island of Hawai‘i (Figures 1, 2, and 3). The proposed project involves replacing the existing Waiaka Bridge with an approximately 53-foot wide by 80-foot-long replacement bridge to accommodate two travel lanes, one in each direction, a shoulder/bike lane, and raised sidewalk. Additionally, the approaches will be realigned to create a smoother transition to the replacement bridge and the Kawaihae Road (Highway 19) – Kohala Mountain Road (Highway 250) intersection would be reconfigured to include a traffic signal or roundabout. A potential staging area for construction equipment is located approximately 2,000-feet east from the Waiaka Bridge in a lot owned by the State of Hawai‘i Department of Hawaiian Home Lands (DHHL).

The expenditure of state funds and the use of state land qualifies the proposed project as an action subject to the Hawai‘i Environmental Policy Act (HEPA) as codified in Hawai‘i Revised Statutes (HRS) Chapter 343. This CIA study is intended to inform an Environmental Assessment (EA) conducted in compliance with HRS Chapter 343, pursuant to Act 50 and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impacts,* adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (OEQC 1997). Act 50, which was proposed and passed as Hawai‘i State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, specifically acknowledges the State’s responsibility to protect native Hawaiian cultural practices. Act 50 further states that “environmental assessments . . . should identify and address effects on Hawaii’s culture, and traditional and customary rights” and that “native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the ‘aloha spirit’ in Hawai‘i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.”

This report is divided into four main sections, beginning with an introduction, which includes a description of the proposed project, as well as a physical description of the project area. To provide a cultural context, Section 2 includes a detailed culture-historical background specific to Kauniho, Lālāmilo, Waiaka 1st and 2nd Ahupua‘a, the greater Kalana of Waimea, and a presentation of prior cultural and archaeological studies conducted in the vicinity of the proposed project area. Section 3 presents the results of the consultation process and Section 4 concludes with a discussion of potential cultural impacts and recommended actions and strategies that may help to mitigate any such impacts.

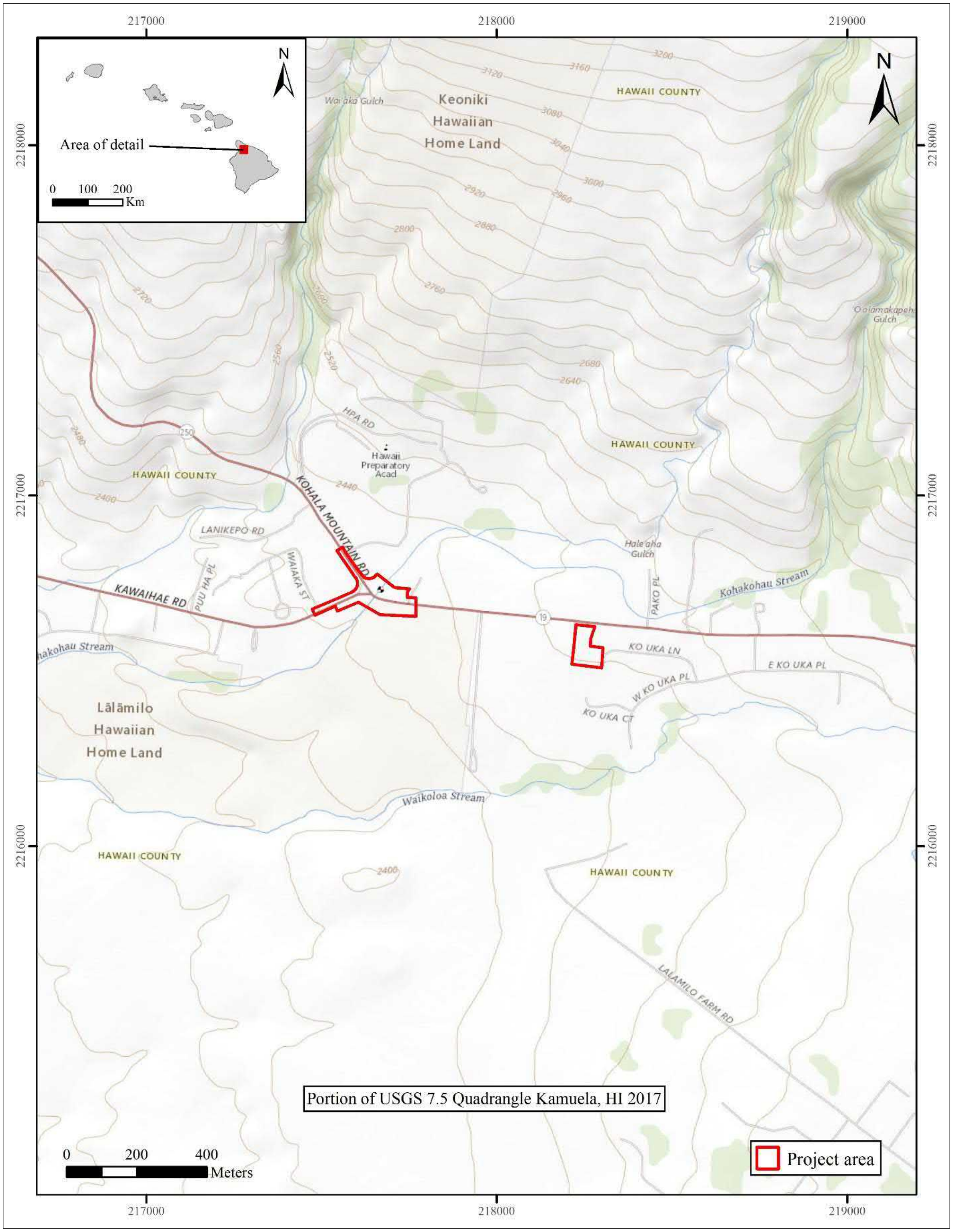

Figure 1. Portion of USGS Kamuela Quadrangle showing the location of the project area.

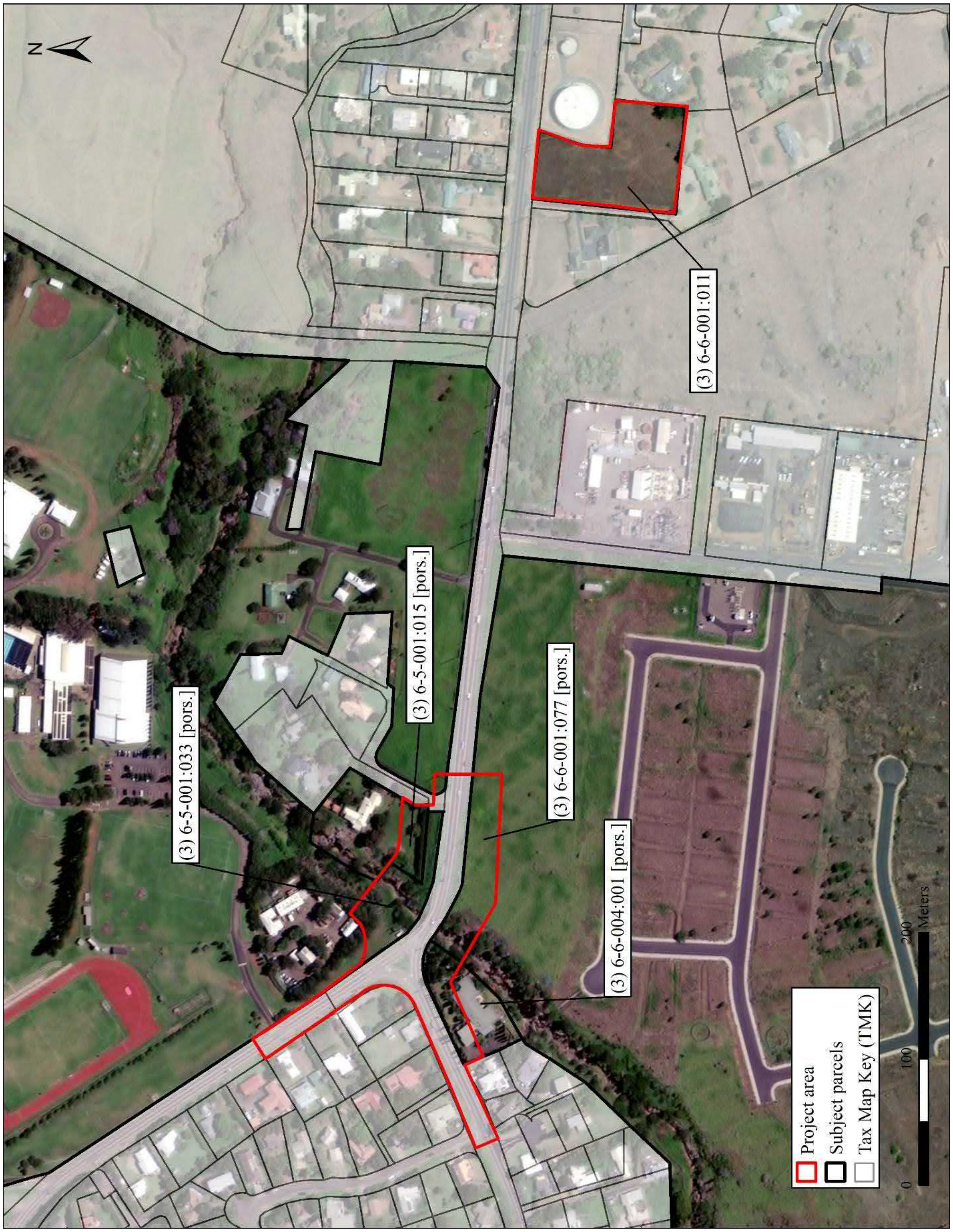

Figure 2. Aerial image with overlay of Tax Map Key (TMK) parcels and project area.

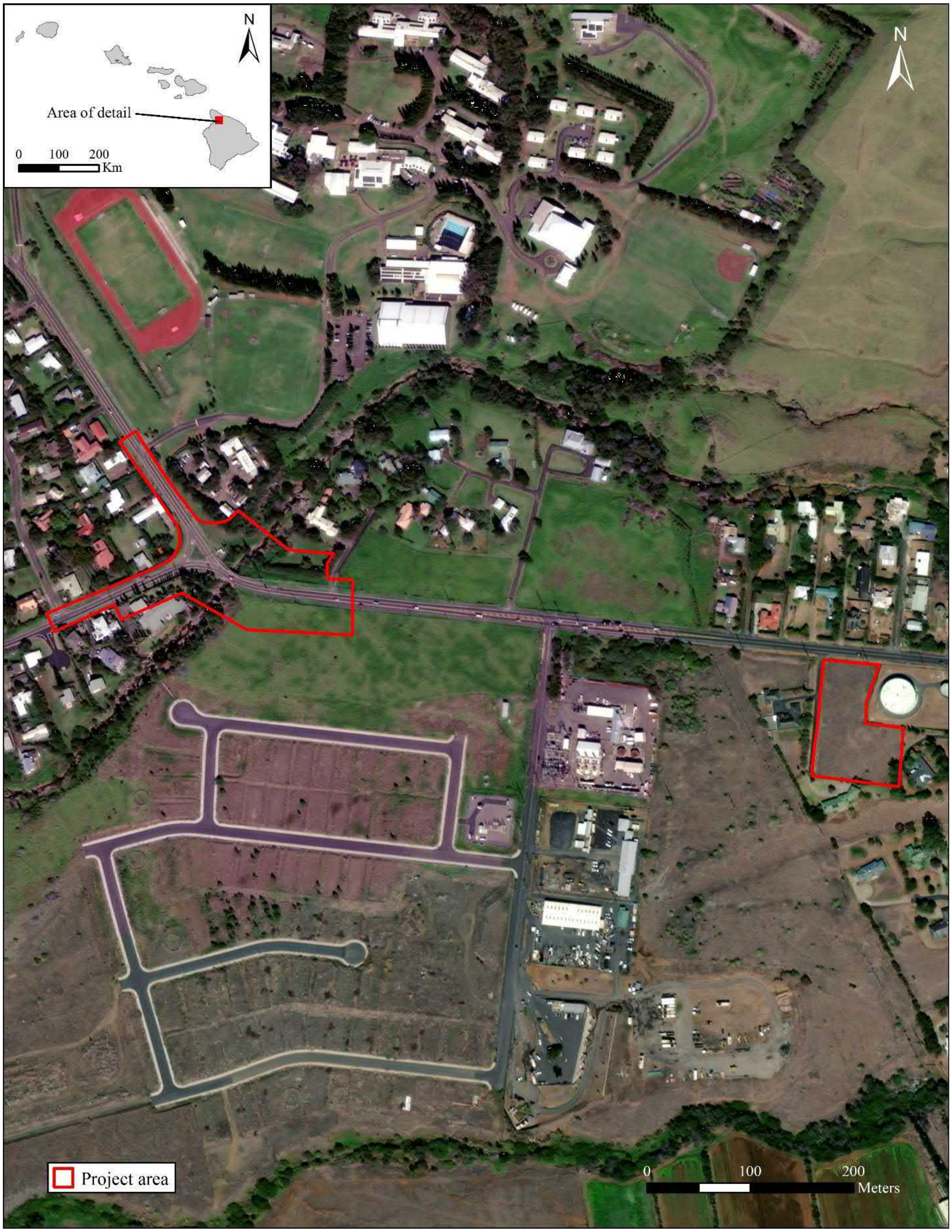

Figure 3. Satellite aerial imagery of project area.

NATURAL AND BUILT ENVIRONMENT

The project area extends across the traditional *ahupuaʻa* (from north to south) of Kauniho, Waiaka 2nd, Waiaka 1st, and Lālāmilo, all of which are located within the Kalana of Waimea, South Kohala District, Island of Hawaiʻi. The project area is located roughly 2-miles west of Waimea Town and 10-miles southeast of Kawaihae Harbor (Figure 4). The overall project area measures 316,143-square feet (7.3-acres) and includes a potential staging and temporary use area. The project area is located at an elevation ranging from 732 meters (2,401 feet) to 741 meters (2,431 feet) above sea level along the southwestern slope of the Kohala Mountains, approximately 13.2 kilometers (8.24-miles) from the South Kohala coast. Surface geology in the project area is mapped in Figure 5 and described as “Qhm” or Hamakua Volcanics dating between 64,000-300,000 years ago (Sherrod et al. 2007). Soils in the project area are of two types (Figure 30); the project area east of Keanuʻimanō Stream (labeled as “383” in Figure 30) is comprised of soils mapped as Waimea medial very fine sandy loam, 0 to 6 percent slope, and a section of the project area laying west of Keanuʻimanō Stream (labeled as “379” in Figure 30) is described as rock outcrop-Kamakoa complex with a 6 to 20 percent slope (Soil Survey Staff 2020). The project area’s climate is generally cool and dry with mean annual temperatures ranging between 62 to 71 degrees Fahrenheit (Giambelluca et al. 2014). The mean annual rainfall within the project area is 41-inches (approximately 1,054-millimeters) with most of the precipitation occurring between December through April (Giambelluca et al. 2013).

The project area is situated over Keanuʻimanō (also known as Keanuiomano) Stream, a perennial stream that begins east of Hawaiʻi Preparatory Academy and flows *makai*. The waters emanating from Lanikepu, Mamaewa, and ʻŌuli Gulches (as depicted in Figure 7) meet with Keanuʻimanō Stream below the project area. Eventually, Waikōloa Stream and Keanuʻimanō converge and becomes Waiulaula Stream, which is not depicted in Figure 7 (Hawaii Statewide G. I. S. Program 2014).

The vegetation within the project area includes a mix of introduced grasses and shrubs. The southern portion of the Waiaka Bridge consists of bougainvillea (*Nyctaginaceae*) and Cook pine (*Araucaria columnaris*) that line the riverbanks while Oʻahu sedge (*Carex wahuensis*), Star sedge (*Carex echinata*) and Bog rush (*Juncus effusus*) can be found in the streambed. The northern portion of the Waiaka Bridge consists of Guinea grass (*Urochloa maxima*), watercress (*Nasturtium officinale*), and Bog rush within the streambed. The potential staging area has been cleared and free of any vegetation. Figures 9, 10, 30, 11, 12, 13, 14, and 15 detail the Waiaka Stream Bridge project area.

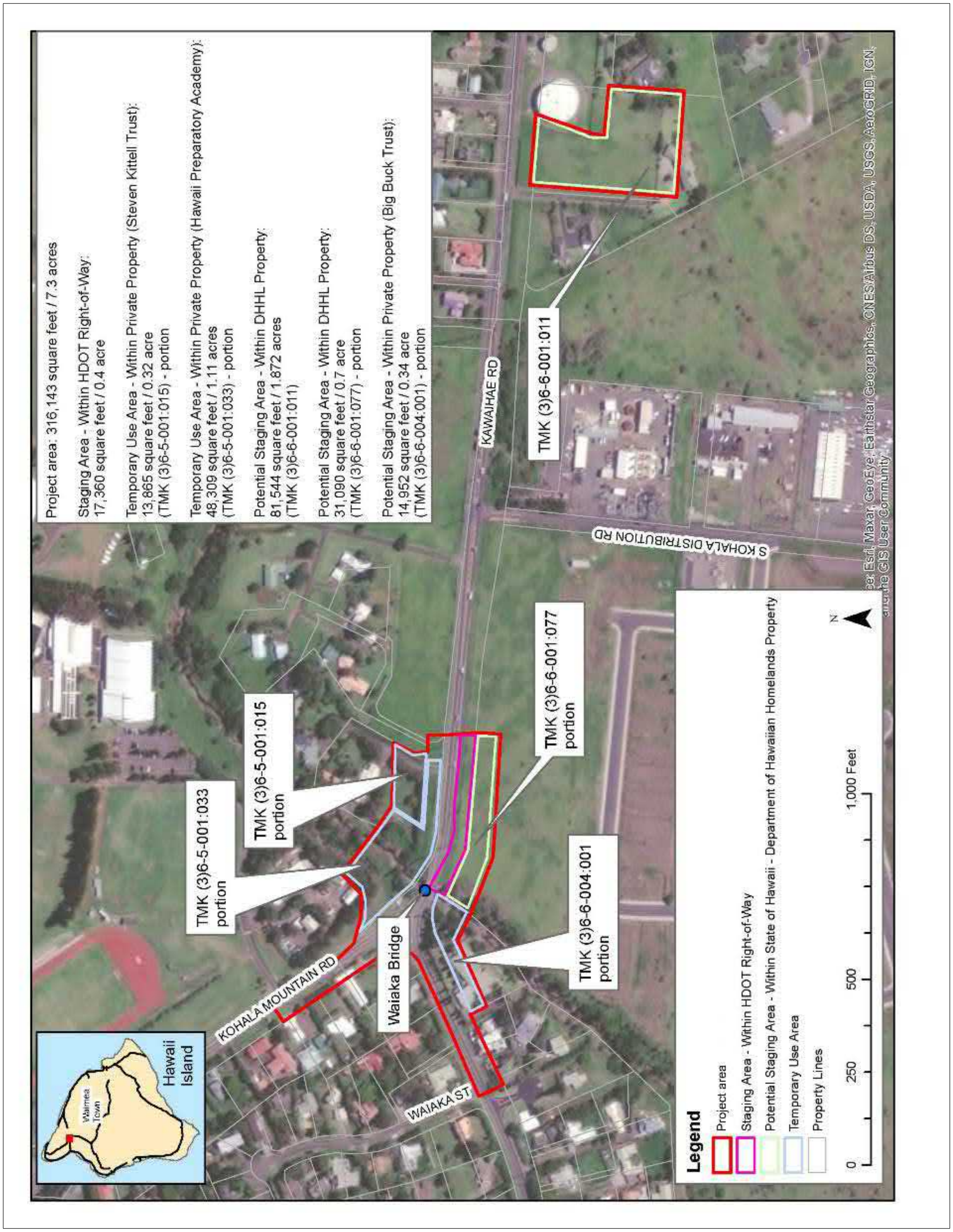

Figure 4. Tax Map Keys within project area (in red) and uses.

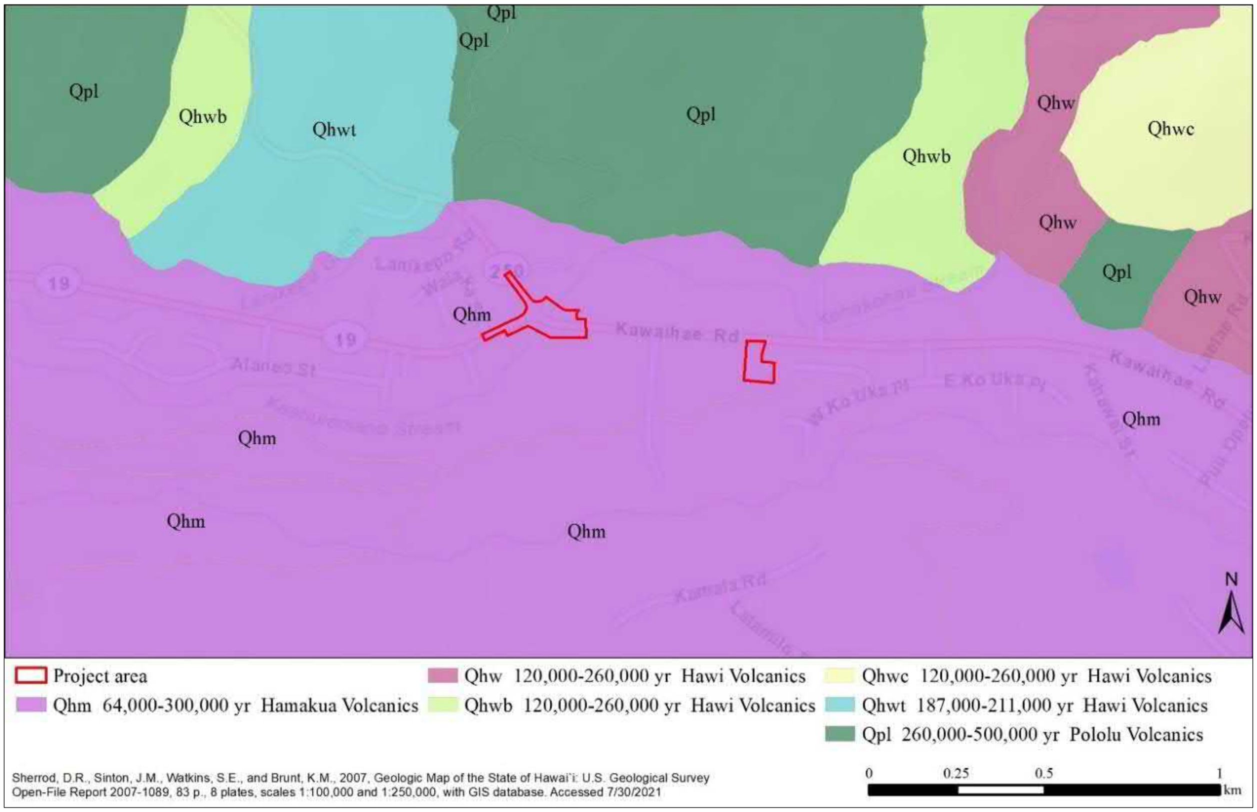

Figure 5. Geology underlying the project area.

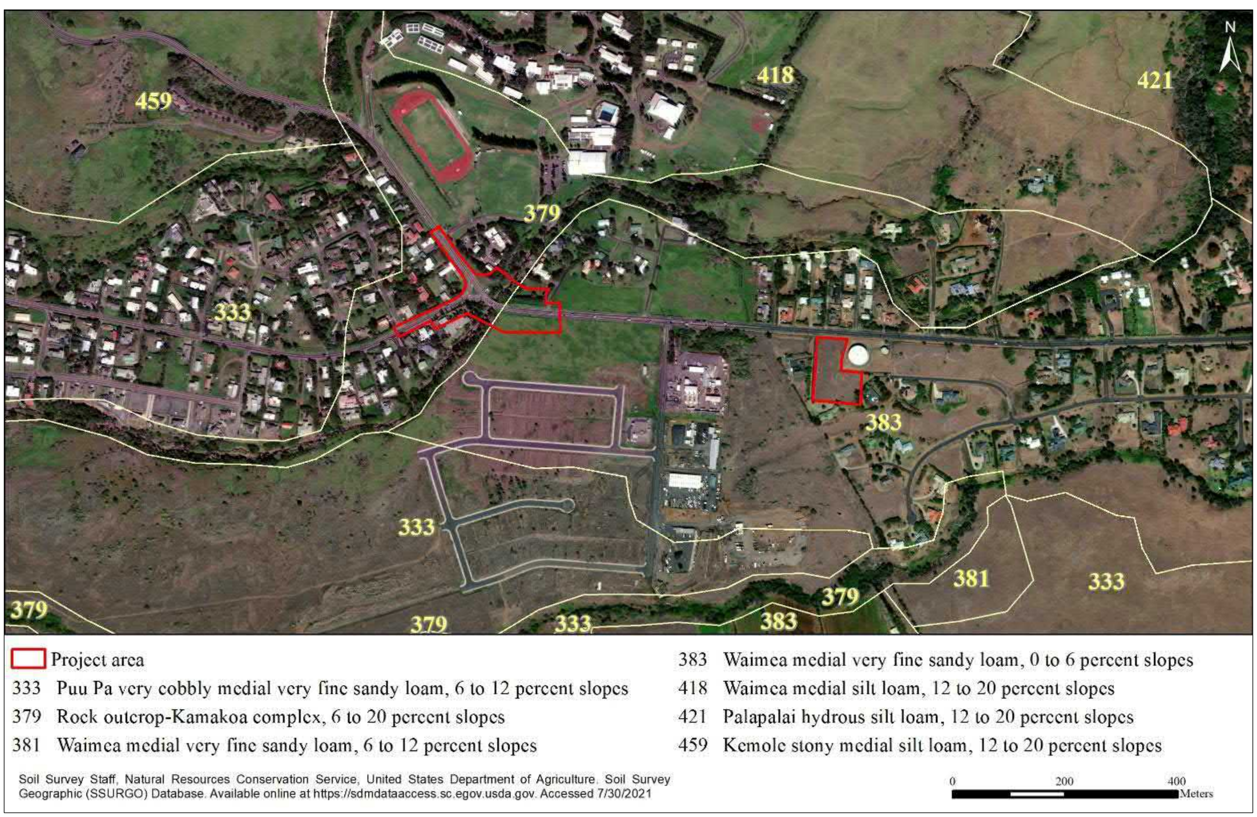

Figure 6. Soil underlying the project area.

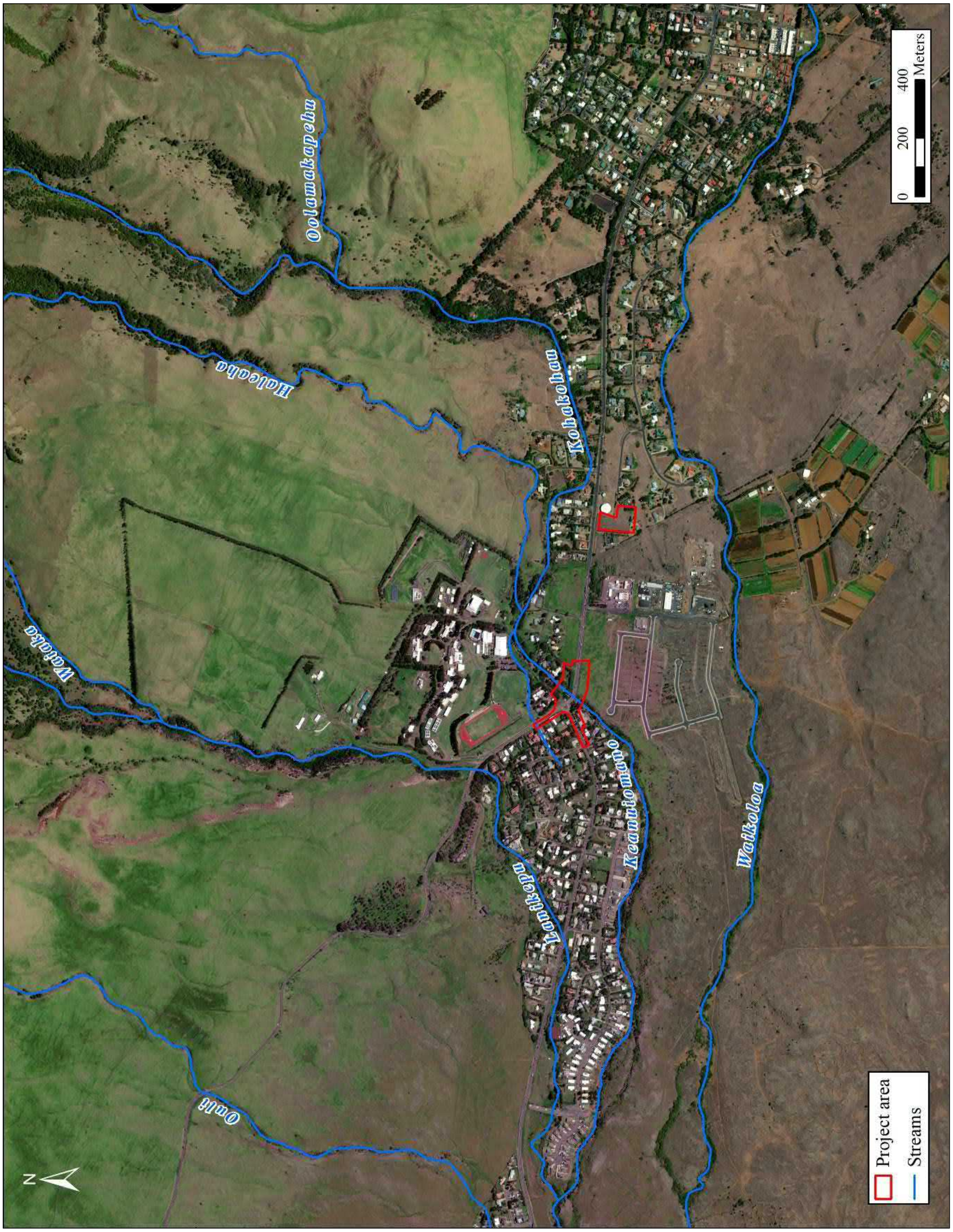

Figure 7. Stream overlay within and in the vicinity of the project area (in red).

Figure 8. Waiaka Bridge, view to the northwest.

Figure 9. Junction of Kawaihae Road (left) and Kohala Mountain Road (right), view to the west.

Figure 10. Keanuʻimanō Stream with Waiaka bridge in the background, view to the south.

Figure 11. East bound lane of Kawaihae Road, view to the east.

Figure 12. Kohala Mountain Road, view to the north.

Figure 13. Another view of the junction of Kawaihae Road (background) and Kohala Mountain Road (foreground), view from the northeast looking southwest.

Figure 14. Waiaka Bridge with Keanuʻimanō Stream below; traffic in background is traveling westbound; view towards southeast.

Figure 15. Exiting the northern portion of Waiaka Bridge with Kohala Mountain Road (left); view to the north.

2. BACKGROUND

As specified in the OEQC *Guidelines for Assessing Cultural Impacts* (1997:1), "…the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment." For this cultural impact assessment, the *ahupuaʻa* of Kauniho, Lālāmilo, Waiaka 1st and 2nd are considered the study area while the proposed project location at the Waiaka Bridge and the potential staging areas are considered the project area. To provide a context for understanding the significance of potential cultural resources and practices associated with the current project area, the background section begins with a general culture-historical context. Following this description is a culture-historical background specific to Kauniho, Lālāmilo, Waiaka 1st and 2nd. Background of the *moku* (district) of South Kohala and *kalana* (subdistrict) of Waimea, the broader regional designations in which Kauniho, Lālāmilo, Waiaka 1st and 2nd are situated, also falls within the parameters of the OEQC guidelines and ensures that a broader set of cultural practices and histories are considered. Following this background section is a discussion of relevant prior archaeological and cultural studies that have been conducted in the vicinity of the project area.

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories including the State Historic Preservation Division, Hawaiʻi State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona ʻĀina, the Ulukau Hawaiian Electronic Library, the Hawaiʻi Genealogical Indexes, and Newspapers.com provided additional historical information. Lastly, secondary sources archived at ASM Affiliates' Hilo office offer general information regarding the history of land use, politics, and culture change in Hawaiʻi, enhancing the broad sampling of primary source materials cited throughout this cultural impact assessment.

CULTURE-HISTORICAL CONTEXT

The following subsections are intended to provide a general overview of Hawaiian origins, settlement, and expansion, emphasizing sociopolitical and cultural transformations over time. The discussion continues with a summary of traditional philosophies associated with the land and the intensification and development of Hawaiian land stewardship practices.

A Generalized Model of Hawaiian Origins and Settlement.

While the question of when Polynesians first settled Hawaiʻi remains unsettled, scholars working in archaeology, folklore, Hawaiian studies, and linguistics have offered several theories. With advances in palynology and radiocarbon dating techniques, Kirch (2011), Athens et al. (2014), and Wilmshurst et al. (2011) have argued that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and A.D. 1200. This initial migration took place on intricately crafted *waʻa kaulua* (double-hulled canoes) to Hawaiʻi from Kahiki, the ancestral homelands of Hawaiian deities and peoples from southern Pacific islands and continued from initial settlement to the 13th century. According to Fornander (1969), Hawaiians brought from their homeland certain Polynesian customs and beliefs that included the major gods Kāne, Kū, Lono, and Kanaloa (who have cognates in other Pacific cultures), the *kapu* system of political and religious governance, and the concepts of *puʻuhonua* (places of refuge), *ʻaumakua* (ancestral deity), and *mana* (divine power). Kenneth Emory, an archaeologist who worked in the early to mid-20th century, reported that the sources of early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). However, Emory's theory is not universally accepted, as Hawaiian scholars in the past and present have argued for a pluralistic outlook on ancestral Hawaiian origins from Kahiki (Case 2015; Fornander 1916-1917; Kamakau 1866; Kikiloi 2010; Nakaa 1893; Poepoe 1906).

While stories of episodic migrations were widely published in the Hawaiian language by knowledgeable and skilled *kūʻauhau* (individuals trained in the discipline of remembering genealogies and associated ancestral stories), the cultural belief that living organisms were *hānau ʻia* (born) out of a time of eternal darkness (*pō*) and chaos (*kahuli*) was also brought and adapted by ancestral Hawaiian populations to reflect their intimate connection to their environment. For example, the *Kumulipo*, Hawaiʻi's most famed *koʻihonua* (a cosmogonic genealogical chant), establishes a birth-rank genealogical order for all living beings (Beckwith 1951; Liliuokalani 1978). One such genealogical relationship that remains widely accepted in Hawaiʻi is the belief that *kalo* (taro) plants (in addition to all other plants, land animals, and sea creatures) are elder siblings to humans (Beckwith 1951). This hierarchical creation concept enforces the belief that all life forms are connected, a belief initial settlement populations developed further over generations through intensive interaction with their local environment to form a unique Hawaiian culture.

In Hawai‘i’s ancient past, inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, communities clustered in the *ko‘olau* (windward) shores of the Hawaiian Islands due to the abundance and easy access to fresh water sources. Sheltered bays allowed for nearshore fisheries (enriched by numerous estuaries) and deep-sea fisheries to be easily accessed (McEldowney 1979). Widespread environmental modification on land also occurred as early Hawaiian *mahi‘ai* (farmers) developed new subsistence strategies, adapting their familiar patterns and traditional tools to work efficiently in their new home (Kirch 1985; Pogue 1978). Areas with the richest natural resources became heavily populated, resulting in the population’s expansion to the *kona* (leeward) side of the islands and more remote areas (Cordy 2000).

As populations expanded, significant socioeconomic changes occurred, such as the development of complex social stratification and land stewardship systems. During this expansion period, additional migrations to Hawai‘i occurred from the islands of Tahiti. Rosendahl (1972) proposed that settlement during this period was seasonally recurrent, in which coastal sites were occupied in the summer to exploit marine resources, and upland agricultural plots were maintained during the winter months. Hommon (1976) adds that increasing reliance on agricultural products may have caused a shift in social networks as kinship links between coastal settlements disintegrated with the expansion of *mauka-makai* (upland-coastal) settlements that allowed for the exchange of agricultural products for marine resources. This shift is believed to have resulted in establishing the *ahupua‘a* system sometime during the 15th century (Kirch 1985). The implications of this model include a shift in residential patterns from seasonal, temporary habitation to the permanent dispersed habitation of both coastal and upland areas.

Overview of Traditional Hawaiian Land Management Strategies

Adding to an already complex society was the development of traditional land stewardship systems, including the *ahupua‘a.* The *ahupua‘a* was the principal land division that functioned for both taxation purposes and furnished its residents with nearly all subsistence and household necessities. *Ahupua‘a* are land divisions that typically include multiple ecozones from *ma uka* (upland mountainous regions) to *ma kai* (shore and near-shore regions), assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupua‘a* land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). Noted Hawaiian historian and scholar Samuel Kamakau in his serialized history of Hawai‘i titled *Ka Moolelo o Hawaii* (The History of Hawaii) listed the various terms that were given to the ecozones found from the mountaintops to the ocean, ecozones that are also found in *ahupua‘a*. Published in the newspaper *Ke Au Okoa* in 1869, a translation of Kamaukau’s original Hawaiian text is provided below:

> Here are some of the terms that were given to the mountainous regions and mountaintops. *Mauna* is the general term for the frequently-used term *kuahiwi*, however, there are numerous terms that are associated with the mountains. Here are some of the terms associated with the mountains. The central region located in front and behind the mountain was termed *kuamauna*. Below the *kuamauna* is the *kuahea*, and below the *kuahea* is the *kuahiwi*, which is where shrubs and small trees grow. It (the *kuahea* and *kuahiwi*) is a place also called the *wao nahele*. Further down, the trees grow taller. This is the *wao lipo*. Below the *wao lipo* is the *wao ‘eiwa*. Below the *wao ‘eiwa* is the *wao ma‘ukele*. Below the *wao ma‘ukele* is the *wao akua*. Below the *wao akua*, is the *wao kanaka*, which is where people farm. Below the *wao kanaka* is the *‘ama‘u*. Below the *‘ama‘u* is the *‘āpa‘a*. Below the *‘āpa‘a* is the *pahe‘e* and *‘ilima*. And below that is the *kula* and the *‘āpoho* all the way to the villages. Below the villages is the *kahakai*, the *kahaone*, the *kālawa*, and then the ‘*aekai*, and that is how the people of old named their environment. (Kamakau 1869:1)

The *maka‘āinana* (commoners, literally the “people that attend the land”) who lived on the land had rights to gather resources for subsistence and tribute within their *ahupua‘a* (Jokiel et al. 2011). As part of these rights, residents were required to supply resources and labor to *ali‘i* (chiefs) of local, regional, and island chiefdoms. The *ahupua‘a* became the equivalent of a local community with its own social, economic, and political practices and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During *Makahiki*, the paramount *ali‘i* sent select members of his/her retinue to collect *ho‘okupu* (tribute and offerings) in the form of goods from each *ahupua‘a*. The *maka‘āinana* brought their share of *ho‘okupu* to an *ahu* (altar) that was marked with the image of a *pua‘a* (pig), serving as a physical visual marker of *ahupua‘a* boundaries. In most instances, these boundaries followed mountain ridges, hills, rivers, or ravines (Alexander 1890). However, Chinen (1958:1) reports that “oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division.” These ephemeral markers, as well as their more permanent counterparts, were oftentimes named as evidenced in the thousands of boundary marker names that are listed in Soehren (Soehren 2008).

Ahupuaʻa were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources. Generally speaking, *aliʻi ʻai ahupuaʻa* had complete autonomy over the *ahupuaʻa* they oversaw (Malo 1951). *Ahupuaʻa* residents were not bound to the land nor were they considered the property of the *aliʻi*. If the living conditions under a particular *ahupuaʻa* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. In turn, *ahupuaʻa* lands were managed by an appointed *konohiki*, oftentimes a chief of lower rank, who oversaw and coordinated stewardship of an area's natural resources (Lam 1985). In some places, the *poʻo lawaiʻa* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011). When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of an area's resources from environmental and spiritual depletion.

Many *ahupuaʻa* were divided into smaller land units termed *ʻili* and *ʻili kūpono* (often shortened to *ʻili kū*). *ʻIli* were created for the convenience of the *ahupuaʻa* chief and served as the basic land unit which *hoaʻāina* (caretakers of particular lands) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As *ʻili* were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with it. The right to use and cultivate *ʻili* was maintained within the *ʻohana*, regardless of the succession of *aliʻi ʻai ahupuaʻa* (Handy et al. 1991). Malo (1951) recorded several types of *ʻili*, including the *ʻili paʻa* (a single intact parcel) and *ʻili lele* (a discontinuous parcel dispersed across an area). Whether dispersed or wholly intact, *ʻili* required a cross-section of available resources, and for the *hoaʻāina*, this generally included access to agriculturally fertile lands and coastal fisheries. *ʻIli kūpono* differed from other *ʻili* lands because they did not fall under the jurisdiction of the *ahupuaʻa* chief. Rather, they were specific areas containing resources that were highly valued by the ruling paramount chiefs, such as fishponds (Handy et al. 1991).

Aliʻi ʻai ahupuaʻa, in turn, answered to an *aliʻi ʻai moku* (chief who claimed the abundance of the entire *moku or* district) (Malo 1951). Although a *moku* comprises multiple *ahupuaʻa*, *moku* were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the *ahupuaʻa* was the most common and fundamental land unit within the traditional Hawaiian land management structure, variances occurred, such as the existence of the *kalana*. By definition, a *kalana* is a division of land that is smaller than a *moku*. *Kalana* was sometimes used interchangeably with the term *ʻokana* (Lucas 1995; Pukui and Elbert 1986), but Kamakau (1976) equates a *kalana* to a *moku* and states that *ʻokana* is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that *kalana* consisted of several *ahupuaʻa* and *ʻili ʻāina*.

This form of district subdividing was integral to Hawaiian life and the product of advanced natural resource management systems. As populations resided in an area over centuries, direct teaching and extensive observations of an area's natural cycles and resources were retained, well-understood, and passed down orally and experientially over the generations. This knowledge informed management decisions that aimed to sustainably adapt subsistence practices to meet the needs of growing populations. The *ahupuaʻa* system and the highly complex land management system are examples of the unique Hawaiian culture that developed in these islands.

