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NOV 23 2020

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAI'I
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TELEPHONE (808) 961-8050 • FAX (808) 961-8657

November 16, 2020

Mr. Scott Glenn, Director
State of Hawai'i
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Dear Mr. Glenn:

Subject: North Kona Mid Level Deepwell Development – Phase 1
Final Environmental Assessment and Finding of No Significant Impact

The enclosed *Final Environmental Assessment for the North Kona Mid Level Deepwell Development* (FEA) assesses the potential effects of constructing, testing, and operating the proposed facilities. Based on the information contained in this FEA and the requirements of Hawai'i Revised Statutes, Chapter 343, and its implementing regulations contained in the Hawai'i Administrative Rules, Title 11, Chapter 200, the County of Hawai'i, Department of Water Supply, has determined that an Environmental Impact Statement is not required and is issuing a Finding of No Significant Impact (FONSI). Please publish a notice of FEA and FONSI in the next edition of the Office of Environmental Quality Control's (OEQC) *The Environmental Notice.*

We have also provided the action summary, significance criteria, and other required information via the OEQC online submittal form.

Please contact our project consultant, Makena White of Planning Solutions, Inc., at (808) 550-4538 if you have any questions.

Sincerely yours,

Keith K. Okamoto, P.E.
Manager-Chief Engineer

JWK:dmj

Enc.

21-085

From: webmaster@hawaii.gov
To: HI Office of Environmental Quality Control
Subject: New online submission for The Environmental Notice
Date: Monday, November 16, 2020 9:15:47 AM

Action Name

North Kona Mid-Level Exploratory Well Project

Type of Document/Determination

Final environmental assessment and finding of no significant impact (FEA-FONSI)

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

North Kona, Hawai‘i

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

(3) 7-5-003:001

Action type

Agency

Other required permits and approvals

Well Construction & Pump Installation Permit; Noise Permit and/or Noise Variance; Grubbing, Grading, and Stockpiling Permit; Building Permit

Proposing/determining agency

Hawaii County Department of Water Supply

Agency contact name

Jason Killam

Agency contact email (for info about the action)

jkillam@hawaiidws.org

Agency contact phone

(808) 961-7249

Agency address

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Hilo, Hawaii 96720
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Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Planning Solutions, Inc.

Consultant contact name

Makena White

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711 Kapiʻolani Boulevard, Suite 950
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Action summary

The County of Hawaiʻi, Department of Water Supply is proposing a new exploratory well at the designated location. The project consists of three phases: (i) site preparation; (ii) drilling and casing an exploratory well; and (iii) pump testing. If test results are positive, the site may be developed into a production facility when demand increases.

Reasons supporting determination

See Chapter 5 for a detailed discussion.

Attached documents (signed agency letter & EA/EIS)

- North-Kona-Mid-Level-Well-Project-FEA-2020-11-10.pdf
- North-Kona-Mid-Level-Exploratory-Well-FONSI-Letter-to-OEQC-2020-11-16.pdf

Shapefile

- The location map for this Final EA is the same as the location map for the associated Draft EA.

Action location map

- Kona_Mid-Level_Area_TMKs.zip

Authorized individual

Makena White, AICP

Authorization

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

FINAL ENVIRONMENTAL ASSESSMENT
NORTH KONA MID-LEVEL EXPLORATORY WELL
Hawai‘i Island, North Kona, Hawai‘i

PREPARED FOR:
Department of Water Supply
County of Hawai‘i

PREPARED BY:
PLANNING SOLUTIONS

NOVEMBER 2020

PROJECT SUMMARY

Project:	North Kona Mid-Level Exploratory Well
Applicant/Approving Agency:	Department of Water Supply County of Hawai‘i Contact: Jason Killam (808) 961-7249 ext. 249 345 Kekūanaō‘a Street, Suite 20, Hilo, Hawai‘i 96720 jkillam@hawaiidws.org
Location:	75 Hienaloli Road, Kailua-Kona, Hawai‘i 96740
Project Description:	The County of Hawai‘i, Department of Water Supply is proposing a new exploratory well at the designated location. The project consists of three phases: (*i*) site preparation; (*ii*) drilling and casing an exploratory well; and (*iii*) pump testing. If test results are positive, the site may be developed into a production facility when demand increases.
Associated Actions Requiring Environmental Assessment:	Use of County and State Drinking Water Revolving Fund funding.
Tax Map Keys:	(3) 7-5-003:001
Judicial District:	North Kona
State Land Use Districts:	Agriculture
County Zoning:	A-5a
Potential Required Permits & Approvals:	▪ HRS Chapter 343 Environmental Assessment ▪ Section 106, National Historic Preservation Act Review ▪ Well Construction & Pump Installation Permits ▪ Noise Permit and/or Noise Variance ▪ Grubbing, Grading, and Stockpiling Permits ▪ Building Permits
Determination:	Finding of No Significant Impact
Parties Consulted:	‘Aha Moku Advisory Council Commission on Water Resource Management County of Hawai‘i, Department of Public Works County of Hawai‘i, Planning Department Department of Hawaiian Home Lands DOH Safe Drinking Water Branch, Environmental Management Div. DOH Safe Drinking Water Branch (Hilo) Komo Brothers, LLP National Park Service, Kaloko-Honokōhau National Historic Park State Historic Preservation Division (SHPD) Loke Aloua
Consultant:	Planning Solutions, Inc. 711 Kapi‘olani Boulevard, Suite 950 Honolulu, Hawai‘i 96813 Contact: Mākena White, AICP (808) 550-4538 makena@psi-hi.com

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Chapter 1: INTRODUCTION

1.1 INTRODUCTION

The Hawai‘i County Department of Water Supply (DWS) is responsible for the development, operation, and maintenance of the municipal water systems throughout the Island of Hawai‘i. DWS is proposing, with assistance from their hydrologic consultant Tom Nance Water Resource Engineering (TNWRE), to construct the Kona Mid-Level Exploratory Well in North Kona, Hawai‘i. The Project will consist of: (*i*) site preparation, (*ii*) drilling and casing an exploratory well, and (*iii*) pumping and water quality testing in order to evaluate it as a potential source of potable water for the North Kona Water System.