Intensification and Development of Hawaiian Land Stewardship Practices

Hawaiian philosophies of life in relation to the environment helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and *ʻāina* (land), Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawaiʻi, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture and and nature begins.
>
> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *ʻāina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001)

The *ʻōlelo noʻeau* (proverbial saying) "*hānau ka ʻāina, hānau ke aliʻi, hānau ke kanaka*" (born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land, including *kanaka* (humans), are connected through kinship links that extend beyond the immediate family (Pukui 1983:57). *ʻĀina* or land, was perhaps most revered, as noted in the *ʻōlelo noʻeau* "*he aliʻi ka ʻāina; he kauwā ke kanaka,*" which Pukui (1983:62) translated as "[t]he land is a chief; man is its servant." The lifeways of early Hawaiians, which were dependent entirely on the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an environmentally responsive management system that integrated the care of watersheds, natural freshwater systems, and nearshore fisheries (Jokiel et al. 2011).

Disciplined and astute observation of the natural world became one of the most fundamental stewardship tools used by Hawaiians of the ancient past. The vast knowledge acquired through direct observation enabled them to detect and record subtle changes, distinctions, and correlations in the natural world. Examples of their keen observations are evident in the development of a Hawaiian nomenclature to describe various rains, clouds, winds, stones, environments, flora, and fauna. Many of these names are geographically unique or island-specific and have been recorded in *oli* (chants), *mele* (songs), *pule* (prayers), *inoa ʻāina* (place names), and *ʻōlelo noʻeau*. Other Hawaiian arts and practices such as *hula* (traditional dance), *lapaʻau* (traditional healing), *lawaiʻa* (fishing), *mahiʻai* (farming) further aided in the practice of knowing the rhythms and cycles of the natural world.

Comprehensive systems of observing and stewarding the land were coupled with the strict adherence to practices that maintained and enhanced the *kapu* and *mana* of living and non-living persons, objects, and materials. In Hawaiian belief, all things—places, people, animals, plants, rocks, etc.—possessed *mana* or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). *Mana* is derived from the plethora of Hawaiian gods (*kini akua*) embodied in elemental forces, land, natural resources, and specific material objects and persons (Crabbe et al. 2017). Buck (1993) expanded on this concept noting that *mana* was associated with "the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather, etc.)" (c.f. Else 2004:244).

To safeguard the *mana* of a person, place, or resource, *kapu* were implemented and strictly enforced to limit over-exploitation and defilement. Elbert and Pukui (1986:132) defined *kapu* as "taboo, prohibitions; special privilege or exemption." Kepelino noted that *kapu* associated with *akua* (deities) applied to all social classes, while *kapu* associated with *aliʻi* were applied to the people (in Beckwith 1932). As *kapu* dictated social relationships, they also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). The companion to *kapu* was *noa*, translated as "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Some *kapu*, particularly those associated with maintaining social hierarchy and gender differentiation, were unremitting, while those *kapu* placed on natural resources were applied and enforced according to seasonal changes. The application of *kapu* to natural resources ensured that such resources remained available for future use. When the *aliʻi* or the lesser chiefs (including *konohiki* and *poʻo lawaiʻa*) determined that a particular resource was to be made available to the people, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa*. Although transitioning a resource from a state of *kapu* to *noa* allowed for its use, people were expected to practice sustainable harvesting methods and pay tribute to the paramount chief and the *akua* associated with that resource. *Kapu* were strictly enforced, and violators faced severe consequences, including death (Jokiel et al. 2011). Violators who escaped execution sought refuge at a *puʻuhonua*, a designated place of refuge, or an individual who could pardon the accused (Kamakau 1992).

In summary, the layering and interweaving of beliefs, land stewardship practices, and the sociopolitical system form the basis of the relationship between Hawaiians and the land. We can develop a more nuanced understanding of land use and relationships to land from a Hawaiian worldview through the analysis and recognition of these dynamic elements.

AHUPUAʻA OF KAUNIHO, LĀLĀMILO, WAIAKA 1ST AND 2ND AND THE GREATER SOUTH KOHALA DISTRICT

The project area is situated within the northwestern portion of Lālāmilo Ahupuaʻa, but also touches on the southern portion of Kauniho, Waika 1st and 2nd Ahupuaʻa. In the *moku* of Kohala, the long ridge of the Kohala Mountains (Figure 16) extends perpendicular to the predominantly northeasterly trade winds, creating an orographic rainfall pattern that separates the district into two distinct environmental zones, a wetter windward zone on the eastern side distinguished by its lush green valleys, and a drier leeward zone on the western side. Traditional poetical expressions for this district also identify other geographical divisions of the district. One such saying derived from an ancient chant titled *Kū e hoʻopiʻo ka lā* states:

ʻO Kohala-iki, ʻo Kohala-nui	lesser Kohala, greater Kohala
ʻO Kohala-loko, ʻo Kohala-waho…	inner Kohala, outer Kohala…
(Pukui and Korn 1973:188)	(Pukui and Korn 1973:190)

Figure 16. Kohala Mountains (background), n.d. (Hawai‘i State Archives).

Although the aforementioned geographical designations cannot be found on historical maps, Maly (1999:25) explains that “the lands from Kawaihae to ‘Anaeho‘omalu are within the region called Kohala waho (outer Kohala) or Kohala makani ‘Āpa‘apa‘a (Kohala of the ‘Āpa‘apa‘a wind)”. Another Hawaiian proverb recorded by Pukui (1983:196) specifies the extent of the Kohala District, “*Kohala, mai Honoke‘ā a Keahuolono*,” which she translated as “Kohala, from Honoke‘ā [a valley in the northeast of the district] to Keahualono [an altar constructed on the district’s southern boundary near ‘Anaeho‘omalu].” Handy et al. (1991) provide the following description of Kohala:

> The district of Kohala is the northernmost land area of the island of Hawaii. ‘Upolu Point, the northwesterly projection, fronts boldly out into the Alanuihaha [*sic*] Channel towards the southeastern coast of Maui, and is the nearest point of communication between the two islands. To the south, along Hawaii’s western coast, lies Kona; to the east the rough coast of Hamakua District unprotected from the northerly winds and sea. Kohala was the chiefdom of Kamehameha the Great, and from this feudal seat he gradually extended his power to embrace the whole of the island, eventually gaining suzerainty of all the Hawaiian Islands. (Handy et al. 1991:528)
>
> The rugged central area of the district is formed by the mountainous remains (elevation 5,505 feet) of the Kohala dome, the oldest of the island’s volcanoes, now long regarded as extinct. The high table land between Mt. Kohala and the vast northern slopes of Mauna Kea, known as Waimea, has one of the finest and most salubrious mountain climates in the Hawaiian Islands, and also offers excellent grazing for cattle. In post-European times it became the seat of the Parker Ranch, one of the largest ranches in the world. (Handy et al. 1991:528)

Like the other districts, Kohala contains multiple land divisions, one of which includes the subject *ahupua‘a* of Lālāmilo whose name Pukui et al (1974:128) translates literally to mean the “*milo* tree branch.” Maly (1999:27) offers a different etymology based on information which he gathered from the *mo‘olelo* (account) *Ka‘ao Ho‘oniua Pu‘uwai no Ka-Miki*:

> The region of Lālāmilo was named for the chief Lālāmilo. Lālāmilo was the grandson of Kanakanaka, an expert *lawai‘a hī-‘ahi* (deep sea tuna lure fisherman) and Piliamo‘o, a powerful priestess and *‘ōlohe*. Kanakanaka and Piliamo‘o were the parents of Nē‘ula (a fishing goddess), and she married Pu‘u-hīna‘i a chief of the inlands. Nē‘ula and Pu‘u-hīna‘i were the parents of Lālāmilo.

While Lālāmilo is currently referred to as an *ahupuaʻa*, traditionally it was one of several *ʻili* that made up the *kalana* of Waimea. Pukui et al. (1974:226) translate the place name Waimea to mean "Reddish Water." As a *kalana*, Waimea was treated as a subdistrict of the greater *moku* of Kohala and contained several other lands divisions (Maly and Maly 2002). The lands subject to the *kalana* of Waimea were those that form the southern limits of the present-day South Kohala District including the lands of ʻŌuli, Waiʻaka (also known as Waiaka), Lālāmilo, Puakō, Kalāhuipuaʻa (also known as Lāhuipuaʻa), ʻAnaehoʻomalu, Kanakanaka, Alaʻōhiʻa, Paulama, Puʻukalani (also known as Pukalani), Puʻukapu, and Waikōloa (Pukui et al. 1974). Additionally, Puakō, the coastal portion of Lālāmilo, was also identified as an *ʻili* of Waimea. In ancient times, Lālāmilo was referred to as Waikōloa Iki (literally, little Waikōloa), while Waikōloa Ahupuaʻa proper was known as Waikōloa Nui (Maly 1999). Bernice Judd, a former librarian at the Hawaiian Mission Children's Society, describes the extent of the *kalana* of Waimea:

> In the early days Waimea meant all the plateau between the Kohala Mountains and Mauna Kea, inland from Kawaihae. This area is from eight to ten miles long and from three to five miles wide. There was no running water on Mauna Kea, so the inhabitants lived at the base of the Kohala Mountains, where three streams touched the plain on their way towards the sea. . . The middle stream, which was famous for wild ducks, was named Waikoloa, or Duckwater. This and the most westerly stream, called Kahakohau, went towards Kawaihae, but neither reached the sea, except in times of flood. (Judd 1932:14)

While the traditional name of this region is Waimea, the name Kamuela (Samuel) has been used since the United States post office in Waimea was renamed in 1901 (The Hawaiian Star 1901). Although originally named after the town, it shared this name with the Waimea post office on Kauaʻi. The post office's practice was to avoid duplicate names within a state or territory to avoid confusion. However, as the office's cashier Kenake said at the time, "Letters come here marked 'Waimea, Hawaii.' Under the old system this would be understood, but now it produces untold trouble on account of the fact that mainland people cannot conceive of two offices of the same name in a Territory" (The Hawaiian Star 1901). The new name, Kamuela, is said to have referred to the postmaster Samuel Spencer or the famed rancher Samuel Parker (Pukui et al. 1974). For whomever this area is named after, most of the references describing the Precontact history and the celebrated cultural landscape refer to this area as Waimea.

Celebrated Cultural Landscape

Nestled at the base of the Kohala Mountains the project area along with the greater South Kohala region boasts stunning views of its wind-swept landscape dotted with rolling and jutting *puʻu* (hills). As noted by Plunkett (2018), "More than just aesthetically pleasing, the puʻu of Waimea as landscape fabric, functions culturally as definers of place." Several *puʻu* located at the base of the Kohala Mountains are visible from the proposed project area including Puʻu Kamoa, Puʻu Lanikepu, and Puʻu Laelae. East of the project area is Puʻu Hōkūʻula, a place noted as the battle site between Lonoikamakahiki and Kamalālāwalu, and the name given to the *kānoa* (*ʻawa* mixing bowl) of Laninuikuʻiamamaoloa (Wilkinson et al. 2012). Figure 30 illustrates the proximity of these *puʻu* to each other along the southern slopes of the Kohala Mountains. The *kānoa* of Hōkūʻula is also said to belong to Lono and associated with rituals connected to the agricultural god (Wilkinson et al. 2012). Souza et al. (2003:7) explain:

> The association of the bowl, or *kānoa* of the god Lono (a provider of abundant crops and rain-laden clouds) with Hōkūʻula may refer to the agricultural lands of the region; i.e., (1) the bowl or container could symbolize a land of agricultural abundance; (b) the sprinkling of waters from the bowl could refer to the waters of the streams that flow from the uplands and spread across the plains; and (c) the importance of the rituals of Lono in agricultural endeavors, particularly in the areas of Kohala where large field systems have been archaeologically documented.

While these *puʻu* are culturally-celebrated natural features of Waimea, so too are the winds. The variety of winds found in Kohala are numerous and several Hawaiian proverbs recorded by Pukui (1983) capture their names and characteristics. Of the famous *ʻĀpaʻapaʻa* winds, she records:

> *Ka makani ʻĀpaʻapaʻa o Kohala.*
> The ʻĀpaʻapaʻa wind of Kohala.
> Kohala was famed in song a story for the ʻĀpaʻapaʻa wind of that district. (Pukui 1983:157)
>
> *Kahilipulu Kohala na ka makani.*
> Kohala is swept, mulch and all, by the wind.
> Kohala is a windy place. (Pukui 1983:143)
>
> ʻ*Opeʻope Kohala i ka makani.*
> Kohala is buffeted by the wind. (Pukui 1983:277)

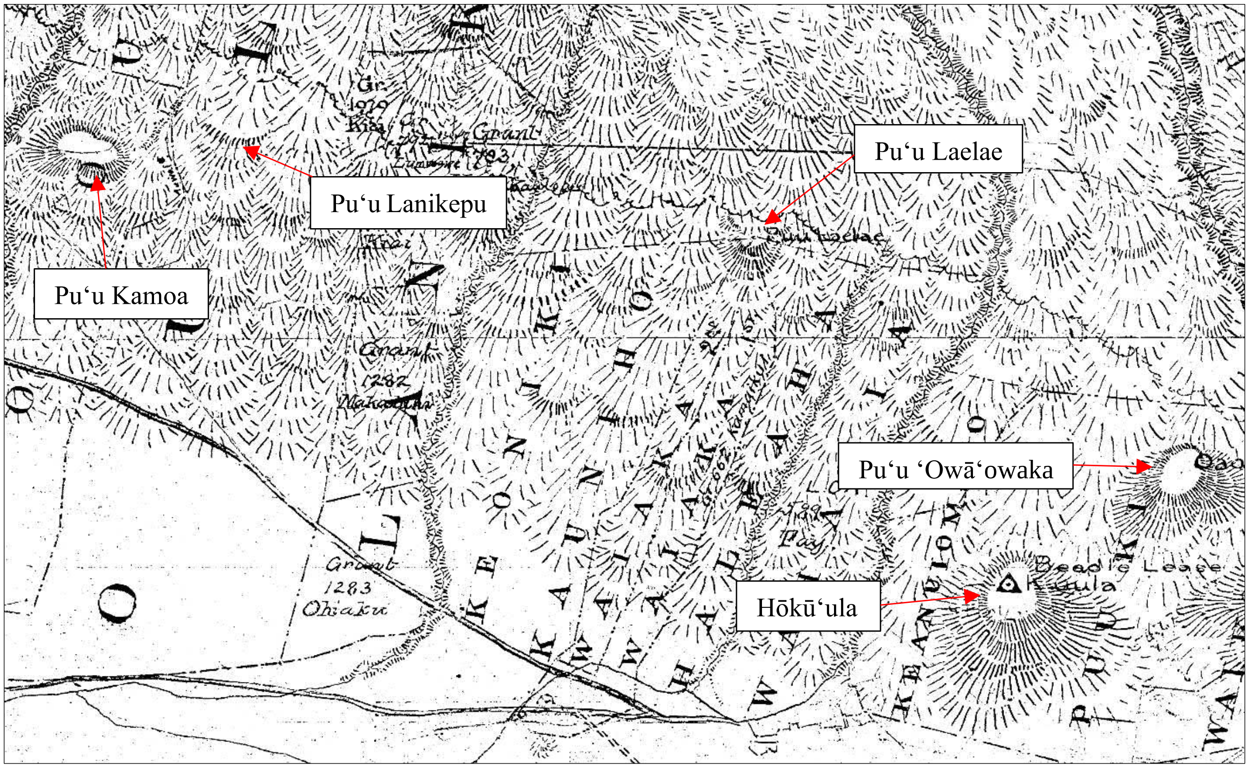

Figure 17. Portion of RM 1080 by Lyons and Wall with *pu‘u* on southern slope on the Kohala Mountains, ca. 1885.

Other winds in Kohala, such as the one that sent clouds racing across the sky, were seen as omens that foretold impending trouble.

> *Makani luna ka lele ‘ino mai lā ke ao.*
>
> There is wind from the upland, for the clouds are set a-flying.
>
> Signs of trouble are seen. This saying originated shortly after the completion of Pu’ukoholā heiau by Kamehameha I. He sent Keaweahuulu to Ka‘ū to invite Keōuakū‘ahu‘ula to Kawaihae for a peace conference between them. Against the advice of his own high priest, Keōuakū‘ahu‘ula went, taking his best warriors along with him. When outside Māhukona, he saw canoes come out of Kawaihae and realized that treachery awaited him. It was then that he uttered the words of this saying. His navigator pleaded with him to go back, but he refused. Arriving in Kawaihae, Keōuakū‘ahu‘ula stepped off the canoe while uttering a chant in honor of Kamehameha. One of the latter’s war leaders stepped up from behind and killed him. All of his followers were slaughtered except for Kuakahela, who hid a later found his way home, where he wailed the sad story. (Pukui 1983:228)

The rains of Waimea are another culturally celebrated natural feature. The rain named *‘Āpu‘upu‘u*—also as *Kīpū*, *Kīpu‘u*, and *Kīpu‘upu‘u*—is a cold wind-driven rain that creates bumps on the skin (Akana and Gonzalez 2015), and the name may include a play on the word *pu‘u* to refer to the hilly land of the Waimea area (Akana and Gonzalez 2015). Pukui (1983) adds that when the *ali‘i* Kamehameha of Kohala organized his army of spear fighters and runners from Waimea, they referred to themselves as the *Kīpu‘upu‘u* after the cold rain of their homeland. Pukui (1983:188) documented the following poetical expression for the Kīpu‘upu‘u rain “*Ke Kipu‘upu‘u ho‘anu ‘ili o Waimea*,” literally translated as “The Kipu‘upu‘u rain of Waimea that chills the skin of people.” Doyle’s (1953:44) description of the *kīpu‘upu‘u* relates it to a certain wind, “This is the piercing wind that suddenly meets the traveler who makes his upward way from the heat of Kawaihae; and as he nears Waimea he comes upon a region once held sacred.”

Another rain, the *‘E‘elekoa*—also known as *Mālana, Mālanalana*, and *Mālana‘e‘elekoa*—is associated with storms. According to Akana and Gonzalez (2015), the *‘E‘elekoa* is also a wind name of Waimea. The *Koko‘ula* and *Leikoko‘ula* rain of Waimea which accompanies a red-hued rainbow is said to be associated with royalty. Sweeping down from the cliffs of Kapaliloa is the *Paliloa* rain and the *Pe'epākaiaulu* is a fierce rain squall that arises suddenly giving the area residents little time to take shelter, thus forcing them to *pe'e* (hide) to prevent from getting soaked. Other rain names for this area include the *'Ākōlea*, *Kīnehelehua*, *Kula'ikanaka*, and the *Leiha'akolo* rain (Akana and Gonzalez 2015). The account of Kāmiki also identifies the *Nāulu* rain which sweeps across the land between Kawaihae and Pu'u Wa'awa'a (Maly 1999).

Hawaiian Legendary Accounts in the Project Area Vicinity

The history of ancient Hawai'i was transmitted orally from one generation to the next, but after the arrival of the first missionaries in 1820, one of the major transformations to Hawaiian culture was the creation of a written Hawaiian language. Although oral traditions were still maintained, many natives and foreigners began inscribing generations' worth of knowledge onto paper. As such, these writings provide us with invaluable insight into Hawai'i's past as they describe elements of Hawaiian culture such as historical figures, beliefs, traditions, *wahi pana* (legendary places), *inoa 'āina* (place names), and *mo'olelo, mele* and *oli*, and *'ōlelo no'eau*; all of which contribute to an in-depth understanding of the people, their culture, and their relationship to place. For example, Hawai'i Registered Map No. 712 from 1866 (Figure 18) identifies several place names in relation to the project area. One of the hallmarks of traditional legendary accounts is their ability to transcend place and time, all while bringing cohesion to landscapes that have been subjected to artificial divisions and boundaries.

The Heart Stirring Story of Ka-Miki

One such account that references Lālāmilo is told in the narrative *Ka'ao Ho'oniua Pu'uwai No Ka-Miki* (The Heart Stirring Story of Ka-Miki), which originally appeared in the Hawaiian language newspaper *Ka Hōkū O Hawai'i* between 1914 and 1917. This *mo'olelo* was likely authored during the late 1800s through the early 1900s by Hawaiian scholars John Wise and J.W.H.I Kihe. Maly, who translated their story noted:

> While "Ka-Miki" is not an ancient account, the authors used a mixture of local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations…While the personification of all the identified individuals and their associated place names may not be entirely "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (Maly 1999:23-24)

The story tells of two supernatural brothers, Ka-Miki and Maka-'iole, who were skilled *'ōlohe,* and their travels around Hawai'i Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *'ōlohe* (expert skills in fighting, wrestling). The brothers were born to Pōhaku-o-Kāne (male) and Kapa'ihilani (female), two *ali'i* of the lands of Kohanaiki and Kaloko, North Kona. Upon the mysterious and premature birth of Ka-miki, he was placed in the cave of Pōnahanaha and given up for dead. He was eventually saved and raised by his ancestress, Ka-uluhe-nui-hihi-kolo-i-uka, a manifestation of the goddess Haumea, at Kalama'ula, an area located on Hualālai. Ka-miki was later joined by his elder brother Maka'iole where their ancestress Ka-uluhe-nui trained thems into *'ōlohe*, riddle solving, and running, and taught them how to use their supernatural powers. Portions of the story that explicitly refer to Lālāmilo, the surrounding lands, and their natural features including *pu'u* (hills) and the coastline are discussed below.

As previously noted, the Ka-Miki story indicates that the land of Lālāmilo was named in honor of the chief by the same name. Lālāmilo's grandfather was Kanakanaka, an expert *'ahi* (Hawaiian tuna fish; *Thunnus albacares*) fisherman and his grandmother was Piliamo'o, a powerful priestess and *'ōlohe*. To this pair was born Nē'ula, a fishing goddess who later married Pu'u-hīna'i, chief of the uplands. From this union was born Lālāmilo. Maly continues thusly:

> Kanakanaka was an expert *lawai'a hī-'ahi* (deep sea tuna lure fisherman), and his sister was the windgoddess Waikōloa. Lālāmilo also gained famed as an expert *'ōlohe* and fisherman. Through his wife Puakō, Lālāmilo came to possess the supernatural *leho* (cowrie octopus lure) which had been an *'ōnohi* (cherished) possession of Ha'aluea, a goddess with an octopus form…How this octopus lure came to rest on the reefs fronting this land remains a mystery. (Maly 1999:27)
>
> The *leho* was so powerful that if it was only shown to the *he'e* (octopus), they would climb upon the canoe and be caught. Lālāmilo carefully guarded this lure and even slept with it. When Lālāmilo did leave the lure, he stored it in the *hōkeo aho hī-'ahi* (tuna lure and *olonā line storage gourd*) of his grandfather Kanakanaka, and this was hidden, tied to the ridge pole of his house. (Maly 1999:27)

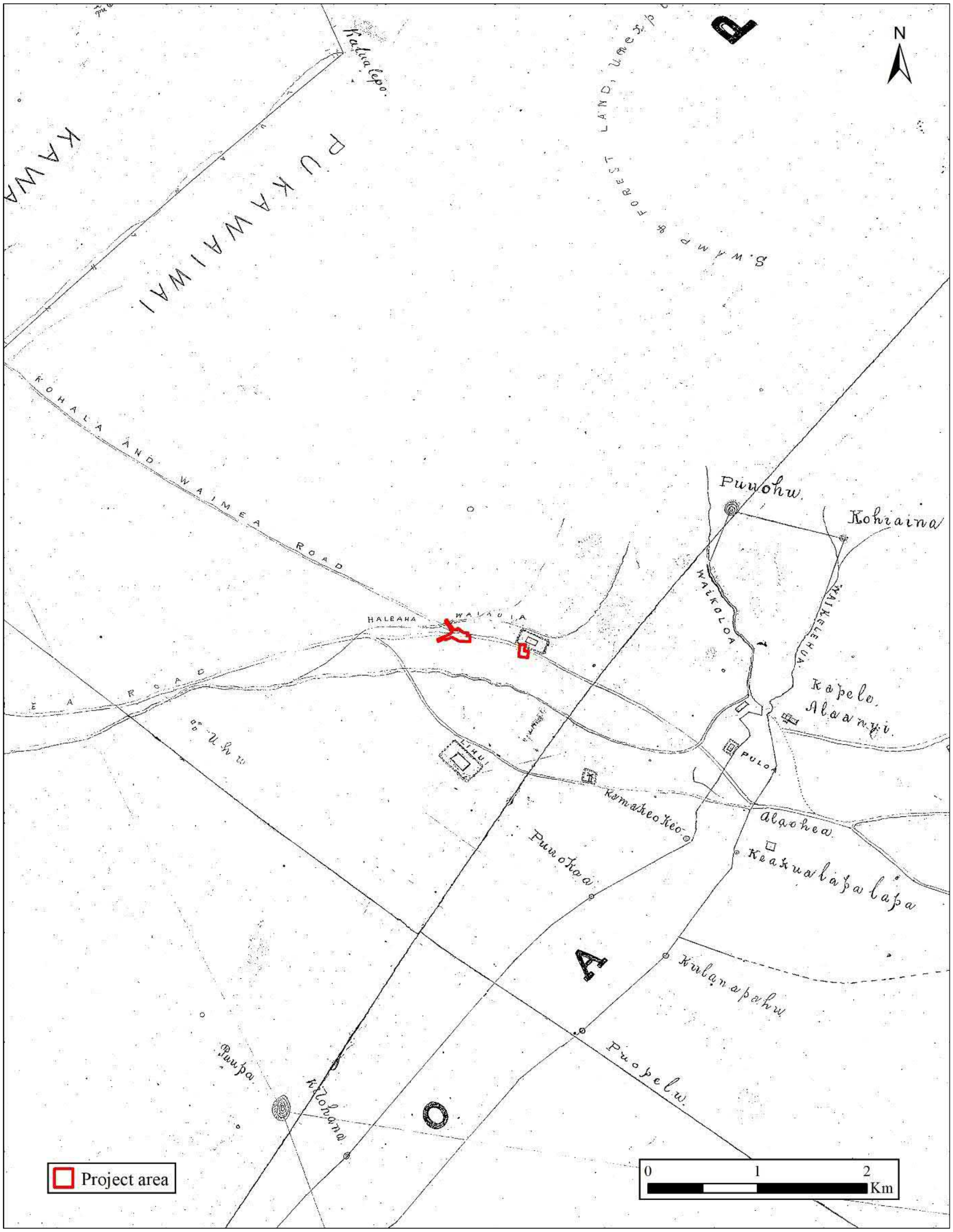

Figure 18. Portion of 1866 map by Wiltse (Hawai'i Registered Map No. 712) showing project area and place names in the nearby vicinity.

The story of how Lālāmilo came into possession of this magical lure is further described. The day after Lālāmilo wed Puakō, the young maiden from Puna who had an insatiable appetite for *he‘e*, she traveled to the shore at Waimā to gather fish and seaweeds. The tide was low, and she walked about the reef flats where she came upon a large *he‘e* spread about the reef. She speared it and struggled to carry it ashore. Nē‘ula, her mother-in-law saw her carrying the enormous *he‘e* and asked who had given it to her, to which Puakō replied that she had indeed caught the large *he‘e*. With a sense of suspicion, Nē‘ula replied that as a native of this place, she had never seen such an octopus in this area. As the two women were talking, Lālāmilo approached them and saw Puakō holding a large octopus. Assuming that another man had given the octopus to his wife, Lālāmilo asked where she got the octopus from and she proceeded to relate the events to him. Accusing his wife of lying, Lālāmilo struck Puakō with a hard blow causing her skin to darken. Nē‘ula interjected and suggested that the couple go look about the reef to see for themselves the place where Puakō had retrieved the large *he‘e*.

As Lālāmilo walked intently about the reef, he investigated the site where Puakō had found the massive *he‘e*, to which he discovered a small hole with something red hidden within. Peering into the hole, he saw a beautiful *leho* tucked within, which had attracted the *he‘e*. Without hesitation, Lālāmilo broke the reef and retrieved the *leho* and it is said that after he had taken this *leho,* no more *he‘e* appeared on the reef flats of this area. Lālāmilo took the *leho* home, cleaned it, and prepared himself a lure, which he kept a close watch over. He kept the lure in a container and when he went out to the *he‘e* fishing grounds he would retrieve the lure from the container and hold it in his hand. Without delay, *he‘e* would climb into his canoe and within a short time, he would be able to retrieve several hundred with little effort. Lālāmilo, however, noticed that when his lure was covered in the container, the *he‘e* stopped climbing into the canoe. Amazed at his catch, Lālāmilo showed his wife Puakō and mother Nē‘ula, to which the latter recommended that he take the lure and an offering of *he‘e* to Piliamo‘o, his grandmother. When Piliamo‘o had seen what Lālāmilo had brought she explained to her grandson:

> …that this was no ordinary cowrie lure, but a god, the *‘ōnohi* (favorite or cherished one) of Ha‘aluea the mysterious supernatural octopus being of the ocean depths. Ha‘aluea and her family came from Kāne-hūnā-moku (The hidden land of Kāne) and settled at Makaīwa in the land of Kapa‘a, Kaua‘i. Ha‘aluea was the wife of the wind and ocean god Halulu-ko‘ako‘a, and grandmother of ‘Iwa-nui-kīlou-moku (Great ‘Iwa the island catcher). (Maly 1999:30)

Piliamo‘o consecrated the *leho* and the *he‘e,* which it attracted and instructed Lālāmilo to always bring the first *he‘e* that he caught to her as an offering. Having learned that her grandson had this magical lure, Piliamo‘o instructed Lālāmilo to extinguish anyone who inquired about the lure. Because of its mystical powers, rumors about the cowrie lure quickly spread throughout Hawai‘i and soon caught the ear of Pili-a-Ka‘aiea, the chief of Kona, who had a great love for octopus fishing. Pili-a-Ka‘aiea sent messengers to inquire about the lure and each was killed by Lālāmilo and Piliamo‘o. While engaged in a contest at Hinakahua, a playing field in Puapua‘a, North Kona, the young and adept Ka-Miki agreed to fetch the lure for Pili-a-Ka‘aiea with the hopes of becoming the foremost favorite of the Kona chief. One day, Lālāmilo decided to visit his father Pu‘u-hīna‘i, his sister Pu‘u‘iwa‘iwa, and his grand-aunt Waikōloa, who was the guardian of Pu‘u‘iwa‘iwa.

> Lālāmilo arose and told his wife Puakō, and his mother Nē‘ula that he was going to the uplands to visit his father, sister, and the people who worked the upland plantations. Lālāmilo desired to eat the sugar cane and bananas, and drink the *‘awa* which grew on the hill of Po‘opo‘o. Po‘opo‘o was also the name of a seer (*makāula*) who saw to the continued peaceful dwelling of the people. Lālāmilo placed the lure in Kanakanaka’s gourd and secured it near the ridge pole of his house. Lālāmilo then asked Puakō and Nē‘ula to go and look after the gourd in which the *‘ōnohi* (eyeball or cherished possession) of Ha‘aluea was kept. (Maly 1999:38)

Lālāmilo left his home and headed for the settlements and agricultural lands of Pu‘u-hīna‘i, however, as he got closer to his intended destination, his thoughts became consumed by his precious lure. Unable to curb his thoughts, Lālāmilo returned to the coast without paying a visit to his father and sister. In the meantime, while Lālāmilo was on his journey to the uplands, the adept Ka-Miki traveled to Lālāmilo’s home and met with a man from the area, Nīheu. Ka-Miki inquired about the whereabouts of Lālāmilo only to find that he was not at home. Ka-Miki gazed into the home of Lālāmilo and confirmed that it was unoccupied, however, a gourd container caught his eye and Ka-Miki proceeded to fetch the container tucked away in the rafters of the house. Without incident, Ka-Miki lowered the gourd and departed with the magical lure.

Because of his premonition, Lālāmilo returned home to find that his prized *leho* had been stolen. Lālāmilo then went to visit his grandmother and upon seeing that her grandson had arrived empty-handed, she paid him no attention. The saddened Lālāmilo then called out in chant to his grandmother to inform her of the stolen lure. After hearing the cries of her grandson, Piliamoʻo commanded that Lālāmilo retrieve a white rooster, *ʻawa* from Poʻopoʻo; an *ʻāhuluhulu* fish; and a red *malo* (loincloth) before the setting of the sun. Lālāmilo quickly retrieved all of the prescribed items and returned to his grandmother's home which overlooked the shore of Kaunaʻoa.

> Pili-a-moʻo told Lālāmilo to release the pig and chicken, and both of them entered the canoe which Pili-a-moʻo had prepared as the path on which Lālāmilo would travel to Kauaʻi-o-Kamāwaelualani, where he could find ʻIwa at Makaīwa, Kapaʻa. (Maly 1999:31-32)
>
> Pili-a-moʻo called to Lālāmilo saying, "The gods have approved your offerings, and here is your path (canoe) to present the offerings to ʻIwa, the mysterious cascal of the land which snares the sun, ʻIwa the sacred ward of Halulu-koʻakoʻa." With the offerings set in the canoe, and the sail raised, Pili-a-moʻo then prepared, an *ʻawa* ceremony.
>
> The pig was at the mast, the *ʻawa* and fish were set on the platform, the rooster sat on the outrigger end, and the *malo* was placed at the stern of the canoe. After Pili-a-moʻo and Lālāmilo drank *ʻawa* they slept and when half the night passed the rooster crowed. Pili-a-moʻo arose and went out of the house where she saw the navigator's star high above. Pili-a-moʻo then called to Lālāmilo, :"Arise great shark of the sea, o offspring of Hulihia-ka-lani, o flippers of the turtle Kamilo-holu-o-Waiākea. Awaken for the light of the star Hīkiʻi-maka-o-Unulau, the *Kualau* (shower bearing wind) blows and the traveler will touch Kauaʻi." Lālāmilo arose, entered the canoe and prepared to sail to Kauaʻi. [August 2, 1917]. (Maly 1999:32)

Piliamoʻo then gave specific instructions to her grandson on how to find and how to use the various items to solicit the help of ʻIwa, the rascal lad of Kauaʻi. Heeding the instruction of Piliamoʻo, Lālāmilo sailed to Kauaʻi and just as his grandmother had described, Lālāmilo found the young ʻIwa. After an exchange, ʻIwa consented to Lālāmilo's request and the two men set sail for Kohala, passing along the north side of the Hawaiian Islands, before turning south along the Kohala coast and sailing to Pālauʻeka in Hōlualoa, Kona. Here they met with Kaʻahaʻaha and Kapakapaka, the two fishermen for the chief Pili-a-Kaʻaiea. After a brief exchange of words, ʻIwa asked the fishermen "…what fish the chief was after today, and Kapakapaka said *heʻe*" (Maly 1999:34). Having learned of this, ʻIwa set in motion a plan to retrieve the prized cowrie lure of Lālāmilo and described the nature of retrieving the largest octopus that dwelled in the deep sea to the two fishermen. While Kapakapaka did not believe ʻIwa, Kaʻahaʻaha was more than willing to investigate the claims made by ʻIwa.

Together, the four men sailed in the fishing canoe into the deep sea, passing the *ʻōpelu*, and *kāhala* fishing grounds. ʻIwa took his prized cowrie lure, Mulali-nui-makakai, and tossed it overboard and called out in chant to his grandmother, Haʻaluea, asking for her assistance. As ʻIwa closed his chant, he felt a tug on his lure line. He quickly pulled the fishing line up and a large *heʻe* slipped into the canoe. Amazed at the sight of the large *heʻe*, ʻIwa proceeded to kill it then turned to the two fishermen and told them this is not the biggest octopus. He again cast his lure into the deep sea but this time, the lure held fast in the ocean, as though it was stuck. At this time, the chief Pili-a-Kaʻaiea drew near the men in his large double-hauled canoe.

> ʻIwa suggested that Kapakapaka *mā* asked Pili to use his lure at this site, so he could secure the largest octopus. Pili's lure was set into the water and ʻIwa called once again to Haʻaluea…
>
> A large *heʻe* rose and embraced Pili's canoe, this *heʻe* was killed and Pili set the lure into the ocean again. This time the goddess Haʻaluea rose in her octopus form and held tight to the canoe and lure. ʻIwa dove into the ocean and swam along Haʻaluea's tentacles, he found the lure and secured it in the folds of his *malo*. ʻIwa then tied the chiefs' line to a coral outcropping and returned to the surface where he joined Lālāmilo. Haʻaluea let go of Pili's canoe, and ʻIwa told Lālāmilo to paddle the canoe towards Maui. In a short time, they arrived along the shore of Waimea (also called Kaunaʻoa), where they were greeted by Pili-a-moʻo. (Maly 1999:35)

Pleased with the outcome of their journey, ʻIwa, Lālāmilo, and Piliamoʻo feasted on food and *ʻawa* and ʻIwa returned to his home on Kauaʻi. As this portion of the story concludes, it is said that Lālāmilo divided his lure with his brother-in-law Pualaʻa who arrived from the Puna District. It is said that because the divided lure resembled baked taro, the lure came to be known as Kalo-kunu (broiled taro). This is how Lālāmailo reclaimed his prized lure.

An Account of Ka-holoi-wai-a-ka-nāulu, the Priest and Rainmaker

In addition to the account narrated above, Maly (1999) also translated and summarized the account of Ka-holoi-wai-a-ka-nāulu, a priest and rainmaker whose showers helped to ease famine and caused the rivers to flow between Kawaihae and Puʻu Waʻawaʻa. Published in the September 2, 1914 edition of the Hawaiian language newspaper, *Ka*

Hōkū O Hawaiʻi, under the title *Puʻuanahulu i ka uka ʻIuʻiu, Kona mau Luhiehu Hihiu* (Puʻuanahulu of the Distant Uplands, with its Uncommon Beauty), Kihe, coauthor of the story of Ka-Miki, reported the following:

> Ka-holoi-wai-a-ka-nāulu was an elder brother of the Pele priestess, Anahulu, when Anahulu and Waʻawaʻa *mā* moved from Puna, to be closer to [their daughters] Anaehoʻomalu and Puakō, Kaholoiwai followed as well. From his dwelling place at Kahoʻopulu, a hill above Kawaihae, Kahoiwai cared for his sister, watching for her needs. When a period of dryness came upon the land, Kaholoiwai would send the *Nāulu* showers across the lands, reaching up to Puʻu Waʻawaʻa. Thus, food plants were able to be grown upon the land. (Maly 1999:35-36)

Manoua (Manaua), Moʻo and Rainmaker

The late Nona Beamer—author, educator, *hula* practitioner—recounted the story of Manoua (also known as Manaua), the *moʻo wahine* (female water spirit) of Waimea who resided in the waters of Kohākohau Stream, which begins *mauka* and east of the project area.

Ka Poʻo O Ka Ohu (the source of the mist) was considered the home of Manoua, an ancient *moʻo wahine* (Beamer 1997:53). Manoua saw the first Hawaiians settle into Waimea who planted *hāwaʻewaʻe* (sprouts from sweet potato), harvested *ʻuala* (sweet potato; *Ipomoea batatas*), and then watched them *ulu hou* (grow again). She witnessed the raising of pigs, the cultivation of *pū* (general name for pumpkin) and *uhi* (yams; *Dioscorea alata*) of various colors. She also saw Kamehameha and his *aliʻi* travel from Pōhakuloa and traverse the many trails he traveled.

Loved by the residents of Waimea, Manoua enjoyed her pool at Kohākohau, which was also a favorite gathering place for *keiki* (children) of the village (Beamer 1997:54). A young girl named Haʻaleʻu would walk up Kawaihae Road to Laʻe Laʻe Village and pick *maile* (*Alyxia olivaeformis*) regularly (see Figure 30 for location of Puʻu Laelae). Laʻelaʻe was also the site of an ancient settlement. One day Haʻaleʻu ventured to Laʻe Laʻe, which was also the day for *ka-pili-kōlea*, a game where *kōlea* (Pacific Golden plover; *Pluvialis dominica*) birds were caught using the *pīlali* (hardened sap of the *kukui*) tree. The boys of the village would gather *ʻōpuʻopuʻu* (cocoons), tie them to stones with a *puka* (hole), then smear the cocoons with the resin (Beamer 1997:46). When the hungry *kōlea* would come to eat the cocoons, their beaks would now be stuck, and the weight of the stones weighed down their feet. The boys would then jump out of the bushes to grab their catch. As the sun shifted, the boys were still boisterous and full of energy mid-afternoon and decided to take a dip in the *kahawai* (stream). They raced to Kohākohau Stream where they hoped to catch a glimpse of the famed Manoua. When they arrived, Manoua moved from her normal resting place—a large stone—to a nearby rock where she sat quietly and watched them. Haʻaleʻu and her friends watched the boys swim, but unfortunately, her brother drowned. Despite everyone's efforts to revive her brother, it was too late. If Manoua had been summoned, she might have been able to save Haʻaleʻu's brother. Heartbroken and sad, Manoua left Kohākohau the day of the burial and was never seen again (Beamer 1997:47).

Another version of this story places the group at Anna's Pond, also known as Kohākohau Falls, which is located on Anna Ranch east of the project area (The Estria Foundation 2019). After the boys participated in *lawaiʻa manu* (bird fishing), they went to the pond. The legend goes that before entering the pond, one places a single ti leaf on the surface of the water. If it floated, they had permission from the *moʻo wahine* to enter her waters, but if it sank you were forbidden from entering (The Estria Foundation 2019).

When the village noticed her absence, they left *lei* (garland) of *maile* and *haku lehua* (braided flowers of the *ʻōhi'a*) at the stone she once sat at (Figure 19). Various *makana* (gifts) would be left at the stone when people passed by. Many years passed and an *ʻohana* (family) who lived near the rock Manoua once sat upon became the guardians of the stone. The immediate area around the stone became *ponokapu* (sacred in righteousness) and a fence was created to surround the stone (Beamer 1997:48). Passersby continued to leave *lei* and *makana* for Manoua throughout the years. When Manoua's stone and the surrounding stones were to be destroyed, her stone was unscathed but the other stones were shattered (ibid.).

Figure 19. Photo of Manaua rock (left) during a ceremony (Mundon 2009).

The Epic Tale of Hiʻiakaikapoliopele

This ancient saga details Pele's migration to Kīlauea and quest for her lover, Lohiʻauipo, then details the travels of her younger sister, Hiʻiakaikapoliopele, to find him. While multiple versions of this sage have been published, the version cited below was originally published daily in the Hawaiian language newspaper, *Ka Naʻi Aupuni*, which ran from 1905 to 1906 and was orated by Hoʻoulumāhiehie. The following excerpt discusses two places within the Waimea region: Mahiki, a mystical forest in the area; and Waiʻaka, seemingly the location where Mahiki is located and also the name of the bridge within the project area. The forest reserve regions of Waimea in relation to the project area can be seen in Figure 20.

Hiʻiaka and her traveling companions stopped in the forest known as Mahiki located in the Waimea region, which was also the residence of Mahiki, a male demigod who had extraordinary powers and great strength (Hoʻoulumāhiehie 2006:107). When Hiʻiaka saw the being, she knew he was ready to battle her, and she had no desire to fight Mahiki but he was determined to defeat her. Hiʻiaka said to Wahineʻōmaʻo, her companion, "Get behind me. Wherever I move, you move with me. I shall fight in my womanly fashion against the shameless one. He, the male, may inflict injury upon us, but you and I, the women, shall inflict such injury that he will end up laid out like the fishes of Hīlia that lie still in the water in easy reach" (ibid.). As Mahiki darkened the forest and commanded a fierce rain upon the two women, Hiʻiaka asked her companion to "make your body forms into a shelter above us, so we are not blinded by the eye-piercing rain of Mahiki Forest" (Hoʻoulumāhiehie 2006:108). As *palaʻā* (lace fern; *Sphenomeris chinensis syn. chusana*) and *ʻamaʻu* (*Sadleria*) ferns sheltered the women as the icy Kīpuʻupuʻu rain pelted down, Mahiki was sure that the conditions he employed would affect the women advancing through the forest, to his dismay, that was not the case.

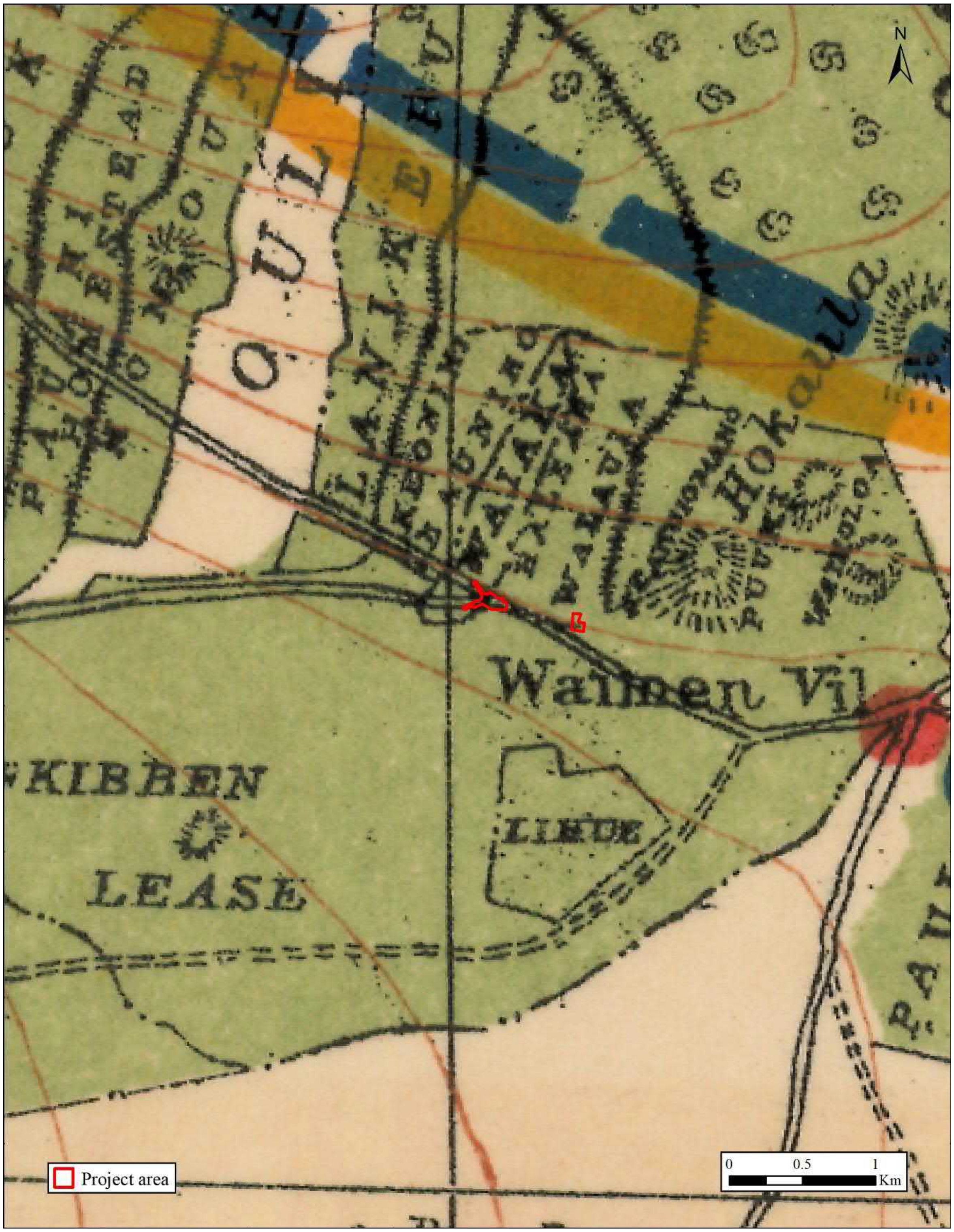

Figure 20. Portion of the 1901 Alexander and Donn map showing project area with place names and demarcation of forest (blue) and grazing lands (yellow) (University of Hawai‘ i at Mānoa MAGIS)

Mahiki furious with Hiʻiaka unleashed all of is plant forms to imprison her and her companions. As various plants began to coil around them, Hiʻiaka struck a blow and all foliage turned into ash instantly (ibid.). Still furious but now tinged with fear and worry, Mahiki stated, "And so it is. You may have escaped death from my plant forms, but you will never escape the throngs and legions of spirits here in Mahiki" (Hoʻoulumāhiehie 2006:109). Mahiki began to summon the spirits of the forest and area. Wahineʻōmaʻo felt the rush of the wind followed by the voices calling out the group and surrounding them. Suddenly Mahiki and his band of spirits pounced on Hiʻiaka and her cohort attacking them from all sides until she struck her "lightning skirt" causing a frenzy with the spirits who began to shriek and cry. As the spirits ceased and the chaos cleared, Mahiki found Hiʻiaka and her friends unfazed. Hoʻoulumāhiehie includes the following lyrics:

> Mahiki is garlanded with rain and wind
>
> The buffeting gusts of the Kipuʻupuʻu strut like billows
>
> Waves adorned by Kawelowelo
>
> Appreciated by Kawiliwahine, there
>
> There we two shared the chilling cold
>
> Enduring the Kīpuʻupuʻu rain
>
> Along with my fellow flotsam in the storm
>
> We warmed ourselves against the cold and wind
>
> A familiar wind from Waihaka
>
> Ornamenting the blossom of the koʻokoʻolau
>
> The forest of Waiʻaka is radiant in its verdure, ah, there. (Hoʻoulumāhiehie 2006:109)

The second instance where Waiʻaka is mentioned in the *moʻolelo* of Hiʻiakaikapoliopele involves ʻĀinakō, the strongest fighter of Waimea, who battled Kauakahiapaoa, the fighting champion of Kauaʻi. Waiʻaka is where the fight took place. When ʻĀinakō heard of his future opponent, he uttered this taunt:

> This is Waimea
>
> Of the pummeling Kīpuʻupuʻu rain
>
> With ʻĀinako's fiery fists
>
> Waiʻaleʻale will be humbled. (Hoʻoulumāhiehie 2006:375)

Once the fight was set, the chiefess of Waimea suggested to Kauakahiapaoa that he should go to the men's eating house. Refusing the invitation he stated, "I shall wait to eat until Waimea beholds the man-smiting moss of Manuʻakepa, and you, O Chiefess, see how truly fine Kauaʻi can be, with Waiʻaleʻale's peak breaking through on high, piercing the storm clouds" (ibid.).

As Kauakahiapaoa made his way to the wrestling grounds, locals eyes were drawn to his features and physique and did not take notice of their champion ʻĀinakō. The two men observed each other and hurled boasts at each other until ʻĀinakō threw a punch so violent, a blast of air burned Kauakahiapaoa's eyes were burning. ʻĀinako did not land his punch and instead, Kauakahiapaoa struck the giant man's hand sending him to spin in the air. As ʻĀinako groaned in pain, Kauakahiapaoa lifted him and threw him *makai* of Waiʻaka. Where ʻĀinakō's body fell is now called Puʻuʻāinakō—the reason that place is named today (Hoʻoulumāhiehie 2006:377).

Brief Account of Several Heiau in Waimea Regarding Hōkūʻula

In Emma Doyle's (1953) book *Makua Laiana The Story of Lorenzo Lyons*, she provides a brief account describing some *heiau*, including their uses and origins that were located along the Kohala Mountains slopes in the area east of the project area. As seen in Alexander and Donn's 1901 map (see Figure 20), it shows Hōkūʻula (spelled in Figure 20 as "Hokaula") to northeast of the project area and Lanikepu to the northwest. Doyle did not know the name of these *heiau*, but includes them as the setting of a story that tells how Akua Makuakua met the beautiful Wao and how they settled on Hōkūʻula after their marriage:

> Vivid were the rainbows of the Lanikepu hills, and red the rain, uakoko, that fell upon their slopes, for in the forest that was then their background was a heiau—a women's heiau, the only one; and by these lovely tinted tokens the gods honored it, and signified their approval.
>
> Founded, dedicated and consecrated by the very high chiefess Hoapiliahae, it was attended exclusively by young virgins. There, in the sanctity of the cool highland forest, they performed the

> sacred ceremonies, learning also the science of healing so that they might eventually minister to others. And the names of the five rains of the heiau were given to the five children of Hoapiliahae.
>
> On a nearby ridge stood another heiau, builded there by the great Akua Makuakua who had come from far off Kahiki. He it was who, flying to a hillside to watch the rainbows, found there the beautiful goddess Wao, clad only in her long, silky hair. Love came swiftly and was mutual, and after glorious wedding festivities the couple went to live at Hokuula, the hill of the red planet.
>
> But to bear each of her children Wao returned to the Waimea hills, thereby made sacred. On these occasions a tabu was proclaimed, the forbidden ground extending down across the plains to whatever place a stone happened to stop rolling when started above by her servants. Stones they were themselves, these retainers, all through the night hours, for so Wao transformed them until daylight, when they became human again. (Doyle 1953:44)

Hoopiliahae was a wife of Keawenuia‘umi, the grandson of the *ali‘i nui* Līloa, and she was the daughter of Līloa’s *kahuna* (priest), Paeamolemole (Clark and Kirch 1983). The earliest recorded chiefs of Waimea descended from the Ulu-Hema genealogical line that led to Līloa, whom Clark and Kirch (1983:23) describe as “the founder of the island dynasty.”

Chiefly Rule in South Kohala

During the late 16th century, Kohala and Kona were ruled together by an *ali‘i* named Kūāiwa (Cordy 2000). The other four *moku* on Hawai‘i Island were ruled by independent chiefs: Kulukulu‘ā in Hilo, Hua‘ā in Puna, ‘Īmaikalani in Ka‘ū, and it is believed that Līloa ruled over Hāmākua (Cordy 2000). Kūāiwa appointed his son ‘Ehuinuikaimalino (also referred to as ‘Ehu) to rule over Kona and a junior son, Hukulani, to rule Kohala. Kūāiwa had two other sons from a previous wife, Kahoukapu and Manauea, and all of his sons became the heads of Hawai‘i’s aristocratic families (Fornander 1880). It was Līloa’s son, ‘Umi-a-līloa, however, who would come to rule the entire island.

In Kona, the ‘Ehu line of chiefs grew to be somewhat powerful, but ‘Ehu was ranked second to Līloa, the ruler of Hāmākua (Kelly 1983). According to Kamakau (1992), ‘Ehu placed his son, Laea-nui-kau-manamana in Līloa’s royal court and for some time they both resided in Waipi‘o in the Hāmākua District where Laea-nui assisted with the construction of the sacred stone slab named *Ka paepae kapu o Līloa*. Upon the death of Līloa, his kingdom passed to his eldest son, Hākau; however, Hākau mistreated his people, and Līloa’s second son, ‘Umi-a-līloa, seized the kingdom from his brother. The chiefs of Hilo, Puna, Ka‘ū, and Kona, however, withheld their allegiance to ‘Umi. One by one, ‘Umi and his army conquered these *moku.* According to Kamakau (1992), when ‘Umi marched on Kona and Kohala, ‘Ehu was old, and his lands were easily seized. ‘Umi eventually moved his royal court to Kailua in Kona, and took the daughter of ‘Ehu, Moku-a-hua-lei-akea as his wife. She bore ‘Umi a daughter named ‘Akahi-‘ili-kapu. ‘Umi’s reign is often celebrated as it marked a time of peace and increased productivity and a move towards craft specialization. According to Kamakau:

> There was no kingdom like his. He took care of the old men, the old women, the fatherless, and the common people. Murder and thievery were prohibited. He was a religious chief, just in his rule…
>
> During ‘Umi-a-Liloa’s reign, he selected workers and set them in various positions in the kingdom. He separated those of the chiefly class (*papa ali‘i*), of the priestly class, of the readers of omens (*papa kilo*), those skilled in the affairs of the land (*po‘e akamai o ka ‘aina*), farmers, fishermen, canoe builders, warriors, and other skilled artisan (*po‘e pale ‘ike*) in the work they were best suited for; and each one applied himself to his own task. . . (1992:19)

Kamakau (1992) adds that ‘Umi was a skilled fisherman, who often fished for *aku* (his favorite fish), *‘ahi*, and *kālā* from beaches of Kalāhuipua‘a to Makaula in South Kohala. ‘Umi’s reign lasted until around A.D. 1620. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). Upon his death, ‘Umi was succeeded by his son, Keawenui a ‘Umi, who ruled over Kohala, Kona, and Ka‘ū, and then his grandson, Lonoikamakahiki (Cordy 2000; Kamakau 1992). During this time, wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *ali‘i*. By the late 17th century, large areas of Hawai‘i Island were controlled by a few powerful *ali‘i ‘ai moku* (district chiefs). There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level.

The Reign of Lonoikamakahiki (ca. A.D. 1640) to Kalaniʻōpuʻu (late 1700s)

Lonoikamakahiki, the son of Keawenui a ʻUmi, and the grandson of celebrated *aliʻi nui* ʻUmi a Līloa, was recognized as an accomplished and dexterous warrior. During his reign, several battles were fought in the coastal portion of South Kohala, and also in the general vicinity of the project area. One such battle was fought between Lonoikamakahiki and his insurgent older brother, Kanaloakuaʻana. According to Fornander (1880) Kanaloakuaʻana and his rebel forces fought and pursued each other across Kohala, including the Waimea Plain. The battle began at:

> . . . Anaehoomalu [ʻAnaehoʻomalu], near the boundaries of Kohala and Kona. The rebel chiefs were encamped seaward of this along the shore. The next day Lono marched down and met the rebels at a place called Wailea, not far from Wainanalii, where in those days a watercourse appears to have been flowing. Lono won the battle, and the rebel chiefs fled northward with their forces. At Kaunaoa [Kaunaʻoa], between Puako and Kawaihae, they made another stand, but were again routed by Lono, and retreated to Nakikiaianihau, where they fell in with reinforcements from Kohala and Hamakua. Two other engagements were fought at Puupa [Puʻupā; on the plain southwest of the project area] and Puukohola [Puʻukoholā], near the Heiau of that name, in both of which Lono was victorious. His brother Kanaloakapulehu was taken prisoner, slain, and sacrificed at the Heiau, but Kanaloakuakawaiea escaped with the scattered remnant of the rebel forces. The rebels now fled into Kohala, and were hotly pursued by Lonoikamakahiki. Several skirmishes were fought during the pursuit; at Kaiopae, where Kanaloakuakawaiea was slain; at Kaiopihi, and finally at Puumaneo [Puʻumaneʻo], on the high lands above Pololu [Pololū], where the last remnant of the rebel force was conquered and slain, and the island returned to its allegiance to Lono and Kaikilani. (Fornander 1880:120-121)

Later in Lonoikamakahiki's reign, Kamalālāwalu, the *aliʻi nui* of Maui invaded the island and led a series of attacks in South Kohala that culminated in the battle at Puoaoaka (also known as Puʻu ʻOwāʻowaka) just northeast of the project area (Fornander 1916-1917). As previously noted, Figure 30 depicts where these *puʻu* are located along the southern slope of the Kohala Mountains. The fighting began at Wailea, moved north to Kaunaʻoa, and then to Puakō (the coastal section of Lālāmilo), where Lonoikamakahiki's brother, the high chief Kanaloakuaʻana, was brutally tortured and slaughtered. Kamalālāwalu and his army then proceeded to *puʻu* Hōkūʻula just east of the current project area, to prepare for the next battle. The Alexander and Donn 1901 map (see Figure 20) depicts the project area and a portion of the Waimea Plain (south of the project area) and the uplands (north of the project area) leading to the Kohala Mountains with demarcations indicating pasture lands and forest reserve areas.

The battle at Puʻu ʻOwāʻowaka is described in detail by Fornander (1916-1917, 1959) and (Kamakau 1992). Once he reached Waimea, Kamalālāwalu positioned himself on Hōkūʻula, the hill that he was told would serve as a refuge for him and his men (Fornander 1959). He had been advised to meet Lonoikamakahiki's forces on the Waimea Plain by two members of his camp named Kauhipaewa and Kihapaewa. Unbeknownst to Kanaloakuaʻana, these two men were secretly working for Lonoikamakahiki. The Maui chief assumed, having positioned his army on the Waimea plain and stationed himself on Hōkūʻula to direct his forces, an easy victory, however:

> Kamalalawalu, upon arrival thereon, found on reconnoitering that there were neither stones nor trees, but only dirt [on Hōkūʻula]. While they were engaged in a conversation with Kumaikeau together with Kumakaia, at that time messengers were sent to summon Lonoikamakahiki and Pupuakea. At Kealakekua, in Kona, was the place where Lonoikamakahiki lived. When the messenger appeared before him, he said to Lonoikamakahiki: "Kamalalawalu and Makakuikalani have come to give battle to you both…When Lonoikamakahiki heard these things, he questioned the messenger: "Where is the battle to take place?" The messenger replied: "There, at Waimea, on top of that hill, Hokuula, where Kamalalawalu and all Maui are stationed." (Fornander 1959:188)

Upon awakening the next morning, however, Kamalālāwalu was stunned to discover that a great constellation of men had amassed near the coast. What seemed like thousands of warriors from all of Hawaiʻi Island had gathered as far as the eye could see and were prepared to savagely wage war upon the intruder Maui chief. According to Fornander (1916–1917:344), "the Kau and Puna warriors were stationed from Holoholoku to Waikoloa. Those of Hilo and Hamakua were located from Mahiki to Puukanikanihia, while those of Kohala guarded from Momoualoa to Waihaka." Realizing that he was vastly outnumbered, Kamalālāwalu attempted to reconcile differences but was denied, as the Hawaiʻi chief was enraged at how his ally Kanaloakuaʻana had been slain. Lonoikamakahiki held the advantage with superior numbers and knowledge of the battleground. The battle commended:

> After Kama-lala-walu's warriors reached the grassy plain, they looked seaward on the left and beheld the men of Kona advancing toward them. The lava bed of Kaniku and all the land up to

> Hu‘ehu‘e was covered with the men of Kona. Those of Kau and Puna were coming down from Mauna Kea, and those of Waimea and Kohala were on the level plain of Waimea. The men covered the whole of the grassy plain of Waimea like locusts. Kama-lala-walu with his warriors dared to fight. The battle of Puoaoaka was outside of the grassy plain of Waimea, but the men of Hawaii were afraid of being taken captive by Kama, so they led to the waterless plain lest Maui's warriors find water and hard, waterworn pebbles. The men of Hawaii feared that the Maui warriors would find water to drink and become stronger for the slinging of stones that would fall like raindrops from the sky. The stones would fall about with a force like lightening, breaking the bones into pieces and causing sudden death as if by bullets.
>
> Maui almost won in the first battle because of Hawaii's lack of a strong champion. Maka-ku-i-ka-lani [representing Maui] was first on the field and defied any man on Hawaii to match strength with him. Maka-ku-i-ka-lani tore Hawaii's champion apart. When Puapua-kea arrived later by way of Mauna Kea, those of Hawaii rejoiced at having their champion. Maka-ku-i-ka-lani and Puapua-kea matched their strength in club fighting on the battle site before the two sides plunged into the fight. (Kamakau 1992:58-59)

Although well-matched, Puapuakea overpowered Makakūikalani, and the warriors of Maui were put to flight. After three days of fighting, Lonoikamakahiki emerged victoriously and Kamalālāwalu and nearly all the invaders, except his son Kauhiakama, were executed. Lonoikamakahiki died without an heir, and the next four rules of Hawai‘i were descendants of his older brother (Cordy 2000). Through their reigns, the Ī lineage of Hilo and the Mahi lineage of Kona grew in power. The resulting political friction culminated in the marriage of Keawe (the fourth of these chiefs) and Lonoma‘aikanaka of the Ī line.

In about A.D. 1740, following the death of Keawe, Hawai‘i was invaded by Alapa‘inui, the son of a former Kona war chief of the Mahi lineage, who had been living on Maui since the death of his father (Kamakau 1992). Alapa‘inui waged war against the chiefs of Kona and Kohala and was eventually victorious, proclaiming those lands as his own (he also later gained control of the Hilo and Ka‘ū Districts). After gaining control of the island, Alapa‘inui is said to have lived in Waimea for a time:

> Alapa‘i dwelt in Hilo for a year and then went to live in Waipi‘o. Shortly after, he and the chiefs moved to Waimea and others went by canoe to Kawaihae. From Waimea, he went to Lanimaomao, where he fell ill. (Kamakau 1992:77)

It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupua‘a* of Kokoiki, near Mo‘okini Heiau (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (Kamakau 1992:67-68) places the birth event sometime between A.D. 1736 and 1758, and probably nearer to the later date. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning signified the night before by a very bright, ominous star, thought by some to be Halley's Comet (this is also controversial). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1918).

Many of the chiefs who had been deprived of their lands by Alapa‘inui battled against Keawe‘ōpala, and he was soon defeated in South Kona by Kalani‘ōpu‘u, who then became the ruler of Hawai‘i Island (Kamakau 1992). Kalani‘ōpu‘u's reign was marked by near-constant warfare as he invaded Maui and defended himself from rebellions by Maui and Hawai‘i *ali‘i* (Kamakau 1992). In A.D. 1775 Kalani‘ōpu‘u and his forces from Hāna, Maui, raided and destroyed the neighboring district of Kaupō, and then launched several more raids on Moloka‘i, Lāna‘i, Kaho‘olawe, and parts of West Maui. It was at the battle of Kalaeoka‘īlio that Kamehameha, a favorite of Kalani‘ōpu‘u, was first recognized as a great warrior and given the name of Pai‘ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalani‘ōpu‘u and Kahekili (1777–1779), Ka‘ahumanu and her parents left Maui to live on the island of Hawai‘i (Kamakau 1992). Kalani‘ōpu‘u was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

The Arrival of Europeans, Missionaries, and the Reign of Kamehameha

The arrival of foreigners in the Hawaiian Islands marked the beginning of drastic changes in Hawaiʻi's culture and political-economy. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas due to war and disease, yet an increase in others, with relatively little change in material culture. Some of the work of the *makaʻāinana* shifted from subsistence agriculture to the production of foods and goods which could be traded with foreign ships. There was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influences were already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui, and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983).

Captain James Cook and his crew onboard the ships the *H.M.S. Resolution* and *Discovery* first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniʻōpuʻu, who was still at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting but chose not to participate (Jarves 1847). Although the expedition did not explore inland to Waimea while sailing up the Kohala coast, Lt. King recorded his observations of that part of the countryside:

> Koaara [Kohala] extends from the Westernmost point to the Northern extremity of the island; the whole coast between them forming an extensive bay, called Toe-yah-yah [Kawaihae], which is bounded to the North by two very conspicuous hills. Toward the bottom of this bay there is foul, coraly ground, extending upward of a mile from the shore, without which the soundings are regular, with good anchorage, in twenty fathoms. The country, as far as the eye could reach, seemed fruitful and well inhabited, the soil being in appearance of the same kind with the district of Kaoo [Kaʻū]; but no fresh water is to be got here. (King 1784:106)

After the death of Captain Cook at Kealakekua and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck the district and Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. While in Kohala, Kalaniʻōpuʻu proclaimed that his son Kīwalaʻō would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to his nephew Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kīwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication, Kalaniʻōpuʻu set out for Hilo to quell a rebellion by a Puna chief named ʻĪmakakoloʻa.

In 1790, John Young and Isaac Davis, sailors on board the ships *Eleanora* and *Fair American*, which were trading in Hawaiian waters, were detained by Kamehameha I and made his advisors. The story of their detention begins when the crew of the *Eleanora* massacred more than 100 natives at Olowalu, on the island of Maui, in retaliation for the theft of a skiff and the murder of a sailor. The *Eleanora* then sailed to Hawaiʻi Island, where John Young went ashore and was detained by Kamehameha's warriors. The other vessel, the *Fair American*, was captured off the Kona coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1992). Kamehameha, with the aid of Young and Davis and their knowledge of the newly acquired foreign arms, then succeeded in conquering all the island kingdoms except Kauaʻi by 1796. It was only in 1810, after two unsuccessful invasion attempts, that Kamehameha through negotiations with the chief Kaumualiʻi of Kauaʻi, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Soon after the arrival of foreigners, the landscape of Waimea began to change. This began with deforestation resulting from the over-harvesting of sandalwood in the uplands, and then by the introduction of cattle (Rechtman and Prasad 2006). In 1792, Captain George Vancouver, who had sailed with Cook during his 1778-1779 voyages, arrived at Kealakekua Bay with a small fleet of British ships, where he met with Kamehameha. Vancouver stayed only a few days on this first visit but returned in 1793 and 1794 to take on supplies. Vancouver introduced cattle to the Island of Hawaiʻi at Kealakekua during these latter two visits, gifting seventeen heads of steer to Kamehameha I, who at the request of Vancouver, immediately made the cattle *kapu*, thus preventing them from being killed and allowing their numbers to increase (Barrère 1983; Kamakau 1992; Vancouver 1984). Some of the offspring of these animals escaped the initial attempts to contain them and spread throughout Kohala, Kona, and the saddle region. In agriculturally productive areas, the animals wrought havoc on crops and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes (Barrère 1983; Henke 1929).

Hawaiʻi's culture and the economy continued to change drastically during Kamehameha's rule as capitalism and industry established a firm foothold in the Islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810. Kamehameha, who resided on the Island of Oʻahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food, and fish (Kamakau 1992). This new burden contributed to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau (1992:204) indicates that "this rush of labor to the mountains brought about a scarcity of cultivated food … The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ʻAmaʻu, or Hapuʻu, from the wild plants resorted to." Once Kamehameha realized that his people were suffering, he "declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land" (Kamakau 1992:202). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy et al. 1991). While in Kailua-Kona, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years until his death. He and his high chiefs participated in foreign trade but also continued to enforce the *kapu* system.

When Kamehameha I died on May 8, 1819, the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate (Kamakau 1992). Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death, a period of *ʻai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history, traditional customs were altered (Kamakau 1992). Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu, and rather than re-establish the *kapu*:

> Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-aliʻi consented to the free eating and it was accepted on Kauai (Kamakau 1992:225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house, and did whatever he desired it was still during a time when he had not reinstituted the *ʻai kapu* (eating taboo), but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kūkāʻilimoku, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was ultimately defeated in the battle of Kuamoʻo in the North Kona District (Kamakau 1992). With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawaiʻi to Kauaʻi, and the arrival of Christian missionaries shortly thereafter, Hawaiʻi's culture and their spiritual beliefs continued to be transformed. By December of 1819, Liholiho had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *ʻaumakua* worship, to continue (Kamakau 1992; Oliver 1961). With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people.

In October of 1819, seventeen Protestant missionaries had set sail from Boston to Hawaiʻi. They arrived in Kailua-Kona on March 30, 1820, to a society whose spiritual system has just been overturned. Some *aliʻi*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western-style and adopted their dress and religion. As missionaries began to introduce Christian concepts and beliefs they also set forth the process of rendering a once purely oral language into written form, and literacy was quickly taken up as a national endeavor (Nogelmeier 2010; Schütz 1994). Soon many *aliʻi* were rewarding these early missionaries with land and positions in the Hawaiian government. During this period, the demands of the *aliʻi* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *aliʻi* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade soon led to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as the focus of industry in Hawaiʻi went from the sandalwood trade to whaling.

Some of the earliest written descriptions of Kohala come from the accounts of the first Protestant Missionaries to visit the island. In 1823, the missionary William Ellis described Waimea as a fertile, well-watered land “capable of sustaining many thousands of inhabitants” (Ellis 1831:399). The population was concentrated in three villages, Keaalii, Waikōloa, and Puʻukapu, as seen below in Figure 21, each located where major streams reached the plain. Ellis noted that another missionary, Asa Thurston, had counted 220 houses in the area, and estimated the population at between eleven and twelve hundred. In the time since Kamehameha I’s death, the harvesting of sandalwood had once again been forced upon the *makaʻāinana*. During his travels along the coast of Kohala, Ellis noted that most of the villages were empty as the men of the region had been ordered to the mountains by the King to collect sandalwood. He wrote:

> About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young… Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Ellis 1831:396-397)

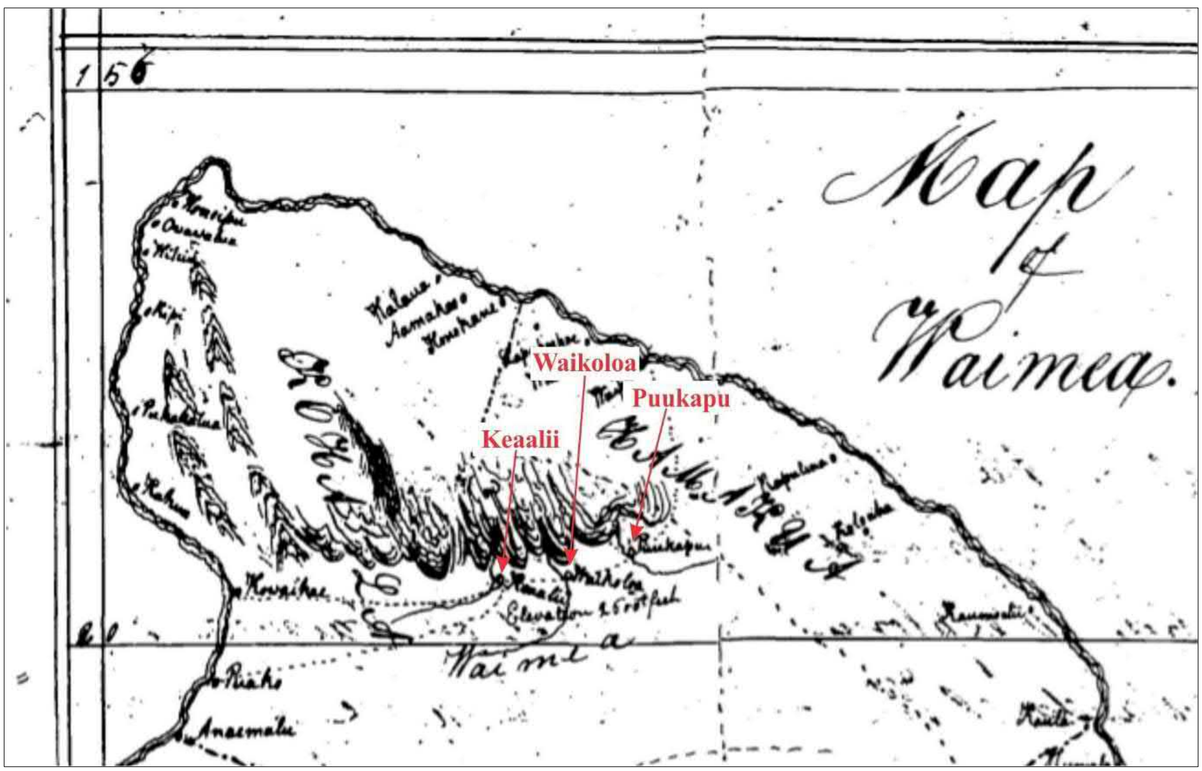

Figure 21. A portion of “Map of Waimea” ca. 1830 with main villages (after Andrews et al. 1830) (Hawaiian Mission Houses Library and Archives Digital Collection).

Agricultural Practices of the Lālāmilo-Waimea Area

The natural landscape found in the upper Lālāmilo-Waimea area set the foundation for highly productive agricultural pursuits during the Precontact and early Historic periods. As described by Kirch (1985:215), "Hawaiians were first and foremost cultivators of the land" and over the generations, they adapted and intensified their agricultural production to levels unseen elsewhere in greater Oceania. Evidence of their adaptive agricultural endeavors is still visible today in the Kohala District. While the central and *makai* (coastal) areas of Lālāmilo and the greater *kalana* of Waimea are generally characterized as hot and dry and inhospitable to major agricultural pursuits, in the uplands of the Waimea-Lālāmilo area, at elevations ranging from roughly 750 and 900 meters (2,460 to 2,950 feet) above sea level, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes, taro, and other crops (Kirch 1985). Archaeological investigations conducted by Barrera and Kelly (1974) identified a dense concentration of sites in the uplands of Lālāmilo in the project area's immediate vicinity. Subsequent studies conducted by Bishop Museum staff (Clark 1981b, 1983) identified remnants of an agricultural field system in the Lālāmilo-Waimea area. These investigations ultimately concluded, "that the present town of Waimea was at the center of a large and intensively cultivated field system, which was in operation by at least the seventeenth century…" (c.f. Kirch 1985:177).

Concerning the Precontact use of the general project area within the various land divisions of Waimea, Clark (1987) offered a regional settlement pattern model that includes four elevational delineated environmental zones. The Coastal Zone extends up to about 150 feet elevation and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with the associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops and was a locus for the collection of wild floral and faunal resources. The current project area, situated at elevations ranging from 2,635 to 2,675 feet, is perhaps at the interface of Clark's (1987) Kula and Wilderness Zones.

Ultimately the increased upland population resulted in the creation of what archaeologists have dubbed the Waimea Field System found at elevations ranging from roughly 2,460 to 2,950 feet (750 and 900 meters) above sea level. The Waimea Field System is at least one of two major field agricultural field systems in the Kohala District. Each field system is vastly different in size and has its own distinguishing feature composition, however, unlike the expansive Kohala Field System, found along the leeward slopes of the Kohala Mountains, that relied almost exclusively on rainfall, the Waimea Agricultural System was also supported by small irrigation channels (*'auwai*) that may have intermittently carried water across the sloping landscape (Kirch 1985). Subsequent archaeological studies conducted on the Waimea Agricultural System throughout the 1990s and early 2000s yielded additional information about the agricultural system. The results from Burtchard and Tomonari-Tuggles's (2005:iii) study of the field system concluded that:

> …short-term, temporary, agriculturally supported residence began on the upper Waimea Plain, possibly as early as the AD 1400s. The agricultural system, however, appears to have been substantially smaller than previously believed, and was limited to non-irrigated cultivation. Elongated earthen ridges are most plausibly remnant dunes that formed at the base of floral windbreaks sheltering fields. Limited irrigation may have begun in the late AD 1700s in support of military undertakings by Kamehameha at Kawaihae on the leeward Hawai'i coast. Most of the extensive irrigation system on the upper Waimea Plain was developed in the 19th century in association with commercial agriculture. In more recent times, the project area was used for the cultivation of corn and hay, a World War II military camp, and pasture for livestock.

Located in Clark's (1987) Kula Zone, more fertile soil and increased rainfall allowed for the extensive cultivation of sweet potatoes and irrigated taro (Kirch 1985). Clark and Kirch (1983) identified four field complexes shown in Figure 22 in the Waimea area, each containing an extensive network of fields fed by a system of irrigation ditches that drew water from the Waikōloa and Kahakohau streams. A portion of the project area is situated within Field Complex 2 while the other portion of the project area is within what Clark and Kirch identified as "residential and commercial areas" (see Figure 22).

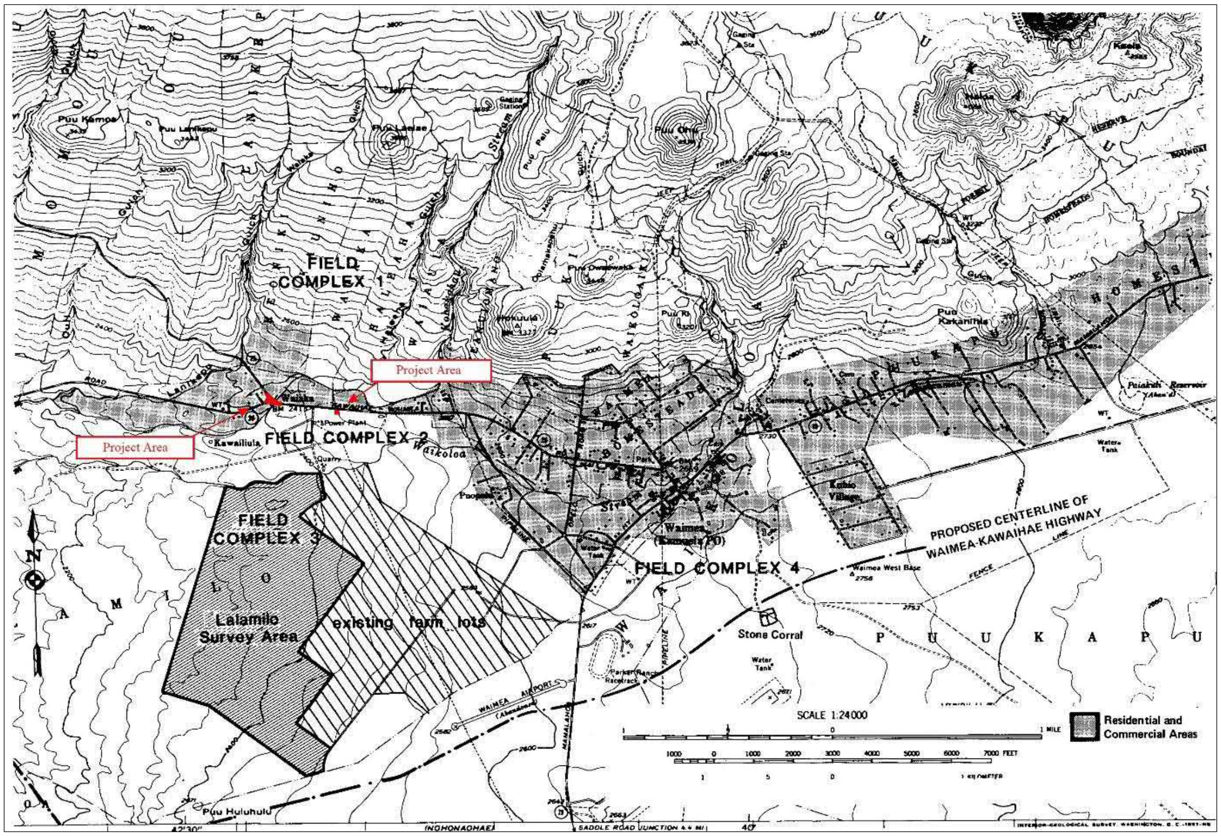

Figure 22. Project area in red with field complexes as described in Clark and Kirch (1983).

Kirch (1985:231) surmises that the fields were perhaps intermittently irrigated with “simple furrows” that were used to “direct water across the sloping field surfaces.” Recent modelling of water flow in a portion of Field Complex 3 (located south of the project area) by McIvor and Ladefoged (2018) suggests that intermittent irrigation there may have been used to grow a variety of crops. In addition to staple crops such as *ʻuala* (sweet potatoes) and *kalo* (taro), crops cultivated within the upland field system included *wauke*, *māmaki*, plantains, *maiʻa* (bananas), *kō* (sugarcane), *niu* (coconuts), and *hala* (pandanus) (Haun et al. 2003). According to Barrère (1983:27), “the cultivating places at Waimea were first expanded to supply the chiefs’ needs while sojourned there and at Kawaihae”.

While most of the taro and sweet potato fields of South Kohala were located in the rainier uplands near the present-day town of Waimea (where there was also a sizeable permanent population). Handy et al. (1991:532) relate that “the coastal section of Waimea, now called South Kohala, has a number of small bays with sandy shores where fishermen used to live, and where they probably cultivated potatoes in small patches . . . Puako near the Kona border was a sizable fishing village at one time where there were undoubtedly many sweet potato patches.” The name of the village of Puakō, which literally translates as “sugarcane blossom” (Pukui et al. 1974:191), suggests that sugarcane was grown there. In fact, it was the A.D. 1880 discovery of wild sugarcane growing near the village of Puakō that would eventually lead to the establishment of the short-lived Puakō Sugar Plantation (Puakō Historical Society 2000).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction that served a variety of important uses. The *kō kea,* or white cane, was the most common and was usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy et al. 1991). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children’s teeth by chewing on it (Handy et al. 1991). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odortissimus*) were not abundant (Malo 1903). Pukui (1983) records two proverbs that liken the toughness of sugarcane to the warriors of Kohala, one of which derives from the battle of Puʻu ʻŌwāʻoaka:

> *I ʻike ʻia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.*
>
> One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.
>
> When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong. (Pukui 1983:127)

> *He pā'ā kō kea no Kohala, e kole ai ka waha ke 'ai.*
>
> A resistant white sugar cane of Kohala that injures the mouth when eaten.
>
> A person that one does not tamper with. This was the retort of Pupukea, a Hawai'i chief, when the Maui chief Makakūikalani made fun of his small stature. Later used in praise of the warriors of Kohala, who were known for valor. (Pukui 1983:95)

Early European explorers who visited the Waimea area also described extensive agricultural fields, plantations, and a sizable population. In 1793, after landing at Kawaihae, Scottish surgeon and botanist Archibald Menzies, accompanied by two native guides traveled inland towards Waimea and recorded the following observation:

> A little higher up, however, than I had time to penetrate. I saw in the verge of the woods several fine plantations, and my guides took great pains to inform me that the inland country was very fertile and numerously inhabited. Indeed, I could readily believe the truth of these assertions, from the number of people I met loaded with the produce of their plantations and bringing it down to the water side to market, for the consumption was now great, not only by the ship, but by the concourse of people which curiosity brought into the vicinity of the bay. (Menzies 1920:56)

Nearly thirty years after Menzies' visit, the early missionary, William Ellis penned his version of the journey taken by fellow missionaries Messrs. Bishop and Goodrich, both of whom passed through Waimea on their way to Kawaihae. Ellis reported that after leaving:

> Kapulena, and, taking an inland direction, [Bishop and Goodrich] passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, through but few inhabitants.
>
> About noon they reached the valley of Waimea, lying at the foot of Mouna-Kea [sic], on the northwest side. Here a number of villages appeared on each side of the path, surrounded with plantations, in which plantains, sugar-cane, and taro, were seen growing unusually large. (Ellis 1917:265)

Between the 1820s and 1860s, agricultural endeavors in Waimea began to shift to accommodate the growing market economy. In the late 1820s, Lau Ki and Aiko, two Chinese immigrants opened a sugar mill in the Līhu'e area in upper Lālāmilo and although their mill was not commercially successful, sugar production continued in the Waimea area (Barrera and Kelly 1974). Productive sugarcane cultivation in Lālāmilo required an extensive network of irrigation ditches that would transport water from the nearby Waikōloa and Lanimaomao streams to the fields. According to Burtchard and Tomonari-Tuggle (2005:26):

> Despite poor irrigation qualities of the Waimea Plain sediments, the network extended 8 km (5 miles) west and south of Waimea town, providing drinking water, mill power, and supplemental field irrigation. Two irrgation canals, Akona's 'Auwai from Waikoloa Stream and Lanimaumau Ditch in Pukalani, appear to have been early constructs in the system. Lyons' 'Auwai, on the other hand, seems to have been built around 1850; this ditch, which also came from Waikoloa Stream, was named for its point of origin near Reverend Lyons' houselot at Pele Gulch. Akona's 'Auwai and Lyons' 'Auwai were specifically for the purpose of irrigating sugarcane and supplying the Līhu'e sugar mill. Lanimaumau Ditch irrigated cane fields that lay on higher ground above the Waikoloa ditches, including fields at Kamalo'o.

The Early Development of Cattle Ranching in Waimea

After being introduced to the Island of Hawai'i in 1793 and 1794 by Captain George Vancouver, cattle populations quickly grew and spread throughout the Kohala, Kona, and the saddle region of the island. Ellis (1831:402) describes a journey by one of his traveling companions to Mauna Kea and the feral cattle herds roaming the mountainside:

> Although there are immense herds of them, they do not attempt to tame any; and the only advantage they derive is by employing persons, principally foreigners, to shoot them, salt the meat in the mountains, and bring it down to the shore for the purpose of provisioning the native vessels. But this is attended with great labour and expense. They first carry all the salt to the mountains. When they have killed the animals, the flesh is cut off their bones, salted immediately, and afterwards put into small barrels, which are brought on men's shoulders ten to fifteen miles to the sea-shore.

In 1822, John P. Parker, originally of Newton, Massachusetts, was among the early foreigners granted permission to hunt wild cattle for the Crown (Brennan 1974). The wild cattle were often captured in bullock pits dug seven to eight feet long by four feet deep that were covered over with sticks and a thin layer of dirt; they were also hunted with guns (Frost and Frost 1977; Wilkes 1845). By the 1830s, the unregulated population of livestock was cause for concern and under the administration of Kauikeaouli (Kamehameha III), *vaqueros* (cowboys of Mexican, Indian, and Spanish descent) from Central and South America were brought to the islands to train Hawaiians in the handling of both horses and wild cattle (Bergin 2004). It was out of these early interactions among the *vaqueros* and Hawaiians that the Hawaiʻi *paniolo* (cowboy) culture developed.

In about 1830, Parker began to establish his own private cattle herd and the business that became Parker Ranch (Figure 30), which would eventually grow into the largest cattle ranch on the island (Henke 1929). That same year, the governor of Hawaiʻi Island, John Adams Kuakini, moved to the town of Waimea to oversee and improve the government cattle industry. He ordered the construction of corrals and had a twelve-mile stretch of trail between Waimea and Kawaihae widened (Escott 2008). In his annual report for 1834, Lorenzo Lyons (1834), the resident missionary in Kohala, reported that a road between Waimea and Hāmākua had been completed. The 1835 missionary census lists 6,175 people living in Kohala and another 1,396 people, including 500 men, 510 women, and 386 children, living in Waimea (Schmitt 1977). Despite the eventual prominence of ranching in Waimea, at the time Lorenzo Lyons (1837:1) reported that "The beef establishment has lost some of its charms; & the attention of the people is more directed to the cultivation of the soil - a great portion of Waimea is being surrounded by a stone wall – to form an extensive garden from which all graminivorous animals are to be excluded & which is to be cultivated by the people for their benefit as well as that of the chiefs." Foreigners appear to have been somewhat transient during this period, as Lyons notes:

> There was a time when the foreign population numbered about 70 - & their children 30. But the number has considerably diminished & it is always fluctuating - sometimes more & sometimes less. They belong to 6 or 7 different nations & are variously employed – beefcatchers - sugar manufacturers - shoemakers, merchants - tanners - lawyers - blacksmiths - -combmakers - masons - doctors - saddlers - farmers & what not. (Lyons 1841:13-14)

Figure 23. Parker Ranch Store that offered various provisions such as gas and food, n.d. (Parker Ranch).

By 1840, bullock hunting had drastically reduced the population of wild cattle on Hawai‘i Island, so much so that a five-year *kapu* was placed on hunting them solely for their hides and tallow (Bergin 2004). This led to further efforts to tame, brand, fence, and herd privately-owned cattle (Wilkes 1845). For a while, agricultural products from Waimea replenished the cargo ships at Kawaihae Harbor, and in the late 1840s many of the potatoes grown in the Waimea area were shipped to California to help feed those involved in the California gold rush (Haun et al. 2003), but the decline of the whaling industry in Hawaiian waters during this time, combined with the *kapu* on killing wild cattle, ultimately led to a period of economic hardship and population decline in the Waimea area (Escott 2008).

At about this time, a Honolulu merchant named William French constructed his residence, currently known as the historic Spencer House, at Pu‘uloa to the northeast of Lindsey Road-Māmalahoa Highway. French operated a store in Kawaihae and another, a “thatched hut” at Pu‘uloa where he “employed a saddle-maker and operated a tannery” under the management of Parker, who “kept busy supervising this operation and collecting beef tallow, and leather to supply the needs of French’s growing business” (Wellmon 1973:50). Despite a lack of money in Waimea at the time, the store did well for both French and Parker, as Wellmon (1973:50-51) explains:

> There was no surplus of currency in Waimea at this time, and most of the business at the Puuloa store consisted of bartering for goods and services. Long-term credit and buying on time was the rule rather than the exception in these transactions. . . French supplied Parker with different goods in exchange for his services and produce. Parker used these goods himself or exchanged them with those who worked for French and those who paid the store in money or goods.

Francis Allyn Olmsted (1841:230), an American author, journeyed to Waimea in 1840 and described French’s storefront and the colorful *vaqueros* and bullock hunters who frequented the store:

> About eight o’clock, we came up with a collection of thatched houses, towards the principal of one which we directed our steps, which was a store belonging to Mr. French of Honolulu. Here a novel scene presented itself to us. In front of the door, a bright fire was blazing in a cavity in the earthern floor, displaying in strong light the dark features of the natives congregated around it in their grotesque attitudes. Immediately back of these, a group of fine looking men, in a peculiar costume, were leaning against the counter of the store. Some of them were Spaniards from California, and they were all attired in the poncho, an oblong blanket of various brilliant colors, having a hole in the middle through which the head is thrust. The pantaloons are open from the knee downwards on the outside seam. A pair of boots armed with prodigiously long spurs completed their costume. They were bullock hunters, employed in capturing the wild bullocks that roam the mountains, and had just returned from an expedition of eight or ten days, in which they had been very successful.

As the decade wore on, however, the population of Kohala began to decline, and settlement patterns changed significantly. Leeward inhabitants relocated to the wetter windward slopes of North Kohala and the Waimea plain, abandoning their agriculturally marginal areas in favor of wetter sugarcane lands more productive farmland. According to Tomonari-Tuggle (1988), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. These settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. Tomonari-Tuggle clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali‘i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment. (Tomonari-Tuggle 1988:33)

These population shifts were accompanied by an overall decline in the number of people living in Kohala. Contemporary observers and modern scholars (Burtchard and Tomonari-Tuggle 2005) offer several explanations, including the decline of the whaling industry, a *kapu* on killing wild cattle (Wilkes 1845), dissatisfaction with William Beckley’s (also known as Wilama Bekele) appointment as *konohiki* (Doyle 1953), and disease (HSA 1848), and epidemics that raged through the islands in 1848 and 1849. The population reduction in Waimea as documented by missionaries was tremendous, as the Rev. Lorenzo Lyons expressed, “if the decrease of local people continues the same, how many years before they are all dead, without any left?” (Schmitt 1973:29). Similarly, an 1848 description of the Waimea population cited by McEldowney (1983:432) laments that “it can scarcely be said that there is any native population at all.”

The *Māhele ʻĀina* of 1848

By the mid-19th century, the Hawaiian Kingdom was an established center of commerce and trade in the Pacific, and recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. This change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. *Mōʻī* (King) Kauikeaouli (Kamehameha III), through deliberations with his high-ranking chiefs and political advisors, defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī*, the *aliʻi* and *konohiki*, and the native tenants known as *hoaʻāina*. In 1846, King Kauikeaouli formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire *ahupuaʻa* or *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupuaʻa*), or by *hoaʻāina* for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. This deadline was extended several times for chiefs and *konohiki*, but not for native tenants (Soehren 2005).

The *Mōʻī* and some 245 *aliʻi* spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the matter was discussed in the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once the *Mōʻī* and his *aliʻi* accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848). The names of all of the *ahupuaʻa* and *ʻili kūpono* of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the *Buke Māhele* (*Māhele* Book) (Buke Māhele 1848). As this process unfolded, the *Mōʻī*, Kauikeaouli, received roughly one-third of the lands of Hawaiʻi, realizing in the process the importance of setting aside public lands that could be sold to raise money for the government and also purchased for fee simple title by his subjects. Accordingly, the day after the division when the name of the last chief was recorded in the *Buke Māhele*, the *Mōʻī* commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kauikeaouli, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Awards (*LCAw*.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land." The lands personally retained by the King became known as "Crown Land." Lastly, the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). For all land designations, whether to the *Mōʻī*, *konohiki*, or Government, the rights of the native tenants were expressly reserved (Garovoy 2005). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed.

During the *Māhele*, *hoaʻāina* (native tenants) residing on lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to parcels that they actively lived on or farmed. The parcels awarded to *hoaʻāina* were and still are referred to as *kuleana*, using the Hawaiian term to describe the relationship of rights and responsibilities held among tenants, *konohiki*, and the land. The Board of Commissioners oversaw the program and administered the *kuleana* as *LCAw*. Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848, to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the *LCAw*. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly and Maly 2002). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and further defined the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly and Maly 2002).

The Disposition of Lands in Waimea and Lālāmilo at the time of the Māhele ʻĀina

The disposition and distribution of the lands of Waimea was a complicated issue and was a matter of much testimony and debate among Commissioners, *kamaʻāina* informants, and land petitioners. Waimea was a discrete land unit but considered by some to not be an *ahupuaʻa*; rather it was considered to be a *kalana* or *ʻokana*, a unit larger than an *ahupuaʻa*. To further complicate the issue, some of the land units within Waimea were considered *ahupuaʻa* and others *ʻili kupono*. As a result of the *Māhele* testimony and decisions rendered by the Boundary Commission, many smaller *ahupuaʻa* names were dropped and the relatively independent *ʻili kupono* were given *ahupuaʻa* status, and except for a portion of the Waikōloa Ahupuaʻa (which was awarded as *konohiki* land), much of the Waimea area was retained as Crown Lands. Almost all of the smaller *ʻili ʻāina* located on the southern slope of Kohala Mountain became Government Land, with two exceptions. The lands of Waiaka 1st and 2nd were awarded to G. Lahilahi (LCAw. 8520-B:2), the first of which (Waiaka 1st) she relinquished to the government. The two *ʻili* of Pauahi and Lanikepu were given to Lunalilo, who relinquished them to the government. The rest of the land, including the large *ahupuaʻa* of Lālāmilo and Kauniho were retained by the government land (Soehren 2005).

Over 140 claims for *LCAw*. were made by native tenants within the Waimea area. Nearly all of these claims were for house lots or cultivated sections (Haun et al. 2003). Of the land commission awards reviewed by Kelly and Nakamura (1981:30), over twenty percent were issued to persons with non-Hawaiian surnames. Seventeen LCAw. were claimed within Lālāmilo, four at the coast (listed as being within Puakō) and thirteen in the uplands (Haun et al. 2003). Four *LCAw.* were claimed in Waiaka (three in Waiaka 1st and one in Waiaka 2nd), while there was one claim in Kauniho. Three *LCAw.* are near the project area and are listed below in Table 1 and shown in Figure 24. Although the lands of Waiauia are not included in this study, lands awarded to James Fay are adjacent to the project area and are listed below in Table 1. Figure 24 displays the *LCAw.* and Land Grant within and in the vicinity of the project area.

Table 1. LCAw. in the vicinity of the project area

LCAw. No.	*Name*	*Location*	*Year Awarded*	*Land Use*
589	Fay, James	Keanuiomano	1850	House lot, cattle pens, fencing
2258	Fay, James	Waiauia	1850	*ʻIli* of Waiauia
8520-B	Lahilahi, G.	Waiaka and Waiaka 2	1852	N/A

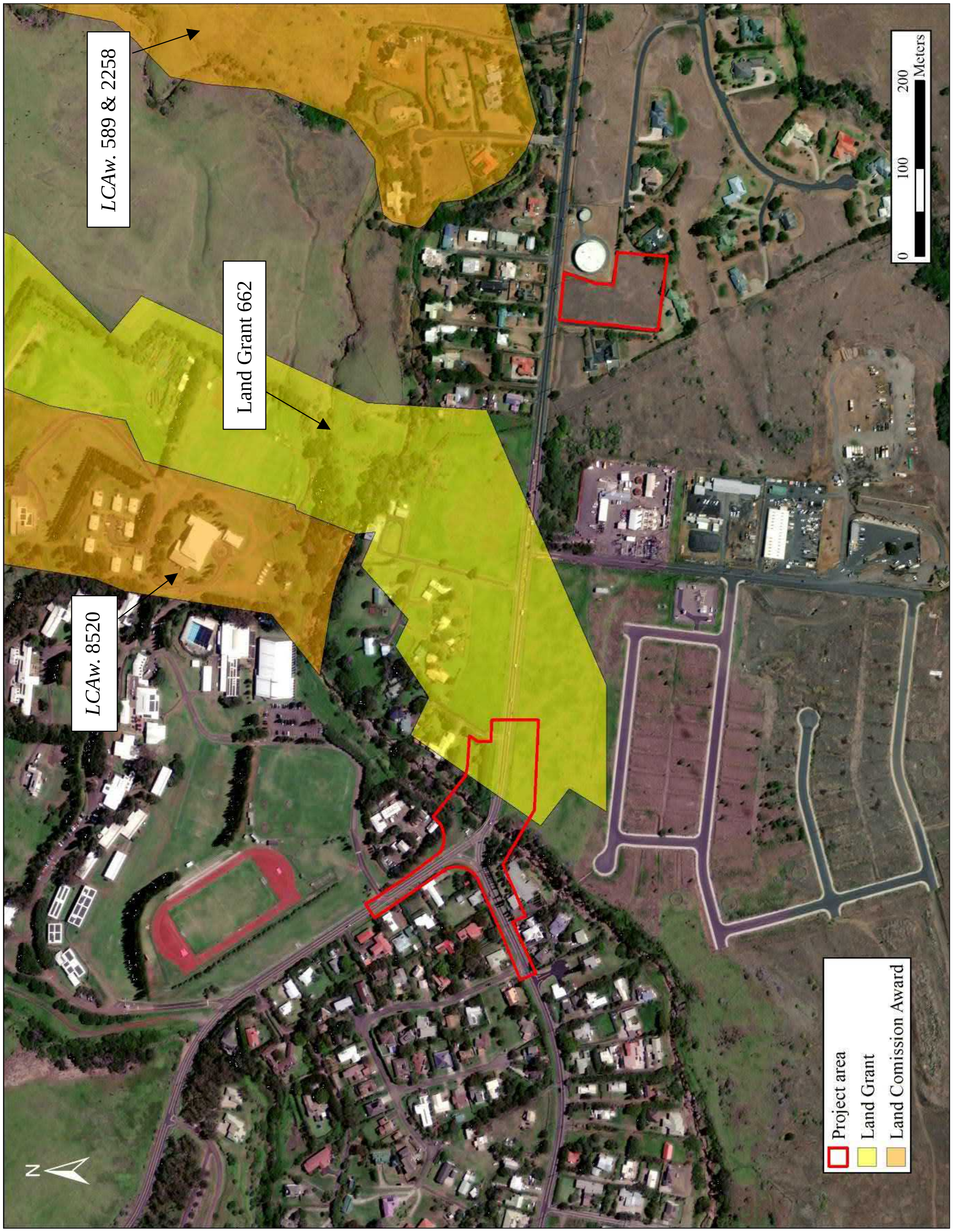

Figure 24. Aerial overlaid with *LCAw*. and Land Grant in the project area.

Government Land Grant Program and the Expansion of Ranching in Waimea

In conjunction with the *Kuleana Act*, the King authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the *Māhele ʻĀina*. These Land Grants were generally larger than those awarded by the Land Commission. The Act resolved that portions of Government Lands should be set aside and sold as grants ranging in size from one to fifty acres for fifty cents per acre. The stated goal of the program was to enable native tenants, many of whom were insufficiently awarded or not awarded land through the *Kuleana Act* to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of Government lands.

Land Grant 662 awarded to Kamaikui covers the eastern portion of the Waiaka Bridge project area. Grace Kamaikui was the daughter of John Young and Kaoanaeha, the niece of Kamehameha I. Kamaikui was born on September 8, 1808 in Kawaihae and was married to Keʻeaumoku (George Cox) until his death and later married Dr. Thomas Rooke. Land Grant 662 was awarded to Kamaikui in 1851 and was comprised of 93.2-acres in Waiakanui ʻIli within Waiaka 1st Ahupuaʻa (as seen in Figure 24).

During the middle to late 1800s, Western businessmen established several diverse industries on these newly available lands. Letters written at the time of the *Māhele* indicate that by 1848 George Davis Hūʻeu had already established a cattle corral, a goat corral, and house lots on lands adjacent to his roughly 95,000-acre Waikōloa award (Maly and Maly 2002). By 1848, John Palmer Parker, founder of the Parker Ranch, had received two acres of land at Mānā where he built a family house and the first ranch buildings (Bergin 2004). In 1850 Parker purchased 640 acres surrounding his Mānā lands, and in 1851 he purchased another 1,000 acres. The next year, Kamehameha III granted Parker a lease on the lands of Waikōloa (presumably Lālāmilo and neighboring lands to the north and east), some of which would eventually be deeded to the ranch by outright purchase. By the middle of the decade, Parker had turned most of the day-to-day operations of Parker Ranch over to his son, John Palmer Parker II. When John Palmer Parker, died on August 20, 1868, the ranch controlled about 47,000 acres of land in the region (Bergin 2004). These lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr.

The decades following the *Māhele ʻĀina* of 1848 were characterized by a growing detraction from traditional subsistence activities as the population along the Kohala coast continued to decline and the inland agricultural fields were largely abandoned as they succumbed to the ravages of free-ranging cattle or were bought up and converted to pastures. During this period the remnant leeward population of Kohala nucleated into a few small coastal settlements or into dispersed upland habitations where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect their homes and gardens from cattle and other free-ranging animals but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. The economy also transitioned, becoming cash-based, and taxes were collected. Foreigners controlled much of the land and most of the businesses, and the native population was largely dependent on these foreigners for food and money (Haun et al. 2003). The written history from the late 19th to the early 20th century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region (McEldowney 1983). Parker Ranch continued to expand its operations in the Waimea area throughout the 1870s and 80s, eventually acquiring the lease to roughly 95,000 acres of Waikōloa that had formerly belonged to the Waimea Agricultural and Grazing Company. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship, new managers were brought in to oversee the day-to-day operations at the ranch.

By the early 1900s, the Parker Ranch headquarters were located near what is now the corner of Lindsey Road and Māmalahoa Highway, in the same building as the old store, post office, and restaurant (Maly and Maly 2005). The ethnic makeup of Waimea at this time was primarily of Hawaiian and part-Hawaiian, Japanese, Portuguese, Chinese, and a small number of *haole* (Euro-American descent); and most of the residents were employed by Parker Ranch or were independent farmers (Paniolo House Committee Friends of the Future 2005). At this time, Parker Ranch was under the direction of Alfred W. Carter, who had been chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. By this time, Parker Ranch was operating on several large leased parcels, but the fee simple holdings amounted to only 34,000 acres (Bergin 2004). Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. In 1903, with only a short period left on its lease, Carter acquired nine-tenths interest in the Waikōloa lands from Ms. Lucy Peabody for $112,000, securing important grazing lands for the ranch (Bergin 2004). Soon thereafter, Carter purchased the adjacent lands of ʻŌuli, adding another 4,000 acres to the ranch's holdings that bridged the former property lines makai of Waimea Town. He also acquired the Puʻuloa Sheep and Stock Company, encompassing over 3,700 acres and including the Keʻāmuku Sheep station in Waikōloa, which he converted to cattle ranching over the next decade. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humuʻula, Kaʻohe, Waipunalei, and Kahuku Ranch (Bergin 2004).

Figure 25 below illustrates the sparse, hilly topography of Waimea. A road alignment predating Kawaihae Road and Kohala Mountain Road can be observed on the map. The project area itself is sparsely inhabited. However, dots that represent habitation to the north and the east of the project area, concentrated near Keanuʻimanō (noted as Waiaka) Stream can be seen. Cattle pens can be observed throughout the map, especially south of the project area, with immediate areas being northwest and north of the Waiaka Bridge. A boundary marker is noted just northwest of the project area.

Figure 29 is a 1932 map of the Kamuela-Mahukona Road alignment (Registered Map 2930), which predates Kawaihae Road (Highway 19) and Kohala Mountain Road (Highway 250). The northern portion of the Waiaka Bridge project area was government-owned by the Territory of Hawaiʻi and consisted of cattle pens north and northwest of the fork. As previously mentioned, the eastern portion of the Waiaka Bridge project area is part of Land Grant 662 to Kaimakui. The proposed staging area east of the Waiaka Bridge is situated on government land as well. Just east of the staging area are several pens north and south of Kawaihae Road owned by Samuel F. Lindsey. A demarcation of an unnamed old road that runs parallel to Kawaihae Road can also be observed. The Keanuʻimanō Stream is *mauka* of the unnamed road before it disappears between the proposed staging area and a portion of *LCAw*. 589 to James Fay and reappears again south of the Waiaka Bridge project area.

Figure 30 is a portion of a 1939 map by C.L. Murray (Registered Map 2993). A cattle pen that was previously noted in Figure 26 north of the Waiaka Bridge project area is present. However, the cattle pen northwest of the Waiaka Bridge project area is reduced to east and south-facing walls. Additional pens north of the project area that were not previously noted in maps are clustered near the confluence of Haleaha and Kohakohau Streams. Between Haleaha and Kohakohau Streams and just east of the confluence, a "large rock" is noted.

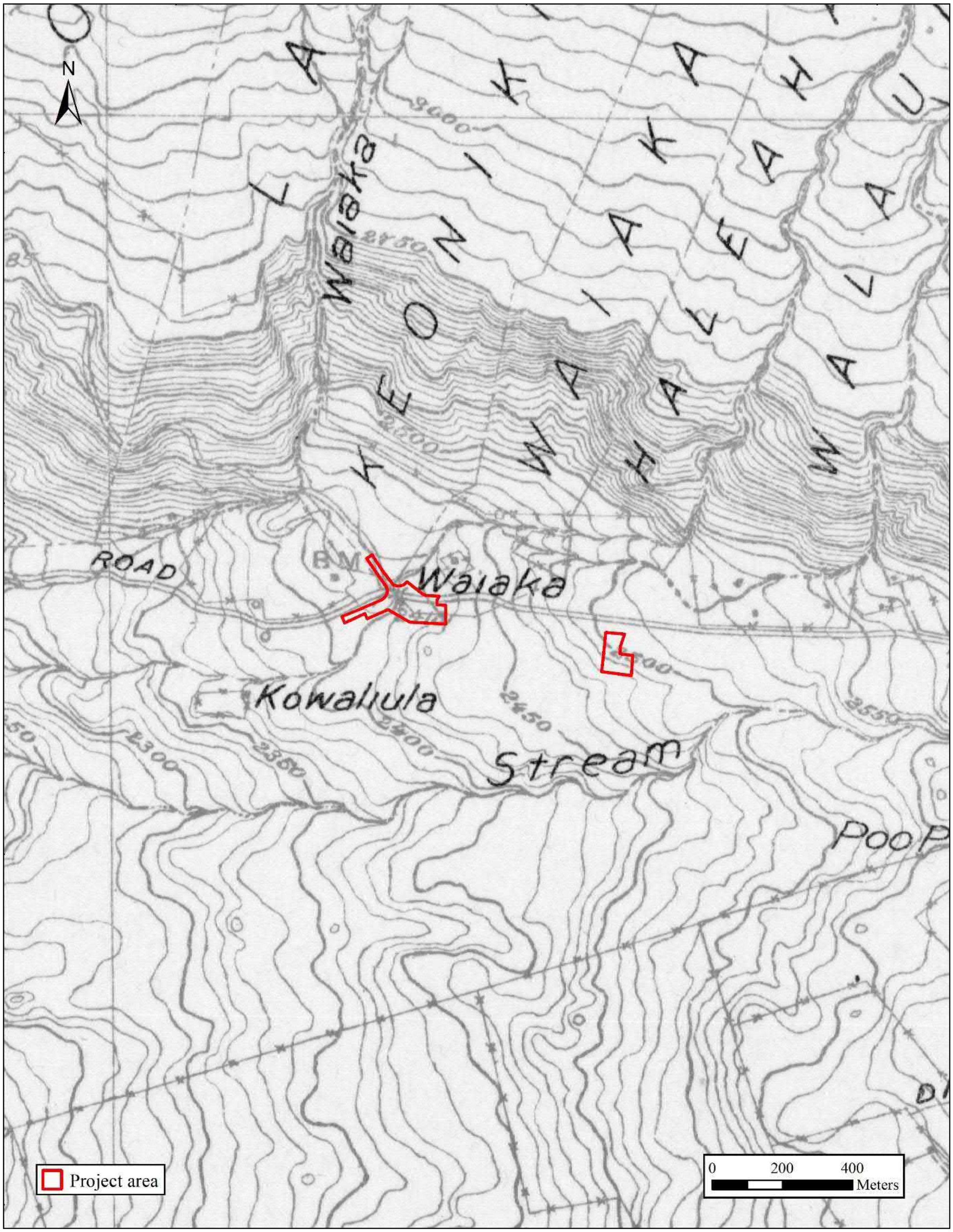

Figure 25. Portion of a 1930 USGS Kamuela Quadrangle with project area (in red).

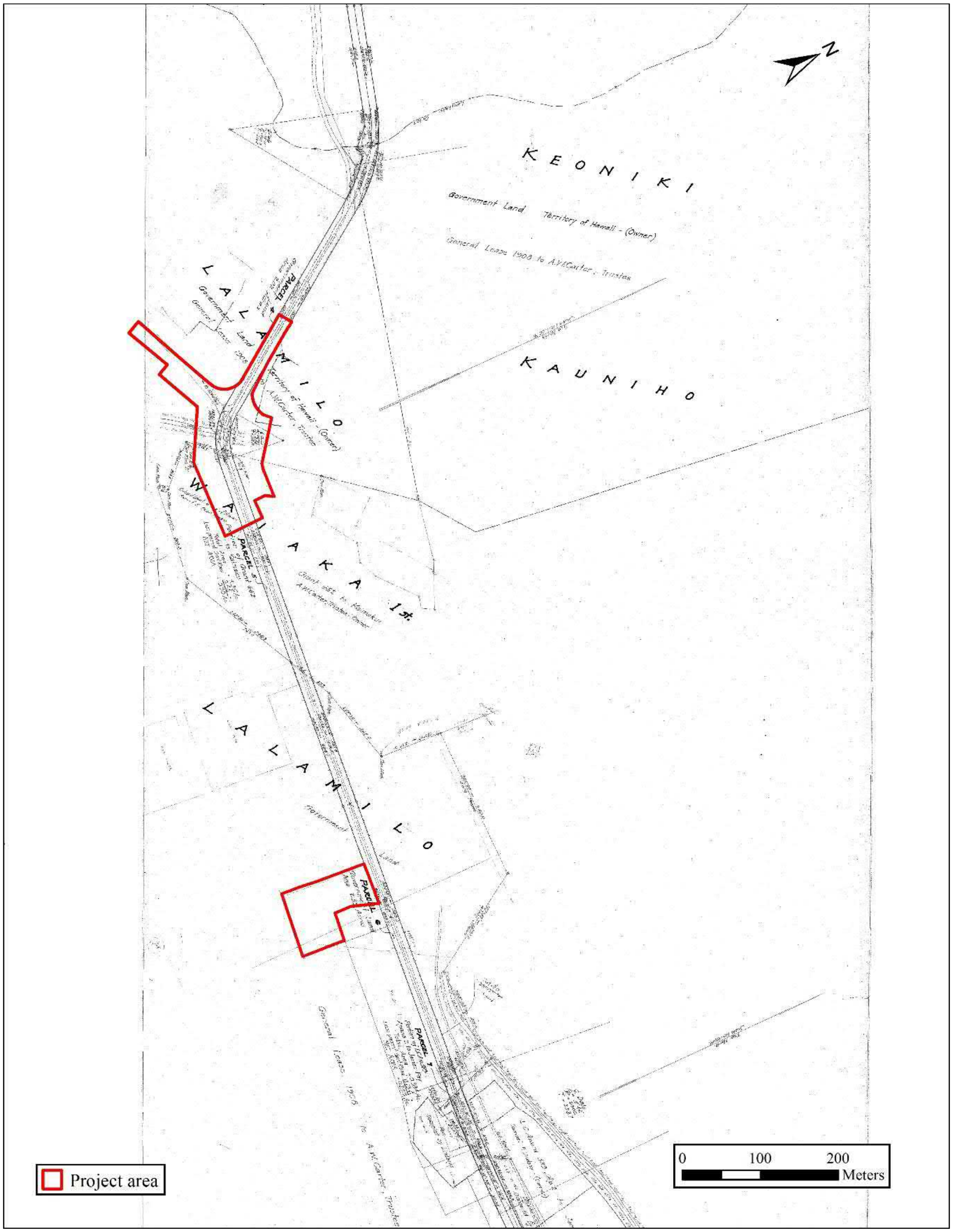

Figure 26. Portion of a 1932 map by C. L. Murray (Registered Map 2930) depicting the alignment of present-day Kawaihae Road (Highway 19) to Kohala Mountain Road (Highway 250) intersection (previously known as Kamuela-Mahukona Road) with project area overlay.

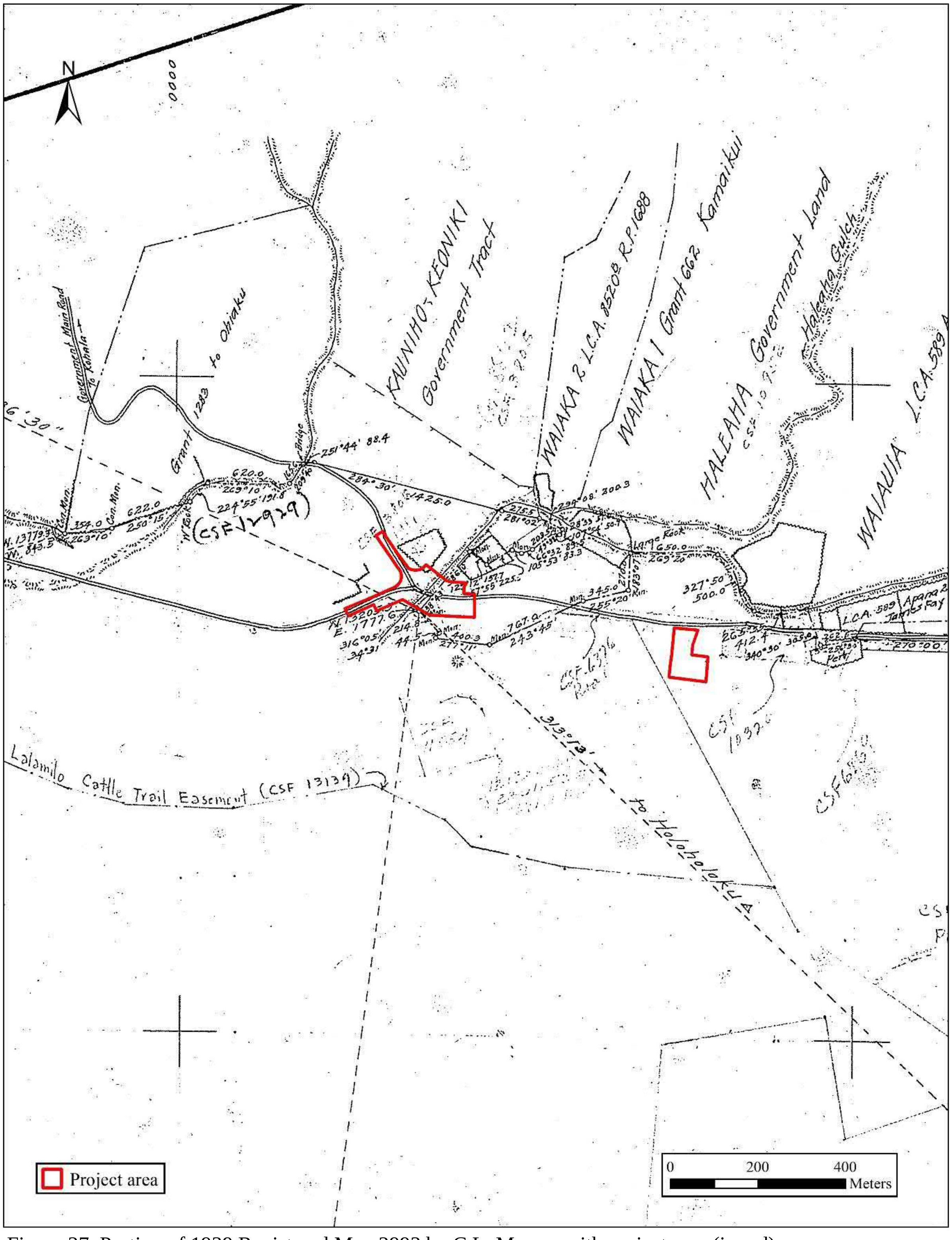

Figure 27. Portion of 1939 Registered Map 2993 by C.L. Murray with project area (in red).

World War II, the Establishment of Camp Tarawa, and Post-War Changes

With the onset of World War II, the population of Waimea would drastically expand. Beginning in 1941, months before the bombing of Pearl Harbor, the United States Army established an infantry headquarters in the Puʻukapu area of Waimea (Bergin 2006) with the majority of the infrastructure located along the south side of Waikōloa Stream. After the United States formally entered WWII, the earlier Army presence in Waimea expanded into one of the largest multi-force (adding the Navy and Marines) U.S. military camps (Camp Tarawa) and training bases in the Pacific. Large areas of the town and the surrounding pastures were turned over to the U.S. Government for campsites that housed approximately 20,000 soldiers and as firing ranges for training U.S. Marines (Brundage 1971).

Maps indicate former locations of infrastructure and facilities including buildings and roads. By spring of 1946, the work to dismantle the camp was underway. The following article published in the Honolulu Star-Bulletin on March 15, 1946, described the dismantling process:

> KAMUELA, Hawaii—The job of dismantling Camp Tarawa, where two marine divisions lived and trained for some of the Pacific war's bloodiest battles, will be completed within the next few weeks.
>
> The 440 acre camp site, which the navy leased for $1 a year, will be returned to its owner, the Parker ranch. The buildings, including the Quonset huts used as warehouses and galleys, are being sold to the highest bidder. Bids close Saturday.
>
> Most of the buildings and equipment are being purchased by ranches and plantations. There is also a ready market for what lumber there is…
>
> It is just one year ago tomorrow that marines who trained here subdued the Japanese garrison on Iwo Jima and declared the island secured. (Beech 1946:4)

Within a year of the Japanese surrender, the U.S. Military had all but left the town, and life in Waimea soon returned to its small pre-war population that was largely dependent upon the cattle industry. By the 1950s, nearly all of the camp buildings had been removed and all that remained of Camp Tarawa was the network of roads and few isolated buildings. The small town of Waimea continued to grow during the rest of the 20th century. Although Camp Tarawa was southeast of the project area and already dismantled, Figure 28 depicts the quiet ranching town. Several homes can be observed at the fork between Kawaihae Road and Kohala Mountain Road and just north of the project area. The alignment of streams is also noticeable based on contours and surrounding vegetation. A cattle pen and home stand between the Waiaka Bridge project area and proposed staging area. Further east of the staging area is a cluster of homes. The cattle pen that was previously shown in drawn maps (see Figure 26 and 30) is faint along with terracing just east of Waiaka Stream.

Throughout the 1960s and 1970s, development in Waimea began to increase and the town center expanded. By the 1970s, the Parker Ranch Center had been built, further illustrating the continuing urbanization and increasing community infrastructures such as cemeteries, parks, schools, and the expansion of first responder infrastructure such as a fire department. Figure 29 illustrates the boom in development from the previous aerial (see Figure 28), which was taken 23-years before. Some of the biggest changes within and in the vicinity of the project area are the number of homes that can be observed along Kawaihae Road. To the north of the project area the cattle pen that was previously observed in Figures 26, 30, and 28 is no longer present and has been replaced by a roadway and home. The Hawaiʻi Prepatory Academy (HPA) campus has been constructed with a series of buildings to the north of the project area and a track adjacent to Kohala Mountain Road. In 1957, two Honolulu firms agreed to help finance the new 55-acre campus at the foothills of the Kohala Mountains (Hawaiʻi Prepatory Academy n.d.). The Waimea Transfer Station can also be observed between the two project areas along with cultivated fields south of Waikoloa Stream. Figure 30 is a portion of a 1985 aerial which depicts more homes constructed west of the Waiaka Bridge project area, heading *makai* towards Kawaihae.

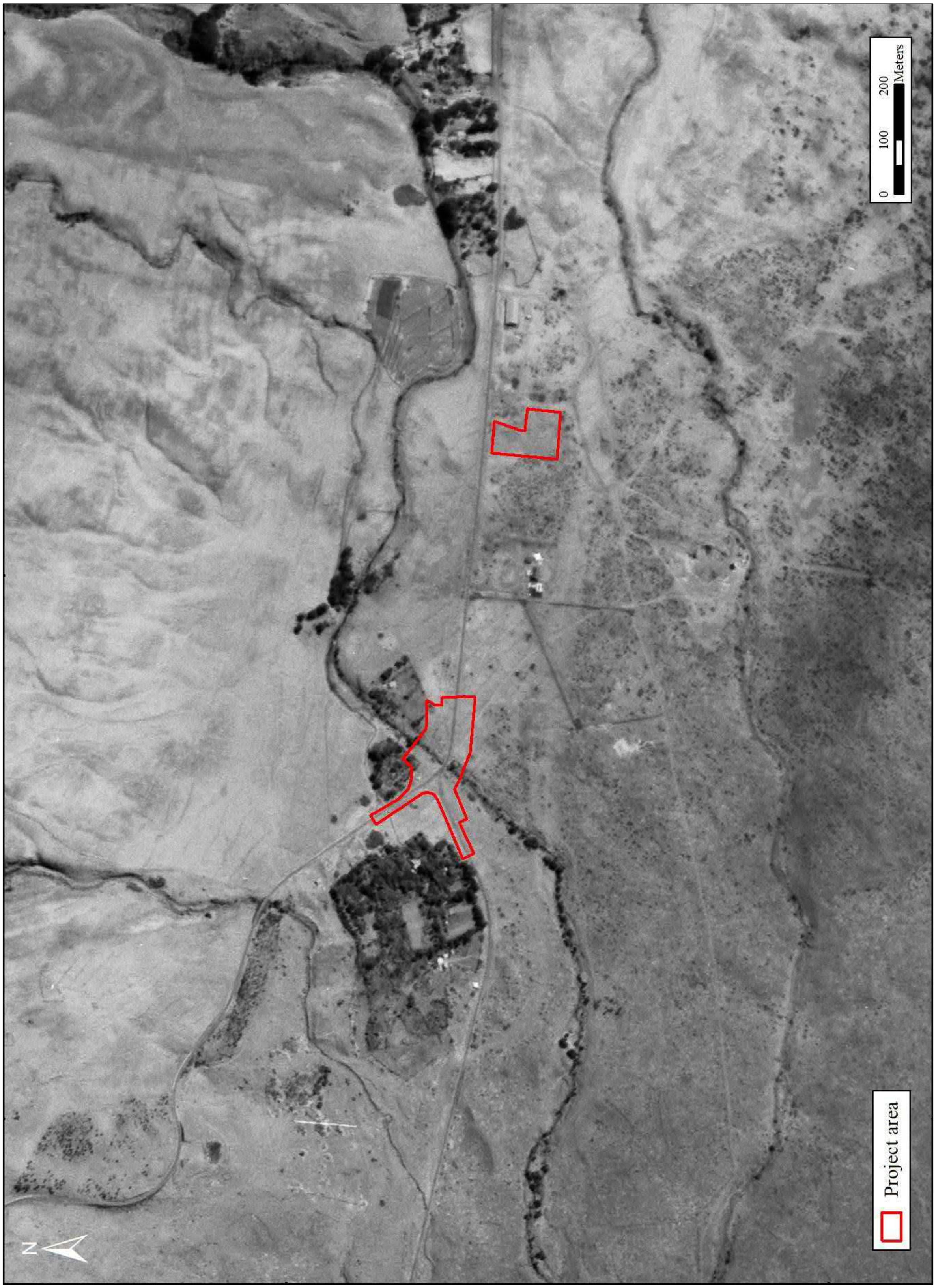

Figure 28. A portion of a 1954 aerial with project area (in red).

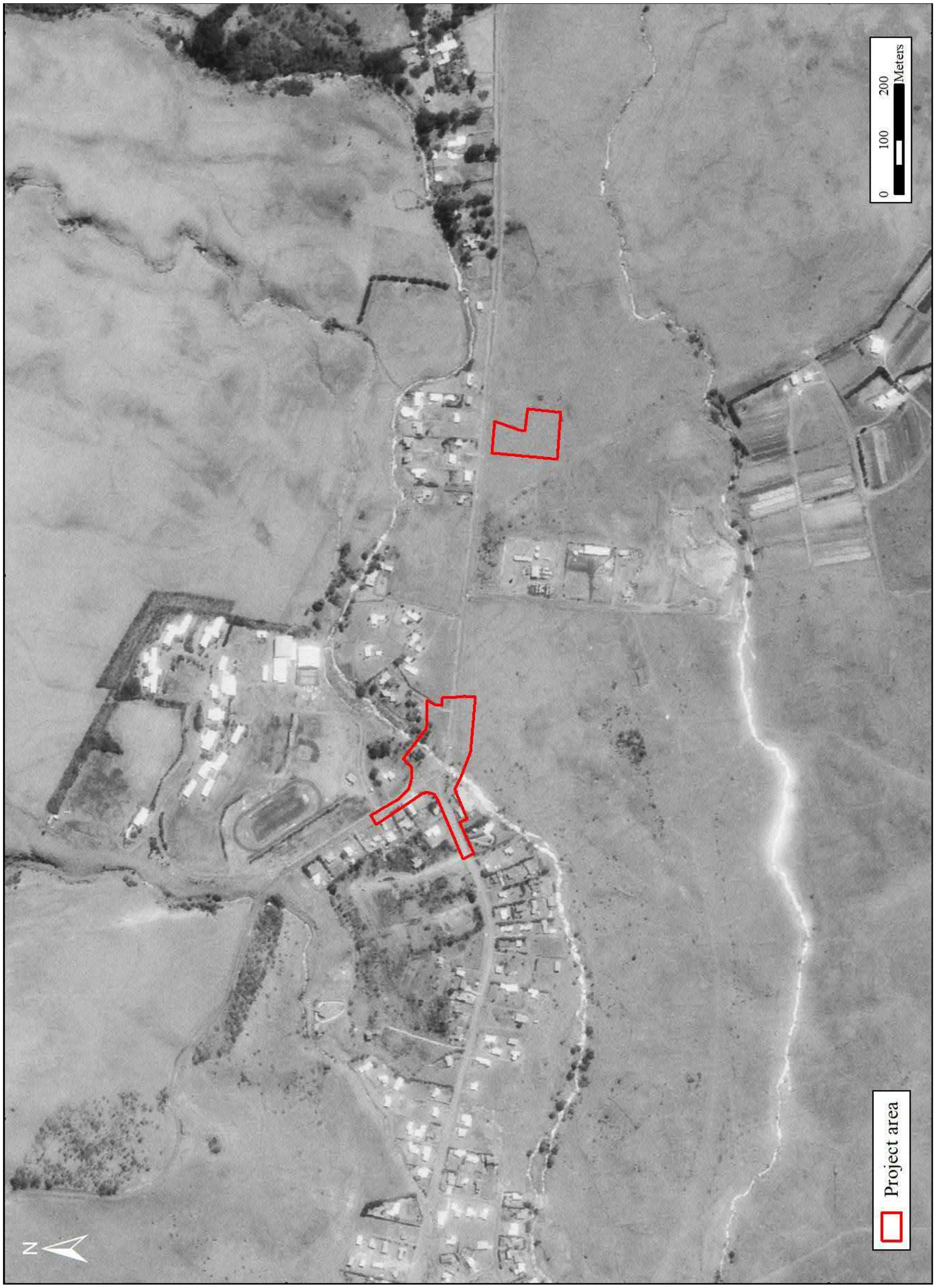

Figure 29. A portion of a 1977 aerial with project area (in red).

Figure 30. A portion of a 1985 aerial with project area (in red).

PRIOR STUDIES

Most of the previous archaeological and cultural studies have been conducted near the center of Waimea town or have focus specifically on the Lālāmilo agricultural field system, a large complex of Precontact agricultural features and associated habitations that were used into Historic (Barrera and Kelly 1974; Barrera 1993; Ching 1979; Clark 1981a; Clark 1987; Clark et al. 1990; Hammatt and Shideler 1989; Haun et al. 2003; Rechtman 2000). Features identified within the Lālāmilo field system include terraces, mounds, enclosures, field boundaries (*kuaiwi*), irrigation ditches (*ʻauwai*), stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond field, and various other miscellaneous types (Haun et al. 2003). Areas associated with the Lālāmilo field system were later utilized for military training and cattle ranching, with sites and features relating to those repurposed functions being interspersed with the Precontact agricultural fields and habitations. Figure 31 depicts previous archaeology conducted within and in the vicinity of the project area (as outlined in red). Table 2 lists historic properties found within the current project area. Table 3 lists these previous studies.

In 1985, Paul H. Rosendahl, Ph.D., Inc. (PHRI), conducted an archaeological reconnaissance survey for the Kawaihae Reservoir No.1 Site on a portion of TMK (3) 6-6-001:005, in the vicinity of the proposed staging area (Rosendahl 1985). No historic properties were encountered on the surface and no further work was recommended.

Cultural Surveys Hawaiʻi (CSH) conducted an archaeological reconnaissance survey of approximately 50-acres in Lālāmilo Ahupuaʻa within TMK (3) 6-6-001:54 and (3) 6-6-006:001 (Hammatt and Borthwick 1986). The survey area is bounded by Kawaihae Road (north), Keanuʻiʻmanō Stream (south), Lālāmilo house lots (east), and the confluence of Keanuʻiʻmanō and Lanikepu Streams. During the reconnaissance, eight sites were encountered including the Keanuʻiʻomanō Pondfields, a wall with midden scatter, an enclosure, a historic pipeline, two mounds, a wall, rectangular enclosure, and the Lanikepu Agricultural terraces. The survey occurred in the vicinity of Kawailiula, one of three major settlements in the Waimea area during the 1820s (Hammatt and Borthwick 1986:6-7). Further investigation and consultation with SHPD were recommended.

In 1988, CSH conducted an AIS with subsurface testing on a 12-acre parcel for the expansion of the Lālāmilo House lots subdivision near the confluence of Keanuʻiʻmanō and Lanikepu Streams (Hammatt et al. 1988). Seven archaeological sites were documented including terraced fields, mounds with enclosing walls, habitation enclosure, and miscellaneous features, which were then interpreted as a habitation and agricultural complex (Hammatt et al. 1988:i). Surface scatter of midden and volcanic glass were recovered near Site 2, the mounds with enclosing wall. Excavations at Site 2 yielded fragments of cowrie, *kukui* (candlenut; *Aleurites moluccana*), charcoal flecks, basalt flakes, a possible anvil stone, and more volcanic glass (Hammatt et al. 1988:26-31). Site 5, which included disturbed two mounds indicative of agricultural use, was excavated. While no cultural material was found, there was a widely dispersed area of charcoal flecks where charcoal and ash samples were taken (Hammatt et al. 1988:31). Site 9, an oval enclosure consisting of a single course of upright stones, was also subject to excavation that revealed an A-horizon with sparse charcoal flecking, basalt pebbles, sparse midden, ash, and charcoal. It was determined that Site 9 was used for habitation. Site 10, a rock-faced terrace wall associated with Site 2 was also subject to excavation, which revealed a C-horizon. No cultural material was present indicating an agricultural function (Hammatt et al. 1988:35-36). Site 11, a low rectangular walled enclosure with upright stones, was noted to have probably been higher once in time. However, with cattle roaming the area combined with rock robbing, the walls were most likely reduced to their present state. The interior was noted to be level with soil. Trenching at Site 11 revealed a hearth feature with sparse midden, a pig bone, volcanic glass, and charcoal flecking that was recovered for carbon dating (Hammatt et al. 1988:36-44). Site 12 is a triangular-shaped feature associated with Lanikepu Stream that consists of northern and western boulder alignments (Hammatt et al. 1988:44). The site was also excavated, which yielded an A-horizon with charcoal flecks followed by a C-horizon in stratum III with water-rounded gravel (Hammatt et al. 1988:45). A total of 294 artifacts were recovered from Sites 2, 9, and 11. A single historic-era artifact—a glass bottle fragment from Site 9—was found. The remaining 293 artifacts were from the precontact-era with the bulk of pieces being volcanic glass (flakes, cores, retouched flakes, and a core) followed by basalt (flakes, adz flakes, abrader fragments, adz fragments, and a hammerstone) (Hammatt et al. 1988:46). Abraders included grindstone fragments, a burnishing stone, and a lava file. Marine-related artifacts included cut shells and coral files. The area was thought to be used for domesticated activities and possibly was the home or religious site to someone of high rank based on the presence of pig bone. No further was recommended except for Site 11, which garnered further consultation with SHPD.

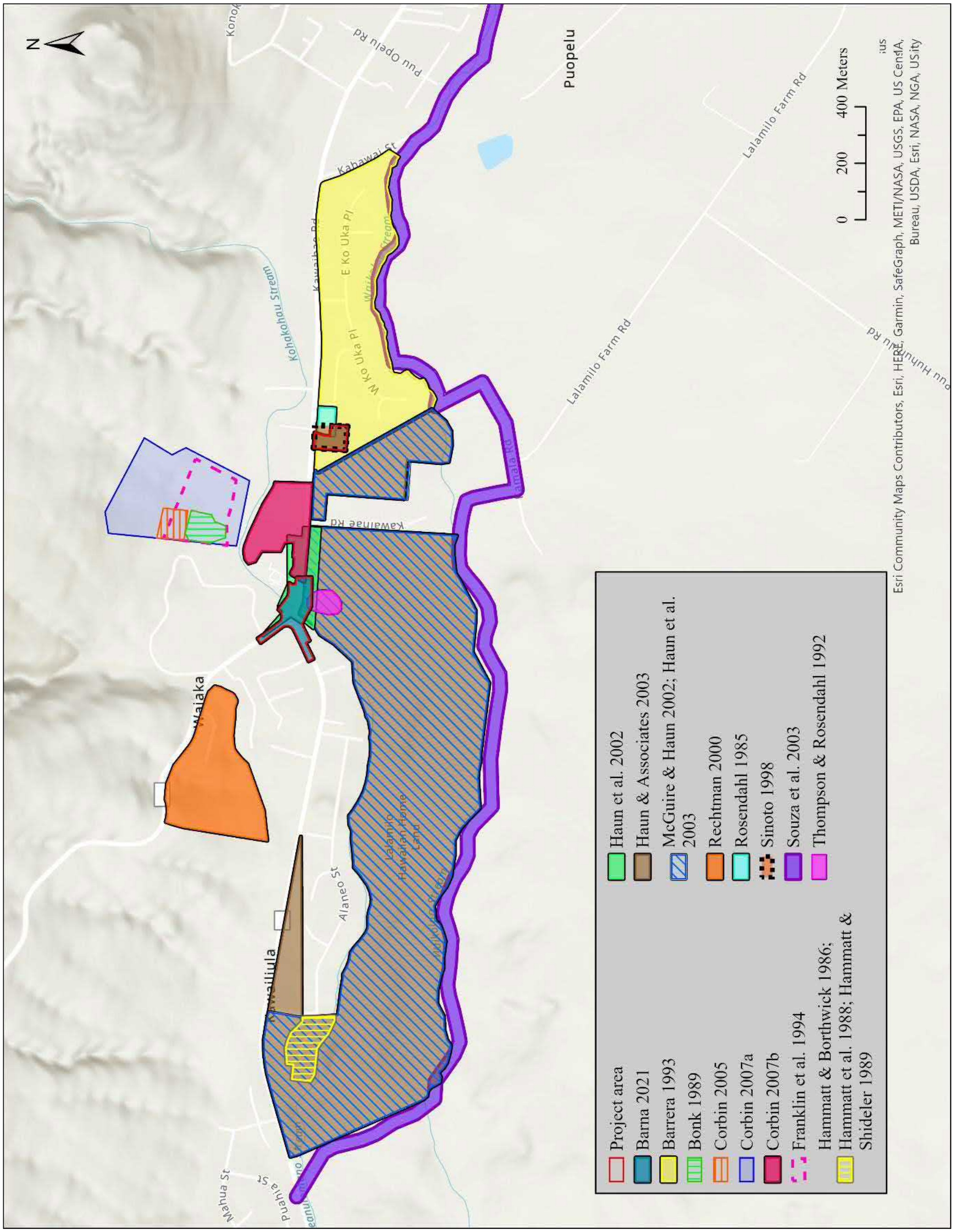

Figure 31. Previous archaeology conducted in the vicinity of the project area (outlined in red).

Additional archaeological investigations and excavations were conducted in May of 1989 by CSH based on fieldwork previously carried out by Hammatt et al. (1988) (Hammatt and Shideler 1989). An additional eleven trenches were excavated at Site 11, which yielded an additional 336 artifacts. Again, only one historic artifact was found, which was a single .42 caliber bullet casing that was noted of having no relation to the site's function (Hammatt and Shideler 1989:8). They were able to conclude that Site 11 was not used for historic habitation as features predated 1820. Approximately 45% of the artifacts were basalt waste flakes. One basalt core was a water-rounded cobble thought to be from Keanuʻiʻmanō Stream, approximately 80 meters south (ibid.). Other artifacts collected include volcanic glass flakes, a coral saw, four coral files, a worked dog bone, and a gourd fragment (Hammatt and Shideler 1989:10). Midden collected at Site 11 range from mollusks, crabs, sea urchins, a variety of reef fish, chicken bones, *nēnē* (Hawaiian goose; *Nesochen sandvicensis*), the extinct Hawaiian Rail (*Porzana sandwicensis*), pig bones, dog bones, rat bones, and *kukui*. Carbon dating was available for Hammatt et al. (1988) and Hammatt and Shideler (1989), which yielded an early date of 1205 AD (Site 5) and a modern date of 1950 AD (Site 2 and 11) (Hammatt and Shideler 1989:26). No recommendations or mitigation measures were available.

The University of Hawaiʻi at Hilo conducted an archaeological reconnaissance survey in 1988 northeast of the current Hawaiʻi Preparatory Academy (HPA) campus and northeast of the current project area (Bonk 1989). The HPA study area is located within Field Complex #1 as defined by Clark and Kirch (1983). Historic properties encountered include varying sizes of agricultural terraces, however, no *ʻauwai* or habitation structures were observed during the survey. Archaeological data recovery and additional mapping of the agricultural terraces were recommended prior to construction.

Barrera (1993) conducted an archaeological inventory survey (AIS) of a 50-acre property that became the Sandalwood Estates subdivision, which is in the vicinity of the proposed staging area. During that survey, thirty-three earthen field ridges were recorded as Site 50-10-06-14948, which Barrera associated with Field Complex #2 of the Waimea Agricultural System.

In 1994, PHRI conducted an AIS for the HPA expansion, which is northeast of the current project area (Franklin et al. 1994). Fieldwork yielded seven sites spanning from Site 50-10-06-19643 to -19649, which were associated with agriculture and habitation (specifically a water channel, cemetery, terrace, concrete foundation, and alignment). Two sites were determined to be significant: Site 19648, a historic habitation terrace; and Site 19649, a cemetery with an associated feature.

Table 2. Previously recorded historic properties within current project area

SIHP Site No.	***Type***	***Function***	***Age***
16095	*ʻAuwai* System	Agriculture	Precontact
22632	Complex	Agriculture	Precontact
23313	Concrete Foundation	Stream monitoring	Historic
29221	Waiaka Bridge	Transportation	Historic

In 2000, Rechtman Consulting, LLC conducted a supplemental AIS for TMK (3) 6-2-001:091, located northwest of the current project area (Rechtman 2000). The supplemental AIS assessed previously documented historic properties and encountered one new historic property—Site 50-10-06-18579, a historic trash dump. In addition, new agricultural features of Site 50-10-06-18581, a Precontact agricultural complex previously identified by Barrera (1994).

In 2005, PHRI conducted an AIS on a five-acre parcel for HPA's Faculty Housing Complex-Phase III project (Corbin 2005). No new archaeological sites were identified during the surface survey, and it was determined that the area was modified by previous ranching activities. Eight trenches were placed throughout previously identified Site 50-10-06-19646, agricultural terracing, where three radiocarbon samples were recovered from trench walls. The samples yielded dates spanning from 1440 AD to 1950 AD (Corbin 2005:33). No cultural matrices, subsurface features, or other cultural remains were discovered during the survey. As a result, no further archaeological work or preservation was recommended.

PHRI conducted another AIS on the HPA campus for the proposed K-8 Campus (Corbin 2007). During the surface survey of the 16-acre parcel, nine sites were identified including a historic boundary wall, historic ranching walls, a Precontact to Historic sharpening station, a *kuaiwi* (long, straight) wall, a mound, a buried vault with a canoe, and two rectangular ditches with unknown functions. All sites were assessed as significant for information content (Criterion d). A temporary number was assigned to Site 2618-7, a rock mound enclosed by a white wooden fence. Based on community input, it was thought that the mound may cover the entrance of a cave, which allegedly contained a

Precontact canoe and human burials (Corbin 2007:41). A portion of a coconut shell was observed on the mound. At the north-central portion of the mound was an oval arrangement of large boulders that appeared to cover an entrance. After removing the stones, a vault with a Prehistoric or Historic canoe was found. The rounded stern of the canoe faced the opening of the vault, which blocked further entry. Visual inspection of the vault revealed stacked boulders, two slabs laid east-west, and smaller cobbles that outlined the roof and western portion of the vault. The canoe was measured at 0.4 meters wide, 0.4 meters high, and approximately 2.0 meters in length. The condition was broken and deteriorated on the bow, but otherwise considered in fair shape. A small, unidentifiable bone fragment was located near the stern of the canoe. As a result, Site 2618-7 was assessed under Criterion c (excellent example of a site type) and e (cultural value) (Corbin 2007:51). The site was already protected (fence and landscaping) and no further protection was deemed necessary. No further archaeological work was recommended.

Previous Studies Conducted on the Subject Parcels

In 1992, PHRI conducted an AIS for the potential North Hawaiʻi Community Hospital, which consisted of seven proposed sites. One of the proposed sites was located within the Waiaka Bridge project area (Thompson and Rosendahl 1992). The AIS further documented Site 50-10-06-16095, an *ʻauwai* system, near the project area. Archaeological monitoring was recommended.

Aki Sinoto conducted an archaeological assessment on a 2.33-acre parcel (TMK (3) 6-6-001:011) for the proposed location of Kingdom Hall for the Kamuela Congregation of Jehovah's Witnesses (Sinoto 1998). The parcel was used as pastureland for horses and was bounded by Kawaihae Road (north), Kawaihae Reservoir No. 1 Site (east), and pastureland (south and west). The parcel is situated in the vicinity of Complex 2 of the Waimea Agricultural System as defined by Clark (1983). It was noted that ranching activities and road construction may have adversely impacted the area as no archaeological remains were present. No subsurface was warranted for the subject parcel, however, archaeological monitoring during construction-related subsurface work was recommended to address any inadvertent findings.

With respect to an earlier iteration of the current project, an archaeological inventory survey was conducted in 2002 and revised in 2012 for TMKs: (3) 6-5-001:033 (por.), 6-6-001:077 (por.), and 6-6-004:001 (por.) by Haun et al. (2002), which encompasses a portion of the project area. Fieldwork consisted of a 100% pedestrian survey of the project area; no subsurface testing was conducted. During the AIS four sites were found. Site 22632 consisted of a large agricultural complex with 700 features. The other three sites include an irrigation ditch (Site 23312), a concrete foundation within Keanuiomano Stream (Site 23313), and the existing Waiaka Bridge (Site 29221). All sites were assessed significant under Criterion "d" as the sites yield important information pertaining to late prehistoric to historic land use. Site 22632 was also assessed under Criterion "a" for its associated broad pattern of traditional and early historic agricultural intensification in Hawaiʻi; and "c" as a well-preserved example of an agricultural field complex. The Waiaka Bridge was determined by SHPD to be eligible for listing in the National Register of Historic Places (NRHP) under Criterion "C." No further work or preservation measures were needed for Site 23313. The Waiaka Bridge was recommended for data recovery, which consisted of documenting the bridge in accordance with Historic American Engineering Record (HAER) guidelines. Sites 22632 and 23312 were recommended for data recovery if the sites were to be impacted by road improvements. Six alternatives were proposed for replacing the bridge, realignment approaches, and intersection were under consideration by the State of Hawaiʻi Department of Transportation (HDOT). Site 22632 would be impacted by Alternatives 2, 3, 3A, 4, and 5 but not by Alternative 1. Site 23312 was outside of the proposed development and would not be impacted by any of the alternatives. It was recommended that all ground-disturbing activities be monitored by an archaeologist, which was to be outlined in an Archaeological Monitoring Plan prepared for DLNR-SHPD review and acceptance.

Haun & Associates conducted a cultural impact assessment for the proposed DHHL Lālāmilo on TMKs (3) 6-6-001:010, 054, and 077; and (3) 6-6-004:012 to 017 (McGuire and Haun 2002). The proposed DHHL lands were primarily utilized as pastureland where a portion was leased by Parker Ranch for grazing until the mid-20th Century. Interviews were conducted with *kūpuna* of Waimea including Hisao and Yutaka Kimura, Radcliffe Greenwell, Helen Aveiro, Elizabeth Lindsey Kimura, Mrs. Nobriga, Allen Lindsey, Ethel Andrade, Kū Kahakalau, and an anonymous interviewee. Interviewees recalled the proposed DHHL Lālāmilo lands formerly being pasture lands and that the property was also used for military activities during WWII. It was also the location of a Historic dump. It was relayed that most of the *kamaʻāina* and *kūpuna* familiar with that particular area have moved way or passed away and obtaining further information may be futile. McGuire and Haun (2002) recommended cultural monitoring for all ground disturbing activities and that all burials identified would be preserved in place.

In 2003, Haun & Associates conducted an AIS for the proposed DHHL Lālāmilo Residential Development, which included TMKs (3) 6-6-001:010, 054, and 077; and (3) 6-6-004:012 to 017 (Haun et al. 2003). Approximately 266.4-

acres were surveyed, and 76 sites with 819 features were identified. Subsurface testing occurred at 33 features of 24 sites (Haun et al. 2003:ii). Feature types included terraces, mounds, enclosures, field boundaries, stone walls, *'auwai*, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and miscellaneous types. Functions included agricultural use, permanent and temporary habitation, burial, marker, military use, historic foundations, storage, and quarry. The various sites and features conformed to the site/feature types identified in Clark's (1987) Kula Zone in the Waimea-Kawaihae region based on previous archaeological work and research. Based on radiocarbon dating, artifact assemblages, and research, it was determined that the DHHL Lālāmilo survey area was subject to traditional Hawaiian habitation and utilization as early as the 1500s and continuing until at least the mid-1800s (Haun et al. 2003:ii). Military ordnance and impact craters were found throughout the DHHL survey area, which correlates with military training that was occurring in the area in the 1940s. Ranch-related infrastructure such as wire fencing, corrals, and water troughs were also observed and documented. The 76 sites were assessed as significant under Criterion "d," having yielded information important for understanding the late prehistoric to historic land use of the area. Nine sites were assessed as culturally significant (Criterion "e") due to the high probability of Hawaiian burials present, and six sites were additionally assessed as significant under Criterion "c" as a well-preserved site type examples that included an agricultural field complex, a historic cemetery, a basalt quarry, and three permanent habitation sites. Site 50-10-06-22632, an agricultural field complex, was also assessed as significant under Criterion "a" due to its association with broad patterns of traditional and historic agricultural intensification. Further documentation (i.e., mapping, detailed descriptions, photography, test excavations) occurred at seven sites leading to a no further work needed recommendation. The nine burial sites and six sites assessed for example of types were recommended for preservation. Portions of Site 22632 were preserved in two clusters. (SHPD concurred via letter on March 17, 2003; Log No: 31682, Doc No: 0302PM02). Subsequently in 2003, Haun & Associates prepared an interim archaeological preservation plan for the DHHL residential development at Lālāmilo (Haun & Associates 2003) for the sites recorded during their 2003 AIS.

CSH conducted a cultural impact assessment for a six mile portion of the proposed Waimea Trails and Greenway Project Route (Souza et al. 2003). The proposed trail route was adjacent to Waikōloa and Keanuiomano Streams within TMKs (3) 6-2, 5, and 6. Formal interviews were conducted with Melvin Hewett, Hisao Kimura, Alan Lindsey, and Lynn Taylor who expressed concern about climate change and lack of water within the stream beds but did not feel that the proposed Waimea Trails and Greenway Project would impact the streams. The study revealed that the proposed trail would traverse agricultural, habitation, and burial sites. Consultation did not identify any active cultural practitioners associated with the trail alignment and/or any on-going traditional cultural practices occurring. Souza et al. (2003) did not provide any specific mitigation measures but did point out the presence of historic properties and the likelihood of finding cultural material during the construction of the trail.

In addition to the archaeological study, Section 106 consultation was conducted for the Waiaka Bridge replacement project in 2011 and 2012 (FHWA 2012). This included public notices in the *Honolulu Star-Advertiser*, *West Hawaii Today*, and *Hawaii Tribune*. Groups and individuals consulted included Pua Aiu, Administrator of DLNR-SHPD; Kimo Lee, Chair of the Hawaii Island Burial Council (HIBC); Keola Lindsey of the Office of Hawaiian Affairs (OHA); Jeffrey Fujimoto of the DHHL; Katie Kissling of the Hawaii Historic Foundation (HHF); Halealoha Ayau of Hui Malama I Na Kupuna O Hawaii; Mr Hugh "Buttons" Lovell and Ms Leimana Damate of the Aha Kiole Advisory Committee, Aha Moku; Waimea Hawaiian Civic Club (WHCC), Kaena Peterson and Maulili Dickson of the South Kohala Civic Club (SKCC) ;and Ms. Nicole Lui. Among the information shared by consulting parties was a perception that Waiaka Bridge appears to span a portion of Keanu'i'omanō Stream that is not ideal for the concealment of *iwi* and that *iwi* are located further *mauka* above Hawaii Preparatory Academy and further south. Generally, Keola Lindsey (OHA) commented that OHA was comfortable with the level of effort taken to identify historic properties of significance to the Hawaiian People within the 2012 APE. With respect to the proposed replacement of Waiaka Bridge, some respondents were in favor of replacment. Kiersten Faulkner of the Historic Hawaii Foundation concurred with the NRHP eligibility determination and the "adverse effect" determination for the replacement project.

An archaeological data recovery report for the DHHL Phase II Lālāmilo Residential Subdivision, which includes a portion of the current project area, was conducted by SCS in 2012 (Escott 2019). Data recovery was conducted at twenty-one sites within the DHHL Lālāmilo project area (TMKs 6-6-001:077 and 6-6-012:022). The AIS Haun et al. (2002) interpreted sixteen of the sites as permanent habitation sites. The mitigation plan called for data recovery for fourteen of the permanent habitation sites, while two sites were mapped and recorded. Site 22632 data recovery focused on recording feature construction, base of architecture, and determining feature function and temporal association via artifact collection and radiocarbon dating. (Escott 2019) reported two radiocarbon dates for the *'auwai* feature of Site 22632: A.D. 1660 and A.D. 1810. No other sites from the Haun et al. (2002) AIS were included in the data recovery report.

ASM conducted a Section 106 Historic Properties Assessment (Barna 2021) of the current project area. The condition of the project area was compared to the results of. Generally, the results were the same as those reported in the prior AIS (Haun et al. 2002), and archaeological monitoring during construction was still recommended. Features of the agricultural site (Site 22632) were identified to be entirely outside of the Kawaihae Right-of-Way (ROW). The concrete foundation (Site 23313) was deemed to be in similar condition as was reported in 2012. A new stream gauge was observed to have been installed on the foundation. With respect to the status of architectural mitigation for the Waiaka Bridge, it was reported (Barna 2021) that there were no major changes in terms of character defining qualities, and that the mitigation measure (HAER documentation) remains outstanding.

Table 3. Previous archaeological and cultural studies conducted in the vicinity of the current study area.

Year	*Author(s)*	*Type of Study*	*Ahupua‘a*
1985	Rosendahl	Archaeological Reconnaissance	Lālāmilo
1986	Hammatt and Borthwick	Archaeological Reconnaissance	Lālāmilo
1988	Hammatt et al.	Inventory Survey	Lālāmilo
1989	Hammatt and Shideler	Supplemental Survey	Lālāmilo
1989	Bonk	Archaeological Reconnaissance	Lālāmilo, Kauniho, Waiaka 1st
1992	Thompson and Rosendahl	Inventory Survey	Lālāmilo
1993	Barrera	Inventory Survey	Lālāmilo
1994	Franklin et. al	Inventory Survey	Lālāmilo, Kauniho, Waiaka 1st
1998	Sinoto	Archaeological Assessment	Lālāmilo
2000	Rechtman	Supplemental Inventory Survey	Lanikepu
2002	Haun et al.	Inventory Survey	Lālāmilo, Kauniho, Waiaka 1st, Waiaka 2nd
2002	McGuire and Haun	Cultural Impact Assessment	Lālamilo
2003a	Haun et al.	Inventory Survey	Lālāmilo
2003b	Haun et al.	Inventory Survey	Lālāmilo
2003	Souza et al.	Cultural Impact Assessment	Lālāmilo, Waikōloa, ‘Ōuli
2005	Corbin	Inventory Survey	Lālāmilo, Kauniho, Waiaka 1st
2007	Corbin	Inventory Survey	Lālāmilo, Kauniho, Waiaka 1st
2019	Escott	Data Recovery	Lālāmilo
2021	Barna	Archaeological Reconnaissance	Lālāmilo, Kauniho, Waiaka 1st, Waiaka 2nd

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC (1997) *Guidelines for Assessing Cultural Impacts*, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

SCOPING AND INTERVIEW METHODOLOGY

To identify individuals knowledgeable about past and ongoing customary and traditional cultural practices associated with the current project area, efforts were made by ASM staff to contact sixteen individuals and/or organizations via mail and email. The names of those contacted for this project are listed below in Table 4. These individuals were identified as persons who were believed to have genealogical ties, long-standing residency, or knowledge of Lālāmilo, Kauniho, Waiaka 1st, Waiaka 2nd, and the greater Waimea District. Of the sixteen individuals and organizations contacted, four responses were received from Dr. Billy Bergin. Leningrad Elarionoff, Kuʻulei Keakealani, Nicole Lui, and Barbara Robertson. Dr. Bergin and Ms. Keakealani were interviewed via phone and their summaries can be found below. Mr. Elarionoff and Ms. Lui submitted email responses, which are provided below. A site visit to the HPA campus and interview summary with Barbara Robertson are forthcoming. Additionally, a public notice was submitted to the Office of Hawaiian Affairs (OHA) on August 11, 2021 for their monthly newspaper, *Ka Wai Ola*. The notice was published in the September 2021 edition of *Ka Wai Ola* and a copy of the notice has been included in Appendix A of this report. As of the date of the current report, no responses have been received from the public notice.

While interviews for CIA's are typically held in person and sometimes accompanied by a site visit, in light of the COVID-19 pandemic and state social distancing recommendations, interviews were conducted via phone. ASM staff provided the potential interviewees with information about the nature and location of the proposed project and the scope of the current project area. The potential interviewees were informed that the interviews were voluntary and that they would be given an opportunity to review and edit their interview summary before inclusion in this report. With their consent, ASM staff then asked questions about their background, their knowledge of past land use, and the history of the project area, as well as their knowledge of any past or ongoing cultural practices. The informants were also invited to share their thoughts on the proposed development and offer mitigative solutions. Below are the interview summaries that have been reviewed and approved by the consulted parties.

Table 4. Persons Contacted for Consultation

Name	*Affiliation*	*Initial Contact Date*	*Response*
Cachola, Fred	ʻAha Moku Kohala Representiative	August 18, 2021	No
Tanimoto, Jojo	ʻAha Moku Kohala Representative	August 18, 2021	No
Anna Ranch Heritage Center		August 18, 2021	No
Bergin, Billy	Former Parker Ranch veterinarian, *kamaʻāina*	August 18, 2021	Yes, summary below.
Elarionoff, Leningrad	*Kamaʻāina*	August 18, 2021	Yes, feedback below.
Faulkner, Kiersten	Historic Hawaiʻi Foundation	August 18, 2021	No
KAHEA, the Hawaiian Alliance		August 18, 2021	No
Keakealani, Kuʻulei	*Kamaʻāina*	August 18, 2021	Yes, summary below.
Lui, Nicole	*Kamaʻāina*, descendant	August 18, 2021	Yes, feedback below.
OHA		August 18, 2021	No
Paniolo Preservation Society		August 18, 2021	No
Plunkett, Kamu	*Kamaʻāina*	August 18, 2021	No

Robertson, Barbara	*Kamaʻāina*	August 30, 2021	Yes
South Kohala Hawaiian Civic Club		August 18, 2021	No
Waimea Hawaiian Civic Club		August 18, 2021	No
E Mau Nā Ala Hele	Trails advocacy group	August 18, 2021	No

BILLY BERGIN

Dr. Billy Bergin spoke to ASM Affiliates staff, Ms. Nicole Ishihara via phone on August 19, 2021, for the cultural impact assessment regarding the proposed Waiaka Bridge replacement and road realignment project. Dr. Bergin was asked about his connection to the project area, if he knew of any past and/or ongoing traditional cultural practices within or in the vicinity of the proposed project area, and if he had any concerns about the project or could offer mitigation measures.

Born in Laupahoehoe in 1940, Dr. Bergin grew up in Hāmākua and Hilo. From the age of eight years old until he left for college, he began to spend more time working at the ranches that surround Mauna Kea. By the late 1950s, he had worked at most of the ranches around the island as a summer employee but continued to reside at Kūhiō Village in Waimea. In 1958, he left for Kansas to attend veterinary medical school and returned a decade later to practice veterinary medicine in Kona before moving back to Waimea where he served as Parker Ranch's veterinarian for twenty-five years. He also authored four books on the history of Parker Ranch.

As a resident of Waimea for over fifty years, Dr. Bergin has used the Waiaka Bridge and roadway many times as a mode of transportation. The bridge was used extensively to visit family and places in the Waimea and Kohala region as he has a passion for learning the early history of the area. Concerning the project area, Dr. Bergin shared three places of interest in the vicinity: the location of the first Catholic church in Waimea; the evolution of the Hawaiʻi Preparatory Academy (HPA); and the history of the Kamuela Museum.

Dr. Bergin shared that the first Catholic church in Waimea was built in the vicinity of the project area with assistance from Saint Damien, also known as Father Damien who is known for his missionary efforts with the leper colony at Kalaupapa, Molokaʻi. Many do not know that before his work on Molokaʻi, he spent several years on Hawaiʻi Island, which included time spent in the Kohala District. After Dr. Bergin had a conversation with resident Barbara Robertson whose family has a long-standing history in the area, Ms. Robertson believes the former Catholic church once stood within the HPA property (outside of the project area boundaries). She also mentioned that HPA built homes for their staff near Kawaihae Road and believes the church was either where the staff homes were or in the vicinity of the staff homes.

According to Dr. Bergin, the HPA campus is located to the north of the project area on land once owned by Parker Ranch. He stated that the school opened to the public in 1949 and was originally called Hawaiʻi Episcopal Academy and once occupied the grounds of St. James Episcopal Church on Kawaihae Road, east of the current project area. He added that when they acquired the current property, it became a place of significant expansion for the campus with the school eventually changing its name and becoming non-denominational. Dr. Bergin pointed out that the school was once heavy in horsemanship and polo, but the focus of the school has since shifted. Considered "the gem of schools within the Hawaiian Islands," he stated that the tuition is very expensive and often a deterrent for local families. However, in recent years the school has drawn in many international families and students. Since the COVID-19 pandemic, Dr. Bergin related that many families from the continental U.S. have since moved to Waimea, purchasing real estate and enrolling their children at HPA.

The last point of interest is where the Kamuela Museum stands, which is within the project area boundaries and immediately southwest of the Waiaka Bridge. Dr. Bergin shared that the museum was built by the Solomon family—a longtime Kohala family—and described the museum as a regional museum underscored by the ranching industry. He recalled the museum consisting of several rooms with an "eclectic collection" of Hawaiiana with "some modern things." For example, he recalled a 6-inch cord from a parachute being on display that was from Camp Tarawa as well as saddles and saddle parts.

Regarding cultural sites, Dr. Bergin knows of the *pōhaku* (stone) called Manaua being in the vicinity of the project area. Dr. Bergin shared that Parker Ranch staff would trek to the stone to leave offerings and conduct blessings, especially during droughts. He pointed out that Waimea is currently in a drought and that a recent brushfire in the region destroyed approximately 40,000-acres. In the past, he recalled elders in the area describing "The Great Fire," a large fire that occurred in the 1800s, which destroyed vegetation along the Mauna Kea mountains and forest reserve, but also the forested plains below. He pointed out that the devastation was so intense, that the trees never grew back on the plains. Dr. Bergin suggested speaking to Kuʻulei Keakealani, Pua Case, and/or Ms. Robertson for more details on Manaua.

Dr. Bergin pointed out that portions of the Kohala Mountain Road alignment were once an ancient foot trail that was converted to a horse and cattle trail and later into a wagon trail. As a resident of Lālāmilo, he can see remnants of the carriage road from his home. He added that the Kohala Mountain Road is considered a lifeline for residents who live further north such as Hāwī and Kapaʻau.

He also shared that if you look at the slope of the Kohala Mountains at the brow above Waiaka, the flat façade is known as Haleaha and from the brow descending *makai* (towards the ocean) were taro *loʻi* (terrace) that lead to the Waimea field system. The three waterways—Waikoloa, Waiaka, and Keanuimano (also known as Keanuʻiʻomanō)—that traverse the Waimea landscape were known to have been intensively farmed. Additionally, Waimea was known for its dryland agriculture in comparison to Waipiʻo Valley that was rich in wetland agriculture. When asked if the Waiaka Stream was intermittent or perennial, he considered it to be perennial because during severe droughts there might be some water in it. He also pointed out that during the 1960s, a comprehensive Federal project related to the Mauna Kea Soil Conservation District diverted a part of the Waikoloa Stream for flood control measures.

Regarding impacts to traditional cultural practices within or in the vicinity of the project area, Dr. Bergin does not believe the project will impact any cultural practices. Regarding recommendations and/or mitigation measures, he stated there have always been accidents and fatalities at the Waiaka Bridge intersection. He recalled the late Freddy Rice, a local rancher, owning the property on the right side before the bridge and being aware of the number of accidents that occurred there. When asked which direction where accidents occur the most, he stated when traveling from Kawaihae to Waimea (west to east); down from Kohala (north to south); and up to Kohala (east to north). As a member of the Traffic Safety Committee in partnership with the Waimea Community Association, Dr. Bergin shared that the purpose of the group is to help promote traffic safety. An ongoing regional highway safety plan was able to identify two areas where there are traffic concerns: the intersections of Māmalahoa Highway/Lindsey Road and Lindsey Road/Kawaihae Road. He pointed out that the latter is directly correlated to the Waiaka Bridge project area as it was another place known to bottleneck and connects to the thoroughfare.

LENINGRAD ELARIONOFF

Mr. Elarionoff provided the following feedback via email on August 18, 2021:

- Shared that Waiaka means “shadow water” or “shadow brook.”
- Knows of a burial cave with a canoe further *mauka* in the pasture but has never been to the site.
- As a former policeman of the area, he was tasked to warn HPA students to not enter the cave.
- To his understanding, the cave was closed and sealed.
- During the late 1960s to early 1970s, Mr. Elarionoff served on the Waimea Traffic Committee with *kupuna*, the late Aunty Anna Perry Fisk who all looked forward to the replacement of the Waiaka Bridge.
- Does not know of any traditional cultural practices within or in the vicinity of the project area.

NICOLE LUI

Ms. Lui provided the following feedback via email on August 30, 2021:

> The cultural practice that continues in Waimea is just up the road from the Waiaka bridge at the Jackaranda Inn. At this place is the Rain rock where the people of Waimea still go and give hookupu for rain and water. This rock is known to the people of Waimea for hundreds of years and a Moʻo guards this rock. My mother once saw the Moʻo in its reptile form once. We go when we have the chance. So far we have attended twice ceremony there. The Case ohana care for this rock till this very day. Kupuna Bill Case remembered the old people talking about this rock and went to look for it in the 70’s and found it covered over with grass and trees. He used to work for Parker Ranch and was in charge of all the water pumps in the upper regions of Waimea. At that time there was a really bad drought and it got so bad that water had to be trucked in to Waimea to feed the people and cattle. He and some workers cleared the rock off and he got the families together and they did prayers and gave hookupu to the rock and their prayers were answered and the rains came back and the reservoirs

and rivers were once again filled with water. This lasted for many years. This is one of the cultural practices still going on.

The other thing I wanted to share is about the former Kamuela Museum. The Kamuela museum belonged to my Great Granduncle Kehau Solomon. This is the Alapia (Arabian) Solomon not the Hawaiian Kolomona ohana who later changed their name to Solomon. Kehau built that house with his own two hands and the wall surrounding it. Planted all its trees and operated the museum along with his wife Hennrietta Waipa who was a greatgranddaughter of Samuel Parker. His first wife was Ruth Camacho. I am connected to many families on my Mother and Fathers side. On my fathers side I am connected to the Stevens and the Purdys, the Raymonds of Kohala and the Solomons. Senator Malama Solomon is my cousin. On my mothers side the Bells, Lincolns, Lindseys, I have all my genealogy and it would be to much to share with you at this point. I just wanted to share my connections on the surface.

The Kamuela Museum was owned by Rosanne Barr the last time I heard. It is just around the corner of Waiaka Bridge. We used to go to the river side when we would visit my Uncle and put our feet in the cool waters and lounge on the side of the river bank. Such wonderful times when there was hardly a car in sight and when Waimea was so sleepy and Kohala even sleepier. I miss those days and sometimes think about the old ones and try to remember them. Seems so long ago. I will be 60 next year and I want to share all I know from those days when Hawaii Island was pristine and the old language was spoken and the stories were told to a rather inquisitive child like myself.

KU‘ULEI KEAKEALANI

ASM Affiliates staff, Nicole Ishihara interviewed Ku‘ulei Keakealani via phone on August 30, 2021. Ms. Keakealani was asked about her connection to the project area; traditional and/or historical cultural practices that occur within and in the vicinity of the project area; and if she had any further recommendations, mitigation, and/or referrals.

Born in Kealakekua at Kona Hospital, Ms. Keakealani was raised at Pu‘uanahulu and Waimea. Her father was a cowboy for Parker Ranch, often spending the weekdays in Waimea and weekends and school breaks at Pu‘uanahulu with her grandparents. She considers both places her *‘āina kūpuna* (ancestral lands).

When asked about any ongoing traditional and/or historical cultural practices within or in the vicinity of the Waiaka Bridge project, Ms. Keakealani confirmed that cultural practices still occur within and along the entire Waiaka Stream corridor. These traditional cultural practices include ceremonies along the stream and ceremonial baths within the stream. For *hula* (traditional dance) practitioners, *pōhaku* are gathered from the streambed then *mele* is composed that honors Waimea and the waters of that *wahi* (place). When the *mele* is completed, the *pōhaku* are returned to Waiaka Stream. When asked if *imu* (underground oven) stones were gathered there as well, she stated that the *pōhaku* found within Waiaka Stream are too big and *imu* stones are gathered elsewhere. Ms. Keakealani was asked if she knows of any plants or animals that were gathered from Waiaka Stream. She stated that she has not seen anything personally but would not rule out the possibility of gathering such resources. She recalled once attempting to reestablish the *‘ōpae* (general name for shrimp) population *mauka* of Waiaka Stream but they did not take.

Ms. Keakealani retold a traditional account of a *mo‘o wahine* named Manaua who resides throughout the Waiaka Stream corridor. She shared that the source of this account is from the late Mary Kalani Ka‘apuni Phillips whom she is directly related to. According to Ms. Keakealani, the story of Manaua is linked to a *lawai‘a manu* story called “The Bird Fisherman of Waimea.” She pointed out that the traditional practice of *lawai‘a manu* in the area no longer exists due to the fact that there are restrictions around the *kōlea* (Pacific golden plover; *Pluvialis dominica*)--the bird primarily hunted, caught, and eaten. She also mentioned that Manaua is the name of a *pōhaku* located in Waimea and many cultural practices still occur at that particular site. These practices include but are not limited to water ceremonies that request and show gratitude for rain; *ha‘i mo‘olelo* (storytelling) in place; and *hula* and *mele* offerings.

Concerning water sources, Ms. Keakealani pointed out that many of the traditional settlement patterns in Waimea were prominent along the stream and riverbanks. She felt this made sense for people to live close to their water source as it is vital to our living. An important feature she pointed out was that the stream changes its name based on the land section it is in. According to Ms. Keakealani, as the water flows down *makai* the stream is called Kohakohau then Waiauia, Waiaka, Keanuimano (also known as Keanu‘i‘omanō), and Wai‘ula‘ula before it drains into the ocean. She has walked most of the tributary but not to the *po‘owai* (headwaters) located in the Kohala Mountains.

Regarding cultural impacts, she does not believe there would be any impacts to cultural practices at or in the vicinity of the Waiaka Bridge as there are easier access points to the stream. She pointed out that they exercise their cultural practices either much more *mauka* or *makai* from the Waiaka Bridge project area. Regarding recommendations, Ms. Keakealani does not want the stream altered in any way, which also includes the *pōhaku* of the stream, streambanks, and especially the water as it is *waiola a Kāne*—the lifegiving waters of Kāne. She feels that realignment of the roadway is necessary and pointed out that two semi-trucks cannot pass the Waiaka Bridge at the same time, which is an issue of necessary space and safety. She recommended speaking to the *hoaʻāina* (tenant) families of the Waiaka area such as the Phillips *ʻohana* (family) and Chico Lindsey.

BARBARA ROBERTSON

Interview summary pending.

4. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include "...subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs" (OEQC 1997:1). The guidelines also identify the types of cultural resources, associated with cultural practices and beliefs that are subject to assessment. These include other types of historic properties, both man made and natural, submerged cultural resources, and traditional cultural properties. The origin of the concept and the expanded definition of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service (Parker and King 1998). An abbreviated definition is provided below:

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

"Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties.

As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and 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;

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.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Paʻakai O Ka ʻĀina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

SUMMARY OF CULTURE-HISTORICAL BACKGROUND INFORMATION

The cultural-historical information gathered as part of this study illuminates the project area's long and rich history. Situated within the northwestern portion of Lālāmilo Ahupuaʻa while touching the southern portions of Kauniho, Waiaka 1st and 2nd Ahupuaʻa, the project area is located at the ascent of the Kohala Mountains. While these places are known as *ahupuaʻa* now, traditionally it was one of several *ʻili* that made up the *kalana* of Waimea. As a *kalana*, Waimea was treated as a subdistrict of Kohala. The lands subject to the *kalana* of Waimea are those that form present-day South Kohala District including ʻŌuli, Waiʻaka, Lālāmilo, Puakō, Kalāhuipuaʻa, ʻAnaehoʻomalu, Kanakanaka, Alaʻōhiʻa, Paulama, Puʻukalani, Puʻukapu, and Waikōloa. In 1901, the name Kamuela (Samuel) was adopted by the United State post office in Waimea to differentiate from Waimea, Kauaʻi and avoid duplicate names causing confusion. It is said that the new name was to commemorate either the postmaster Samuel Spencer or the famed rancher Samuel Parker.

The *moʻolelo* of Manoua (also known as Manaua) recounts the *moʻo wahine* and rainmaker who lived in Kohākohau Stream, which starts above the project area and travels *makai* eventually becoming Waiaka (also known as Waiʻaka) Stream. The story of Manoua also relates to "The Bird Catcher of Waimea" which recounts three *lawaiʻa manu* or bird catchers who hunted for *kōlea* and took a dip where the famed *moʻo wahine* of Waimea resided.

The arrival of foreigners in the Hawaiian Islands marked the beginning of major changes within the Hawaiian culture, politics, and economy. The focus shifted from subsistence agriculture to food production and goods that could be bartered with foreign ships. By the time Kamehameha conquered the islands of Oʻahu, Maui, and Molokaʻi in 1795, Hawaiʻi began a market system economy. This new endeavor impacted the landscape of Waimea tremendously beginning with deforestation caused by the overharvesting of sandalwood followed by the introduction of cattle when Captain George Vancouver gifted seventeen heads of steer to Kamehameha. Early descriptions of Kohala stem from the first Protestant Missionary accounts. In 1823, missionary William Ellis described the Waimea region as fertile, well-water lands that could sustain a large population. Concentrated areas include Keaalii, Waikōloa, and Puʻukapu where major streams traversed the land. The upper Lālāmilo-Waimea area was considered to be a highly productive agricultural area from the Precontact to early Historic periods with evidence of a large and intensive cultivated field system known as the Waimea Field System found at an elevation of approximately 2,460 to 2,950 feet above sea level. Another system known as the Kohala Field System is found along the leeward slopes of the Kohala Mountains and relied almost exclusively on rainfall. The Waimea Field System was supported by *ʻauwai*. Crops such as *ʻuala*, *kalo*, *wauke*, *māmaki*, plantains, *maiʻa*, *kō*, *niu*, and *hala* were cultivated. Previous archaeological studies indicate that the Lālāmilo agricultural field system was utilized from Precontact to historic times and included terraces, mounds, enclosures, field boundaries, *ʻauwai*, stone walls, platforms, walled terraces, C-shapes, U-shapes, modified outcrops, surface hearths, L-shapes, cairns, pond fields, and other miscellaneous types. An archaeological inventory survey conducted by Haun et al. in 2002 consisted of a 100% pedestrian survey but no subsurface testing. During the survey, four sites and fourteen features were found including Sites 16095 (an *ʻauwai* system), Site 22632 (a large agricultural complex with 700 features), Site 23313 (concrete foundation within Keanuiomano Stream), and Site 29221 (Waiaka Stream). A visual field inspection conducted by ASM in October 2020 (in prep, Barna 2021) noted the same sites except for features related to Site 22632 being entirely outside of the Kawaihae ROW. The field inspection concluded that no additional fieldwork is necessary, however, archaeological monitoring during construction is still recommended.

During the mid-1800s, John P. Parker from Newton, Massachusetts was one of the early foreigners who received permission from the Crown to hunt wild cattle as the gifts that Captain Vancouver ravaged the uplands of Kohala, Kona, and the saddle region of Hawaiʻi Island. By 1830, Parker established his own private cattle herd resulting in a business called Parker Ranch. Eventually, Parker Ranch became the largest cattle ranch on Hawaiʻi Island. By 1840, bullock hunting drastically reduced the population of wild cattle resulting in a five-year restriction on hunting them solely for their hides and tallow. Agricultural products from Waimea continued to be used to replenish ships docked at Kawaihae Harbor. During this time potatoes were grown in the Waimea area and shipped to California to help feed those involved with the gold rush. With the decline of the whaling industry paired with the *kapu* of cattle, this led to economic hardship and a downturn in the Waimea population.

The *Māhele ʻĀina* of 1848 divided all the lands of Hawaiʻi including those held by the *Mōʻī*, *aliʻi*, *konohiki*, and *hoaʻāina*. Parcels awarded to *hoʻāina* were and still are referred to as *kuleana* lands. A total of three LCAw. were awarded in the vicinity of the project area including *LCAw.* 589 (James Fay), *LCAw.* 2258 (James Fay), and *LCAw.*

8520-B (M. Lahilahi). Land Grant 662 was awarded to Kamaikui and covers the eastern portion of the Waiaka Bridge project area.

After the Māhele, the population of Waimea expanded exponentially. Prior to the bombing of Pearl Harbor, the United States Army established infantry headquarters in the Puʻukapu area. After the United States formally entered WWII, the Army's presence expanded into one of the largest multi-force military camps known as Camp Tarawa. Shortly after Japan surrendered to the United States, the military left Waimea and by the 1950s most of the camp buildings were demolished with a network of roads still intact.

Two formal interviews were conducted with participants Dr. Billy Bergin and Ms. Kuʻulei Keakealani, while two emails from Mr. Leningrad Elarionoff and Ms. Nicole Lui provided feedback regarding knowledge of cultural resources in the vicinity and concerns. Dr. Bergin shared that the first Catholic church in Waimea was constructed in the vicinity of the project area by Saint Damien, also known as Father Damien. He believes the location of the former Catholic church once stood within the HPA property but outside of the project area boundaries. He also shared that the current HPA campus is on land once owned by Parker Ranch. According to Dr. Bergin, HPA was originally located east of the project area on the ground of St. James Episcopal Church on Kawaihae Road and named Hawaiʻi Episcopal Academy. When it moved to its current location, the school expanded tremendously, changed its name, and became non-denominational.

Interviewees also mentioned the Kamuela Museum, which is within the project area boundaries and immediately southwest of the Waiaka Bridge. Dr. Bergin and Ms. Lui shared that the museum was built by the Soloman family—a longtime Kohala family—who created a regional museum with an emphasis on the ranching industry in Waimea. Ms. Lui's great-granduncle Kehau Soloman built the museum, the surrounding wall, and landscaped the property himself. The late Mr. Soloman, along with his wife Hennrietta Waipa (the great-granddaughter of Samuel Parker) operated the museum.

Regarding *moʻolelo* and *wahi pana*, several interviewees shared their knowledge of Manaua—the celebrated *moʻo wahine* of Waimea and a *pōhaku* located east of the project area. Dr. Bergin, Ms. Lui, and Ms. Keakealani shared that the Native Hawaiian cultural traditions of leaving *hoʻokupu*, *pule*, performing *hula*, and other ceremonies are still practiced at the Manaua *pōhaku*, especially during droughts. Ms. Lui shared that the Case ʻOhana *mālama* (to take care of) the *pōhaku* after it was rediscovered in the 1970s. In terms of the progression of modes and means of transportation, Dr. Bergin pointed out that portions of the Kohala Mountain Road alignment were once part of an ancient foot trail that was converted to a horse and cattle trail and later a wagon trail. Dr. Bergin and Ms. Keakealani mentioned that agricultural and habitation settlements were clustered near the waterways of Waimea and contributed to the Waimea Field System. In terms of the stream, Ms. Keakealani stated that cultural practices still occur within and along the entire Waiaka Stream corridor including ceremonies along the stream, ceremonial baths, and gathering of *pōhaku* to create *mele* for *hula* practitioners. She also pointed out that the stream changes its name as it travels from *mauka* to *makai*, passing through the land section it is in. According to Ms. Keakealani, the tributary starts as Kohakohau then is referred to as Waiauia, Waiaka, Keanuimano (also known as Keanuʻimanō), and Waiʻulaula as it drains into the sea. Mr. Elarionoff shared his knowledge of a burial cave with a canoe *mauka* of the project area but has never been to the site (referred to as Site 2618-7 in Corbin 2007). To his understanding, the cave was closed and sealed. As a former policeman of the area, Mr. Elarionoff was tasked to warn HPA students to not enter the cave. Ms. Keakealani shared that the cultural practice of *lawaiʻa manu* in Waimea no longer exists due to restrictions surrounding the *kōlea*—the bird that was primarily hunted, caught, and eaten.

Concerning impacts to traditional cultural practices within the project area, feedback from those who responded to the consultation letter all stated that there are no ongoing practices that they know of within the project area. They did mention that there are ongoing traditional practices that still occur within the stream above and below the project area, as well as in the vicinity of the project area. Three of the four respondents mentioned that this is a long-standing project that is a matter of necessity and safety. In terms of recommendations, Ms. Keakealani does not want the stream altered in any way that would affect *pōhaku*, streambanks, and especially the water.

Identification of Potential Cultural Impacts and Recommended Mitigative Measures

Data gathered indicated that there are no past or ongoing traditional cultural practices occurring within the current project area. However, it was pointed out that ongoing practices are occurring within the same stream corridor and along the Keanuiomano Stream. There are traditional cultural practices that are exercised in the vicinity of the project area, specifically, to the east of the project area limits. Specific traditional cultural practices within and along the streambanks include ceremonies along the stream; ceremonial baths; and gathering of *pōhaku* for *hula* practitioners, which occur further *mauka* and *makai* from the project area. The *pōhaku*, Manaua (also known as Manoua), and revered *moʻo wahine* that hails from Waimea is located outside and east of the Waiaka Bridge project area. The *pōhaku* continues to be honored and cared for by residents and cultural practitioners that include but are not limited to *hoʻokupu*, *pule* (especially during droughts), perform *hula* and other ceremonies. The authors of the current study recommend that the project proponent implement measures to protect the stream environment and associated resources during construction activities, so as avoid potential effects to the cultural practices related to the use of the stream that take place beyond the boundaries of the current project area.

A review of previous archaeological reports, *Māhele ʻĀina* documentation, and consultation suggest that agricultural efforts and habitation likely occurred within or in the vicinity of the project area. The *ʻauwai* system (Site 16095) and agricultural complex with 700+ features (Site 22632) indicate a large field system under Precontact use. The project area is said to be situated within Complex 2 of the Waimea Agricultural System as defined by Clark (1983). Interviewees, Dr. Billy Bergin and Ms. Keakealani, indicated that agriculture and habitation were clustered near waterways. Additionally, peripheral sites discussed in previous archaeological reports and during the consultation, such as a burial vault with a canoe (Site 2618-7) and a Precontact-Historic trail, are indicators that the surrounding areas were very much in use.

Based on the information and concerns voiced by the community, it is evident to the authors of this study that the project is long overdue as consultees voiced the need for widening the bridge as it has been a major safety concern to the wider community for decades. In addition, the authors of this study concur with the recommended (Barna 2021) archaeological monitoring when construction activities are occurring.

In summary, the information and recommendations provided above are to ensure that the project developers consider the thoughts and concerns shared by the consulted parties and remain mindful of the cultural, social, and environmental uniqueness of the broader Kohala district. Attention to and implementation of the above-described issues and measures will help to ensure that no valued cultural or historical resources and customary practices will be adversely affected by the widening of the Waiaka Stream Bridge project.

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APPENDIX A

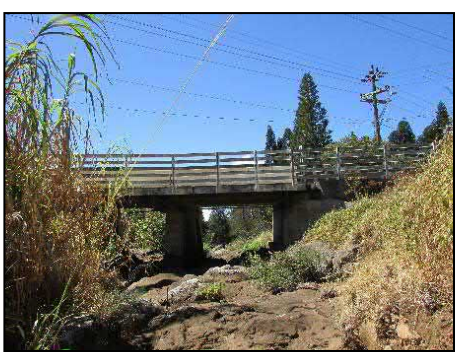
KA WAI OLA PUBLIC NOTICE

Cultural Impact Assessment Notice: Waiaka Stream Bridge, South Kohala

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) for the proposed replacement of the Waiaka Stream Bridge and the realignment of roadway approaches in the ahupua'a of Kauniho, Waika 1st, Waiaka 2nd, and Lālāmilo; Kalana of Waimea; South Kohala District; Island of Hawai'i. The United States Department of Transportation Federal Highway Administration (FHWA) and the State of Hawai'i Department of Transportation (HDOT) intend to replace the existing Waiaka Stream Bridge with an approximately 53-foot wide by 80-foot wide long replacement bridge to accommodate two travel lanes, a shoulder/bike lane, and raised sidewalk. Approaches will be realigned to create a smooth transition to the replacement bridge and the Kawaihae Road—Kohala Mountain Road intersection would be reconfigured to include a traffic signal or roundabout. A potential staging area for construction equipment storage is located approximately 2,000-feet east from the Waiaka Stream Bridge.

We are seeking consultation with community members that have long-standing cultural connections of the Waimea area and may possess knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices within the vicinity of the Waiaka Stream Bridge. If you would like to participate in consultation please contact Nicole Ishihara (nishihara@asmaffiliates.com); phone (808) 969-6066, mailing address ASM Affiliates 507 E. Laniakaula Street, Hilo, Hawai'i 96720. ■

APPENDIX E FLORA AND FAUNA SURVEY



H. T. HARVEY & ASSOCIATES

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Kawaihae Road Waiaka Bridge Replacement Project
Biological Survey Report

Project # 4468

Prepared for:

Mālie McClellan , Lean Planner
WSP USA

Prepared by:

H. T. Harvey & Associates

April 15, 2021

91-1020 Kai Loli Street • Ewa Beach HI 96706 • 808.499.9092 • www.harveyecology.com

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Section 1.0 Introduction

The Waiaka Bridge is located at mile marker 58.88 at the intersection of Kawaihae Road (State Route 19) and Kohala Mountain Road (State Rounte 250). Situated in the town of Kawaihae, it is about two miles to the west of Waimea Town in South Kohala District on the Island of Hawaii. The Waiaka Bridge Project Site is situated on the broad plateau formed by the Kohala Mountains and Mauna Kea. The Hawaii Preparatory Academy (HPA) campus to the northwest, residential subdivisions and the old Kamuela Museum to the west, undeveloped house lots to the south and undeveloped land owned by the Department of Hawaiian Home Lands to the east comprise the immediate vicinity of the Project Site (Figures 1 and 2).

Built in 1932, the Waiaka Bridge is a 38-foot long and 25-foot wide bridge that consists of a concrete slab structure with a bolder 3-foot wooden walkway (Wilson Okamoto Corporation 2012). The Waiaka Bridge, as well as the Kawaihae Road and Kohala Mountain Road, fall under the jurisdiction of the Hawaii Department of Transportation (HDOT). Waiaka Bridge is inspected every two years, and these inspections show that the existing bridge is structurally sound but eligible for replacement. The proposed project will provide a replacement Waiaka Bridge in conformance with American Association of State Highway and Transportation Officials (AASHTO) design requirements. This proposed replacement of Waiaka Bridge effort to meet Federal and State design guidelines also presents an opportunity for HDOT to improve the alignment of roadway approaches to the bridge and traffic operations for the nearby intersection of Kawaihae Road with Kohala Mountain Road. Realignment of the existing approaches to this intersection will improve operations by increasing line-of-sight distances.

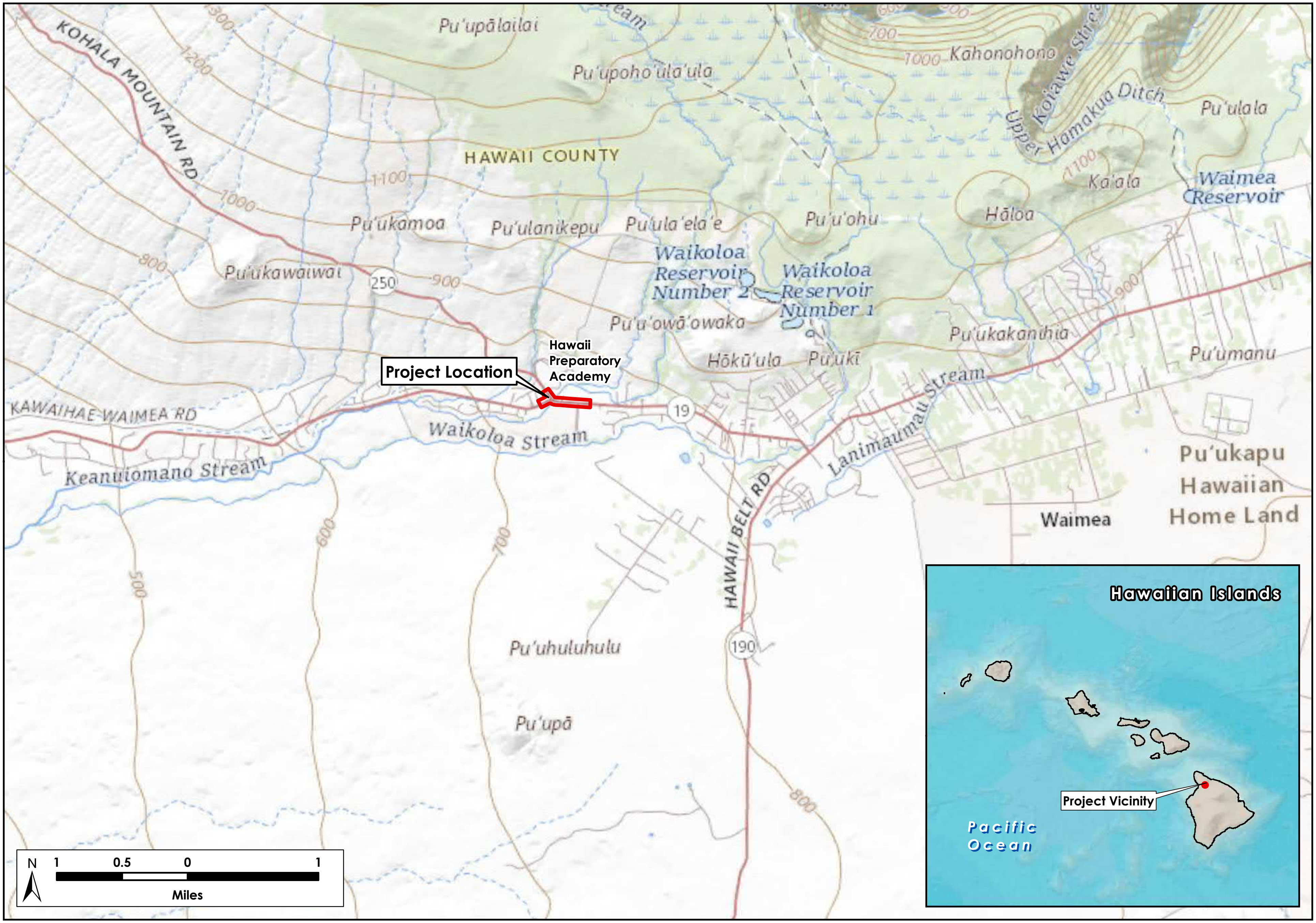
The Bridge currently serves as a major link between the east and west side of Hawaii, including Kawaihae Harbor. HDOT proposes to replace the Waiaka Bridge with an approximate 53-foot wide by approximate 80-foot long bridge that meets state and federal design guidelines and could accommodate two travel lanes on each side, a shoulder/bike lane, and a raised sidewalk (the Project). In addition, HDOT also proposes to realign the approaches to Kawaihae Road and Kohala Mountain Road to improve traffic conditions. A revised environmental assessment for this Project is being prepared by WSP USA. This biological survey report presents the methods and findings of the flora and fauna study conducted in support of the environmental planning studies for this Project.

The objectives of this biological study were to:

- Conduct a reconnaissance-level wildlife survey to detect and record the wildlife species (birds and mammals).
- Conduct a reconnaissance-level botanical survey to identify and document the vegetation communities and the plant species.

- Identify and document biological issues of concern, including the presence of any taxa that are state or federally listed as threatened or endangered, candidate species for listing, or sensitive habitats.
- Identify the potential impacts of implementing the Project and conservation measures that may be considered for inclusion into the planning and design phase if any listed taxa, candidate species for listing, or sensitive habitats are found at the Project Site.

The Project Site does not overlap with critical habitat for threatened or endangered taxa. There are three streams in the vicinity of the Project Site—Waikoloa, Keanuiomano, and Lanimaumau Streams (Figure 1). The existing Waiaka Bridge is situated over the Keanuiomano Stream, a tributary of the Waikaloa Stream which flows to the Pacific Ocean. The National Wetland Inventory (NWI) identifies the Keanuiomano Stream as a wetland feature at the Project Site: R5UBFx: Riverine, Unknown Perennial, Consolidation Bottom, Semipermanently Flooded, Excavated (NWI 2021). The Project Site is at about 2400 feet (above mean sea level) and has a mostly dry weather with average annual rainfall in the range of 8-30 inches (Giambelluca et al. 2013).



N:\Projects4400\4468-01\Reports\Fig 1 Vicinity Map.mxd

H. T. HARVEY & ASSOCIATES
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Figure 1. Project Vicinity Map

Kawaihae Road Waiaka Bridge Replacement Project (4468-01)

December 2020

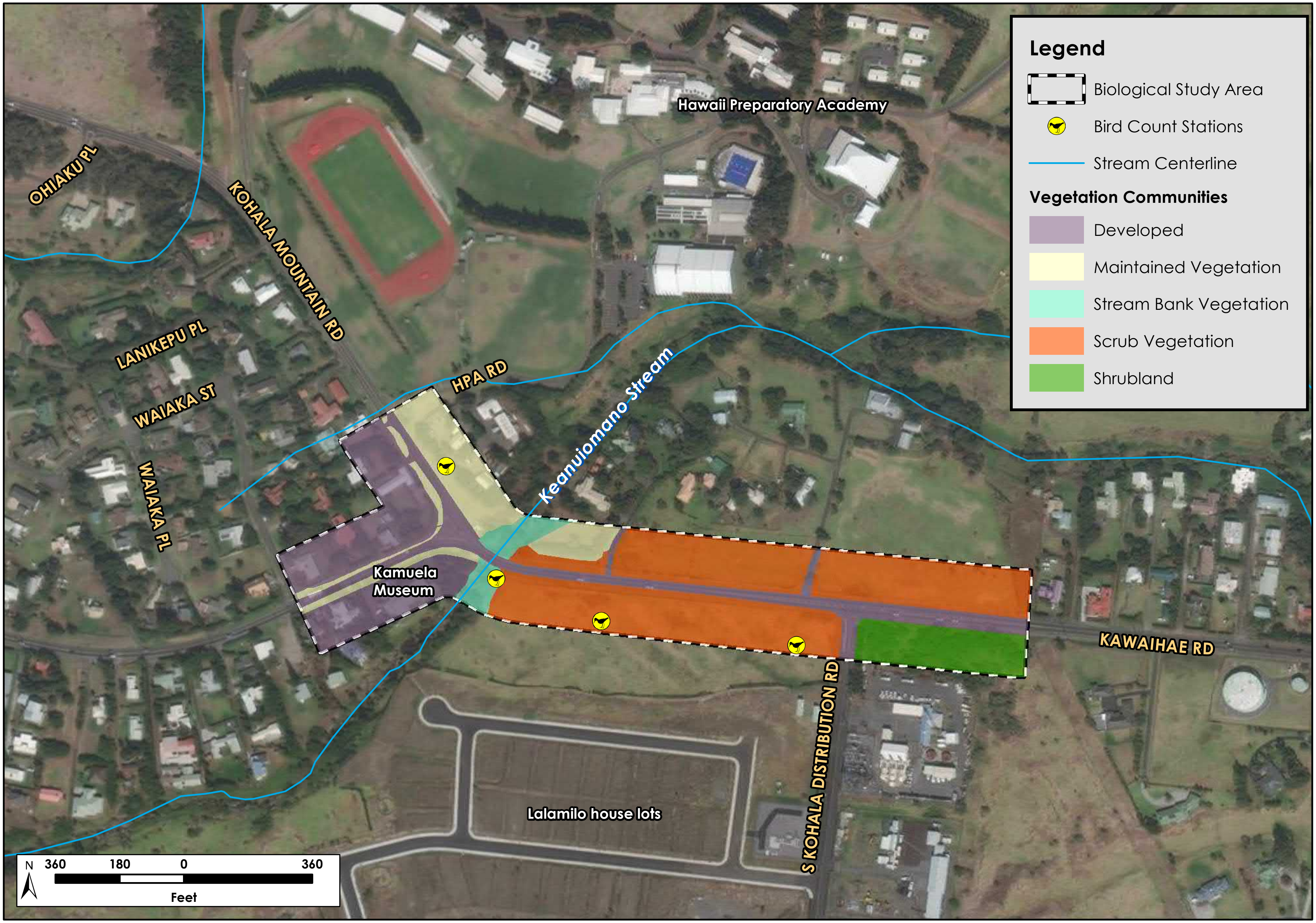

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Figure 2. Biological Study Area and Vegetation Communities

Kawaihae Road Waiaka Bridge Replacement Project (4468-01)

February 2022

H. T. HARVEY & ASSOCIATES

Ecological Consultants

Section 2.0 Methods

The Biological Study Area (BSA) for the flora and fauna studies comprised approximately 16.5 acres of the Project Site; a swath of 300 feet centered on the Bridge and the Kawaihae and Kohala Mountain Roads. A reconnaissance-level survey of the BSA was conducted on October 22, 2020. Sunny skies with moderate trade winds prevailed during the survey. One botanist and one wildlife biologist (hereafter referred to as biologists) conducted the survey together. The biologists walked the BSA and documented the vegetation communities, plants, birds and mammals observed. A handheld Global Positioning System (GPS) device preloaded with spatial data (e.g., BSA boundary) was used to navigate during the survey and record field observations. In general, rocky outcrops, shaded areas, and topographic depressions, which are more likely to support native plant species, were surveyed more extensively.

The biologists recorded observations of birds, mammals and reptiles in the BSA. Visual and auditory detection, as well as secondary indicators (e.g., nests) were used to identify the bird species present. To survey for birds, 10-minute point counts were made from four locations in the BSA (Figure 2) between 10:15 a.m. to 12:00 a.m. This effort included tallying all birds seen or heard by a single observer from a fixed point over a period of 10 minutes. Hawaii does not have native reptiles and amphibians. Binoculars (e.g., Eagle Optics 10×50) were used to assist with visual identifications. In addition to these focused point-count surveys, incidental detections of birds were recorded throughout the duration of the survey. An avian species list was compiled, which includes common and scientific names of the individual species, the legal regulatory status, the average number of individuals detected per count station, and how many count stations were occupied. We used the last two metrics to provide a qualitative relative abundance of observed bird species.

The only native terrestrial mammal, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), is known to occur on Hawaii Island (Tomich 1986). For the purpose of this biological study, it is assumed that Hawaiian hoary bats may use the BSA. Also, special surveys to look for the endangered Blackburn's sphinx moth (*Manduca blackburni*) that are known to occur on Hawaii Island was outside of the scope of this biological survey. But, during the botanical survey we did search for the presence of introduced tree tobacco (*Nicotiana glauca*) plants which are common roadside weeds and on which Blackburn's sphinx moth larvae have been documented to be found.

Section 3.0 Results

3.1 Flora

The taxa recorded during the reconnaissance-level survey are indicative of the season (i.e., fall) and the environmental conditions at the time of the survey. No rare native Hawaiian plant taxa that are state or federally listed as threatened, endangered, or candidates for listing were observed in the BSA. Table 1 provides a list of the plant species observed and their relative abundance in the BSA. A total of 64 plant taxa were found, of which two (3%) are believed to be native (indigenous) and 62 (97%) are alien species (Wagner 1999, Imada 2019).

Table 1. Plant Species Observed in the Biological Study Area

Family	Scientific Name	Common Name	Status[1]	Relative Abundance
Gymnosperms				
Araucariaceae	*Araucaria columnaris* (G.Forst.) Hook.	Cooks Pine	alien	U
Cupressaceae	*Cupressus sp.*	Cypress	alien	U
	Platycladus orientalis (Linnaeus) Franco	Chinese arborvitae	alien	U
Pinaceae	*Pinus* sp.	Pine	alien	U
Angiosperms – Monocots				
Agavaceae	*Agave sisalana* Perrine	Sisal	alien	C
Commelinaceae	*Commelina diffusa* Burm.f.	Honohono	alien	R
Cyperaceae	*Cyperus polystachyos* Rottb.	Pycreus	ind	R
	Cyperus rotundus L.	Purple nut sedge	alien	R
	Kyllinga brevifolia Rottb.	Green kyllinga	alien	U
Poaceae	*Arundo donax* L.	Giant reed	alien	U
	Cenchrus ciliaris L.	Buffel grass	alien	A
	Cenchrus setaceus (Forssk.) Morrone	Fountain grass	alien	R
	Chloris barbata Sw.	Swollen finger grass	alien	C
	Cynodon dactylon (L.) Pers.	Bermuda grass	alien	U
	Digitaria insularis (L.) Mez ex Ekman	Sour grass	alien	R
	Eragrostis pectinacea (Michx.) Nees var. pectinacea	Caroline love grass	alien	U
	Festuca myuros L.	Rat tail fescue	alien	U
	Melinis repens (Willd.) Zizka	Natal red top	alien	U

Family	Scientific Name	Common Name	Status[1]	Relative Abundance
	Sporobolus diandrus (Retz.) P.Beauv.	Indian dropseed	alien	U
	Urochloa maxima (Jacq.) R. Webster	Guinea grass	alien	U
	Urochloa mutica (Forssk.) T.Q.Nguyen	California grass	alien	C
Angiosperms – Dicots				
Amaranthaceae	*Amaranthus spinosus* L.	Spiny amaranth	alien	U
Anacardiaceae	*Mangifera indica* L.	Mango	alien	R
	Schinus molle L.	California pepper tree	alien	R
	Schinus terebinthifolius Raddi	Christmas berry	alien	U
Apiaceae	*Ciclospermum leptophyllum* (Pers.) Sprague ex Britton & P.Wilson	Fir-leaved celery	alien	R
Apocynaceae	*Nerium oleander* L.	Oleander	alien	U
Asclepediaceae	*Asclepias physocarpa* (E.Mey.) Schltr.	Balloon plant	alien	R
Asteraceae	*Bidens pilosa* L.	Spanish needle	alien	C
	Alternanthera pungens Kunth	Khaki weed	alien	U
	Conyza canadensis (L.) Cronquist var. *pusilla* (Nutt.) Cronquist	Horseweed	alien	U
	Senecio madagascariensis Poir.	Fireweed	alien	U
	Sonchus oleraceus L.	Sow thistle	alien	U
	Tridax procumbens L.	Coat buttons	alien	U
Bignoniaceae	*Tecomaria capensis* (Thunb) Spach	Cape honeysuckle	alien	U
Brassicaceae	*Lepidium virginicum* L.	Peppergrass	alien	U
Cactaceae	*Opuntia ficus-indica* (L.) Mill.	Panini	alien	R
Casuarinaceae	*Casuarina equisetifolia* L.	Ironwood	alien	C
Chenopodiaceae	*Chenopodium murale* L.	Lamb's quarters	alien	R
Crassulaceae	*Kalanchoe daigremontiana* Raym.-Hamet & H.Perrier	Mother of million	alien	R
Euphorbiaceae	*Euphorbia hyssopifolia* L.	Graceful spurge	alien	U
	Ricinus communis L.	Castor bean	alien	U
Fabaceae	*Acacia mearnsii* De Wild.	Black wattel	alien	C
	Desmodium sp.	Clover	alien	U
	Desmodium intortum (Mill.) Urb.	Tick clover	alien	U
	Indigofera spicata Forssk.	Creeping indigo	alien	U

Family	Scientific Name	Common Name	Status¹	Relative Abundance
	Indigofera suffruticosa L.	Upright indigo	alien	U
	Leucaena leucocephala (Lam.) de Wit	Haole koa	alien	A
	Macroptilium atropurpureum (DC.) Urb.	Vining cow pea	alien	U
Liliaceae	Crinum sp.	Spider lily	alien	U
Malvaceae	*Abutilon grandifolium* (Willd.) Sweet	Hairy abutilon	alien	R
	Malva parviflora L.	Cheese weed	alien	R
	Sida rhombifolia L.	Cuban jute	alien	C
Myrtaceae	*Callistemon citrinus* (Curtis) Skeels	Red bottle brush	alien	R
Nyctaginaceae	*Boerhavia coccinea* Mill.	Boerhavia	alien	R
	Bougainvillea sp.	Bougainvillea	alien	U
Oleaceae	*Olea europaea* L. *ssp. cuspidata* (Wall. ex G.Don) Cif.	African olive	alien	C
Plumbaginaceae	*Plumbago auriculata* Lam.	Cape leadwort	alien	U
Polygalaceae	*Polygala paniculata* L.	Milkwort	alien	R
Proteaceae	*Grevillea robusta* A.Cunn. ex R.Br.	Silk oak	alien	U
Sterculiaceae	*Waltheria indica* L.	Uhaloa	Ind?	U
Typhaceae	*Typha latifolia* L.	Common cattail	alien	R
Verbenaceae	*Stachytarpheta cayennensis* (Rich.) Vahl	Vervain	alien	U
	Verbena litoralis Kunth	Vervain	alien	U

[1] **Status Notes:** alien = introduced or all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact [i.e., Cook's arrival in the islands in 1778]). ind = indigenous = species that occur naturally in the archipelago but that also have a wider distribution outside of Hawaii. ind? = questionably indigenous (species for which dates of introduction or other information do not make a clear argument for their dispersal here by natural or human-related mechanism but for which the weight of the evidence suggests that they are probably indigenous).

Qualitative Relative Abundance of Observed Species in Study Area: A = abundant—forming a major part of the vegetation in the Biological Study Area. C = common—widely scattered throughout the Biological Study Area or locally abundant in a portion of it. U = uncommon—scattered sparsely throughout the Biological Study Area or occurring in a few small patches. R = rare—only a few isolated individuals in the Biological Study Area.

Additional Notes: This checklist is an inventory of all the plant species observed on October 22, 2020, in the Biological Study Area of the Kawaihae Road Waiaka Bridge Replacement Project. The plant names are arranged alphabetically by family, then by species. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999); recent name changes are those recorded in Wagner and Herbst (1999) and Imada 2019.

In general, the vegetation in the BSA was highly disturbed, comprising primarily non-native plant species. Four main vegetation types were seen in the BSA: Scrub Vegetation, Shrubland, Stream Bank Vegetation, and Maintained Vegetation. The Scrub Vegetation type was limited to east of the Waiaka Bridge and was present on both sides of Kawaihae Road encompassing the narrow highway ROW and the private DHHL land adjacent to the ROW (Figures 3 and 4). The vast majority of this vegetation comprised dead or dried grasses about 12 to 18 inches high. Buffel grass (*Cenchrus ciliaris*) was the dominant plant species in the dry Scrub Vegetation. Guinea grass (*Urochloa maxima*) and swollen finger grass (*Chloris barbata*) were also commonly seen in this vegetation type. Vining cow pea (*Macroptilium atropurpureum*) was abundant amongst the ground vegetation, sprawling over the standing dead grass. Most of the live plants in the Scrub Vegetation were seen in the narrow highway ROW and comprised weedy herbaceous species such spiny amaranth (*Amaranthus spinosus*), creeping indigo (*Indigofera spicata*), peppergrass (*Lepidium virginicum*), and cheese weed (*Malva parviflora*) (Figure 5). Some common shrub species scattered in the Scrub Vegetation were panini (*Opuntia ficus-indica*), castor bean (*Ricinus communis*), and African olive (*Olea europaea*) and haole koa (*Leucaena leucocephala*) (Figure 5).

Figure 3. Scrub Vegetation South of Kawaihae Road
Note: Vast majority of this vegetation comprised dead or dying grass, predominantly buffel grass (*Cenchrus ciliaris*).

The Shrubland vegetation type was limited to the southeastern corner of the BSA on the Hawaiian Electric Company Property east of the South Kohala Distribution Road (Figure 2). This Shrubland was predominantly composed of African olive shrubs (Figure 6).

The Stream Bank Vegetation type in the BSA was present along the banks of the Keanuiomano Stream that flows below the Waiaka Bridge (Figure 2). South of the bridge, the bank vegetation is mostly composed of trees of black wattle (*Acacia mearnsii*), cooks pine (*Araucaria columnaris*), ironwood (*Casuarina equisetifolia*), silk oak (*Grevillea robusta*) and bougainvillea bushes (*Bougainvillea* sp.) (Figure 7). Large boulders comprise the rocky stream bed to the south, which was mostly dry with few pockets of shallow standing water, and was generally devoid of vegetation. A large clump of giant reed was found on the eastern bank next to the bridge (Figure 8). North of the bridge the stream bed narrows and weedy grasses such as giant reed, California grass (*Urochloa mutica*), guinea grass (*Urochloa maxima*), vining cow pea, and cats tail (*Typha sp.*) comprise the lower banks, while shrub and tree species such as Christmas berry and ironwood comprise the upper banks (Figure 9).

Figure 4. Scrub Vegetation North of Kawaihae Road
Note: Vast majority of this vegetation comprised dead or dying grass, predominantly buffel grass (*Cenchrus ciliaris*)

Figure 5. Live Herbaceous Plants in the Scrub Vegetation Mostly Limited to the Highway Right-of-Way
Note: Dead dry gasses to the right are beyond the highway right-of-way on private

land. The dark green shrubs to the right are panini (*Opuntia ficus-indica*. Seen here to the left, in the ROW is mostly vining cow pea (*Macroptilium atropurpureum*) sprawling over the dead grass.

Figure 6. Shrubland Vegetation (left) Mostly Comprising African Olive Shrubs (*Olea europaea* L. ssp. *cuspidate*) at the Southeastern Corner of the Biological Study Area
Note: Right side is Scrub Vegetation comprising dead and dying grasses predominantly buffel grass (*Cenchrus ciliaris*).

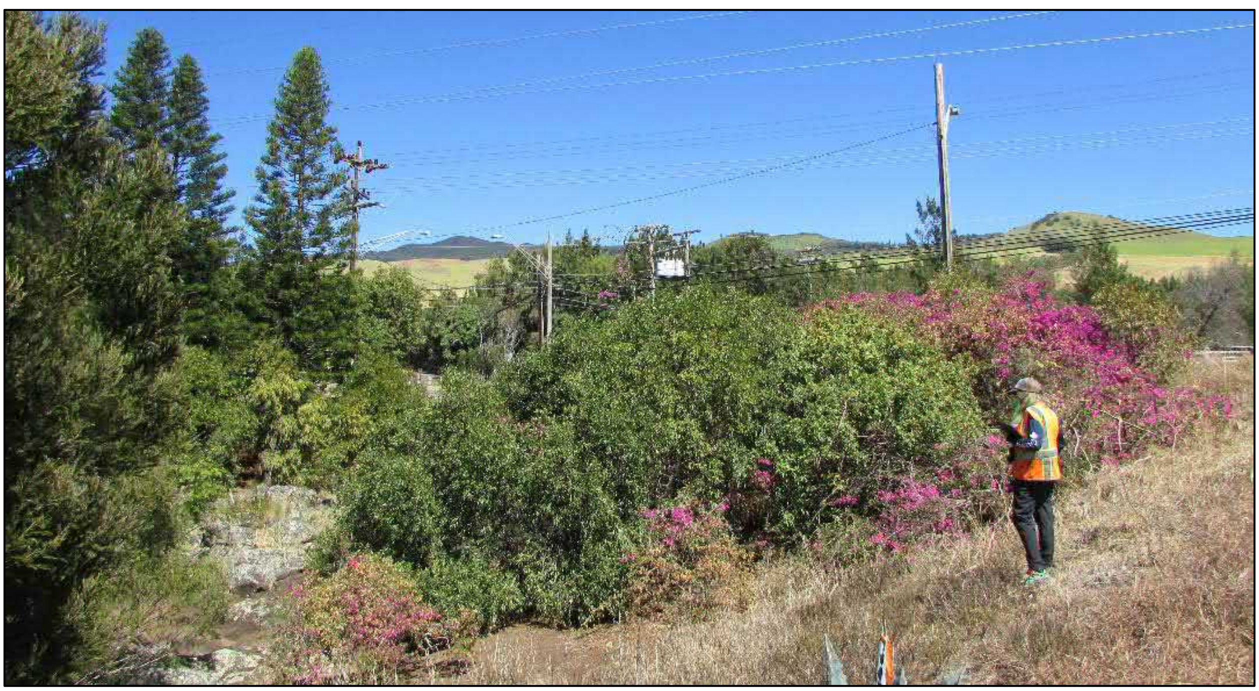

Figure 7. Stream Bank Vegetation to the South of the Waiaka Bridge
Note: Bougainvillea (*Bougainvillea* sp.), Christmas berry (*Schinus terebinthifolius*) and

black wattle (*Acacia mearnsii*) are seen in the foreground along the eastern bank with cook pines (*Araucaria columnaris*) in the background along the western back.

Figure 8. Large Boulders and a Dry, Rocky Stream Bed to the South of the Waiaka Bridge
Note: Silk oak (*Grevillea robusta*) tree to the left and large clump of giant reed (*Arundo donax*) seen to the right (red arrow) near the bridge.

Figure 9. Stream Bank Vegetation to the North of the Waiaka Bridge
Note: Large clump of giant reed (*Arundo donax*) on the eastern (left) bank, while western bank (right) comprises ironwood (*Casuarina equisetifolia*) trees (background) and California grass (*Urochloa maxima*) and cat tail (*Typha sp.*)(foreground).

Vegetation in the remaining parts of the BSA can be described as Maintained Vegetation (Figure 2). The narrow mowed highway ROWs along Kohala Mountain Road and Mamalahoa Highway, as well as the residential units and the HPA property along these roads that overlap the BSA comprise this Maintained Vegetation type. Several ornamental plants such as oleander (*Nerium oleander*), plumbago bushes (*Plumbago auriculata*), Cape honeysuckle (*Tecomaria capensis*) and trees such as California pepper tree (*Schinus molle*), Chinese arborvitae (*Platycladus* orientalis), and Cypress (*Cupressus sp.*) were found in this vegetation type (Figure 10).

Figure 10. Maintained Vegetation Type Along Kohala Mountain Road and Mamalahoa Highway
Note: Left photo—Maintained vegetation along Mamalahoa Highway with mowed grass in the right-of-way and ornamental trees such as cypress (*Cupressus sp.)*, oleander (*Nerium oleander*), and Chinese arborvitae (*Platycladus orientalis*) on private property. Right photo—oleander and spider lily (*Crinum sp*.) along Kohala Mountain Road.

3.2 Fauna

Point count surveys identified 50 individual birds from 10 species (Table 2). No native or indigenous birds were observed during this survey, but the endemic Hawaiian Hawk (io) is known to occur in this area. The warbling white-eye (*Zosterops japonicus*) was the most abundant species, and was observed in all vegetation types (Scrub, Shrubland, Stream Bank, and Maintained Vegetation Types). Zebra doves (*Geopelia striata*) were the second most common species, found in trees along the Stream Bank Vegetation and on electrical wires in the highway rights-of-way. Common waxbills (*Estrilda astrild*) were observed in the Scrub Vegetation, at the furthest distance from the roadway within the BSA. A group of seven ring-necked pheasant (*Phasianus colchicus*) chicks with an adult were observed in the brush vegetation near the streambed. Only the introduced Northern Cardinal (*Cardinalis cardinalis*) is protected by the Migratory Bird Species Act. Spotted doves (*Streptopelia chinensis*) and warbling white eyes are on the State of Hawaii Injurious Wildlife list and are known to be harmful to agriculture, aquaculture, or indigenous wildlife or plants, or to constitute a nuisance or health hazard (DLNR 2015a).

Mammal species were not observed in the survey area. Pig scat was observed on the streambank, though the scat was not recent.

An introduced Jackson's Chameleon (*Trioceros jacksonii*) was observed in the branches of a silk oak tree on the eastern stream bank, south of the bridge.

Table 2. Bird Species Observed in the Biological Study Area

Scientific Name	Common Name	Status	Average Number of Individuals per Point Count Station (n=5)	Number of Stations Occupied (n = 5)	Qualitative Relative Abundance
Acridotheres tristis	Common myna	X	1.2	2	uncommon
Cardinalis cardinalis	Northern cardinal	X, M	0.8	2	uncommon
Estrilda astrild	Common waxbill	X	0.8	3	uncommon
Francolinus pondicerianus	Gray Francolin	X	0.2	1	rare
Gallus gallus	Red jungle fowl	X	0.2	1	rare
Geopelia striata	Zebra dove	X	2.8	1	common
Passer domesticus	House sparrow	X	0.6	1	uncommon
Phasianus colchicus	Ring-necked pheasant	X	0.8	1	uncommon
Streptopelia chinensis	Spotted Dove	X, IW	0.8	2	uncommon
Zosterops japonicus	Warbling White-eye	X, IW	4.8	4	abundant

Abundance based on the average number of individuals observed per count station, averaged across all point count stations, as follows:

Abundant – average > 4 individuals per station

Common – average between 3.9 and 2.5 individuals per station

Uncommon – average 2.4 and 0.5 individuals per station

Rare – average < 0.5 individuals per station

ES = state or federally listed as endangered

I = indigenous (native to the Hawaiian Islands and elsewhere)

IW = State (HAR 12-124, Exhibit 5) or Federal (18 U.S.C. 42) injurious wildlife species

X = introduced or alien (non-native species)

M= Listed as a Migratory Bird Treaty Act Protected Species (10.13 List)

Section 4.0 Conclusions and Recommendations

4.1 Flora

It is unlikely that the proposed Project would result in a substantial adverse effect on any plant species that is state or federally listed as threatened or endangered, candidate species for listing, rare native plant species, or native plant species of concern. The study did not find any botanical concerns associated with the BSA. The BSA encompasses a highly disturbed and developed area, and all but two plant species found in the BSA are non-native. Removal of the two native species—pycreus and uhaloa, is not expected to have an adverse effect on these species' populations locally or regionally as these species are known to have a widespread distribution on Hawaii Island as well as in the State.

A potential impact of implementing the Project is the introduction and spread of invasive species during the construction phase. For example, fireweed and fountain grass found in the BSA are high-impact invasive plants targeted for control on Oahu and Maui (OISC 2021, MISC 2021) respectively, while giant reed also found among the Stream Bank vegetation in the BSA is targeted for control on Kauai (KISC 2021) H. T. Harvey & Associates understands that this biological study is in support of the Project's planning and design phase. Nonetheless, we recommend that the Project plan and design incorporate specifications that will result in the adoption of best management practices to minimize the introduction and spread of invasive species at the Project Site. These best management practices may include the following:

- All construction equipment and vehicles should arrive at the work site for the first time in clean condition and free of: any soil; plants or plant parts, including seeds; insects, including eggs; and reptiles and amphibians, including their eggs. Similarly, all construction equipment and vehicles should also be cleaned after use on the Project site and before leaving the site. This would be particularly important for equipment movement between the Project site and the other islands.
- All materials imported to the Project site, including gravel, soil, rock, and sand, should be certified weed free. Invasive species found on stockpiled materials should be removed either chemically or mechanically.
- Only weed-free seed mixtures should be used for hydroseeding and hydromulching on the project site. A qualified botanist should inspect the seeded areas a minimum of 60 days after the hydroseed/hydromulch is applied. Any species of plant other than those intended to be in the hydroseed/hydromulch should be removed. In particular, plant species that are not known to occur on Hawaii Island and those that are actively being controlled on the island should be removed.
- To the extent feasible the Project should use native plants for revegetation or landscaping purposes. Potential native plants that are ecologically suitable for landscaping at the Project site include species such as koa (*Acacia koa*), hala (*Pandanus tectorius*), ilima (*Sida fallax*), aalii (*Dodonea viscosa*), kului

(*Nototrichum sandwicense*), and Oahu sedge (*Carex wahuensis*). If native plants do not meet landscaping objectives, plants with a low risk of becoming invasive may be substituted. Additional information on selecting appropriate plants for landscaping can be obtained from the Plant Pono website (http://www.plantpono.org/).

- Only plants grown on Hawaii Island should be used for landscaping purposes. If locally grown plants are unavailable, then imported plants may be used, but they should be thoroughly inspected or quarantined if necessary to ensure that they are free from invasive pests such as little fire ants (*Wasmannia auropunctata*), and invasive plant seeds and seedlings that could arrive inadvertently.

4.2 Fauna

No native wildlife species were observed at the Project Site. The Northern cardinal seen during the survey is protected under the MBTA but, it is common on Hawaii Island as well as on other main Hawaiian Islands. It is unlikely that the proposed Project would have an adverse impact on the population of this species.

Even though, io, the only hawk native (endemic) to the Hawaiian Islands was not seen during this biological survey, it is known to occur on Hawaii Island (DLNR 2015b). In fact, io are found over much of the Hawaii Island, at all elevations, and occupy a variety of habitat types, including native forest, secondary forest consisting primarily of nonnative plant species, agricultural areas, and pastures (NRCS 2007, DLNR 2015b). They occur at relatively higher densities in the North and South Kona Districts but, the Project Site is not located within the identified io breeding range (Gorresen et al. 2008). The relatively open Scrub Vegetation, within the BSA could be used by the io for foraging although this habitat type is also common and readily available beyond the BSA, on the adjacent DHHL homestead lease lands. It should also be noted that the io was on the federal endangered species list for several decades and was only recently delisted in April 2020 (USFWS 2020). In the delisting rule, the USFWS opined that a federal delisting automatically removes the species from the State endangered species list under Hawaii Revised Statute (HRS) 195D-4. Even though it was federally delisted as an endangered species, it may still be considered an endangered species by the State, depending on interpretation of state law by state authorities. H. T. Harvey & Associates recommends that HDOT consult with the State Department of Land and Natural Resources (DLNR) before construction work begins and determine the most current status and distribution of io and obtain guidance to avoid and minimize potential impacts to the io.

Even though endangered Hawaiian waterbirds [Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian duck (*Anas wyvilliana*), Hawaiian common gallinule (*Gallinula galeata sandvicensis*)] were not seen during this survey, it should be noted that the stream habitat within the BSA may provide habitat for these species. Therefore, it is not out of the realm of possibility for endangered Hawaiian waterbirds, including nene, to visit the Project Site. If Hawaiian waterbirds or nene are seen at the Project site, H. T. Harvey & Associates recommends that the HDOT consult with U.S. Fish and Wildlife Service to assess the potential for adverse impacts on Hawaiian waterbirds from Project activities, and seek guidance on conservation measures that may need to be incorporated to avoid and minimize impacts.

The native Hawaiian short-eared owl, or pueo (*Asio flammeus sandwichensis*), is known to occur in the Kailua-Kona area, but none were observed on the Project Site. Like the io, the pueo may use the open Scrub Vegetation with sparsely scattered trees and shrubs for foraging. As mentioned above, this type of habitat is common and readily available beyond the BSA on the adjacent private DHHL lands. If pueo are seen at the Project Site, H. T. Harvey & Associates recommends that HDOT consult with the DLNR to assess the potential for adverse impacts on pueo from Project activities, and seek guidance on conservation measures that may need to be incorporated to avoid and minimize impacts to the native owl.

Although the Hawaiian hoary bat was not surveyed for during this reconnaissance-level survey, there are numerous records for this species on Hawaii Island (Tomich 1986, DLNR 2015b). Therefore, their presence at the Project Site cannot be ruled out at the time of preparation of this report. Hawaiian hoary bats are known to roost in large (typically greater than 15-foot-tall) dense-canopy trees, sometimes at the edges of water bodies, such as streams and lakes (USFWS 1998). Hawaiian hoary bats may hunt for flying insect prey along roadways, gulches, and open areas and occasionally roost in large, dense-foliage trees such as those found in the Stream Bank vegetation within the BSA. U.S. Fish and Wildlife Service (USFWS) provides guidelines on measures to avoid and minimize impacts to Hawaiian hoary bats), during project implementation (USFWS 2021). If HDOT determines that it is necessary to remove large trees during Project implementation, H. T. Harvey & Associates recommends that they follow the USFWS guidelines, which recommend that no trees greater than 15 feet tall be trimmed or removed during the bat pupping season from June 1 to September 15; and to not use barbed wire on fences (USFWS 2021). If Project activities are not compatible with these guidelines, then HDOT should consult with the USFWS for further guidance.

Tree tobacco (*Nicotiana glauca*) plants were not observed within the BSA during this survey. However, this plant species is a common roadside weed and if it establishes in the highway ROW at the Project Site then it could potentially be a concern as it is one of the most common host plants for larvae of the endangered Blackburn's sphinx moth (*Manduca blackburni*). Blackburn's sphinx moth larvae have been documented on tree tobacco plants between September and May, with highest numbers during December through March, and they are less abundant from June through August (DLNR 2015b). Moth larvae primarily use trees larger than approximately 3 feet in height. If tree tobacco plant is found at the Project Site and needs to be cleared, H. T. Harvey & Associates recommends that mowing or removal of tree tobacco plants be conducted during June through August, with follow-up control conducted every 2 months thereafter to remove plants before they become 3 feet tall. This approach would minimize the potential take of Blackburn's sphinx moth larvae and eggs (DLNR 2015c).

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APPENDIX F NOISE TECHNICAL REPORT

FINAL
Noise Technical Report
Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project No. BR-NH-019-1(045)
Waimea , South Kohala, Island of Hawai‘i

Prepared for:

State of Hawai‘i Department of Transportation

Prepared by:

WSP USA

March 2022

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EXECUTIVE SUMMARY

The State of Hawaiʻi Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) are proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project in South Kohala on the Island of Hawaiʻi. The Project is located at the intersection of Kawaihae Road and Kohala Mountain Road at Waiaka Bridge (Mile Post 58.88), in the town of Waimea, on the island of Hawaiʻi (Figure 2-1).

The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for this project, each of which replaces the bridge:

- Build Alternative 4: Roundabout
- Build Alternative 5: Signalized T-intersection

The existing and future posted speed limit is 25 mph on both Kawaihae Road and Kohala Mountain Road that approach the Waiaka Bridge. A location map of this area can be found in Figure 2-1.

A traffic noise study was prepared for the Project in 2010 (HDOT, 2010). The purpose of this study is to analyze updated Project Alternatives and traffic data following current HDOT Highway Noise Policy and Abatement Guidelines (HDOT, 2016).

A noise study is required for this project because the build alternatives include a substantial horizontal alignment change between the roadway and noise sensitive receivers which meets the definition of a Type I Project (HDOT, 2016). Type I projects require mitigation of noise levels that approach or exceed the FHWA noise abatement criteria if the mitigation is found to be both feasible and reasonable to provide.

The following is a description of the proposed Project considered in this report:

> <u>The Project</u> – The Project involves bridge replacement and realignment of approaches to the bridge on Kawaihae Road and Kohala Mountain Road. The Project also involves replacement of bridge railings, and bicycle and pedestrian access. The posted speed limit would remain 25 mph on Kawaihae Road and Kohala Mountain Road.

Existing land uses located within the noise study for the Project include residences and a museum. No other noise-sensitive land uses are located in the noise study area.

Six short-term (1-hour) measurements were taken at three locations near the proposed alignment to validate the traffic noise model. Eleven additional sites were modeled to predict existing and future conditions noise levels.

The FHWA Traffic Noise Model (TNM) was used to model the noise levels at 11 sites for existing conditions and future project conditions within the noise study area. Traffic data used for Existing Year 2021 and Future Year 2024 noise predictions were representative of the PM peak truck hour traffic volumes, which would be the loudest operating condition for both freeways (i.e. the most vehicles operating at the posted speed limit).

Eleven modeled sites were included in the traffic noise model to represent a total of 8 residences and 3 outdoor use areas at the museum.

Existing modeled worst-hour traffic noise levels range from 57 dBA to 68 dBA (Results of Existing Noise Measurements

Error! Not a valid bookmark self-reference. presents the modeled existing worst-hour traffic noise levels, the number of receptors represented by each measurement site, and the NAC for each of the short-term and modeled measurement locations. Worst-hour traffic noise levels for residential areas range from 57 dBA to 68 dBA depending on the proximity of the receiver to the roadway traffic and the presence of buildings and topography providing noise attenuation between the receiver and the roadway. The worst-hour traffic noise levels approach or exceed the NAC at 4 of the 11 modeled sites representing 4 residences.

Table 3-4). The existing worst-hour traffic noise levels approach or exceed the Noise Abatement Criteria (NAC) of 67 dBA constant energy level equivalent (Leq) at 4 of the 11 modeled sites representing 4 residences.

Future modeled worst-hour traffic noise levels without the Project range from 58 dBA to 68 dBA. The future worst-hour traffic noise levels without the Project approach or exceed the NAC of 67 dBA Leq at the same 4 of the 11 modeled sites representing the same 4 residences as Existing conditions. An increase of 0 to 1 dBA in future noise levels without the Project is predicted at one site which results from the lane alignment changes. No substantial increase in noise levels of 15 dBA or more above existing conditions were predicted without the Project.

Future modeled worst-hour traffic noise levels with Build Alternative 4 (Roundabout) range from 57 dBA to 68 dBA and range from 58 dBA to 68 dBA with Build Alternative 5 (Signalized T-Intersection). The future worst-hour traffic noise levels approach or exceed the NAC of 67 dBA Leq at the same 4 of the 11 modeled sites representing the same 4 as with Existing conditions and future No Build Alternative. (Table 4-2). An increase of 0 to 1 dBA in future noise levels is predicted at 3 sites with Build Alternative 4 (Roundabout) which results from the lane alignment changes. A change in noise levels ranging from -1 to 2 in future noise levels is predicted at 3 sites with Build Alternative 5 (Signalized T-Intersection) which results from vehicles accelerating as they travel away from the intersection. No substantial increase impacts of 15 dBA or more above existing conditions were predicted with either Project Alternative.

The same three noise barriers were evaluated to reduce traffic noise levels at sites where noise impacts were predicted with both Build Alternatives for the Project. Under Build Alternative 4 – Roundabout, all three evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria and are within HDOT's cost per benefitted residence allowance for at least one of the two wall types evaluated; therefore all three noise barriers are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 4 of the Project.

Under Build Alternative 5 – Signalized T-Intersection, all three evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria and Noise Barrier 1 and Noise Barrier 3 are within HDOT's cost per benefitted residence allowance for at least one of the two wall types evaluated; therefore Noise Barrier 1 and Noise Barrier 3 are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 5 of the Project. Details of each barrier evaluation is provided in Chapter 5 of this report.

An existing wall located alongside the museum and Kawaihae Road is planned for removal in order to construction the Project. This existing wall would be replaced in kind by the Project at a similar location between Kawaihae Road and the museum and west of the Waiaka Bridge.

Minority and low-income communities are represented along the project area. Existing and future traffic noise levels are generally consistent along the Kawaihae Road and Kohala Mountain Road within the Project area and were not identified to disproportionately impact minority or low-income communities located along the project area.

A copy of this final report will be made available to local jurisdictions by HDOT. This report will serve to inform the local planning department of the effects of the highway and highway-construction related noise in the area studied. The information contained within this report can assist local officials in their planning process.

At the time of this report, several undeveloped or vacant lots were located near the proposed project improvements. According to HDOT traffic noise policy, if building permits have been submitted for undeveloped properties, the proposed development needs to be included in the noise study. A review of available County of Hawaiʻi Real Property Tax Office building permits was conducted online in March 2022. The review identified no permits or approvals on file for new developments that include noise-sensitive land uses within available online files.

CHAPTER 1 INTRODUCTION

The State of Hawaiʻi Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) are proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project in South Kohala on the Island of Hawaiʻi. The Project is located at the intersection of Kawaihae Road and Kohala Mountain Road at Waiaka Bridge (Mile Post 58.88), in the town of Waimea, on the island of Hawaiʻi (Figure 2-1).

The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for this project, each of which replaces the bridge:

- Build Alternative 4: Roundabout
- Build Alternative 5: Signalized T-intersection

The purpose of this report is to analyze the traffic noise impacts of the proposed Kawaihae Road, Waiaka Bridge Replacement and Realignment of Approaches Project.

This study was prepared in accordance with Federal Highway Administration (FHWA) rules and procedures (FHWA, 1995) and the State of Hawaiʻi Department of Transportation (HDOT) Highway Noise Policy and Abatement Guidelines (HDOT, 2016). Report elements include:

1. Measurements of existing noise levels at representative noise sensitive receivers;
2. Prediction of future traffic noise levels;
3. Comparison of existing and predicted future traffic noise levels with the FHWA/HDOT Noise Abatement Criteria (NAC);
4. Recommendations to reduce noise impacts;
5. Evaluation of possible noise barriers; and
6. The effects of construction noise and proposed mitigation measures.

CHAPTER 2 PROJECT DESCRIPTION

The State of Hawaiʻi Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) are proposing the Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches Project in South Kohala on the Island of Hawaiʻi. The Project is located at the intersection of Kawaihae Road and Kohala Mountain Road at Waiaka Bridge (Mile Post 58.88), in the town of Waimea, on the island of Hawaiʻi (Figure 2-1).

The purpose of this project is to bring Waiaka Bridge up to current standards for roadway width, load capacity, bridge railings, and bicycle and pedestrian access. This project proposes to replace the existing bridge and realign the roadway approaches toward the bridge. There are two build alternatives being considered for this project, each of which replaces the bridge:

- Build Alternative 4: Roundabout
- Build Alternative 5: Signalized T-intersection

The Project will provide a cost effective and immediate solution to reduce congestion, increase capacity, and to accommodate vehicles utilizing this section of the freeway.

The project route is one of the primary corridors for commuters traveling on the northside on the island of Hawaiʻi and has heavy traffic volumes during the morning (eastbound) and afternoon (westbound) peak periods. It is part of the National Highway System (NHS) that connects to a major collector (Kohala Mountain Road).

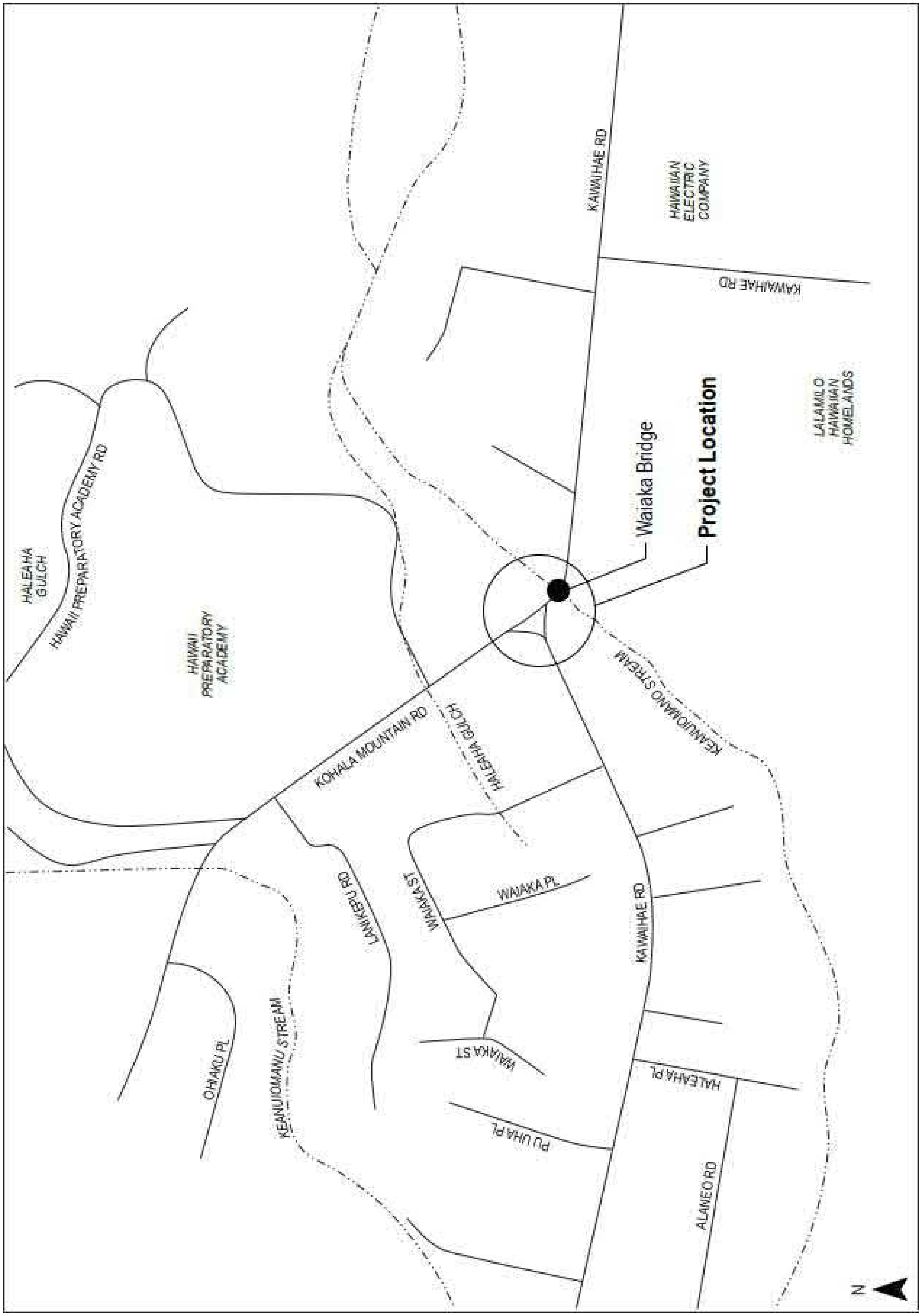
A traffic noise study was prepared for the Project in 2010 (HDOT, 2010). The purpose of this study is to analyze updated Project Alternatives and traffic data following current HDOT Highway Noise Policy and Abatement Guidelines (HDOT, 2016).

A noise study is required for this project because the build alternatives include a substantial horizontal alignment change between the roadway and noise sensitive receivers which meets the definition of a Type I Project (HDOT, 2016). Type I projects require mitigation of noise levels that approach or exceed the FHWA noise abatement criteria if the mitigation is found to be both feasible and reasonable to provide.

The following is a description of the proposed Project considered in this report:

> The Project – The Project involves bridge replacement and realignment of approaches to the bridge on Kawaihae Road and Kohala Mountain Road. The Project also involves replacement of bridge railings, and bicycle and pedestrian access. The posted speed limit would remain 25 mph on Kawaihae Road and Kohala Mountain Road.

Figure 2-1. Project Location



WSP USA, 2021

CHAPTER 3 EXISTING NOISE ENVIRONMENT

3.1 BACKGROUND

Noise is defined as any sound that is undesirable or interferes with normal human activities. The decibel (dB) scale is used to quantify sound intensity and represents the ratio between a given sound and the faintest sound detectable by human hearing. Because sound pressure levels vary widely within the range of human hearing, the dB scale is logarithmic. The human ear is not equally sensitive to all frequencies within the entire sound spectrum. Accordingly, noise measurements are made using an A-weighting (dBA) scale to correspond to human perceptions of noise. A-scale sound levels are currently in use in many community and city noise ordinances and in state and city highway traffic noise codes.

Time variation in noise exposure is typically accounted for as a constant energy level equivalent (Leq) for a given time period. The Leq is the constant noise level over some specified period of time that is equivalent in energy to a fluctuating (or brief) noise "averaged" over that period of time. Leq is also a function of time and is expressed as Leq (time period). For example, Leq(h), expressed in A-weighted decibels (dBA), is the calculated constant noise over one hour which is equivalent in total energy to the varying noise levels actually measured during that one hour.

3.2 NOISE CRITERIA

The HDOT Noise Policy and Abatement Guidelines implements FHWA regulations on noise abatement (23 CFR 772) for the State of Hawai‘i. The regulations and policy require that a noise analysis be performed whenever potentially affected receivers exist, either as developed or undeveloped lands for future use. The FHWA has established Noise Abatement Criteria (NAC), shown on Table 3-1, for different exterior and interior land use activities. The NAC do not constitute legally enforceable noise standards, but represent a yardstick for evaluating the effect of project noise on the surrounding community. The NAC have been adopted by the State of Hawai‘i as its standard.

Under HDOT policy, a noise impact occurs when the predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed the existing noise levels. "Approach" means within 1 dBA less than the NAC, and "substantially exceed the existing noise levels" means an increase of at least 15 dBA. If the NAC are approached or exceeded, or if there is a substantial increase above the existing noise level, noise abatement measures must be considered.

Changes in traffic noise are assessed using human perceptions of sound level changes. Generally, changes in noise levels of less than 3 dBA are barely perceptible to most listeners, but an increase of 10 dBA is perceived as a doubling (or halving for a decrease) of noise levels. These guidelines permit estimation of an individual's probable perception of changes in noise levels.

Table 3-1. Noise Abatement Criteria (NAC)

Activity Category	Activity Leq(h) dBA[1]	Criteria [2] L10(h)	Evaluation Location	Description of Activity
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	70	Exterior	Residential.
C[3]	67	70	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas Section 4(f) sites, schools, televisions studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	----	----	----	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities, (water resources, water treatment, electrical), and warehousing.
G	----	----	----	Undeveloped lands that are not permitted.

Notes: [1] Either Leq(h) or L10(h) (but not both) may be used on a project.
[2] The Leq(h) and the L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[3] Includes undeveloped lands permitted for this activity category.
L10(h) is the noise level exceeded for 10% of the time of the measurement duration (one hour).
Source: Federal Highway Administration

3.3 EXISTING AND FUTURE NOISE-SENSITIVE LAND USES

Existing and future noise sensitive land uses and activities located in the vicinity of the Project include residences, the museum, and agricultural land. Land uses were first identified in the Project Study conducted in 2010 and confirmed during this study. Existing Land use in the Project Study area is shown in Figure 3-1. All noise sensitive receptor locations are identified by their applicable Tax Map Key (TMK) numbers, as shown on Figures 3-2, 4-1, 4-2, 5-1 and 5-2. All residences along the project area are Category B and the outdoor uses at the museum are Category C. Category B and Category C activities have an exterior NAC of Leq(h) 67 dBA.

No undeveloped land that would likely be part of a future development was identified along the Waiaka Bridge Project area. A review of available County of Hawai‘i Real Property Tax Office building permits was conducted online on March 2, 2022 to identify permitted developments located within 500 feet of the centerline of the Waiaka Bridge Project area. At the time of this report no permits are on file at the County of Hawai‘i Real Property Tax Office for planned developments that include new noise-sensitive land uses along the project area.

Figure 3-1. Project Study Area Land Use

Island of Hawai'i, Hawai'i and WSP USA, 2021

3.4 NOISE MEASUREMENT SITES

Six short-term (1-hour) measurements were taken at three locations along the project area to validate the traffic noise model. The approximate locations of the measurements taken at outdoor use locations within 50 feet of the centerline of the project area are illustrated in Figure 3-2 as Measurement Locations A, B, and C. The noise measurements were performed during satisfactory weather conditions and during times when traffic on Project roadways was free flowing.

3.4.1 Noise Measurements

Noise level measurements were conducted for two 1-hour periods at three sites on June 14, 2010 as part of the previous noise study for this project (HDOT, 2010). In coordination with HDOT, the noise measurements conducted in 2010 were determined to represent existing conditions to validate the noise model used for this study.

The measurement sites were taken near outdoor use areas along Kawaihae Road and Kohala Mountain Road near the Waiaka Bridge (see Figure 3-2). Traffic volumes were simultaneously counted for all of the measurement sites. The traffic counts used three vehicle classifications: automobiles, medium trucks, and heavy trucks. Vehicle speeds were observed during all measurements to estimate vehicle speeds during measurement periods. Noise measurements were not taken unless traffic conditions were free-flowing. The descriptions below provide details of each measurement site.

3.4.1.1 Measurement Location A

Location A was measured at near residences located along Kawaihae Road, west of Waiaka Bridge. Two 1-hour measurements were conducted at this location approximately 33 feet from the centerline of Kawaihae Road. Traffic noise from Kawaihae Road was the dominant noise source at this location during both measurements. The surrounding area consists of single- and multi-family housing and a museum. An Leq of 69.8 dBA was recorded during the first measurement conducted from 6:48 a.m. to 7:48 a.m. An Leq of 68.5 dBA was recorded during the second measurement conducted from 1:37 p.m. to 2:37 p.m.

3.4.1.2 Measurement Location B

Location B was measured at near agricultural land located along Kawaihae Road, east of Waiaka Bridge. Two 1-hour measurements were conducted at this location approximately 36 feet from the centerline of Mamalahoa Highway. Traffic noise from Mamalahoa Highway was the dominant noise source at this location during both measurements. The surrounding area consists of agricultural land. An Leq of 68.8 dBA was recorded during the first measurement conducted from 7:52 a.m. to 8:52 a.m. An Leq of 69.0 dBA was recorded during the second measurement conducted from 2:53 p.m. to 3:53 p.m.

3.4.1.3 Measurement Location C

Location C was measured at near residences located along Kohala Mountain Road, north of Waiaka Bridge. Two 1-hour measurements were conducted at this location approximately 33 feet from the centerline of Kohala Mountain Road. Traffic noise from Kohala Mountain Road was the dominant noise source at this location during both measurements. The surrounding area consists of single-family housing and agricultural land. An Leq of 62.0 dBA was recorded during the first measurement conducted from 9:06 a.m. to 10:06 a.m. An Leq of 63.2 dBA was recorded during the second measurement conducted from 12:32 p.m. to 1:32 p.m.

3.5 MODEL CALIBRATION

FHWA Traffic Noise Model (TNM) version 2.5 was used to model existing traffic noise levels at the measurement sites along the existing lane configuration of Kawaihae Road and Kohala Mountain Road near the Waiaka Bridge and the sites along the proposed lane configuration (the Project) (see Figure 3-2). The model estimates the traffic noise level at a receptor location resulting from a series of straight-line roadway segments. Noise emissions from free-flowing traffic depend on the number of automobiles, medium trucks, and heavy trucks per hour; vehicular speed; and reference noise emission levels of specified vehicles. TNM also considers effects of intervening barriers, topography, trees, and atmospheric absorption. By intent and design, noise from sources other than traffic is not included. Therefore, when non-traffic noise, such as aircraft, is considerable in an area, the TNM results can be less than the measured noise levels.

Traffic Noise Models prepared for the 2010 noise study were used to update existing conditions (2021) and future year (2024) traffic volumes and vehicle mix data for Build Alternative 4 (Roundabout) and Build Alternative 5 (Signalized T-Intersection). All modeling assumptions, including noise measurements and model validation used to develop the TNM's for the 2010 noise study remained constant for this study that is intended to update the previous noise study results.

As described in the 2010 noise study for the Project, traffic volumes counted during the short-term measurement periods were entered into the model along with the observed vehicle speeds to calibrate the model. There is reasonable agreement between measured and modeled noise levels (within 3.0 dBA) for all the measured sites near Kawaihae Road and Kohala Mountain Road at Waiaka Bridge. Table 3-2 compares measured noise levels and levels modeled in the TNM for all measured sites.

HDOT suggests traffic data used for existing and design year noise predictions should represent the Design Hour Volume or the peak truck traffic hour or the maximum hourly volume under Level of Service C, depending on which would result in the loudest condition (HDOT 2016). Traffic data used for Existing and Future Year 2024 noise predictions were representative of the peak truck hourly traffic volumes (Table 3-3). Modeled roadway volumes included slightly higher average heavy vehicle percentages (92.54% automobiles, 3.70% medium trucks, 3.20% heavy trucks, <1% motorcycles, and <1% buses) than traffic counted during measurements with an average of 94.82% automobiles, 2.44% medium trucks, 2.74% heavy trucks along Kawaihae Road and Kohala Mountain Road at Waiaka Bridge. Vehicle mix is based on modeled vehicle classifications and traffic information completed by WSP for the Traffic Impact Analysis (WSP, 2021).

Eleven additional sites were added to the model to describe noise levels at additional areas along the Kawaihae Road and Kohala Mountain Road at Waiaka Bridge Project area. The approximate locations of the modeled sites are illustrated in Figure 3-2.

Table 3-2. Noise Measurement Data and TNM Model Validation

Site ID	Site Location	Land Use	Date of Measurement and Start Time	Measured Leq(h), dBA	Modeled Noise Level for Calibration Leq(h), dBA	Difference between Modeled and Measured Noise Level Leq(h), dBA
A	33 feet from the centerline of Kawaihae Road	Right-of-Way, Adjacent to Residential	6/14/10 6:48 a.m.	69.8	69.7	-0.1
A	33 feet from the centerline of Kawaihae Road	Right-of-Way, Adjacent to Residential	6/14/10 1:37 p.m.	68.5	68.5	0
B	36 feet from the centerline of Mamalahoa Highway	Right-of-Way, Adjacent to Residential	6/14/10 7:52 a.m.	68.8	68.8	0
B	36 feet from the centerline of Mamalahoa Highway	Right-of-Way, Adjacent to Residential	6/14/10 2:53 p.m.	69.0	69.3	0.3
C	33 feet from the centerline of Kohala Mountain Road	Right-of-Way, Adjacent to Residential	6/14/10 9:06 a.m.	62.0	61.9	-0.1
C	33 feet from the centerline of Kohala Mountain Road	Right-of-Way, Adjacent to Residential	6/14/10 12:32 p.m.	63.2	62.0	-1.2

Note : All measurements were taken as part of the 2010 Noise Study for the Project at outdoor use areas for 1 hour
Modeled Noise Levels Leq(h) are within 3 dBA of measured values indicating the model is correctly calibrated.
Measurement Locations A, B, and C were only used to validate the noise model and not included in the impact analysis as each site did not represent a noise-sensitive land use.

3.6 MODELED TRAFFIC EXISTING NOISIEST TRAFFIC HOUR

Table 3-3. Existing Conditions 2021 Modeled Traffic

Roadway	Direction	Vehicles per Hour	Posted Speed Limit (MPH)	Modeled Speed (MPH)
EB Kawaihae - West of Kohala Mountain Rd	EB	600	25	35
EB Kawaihae - LT to Kohala Mountain Road	EB	35	25	35
EB Kawaihae - Through to Kohala Mountain Road	EB	565	25	35
EB Kawaihae - East of Kohala Mountain Rd	EB	760	25	35
WB Kawaihae -East of Kohala Mountain Road	WB	640	25	35
WB Kawaihae - RT to Kohala Mountain Road	WB	230	25	35
WB Kawaihae - Through to Kohala Mountain Road	WB	410	25	35
WB Kawaihae - West of Kohala Mountain Road	WB	470	25	35
SB Kohala to Kawaihae	SB	255	25	35
SB Kohala - RT to WB Kawaihae	SB	60	25	35
SB Kohala - LT to EB Kawaihae	SB	195	25	35
NB Kohala from Kawaihae	NB	265	25	35

Notes: Modeled speeds included vehicle acceleration at stops.
EB = Eastbound
WB = Westbound
SB = Southbound
NB = Northbound

Figure 3-2. Noise Measurement and Modeling Locations and Modeled Existing Noise Levels (Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches)

WSP USA, 2021

3.7 RESULTS OF EXISTING NOISE MEASUREMENTS

Error! Not a valid bookmark self-reference. presents the modeled existing worst-hour traffic noise levels, the number of receptors represented by each measurement site, and the NAC for each of the short-term and modeled measurement locations. Worst-hour traffic noise levels for residential areas range from 57 dBA to 68 dBA depending on the proximity of the receiver to the roadway traffic and the presence of buildings and topography providing noise attenuation between the receiver and the roadway. The worst-hour traffic noise levels approach or exceed the NAC at 4 of the 11 modeled sites representing 4 residences.

Table 3-4. Predicted Existing Worst-Hour Traffic Noise Levels

Site ID	Description of Receivers Represented	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing Worst-Hour Leq(h), dBA	Impact Type* (S, A/E, or None)
TMK: 6-6-009:007	Residence at Kohala Mountain Road - 1st Row	1	B/66	**67**	A/E
TMK: 6-6-009:008	Residence at Kawaihae Road - 1st Row	1	B/66	**68**	A/E
TMK: 6-6-009:009	Residence at Kawaihae Road - 1st Row	1	B/66	62	None
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road - 1st Row	1	B/66	**66**	A/E
TMK: 6-6-004:121	2nd Story Residence at Kohala Mountain Road - 1st Row	1	B/66	**68**	A/E
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road – 2nd Row	1	B/66	61	None
TMK: 6-6-004:001a	Outdoor use area at Museum	1	C/66	63	None
TMK: 6-6-004:001b	Outdoor use area at Museum	1	C/66	62	None
TMK: 6-6-004:001c	Outdoor use area at Museum	1	C/66	61	None
TMK: 6-5-001:015	Residence at Kawaihae Road – 1st Row	1	B/66	57	None
TMK: 6-5-001:033	Residence at Kohala Mountain Road - 1st Row	1	B/66	59	None

Note : See Table 3-1 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
Measurement Locations A, B, and C were only used to validate the noise model and not included in the impact analysis as each site did not represent a noise-sensitive land use.
A “Receiver” is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

CHAPTER 4 FUTURE TRAFFIC NOISE LEVELS

The noise impact analysis considers traffic noise levels at receivers for the two build alternatives.

4.1 PREDICTION METHODOLOGY

FHWA Traffic Noise Model (TNM) was used to model the noise levels in 2024 at 11 sites for the proposed project alternatives (Build Alternative 4 – Roundabout and Build Alternative 5 – Signalized T-Intersection) along Kawaihae Road and Kohala Mountain Road at Waiaka Bridge. Input variables to noise modeling and analysis include traffic volumes, speeds and vehicle fleet mix (auto, medium truck, heavy truck, motorcycle, and bus percentages). The noise analysis considers the peak traffic hour as the noisiest hour of the day. The number of vehicles expected to travel on the Project roadways in 2024 is slightly greater than existing conditions and the predicted traffic noise levels for both Build Alternatives would remain similar to existing conditions. Table 4-1 summarizes maximum peak truck hourly traffic volumes in 2024 should either of the proposed project alternatives be implemented.

Table 4-1. Build Alternative 2024 Traffic Volumes (Alternative 4 and Alternative 5)

Roadway	Direction	Vehicles per Hour	Posted Speed Limit (MPH)	Modeled Speed (MPH)
EB Kawaihae - West of Kohala Mountain Rd	EB	610	25	35
EB Kawaihae - LT to Kohala Mountain Road	EB	35	25	35
EB Kawaihae - Through to Kohala Mountain Road	EB	575	25	35
EB Kawaihae - East of Kohala Mountain Rd	EB	775	25	35
WB Kawaihae -East of Kohala Mountain Road	WB	645	25	35
WB Kawaihae - RT to Kohala Mountain Road	WB	230	25	35
WB Kawaihae - Through to Kohala Mountain Road	WB	415	25	35
WB Kawaihae - West of Kohala Mountain Road	WB	475	25	35
SB Kohala to Kawaihae	SB	260	25	35
SB Kohala - RT to WB Kawaihae	SB	60	25	35
SB Kohala - LT to EB Kawaihae	SB	200	25	35
NB Kohala from Kawaihae	NB	265	25	35

Notes: Modeled speeds included vehicle acceleration at stops.
EB = Eastbound
WB = Westbound
SB = Southbound
NB = Northbound

Future vehicle mix is predicted to be an average of 92.54% automobiles, 3.70% medium trucks, 3.20% heavy trucks, <1% motorcycles, and <1% buses along Kawaihae Road and Kohala Mountain Road at Waiaka Bridge. Vehicle mix is based on modeled vehicle classifications and traffic information completed by WSP for the Traffic Impact Analysis (Table 4-1).

4.2 NOISE IMPACT ANALYSIS

In terms of the one-hour Leq(h) noise descriptor, a noise impact could potentially require mitigation if either of the following conditions is predicted to occur:

- Future year traffic noise approaches or exceeds the FHWA NAC; or
- Future year traffic noise substantially exceeds (15 dBA or more) the existing ambient noise level.

4.2.1 The Project (Build Alternative 4 and Build Alternative 5)

Predicted 2024 traffic noise levels for the Build Alternative 4 - Roundabout are expected to be within 1 dBA of existing noise levels. The NAC of 67 dBA Leq(h) is predicted to be approached or exceeded at 4 of the 11 modeled sites representing 4 residences (Table 4-2). An increase of 1 to dBA in future noise levels under the Build Alternative 4 - Roundabout is predicted at 4 sites which results from the lane alignment changes.

Predicted 2024 traffic noise levels for the Build Alternative 5 – Signalized T-Intersection are expected to be within 2 dBA of existing noise levels. The NAC of 67 dBA Leq(h) is predicted to be approached or exceeded at 4 of the 11 modeled sites representing the same 4 residences predicted to approach or exceed the NAC of 67 dBA Leq(h) with the Build Alternative 4 (Table 4-2). An increase of 1 to 2 to dBA in future noise levels under the Build Alternative 5 – Signalized T-Intersection is predicted at 4 sites which results from the lane alignment changes.

Minority and low-income communities are represented all along the project area. Existing and future traffic noise levels are generally consistent along the Kawaihae Road and Kohala Mountain Road at Waiaka Bridge within the Project area and were not identified to disproportionately impact minority or low-income communities located along the project area.

A copy of this final report will be made available to local jurisdictions by HDOT. This report will serve to inform the local planning department of the effects of the highway and highway-construction related noise in the area studied. The information contained within this report can assist local officials in their planning process.

At the time of this report, several undeveloped or vacant lots were located near the proposed project improvements. According to HDOT traffic noise policy, if building permits have been submitted for undeveloped properties, the proposed development needs to be included in the noise study. A review of available County of Hawaiʻi Real Property Tax Office building permits was conducted online on March 2, 2022. The review identified no permits or approvals for new noise-sensitive land uses on file within available online files.

4.2.2 No Build Alternative

Predicted 2024 modeled worst-hour traffic noise levels without the Project range from 58 dBA to 68 dBA. The future worst-hour traffic noise levels without the Project approach or exceed the NAC of 67 dBA Leq at the same 4 of the 11 modeled sites representing the same 4 residences as Existing conditions. An increase of 0 to 1 dBA in future noise levels without the Project is predicted at one site which results from the lane alignment changes. No substantial increase in noise levels of 15 dBA or more above existing conditions were predicted.

Figure 4-1. Modeled 2024 Noise Levels with the Project (Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches) – Build Alternative 4 Roundabout

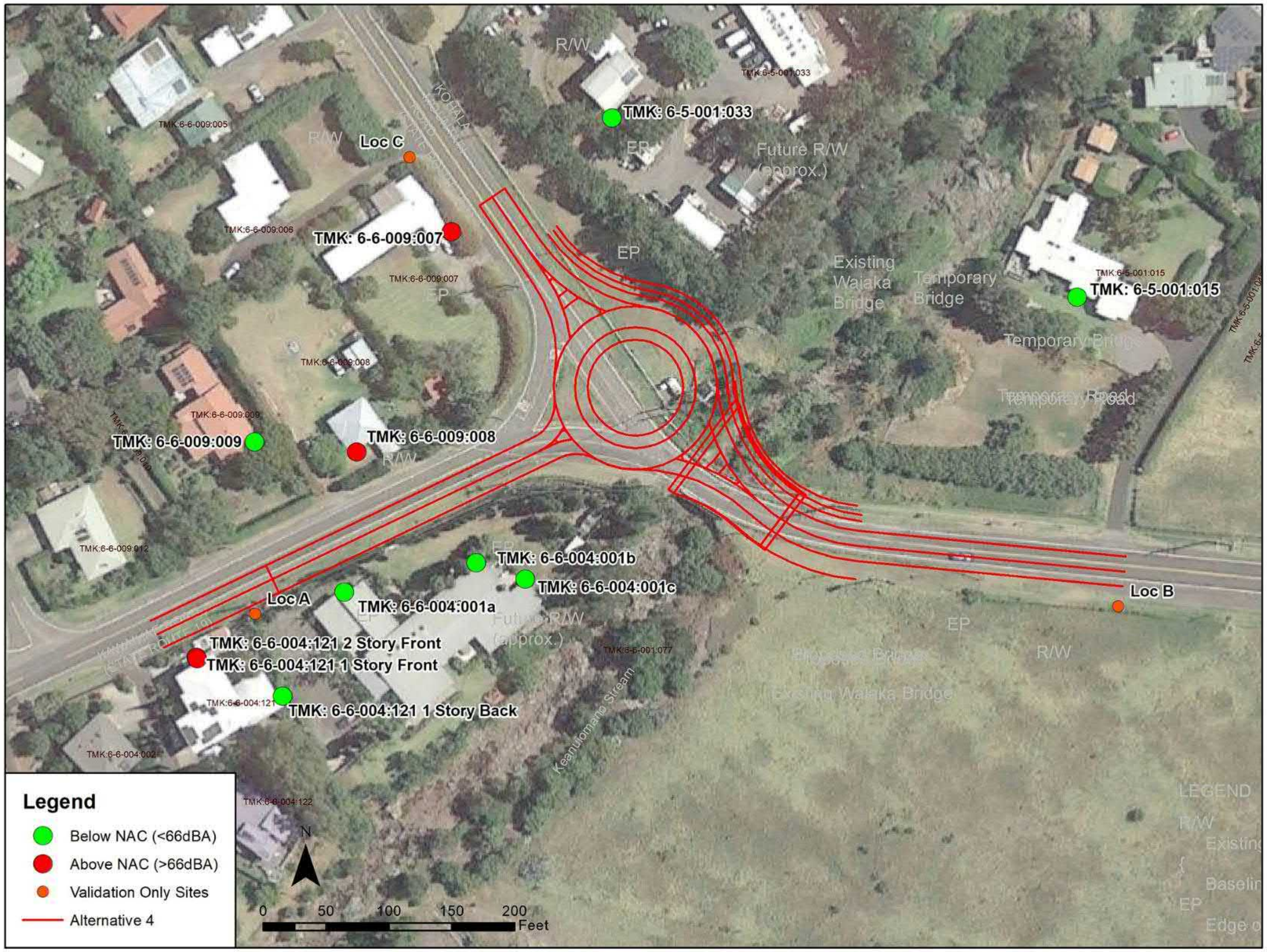


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Figure 4-2. Modeled 2024 Noise Levels with the Project (Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches) – Build Alternative 5 Signalized T-Intersection

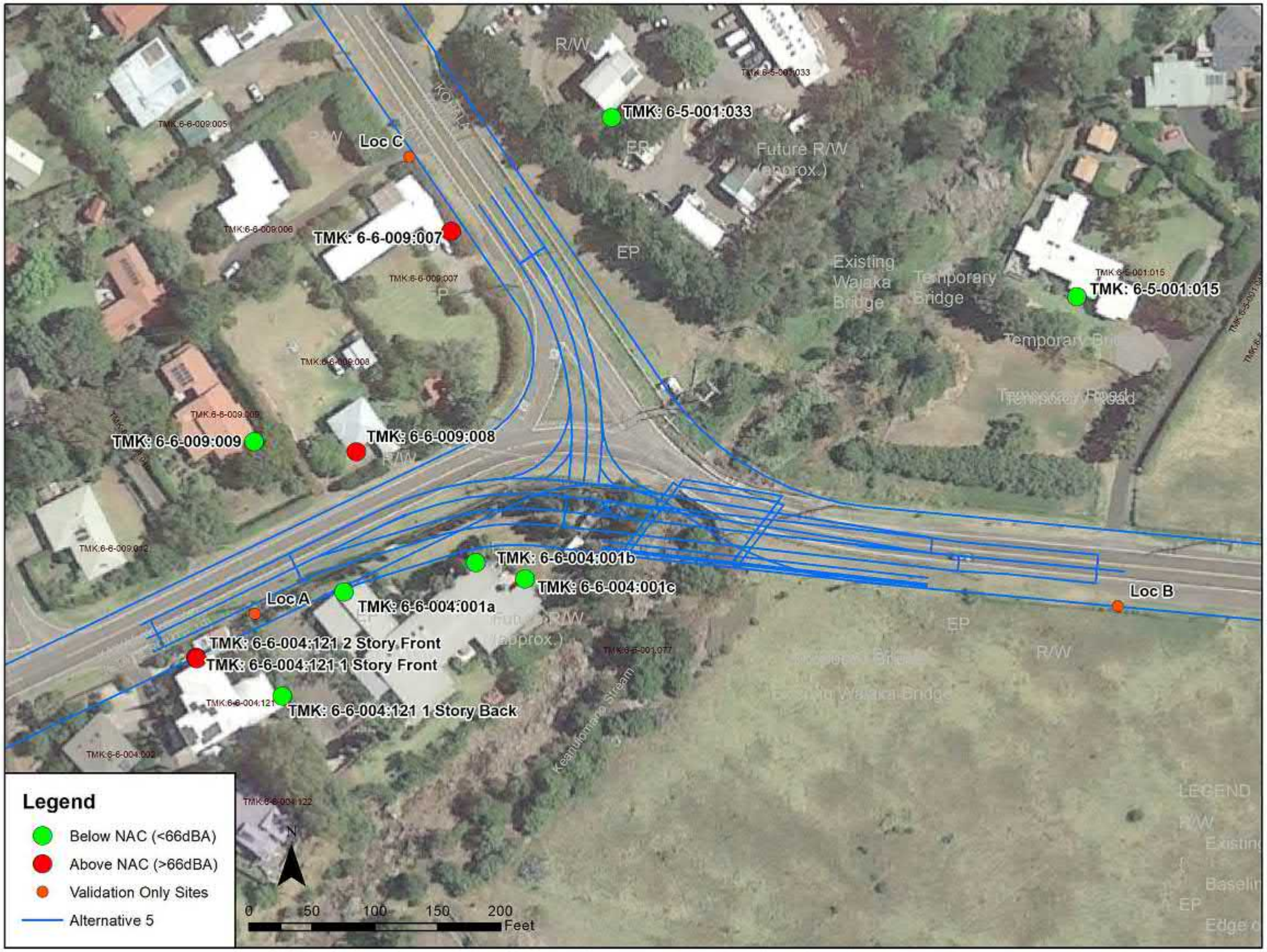

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Table 4-2. Existing and Build Worst-Hour Traffic Noise Levels

Site ID	Location	Modeled Existing Alternative Worst-Hour Leq(h), dBA	Modeled 2024 Build Alternative 4 Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Modeled 2024 Build Alternative 5 Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	2024 Build Impact Type* (S, A/E, or None)
TMK: 6-6-009:007	Residence at Kohala Mountain Road - 1st Row	**67**	**67**	0	**67**	0	B/66	A/E
TMK: 6-6-009:008	Residence at Kawaihae Road - 1st Row	**68**	**68**	0	**68**	0	B/66	A/E
TMK: 6-6-009:009	Residence at Kawaihae Road - 1st Row	62	62	0	62	0	B/66	None
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road - 1st Row	**66**	**67**	1	**66**	0	B/66	A/E
TMK: 6-6-004:121	2nd Story Residence at Kohala Mountain Road - 1st Row	**68**	**68**	0	**68**	0	B/66	A/E
TMK: 6-6-004:121	1st Story Residence at Kohala Mountain Road – 2nd Row	61	62	1	61	0	B/66	None
TMK: 6-6-004:001a	Outdoor use area at Museum	63	63	0	62	-1	C/66	None
TMK: 6-6-004:001b	Outdoor use area at Museum	62	62	0	63	1	C/66	None
TMK: 6-6-004:001c	Outdoor use area at Museum	61	61	0	63	2	C/66	None
TMK: 6-5-001:015	Residence at Kawaihae Road – 1st Row	57	57	0	58	1	B/66	None
TMK: 6-5-001:033	Residence at Kohala Mountain Road - 1st Row	59	60	1	59	0	B/66	None

Note: See Table 3-1 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
Measurement Locations A, B, and C were only used to validate the noise model and not included in the impact analysis as each site did not represent a noise-sensitive land use.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, etc.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

CHAPTER 5 NOISE ABATEMENT MEASURES

Noise abatement measures must be considered as part of the project if traffic noise impacts are identified and should be provided where it is feasible and reasonable to do so. Impacts occur at sites where traffic noise levels approach or exceed the NAC of Leq(h) 67 dBA, or substantially exceed (by 15 dBA or more) the ambient noise levels. HDOT's Highway Noise Policy and Abatement Guidelines (HDOT, 2016) are used to determine whether noise abatement measures can be implemented, depending on whether these measures are reasonable and feasible based on the following criteria:

- Provide at least 5 dBA highway traffic noise reduction for two thirds of front row receptors located along the subject Type I project
- Determination that it is possible to design and construct the barrier after considering issues related to safety, barrier height, topography, drainage, utilities, maintenance, maintenance access to adjacent properties, and access to adjacent properties
- Consideration of viewpoints of the property owners and residents benefited by the barrier
- Cost of noise abatement does not exceed $60,000 per benefited receptor
- Achieve noise reduction design goal of 7 dBA for 75% of the benefited front-row receptors located along the subject project

The noise abatement evaluated for the project is based on a planning level cost estimate of the feasible abatement measures identified in this report. The price per square foot of noise barrier construction is based on an engineer's estimate given site conditions and estimated wall dimensions.

An existing wall located alongside the museum and Kawaihae Road is planned for removal in order to construction the Project. This existing wall would be replaced in kind by the Project at a similar location between Kawaihae Road and the museum and west of the Waiaka Bridge. Existing and future noise levels were below NAC at modeled receptors located behind the existing wall, therefore the replacement of the existing wall was not included in the evaluation of noise barriers. Upon selection of a preferred alternative, the need to replace the existing wall during Project construction can be confirmed and evaluated as necessary to ensure noise levels at receptors located behind the wall are maintained.

5.1 NOISE ABATEMENT EVALUATION: 2024 PROJECT

Future Project noise levels for both Build Alternatives result in 4 of the 11 modeled sites representing 4 residences predicted to approach or exceed the NAC of Leq(h) 67 dBA in 2024 (Table 4-2). The future 2024 noise levels at all 11 modeled sites are predicted to be within 2 dBA of existing noise levels with future 2024 noise levels at the majority of sites within 1 dBA of existing noise levels. With both Project Alternatives, 4 of the 11 sites are considered to have a noise impact requiring the evaluation of noise abatement.

Three noise barriers were evaluated to reduce traffic noise levels at sites where noise impacts are predicted with both Project Alternatives. The locations of the three evaluated noise barriers for Build Alternative 4 - Roundabout are presented in Figure 5-1. The locations of the three evaluated noise barriers for Build Alternative 4 - Roundabout are presented in Figure 5-2. A summary of each noise barrier evaluation is provided in the following section by Build Alternative.

After determining if each evaluated noise barrier can satisfy HDOT's Feasibility Criteria, each feasible noise barrier was then evaluated by comparing the maximum allowable cost to the engineer's cost estimate (summarized in

Table 5-1). Because all three barriers meet cost-reasonableness criteria, adjoining property owners will be consulted to determine if a barrier is desired by the residents. A noise barrier is deemed reasonable only if the estimated cost is less than the maximum allowable cost and a majority of the residents want a barrier.

Figure 5-1. Noise Barrier Locations Evaluated (Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches) – Build Alternative 4 Roundabout

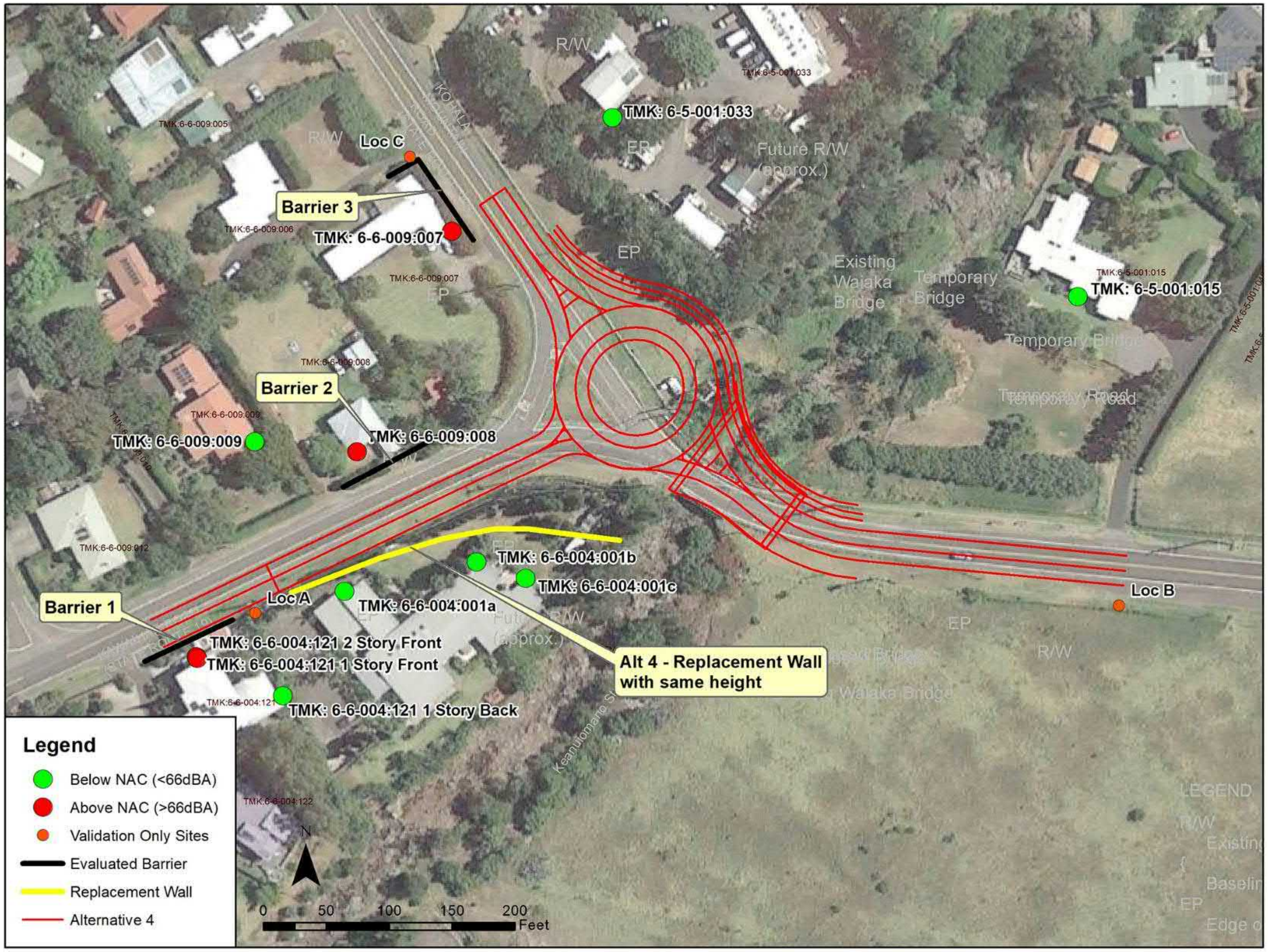

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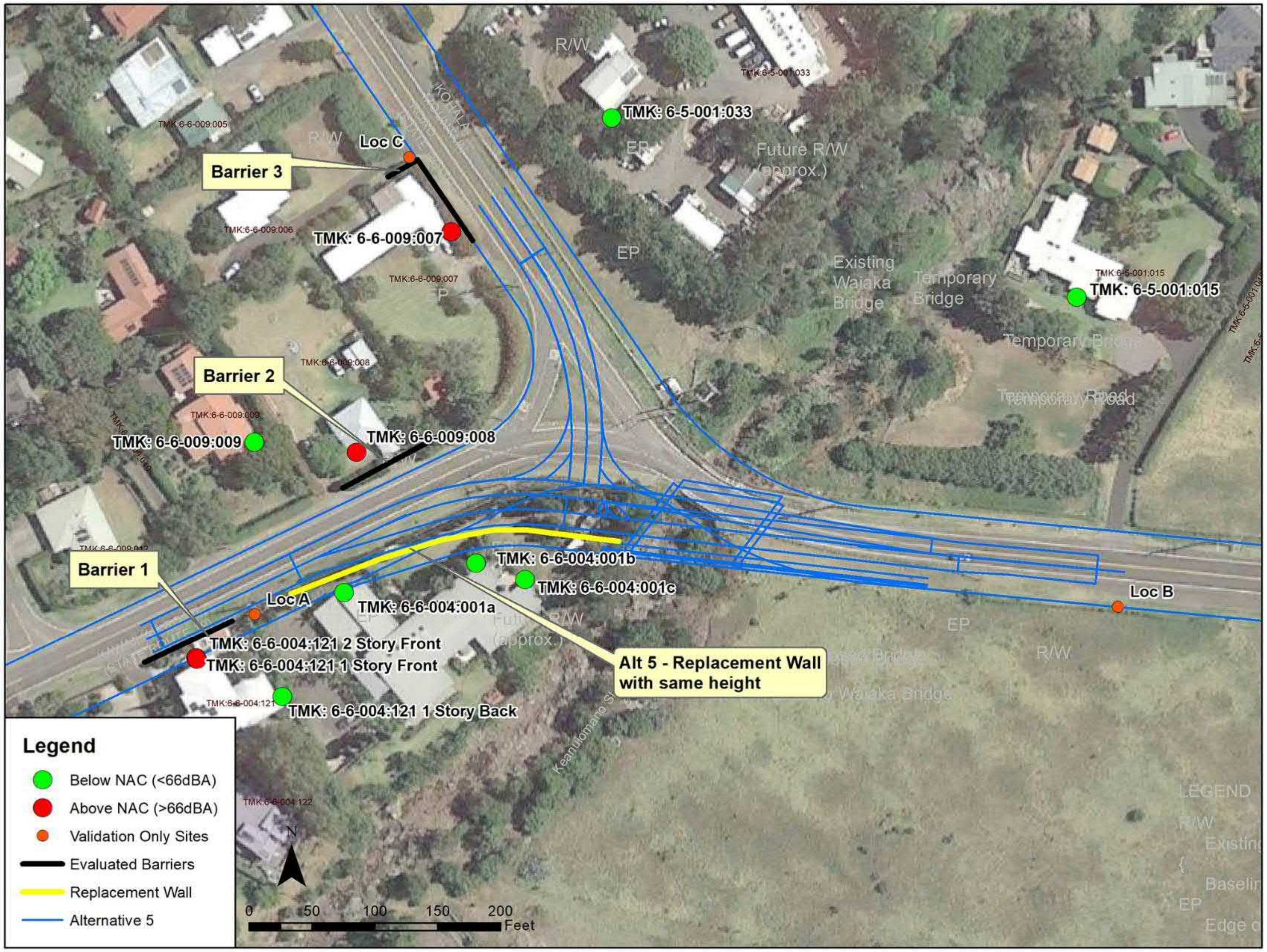
Figure 5-2. Evaluated Noise Barrier Locations Evaluated (Kawaihae Road, Replacement of Waiaka Bridge and Realignment of Approaches) – Build Alternative 5 Signalized T-Intersection



WSP USA, 2021

5.1.1 Build Alternative 4 – Roundabout

5.1.1.1 Noise Barrier 1

Noise Barrier 1 (NB-1) was evaluated along the eastbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Sites TMK: 6-6-004:121-1st Story and TMK: 6-6-004:121-2nd Story. Noise Barrier 1 was evaluated along Kawaihae Road to shield the multi-family residence located at 66-1665 Kawaihae Road. Noise Barrier 1 was evaluated atop an existing retaining wall located on site that ranges from approximately 1 to 3 feet in height. The analysis considered a barrier length of approximately 71 linear feet at heights from 6 feet to 13 feet. At 12 feet high, Noise Barrier 1 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 12 feet high and 71 feet in length, Noise Barrier 1 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 1 is $120,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 1 was estimated at $42,600 and a CRM wall for Noise Barrier 1 was estimated at $83,447. The engineer's cost estimates for each Noise Barrier 1 wall type are within HDOT's cost per benefitted residence allowance; therefore both wall types evaluated for Noise Barrier 1 are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 4 of the Project.

5.1.2 Noise Barrier 2

Noise Barrier 2 (NB-2) was evaluated along the westbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Site TMK: 6-6-009:008. Noise Barrier 2 was evaluated along Kawaihae Road to shield the single-family residence located at 66-1670 Kawaihae Road. Noise Barrier 2 was evaluated atop an existing retaining wall located on site that is approximately 4 foot tall. The analysis considered a barrier length of approximately 89 linear feet at heights from 6 feet to 16 feet. At 13 feet high, Noise Barrier 2 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 13 feet high and 89 feet in length, Noise Barrier 2 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 2 is $60,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 2 was estimated at $59,007 and a CRM wall for Noise Barrier 2 was estimated at $115,712. The engineer's cost estimate for the CMU wall for Noise Barrier 2 is within HDOT's cost per benefitted residence allowance; therefore only the CMU wall type evaluated for Noise Barrier 2 is deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 4 of the Project.

5.1.3 Noise Barrier 3

Noise Barrier 3 (NB-3) was evaluated along the southbound Kahala Mountain Road right-of-way north of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Site TMK: 6-6-009:007. Noise Barrier 3 was evaluated along Kahala Mountain Road to shield the single-family residence located at 66-1663 Kahala Mountain Road. Noise Barrier 3 was evaluated atop an existing retaining wall approximately 2 feet in height. The analysis considered a barrier length of approximately 104 linear feet at heights from 6 feet to 16 feet. At 6 feet high, Noise Barrier 3 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 6 feet high and 104 feet in length, Noise Barrier 3 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 3 is $60,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 3 was estimated at $31,200 and a CRM wall for Noise Barrier 3 was estimated at $56,751. The engineer's cost estimates for each Noise Barrier 3 wall type are within HDOT's cost per benefitted residence allowance; therefore both wall types evaluated for Noise Barrier 3 are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 4 of the Project.

5.1.4 Build Alternative 5 – Signalized T-Intersection

5.1.4.1 Noise Barrier 1

Noise Barrier 1 (NB-1) was evaluated along the eastbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Sites TMK: 6-6-004:121-1st Story and TMK: 6-6-004:121-2nd Story. Noise Barrier 1 was evaluated along Kawaihae Road to shield the multi-family residence located at 66-1665 Kawaihae Road. Noise Barrier 1 was evaluated atop an existing retaining wall located on site that ranges from approximately 1 to 3 feet in height. The analysis considered a barrier length of approximately 71 linear feet at heights from 6 feet to 16 feet. At 16 feet high, Noise Barrier 1 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 16 feet high and 71 feet in length, Noise Barrier 1 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 1 is $120,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 1 was estimated at $56,800 and a CRM wall for Noise Barrier 1 was estimated at $120,700. The engineer's cost estimate for the CMU wall for Noise Barrier 1 is within HDOT's cost per benefitted residence allowance; therefore only the CMU wall type evaluated for Noise Barrier 1 is deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 5 of the Project.

5.1.5 Noise Barrier 2

Noise Barrier 2 (NB-2) was evaluated along the westbound Kawaihae Road right-of-way west of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Site TMK: 6-6-009:008. Noise Barrier 2 was evaluated along Kawaihae Road to shield the single-family residence located at 66-1670 Kawaihae Road. Noise Barrier 2 was evaluated atop an existing retaining wall located on site that is approximately 4 foot tall. The analysis considered a barrier length of approximately 89 linear feet at heights from 6 feet to 16 feet. At 15 feet high, Noise Barrier 2 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 15 feet high and 89 feet in length, Noise Barrier 2 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 2 is $60,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 2 was estimated at $68,085 and a CRM wall for Noise Barrier 2 was estimated at $139,089. The engineer's cost estimate for both wall types are above HDOT's cost per benefitted residence allowance; therefore Noise Barrier 2 is deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in Build Alternative 5 of the Project.

5.1.6 Noise Barrier 3

Noise Barrier 3 (NB-3) was evaluated along the southbound Kahala Mountain Road right-of-way north of the Kawaihae Road/Kahala Mountain Road Intersection (Figure 5-1) to mitigate for noise impacts at Site TMK: 6-6-009:007. Noise Barrier 3 was evaluated along Kahala Mountain Road to shield the single-family residence located at 66-1663 Kahala Mountain Road. Noise Barrier 3 was evaluated atop an existing retaining wall approximately 2 feet in height. The analysis considered a barrier length of approximately 104 linear feet at heights from 6 feet to 16 feet. At 6 feet high, Noise Barrier 3 would provide at least 5 dBA reduction to at least two thirds of the front row receptors and is constructible based on a planning level review and is therefore feasible. At 6 feet high and 104 feet in length, Noise Barrier 3 meets the 7 dBA noise reduction design goal by providing at least a 7 dBA reduction to at least 75% of the benefited first row receptors located behind the barrier. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 3 is $60,000. An engineer's estimate was obtained for two wall types, a CMU wall and a CRM wall. The CMU wall for Noise Barrier 3 was estimated at $31,200 and a CRM wall for Noise Barrier 3 was estimated at $56,751. The engineer's cost estimates for each Noise Barrier 3 wall type are within HDOT's cost per benefitted residence allowance; therefore both wall types evaluated for Noise Barrier 3 are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 5 of the Project.

Table 5-1. Summary of Noise Barrier Feasibility and Reasonableness Analysis with the Project

Noise Barrier I.D.	Height	Number of Benefited Residences	Maximum Cost Allowance Per Noise Barrier	Noise Barrier Planning Level/ Engineer's Cost Estimate (CMU / CRM)	Is Barrier Feasible and Reasonable?
Build Alternative 4 - Roundabout					
NB-1	12 feet	2	$120,000	$42,600 / $83,447	Feasible, Reasonable (both wall types)
NB-2	13 feet	1	$60,000	$59,007 / $115,712	Feasible, Reasonable (CMU only)
NB-3	6 feet	1	$60,000	$31,200 / $56,751	Feasible, Reasonable (both wall types)
Build Alternative 5 – Signalize T-Intersection					
NB-1	16 feet	2	$120,000	$56,800 / $120,700	Feasible, Reasonable (CMU only)
NB-2	15 feet	1	$60,000	$68,085 / $139,089	Not Feasible, Not Reasonable (both wall types)
NB-3	6 feet	1	$60,000	$31,200 / $56,751	Feasible, Reasonable (both wall types)

Note: NA = Not Applicable; cost not calculated because the evaluated noise barrier did not meet HDOT Feasibility Criteria. Engineer's Estimates from WSP USA, November, 2021.

5.2 PRELIMINARY NOISE MITIGATION FINDINGS / STATEMENT OF LIKELIHOOD

Four residential units are predicted to approach or exceed the FHWA noise abatement criteria with both Build Alternatives for the Project. No substantial increase impacts of 15 dBA or more above existing conditions were predicted with either Build Alternative for the Project.

The same three noise barriers were evaluated to reduce traffic noise levels at sites where noise impacts were predicted with both Build Alternatives for the Project. Under Build Alternative 4 – Roundabout, all three evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria and are within HDOT's cost per benefitted residence allowance for at least one of the two wall types evaluated; therefore all three noise barriers are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 4 of the Project.

Under Build Alternative 5 – Signalized T-Intersection, all three evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria and Noise Barrier 1 and Noise Barrier 3 are within HDOT's cost per benefitted residence allowance for at least one of the two wall types evaluated; therefore Noise Barrier 1 and Noise Barrier 3 are deemed reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will be considered for placement during final design of Build Alternative 5 of the Project.

Details of each barrier evaluation including noise barrier locations are provided in Chapter 5 of this report.

CHAPTER 6 CONSTRUCTION NOISE IMPACTS

The duration and level of construction noise depends on the phase and type of activity, including: asphalt removal, grading, paving, and restriping.

Areas where concrete and asphalt is planned for removal will typically generate the highest noise levels during construction of the project. Noise generated by construction equipment, including trucks, graders, excavators, demolition equipment, cold planers, concrete mixers, and generators can reach levels from 77 dBA to 85 dBA at 50 feet. Construction equipment noise emissions are regulated by the Environmental Protection Agency's Noise Control Program (Part 204 of Title 40, Code of Federal Regulations). Presently, air compressors are the only equipment under regulation, and no new regulations are currently under consideration.

Noise levels for equipment which might be used during the excavation and construction of the proposed project are presented in Table 6-1. The noise levels presented are at a reference distance of 50 feet. Since construction equipment noise levels decrease at a rate of approximately 6 dBA per doubling of distance, at 100 feet the noise levels would be about 6 dBA less than the levels shown in the table. Similarly, at 200 feet the noise levels would be approximately 12 dBA less than shown in the table. Intervening structures or topography can act as a noise barrier to further reduce noise levels.

Table 6-1. Construction Equipment Noise Levels

Equipment	Decibels at 50 feet	Equipment	Decibels at 50 feet
Backhoe (Case)*	**94.1**	Labor Truck	75
Backhoe with Hammer*	**90**	Light Tower	62
Backhoe*	**85**	**Paver***	**93.1**
Bobcat Skid Loader*	**85**	Pickup Truck	75
Chain Saw*	**110**	**Post Pounder***	**97**
Chipper*	**110**	Power Broom	67
Cold Planing Machine	83	Propane Truck	78
Compressor (Air)	81	**Rubber Tire Roller (Sakai)***	**91.6**
Concrete Saw	78	**Suttlebuggy***	**94.2**
Distributor Truck	78	Spreader (Paving Machine)	82
Drill with concrete bit*	**90-94**	Static Rollers	75
Dump Truck	78	**Steel Drum Roller (Dynapac)***	**89.7**
Electric Mudgun*	**85**	**Steel Drum Roller (Hypac)***	**99**
Flatbed Truck	75	**Steel Drum Roller (Sakai)***	**103**
Front Loader	79	**Steel Drum Roller w/ Vibration (Bomag)***	**95.6**
Generator	81	Striping Machine (temp 3)	78
Grader*	**85**	**Striping Truck***	**87.5**
Handheld Saw*	**90-95**	**Vac Truck***	**85**
Hedge Trimmer*	**103**	Vac Truck with Sweeper	82
Hoptoe*	**85**	**Vacuum***	**85**
Jumping Jack*	**100**	Vibratory Rollers	83
Kickbroom (Kubota)	84	Water Truck	75
Knuckle Boom Truck	80	**Weed Wacker***	**96**
Komatsu Mini Excavator*	**85**		

Note: * Equipment with Noise Level Readings of 85 Decibels or more

The State of Hawaiʻi Department of Health (DOH) maintains community noise control standards that apply to construction noise. The project is not allowed to exceed the stipulated noise limits unless a variance is granted by the DOH.

The following are anticipated conditions of the Noise Variance. The conditions will be finalized upon issuance of the Noise Variance.

The Noise Variance application will grant permission for the Contractor to work from:

- Sunday: 7:00 a.m. to Monday 6:00 a.m.
- Monday: 8:00 p.m. to Tuesday 6:00 a.m.
- Tuesday: 8:00 p.m. to Wednesday 6:00 a.m.
- Wednesday: 8:00 p.m. to Thursday 6:00 a.m.
- Thursday: 8:00 p.m. to Friday 6:00 a.m.

Subject to the following conditions during the variance hours:

1. The Contractor shall make every effort to minimize noise emanating from the project.
2. The use of reverse signal alarms shall be prohibited during the variance hours. Alternative methods such as utilizing a ground guide for signaling shall be employed.
3. Traffic noise from heavy vehicles traveling to and from the construction site shall be minimized near residences.
4. The Contractor shall have a job-site inspector to whom immediate complaints can be forwarded for prompt response and who shall have the general responsibility of monitoring quiet work procedures.
5. The Contractor shall give sufficient notice regarding the project to any residents that may be impacted by the nighttime activity. The notification for the planned nighttime activity shall also contain the name and telephone number of the job-site inspector. In addition, a copy of any notifications, as well as progress reports, shall be sent to the Indoor and Radiological Health Branch.
6. If noise level is such that the numerous complaints are received by the Department, the Contractor shall cease operations upon receipt of an order and complete the project during hours on weekdays and weekends as directed.
7. The Contractor shall notify the Indoor and Radiological Health Branch, State Department of Health, as to the date and time of any variance hour activity as soon as the dates are confirmed and also when the project is completed.

Noise control measures during construction would be required to minimize impacts on existing noise sensitive land uses. Because impacts to residences cannot be accurately determined without detailed construction plans and schedules, the measures recommended in this section should be re-evaluated in greater detail as project design is refined. General abatement measures presented below are recommended as guidelines in developing construction plans that consider the adverse impacts of construction noise for this project that primarily includes lane restriping.

1. Design Considerations - During the early stages of construction plan development, strategic placement of stationary equipment, such as compressors and generators, can be considered for use as shielding against construction noise.
2. Source Control - The contractor shall comply with HDOT Standard Specifications and all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract. Each internal combustion engine used for any purpose on the job, or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without a muffler.
3. Community Relations - Community meetings can be held to explain the construction work, time involved, and the control measures to be taken to reduce the impact of the construction noise.

The aforementioned measures can be incorporated into site specific construction plans in order to minimize noise impacts to sensitive receivers along the project corridor, and additional noise emission limits could be developed as well. Construction hours could be set, and noise level criteria could be decided upon and adhered to during construction.

CHAPTER 7 REFERENCES

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