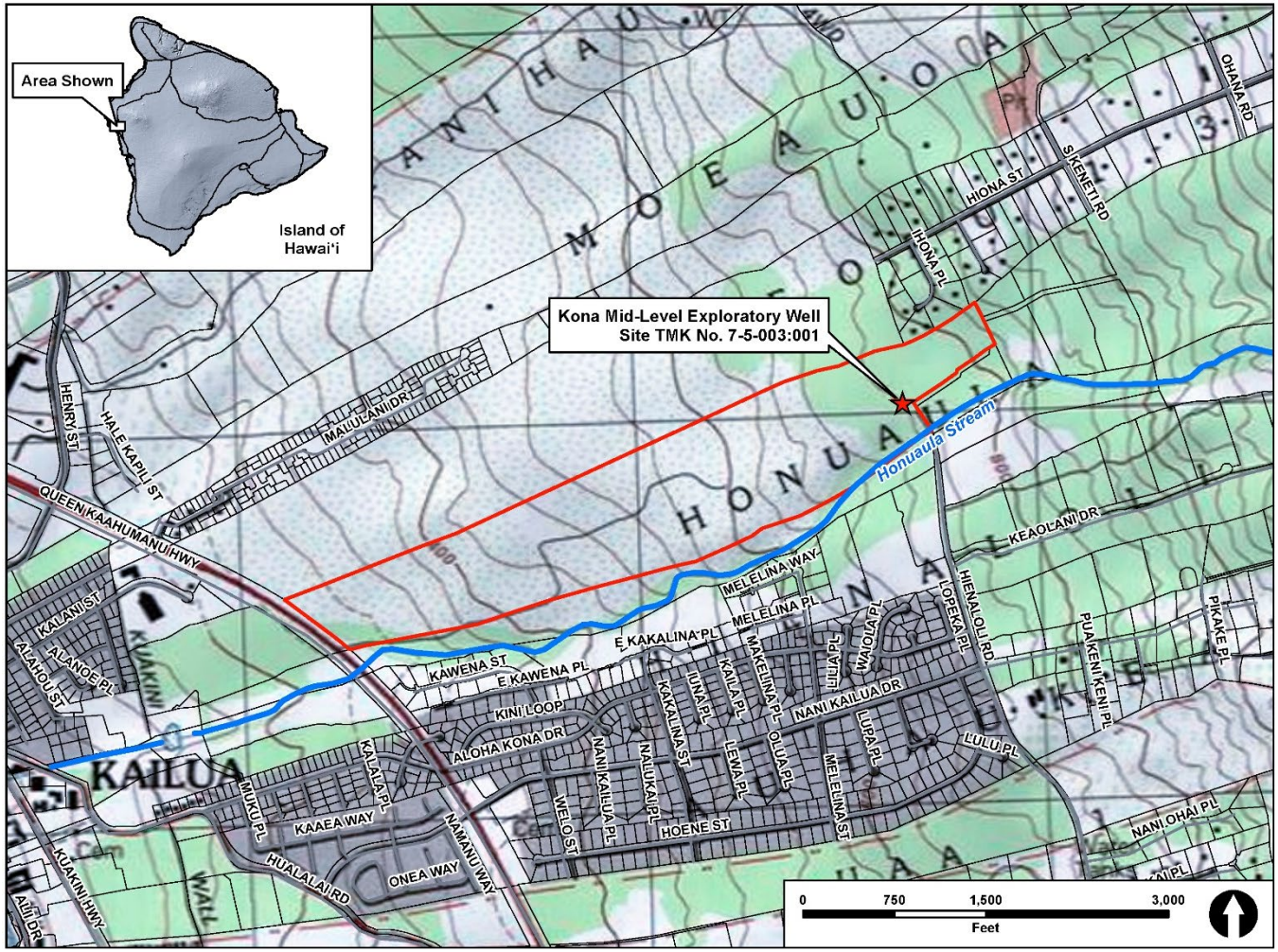
The proposed North Kona Mid-Level Exploratory Well Project is located near the communities of Hōlualoa and Kailua-Kona in the Honua‘ula ahupua‘a of the North Kona District, Island of Hawai‘i (TMK No. 7-5-003:001) (see Figure 1.1). The Project is located on a private parcel owned by Komo Brothers, LLP. Currently, the area is in active use by a lessee as pastureland for cattle (see Figure 1.2). Access to the site is via Hienaloli Road. If the proposed well produces water of adequate quantity and quality, DWS may then pursue the approvals needed to develop the exploratory well into a production well, add storage capacity to the site, and construct a pipeline connecting it with the existing municipal water system. However, only the exploratory phase of the Project is the subject of this Environmental Assessment (EA); any subsequent phases of work would be evaluated in a separate environmental review process.

Hawai‘i Revised Statutes (HRS), Chapter 343 stipulates that:

> *§343-5 Applicability and requirements.*
> *(a) Except as otherwise provided, an environmental assessment shall be required for actions that: Propose the use of state or county lands or the use of state or county funds...*

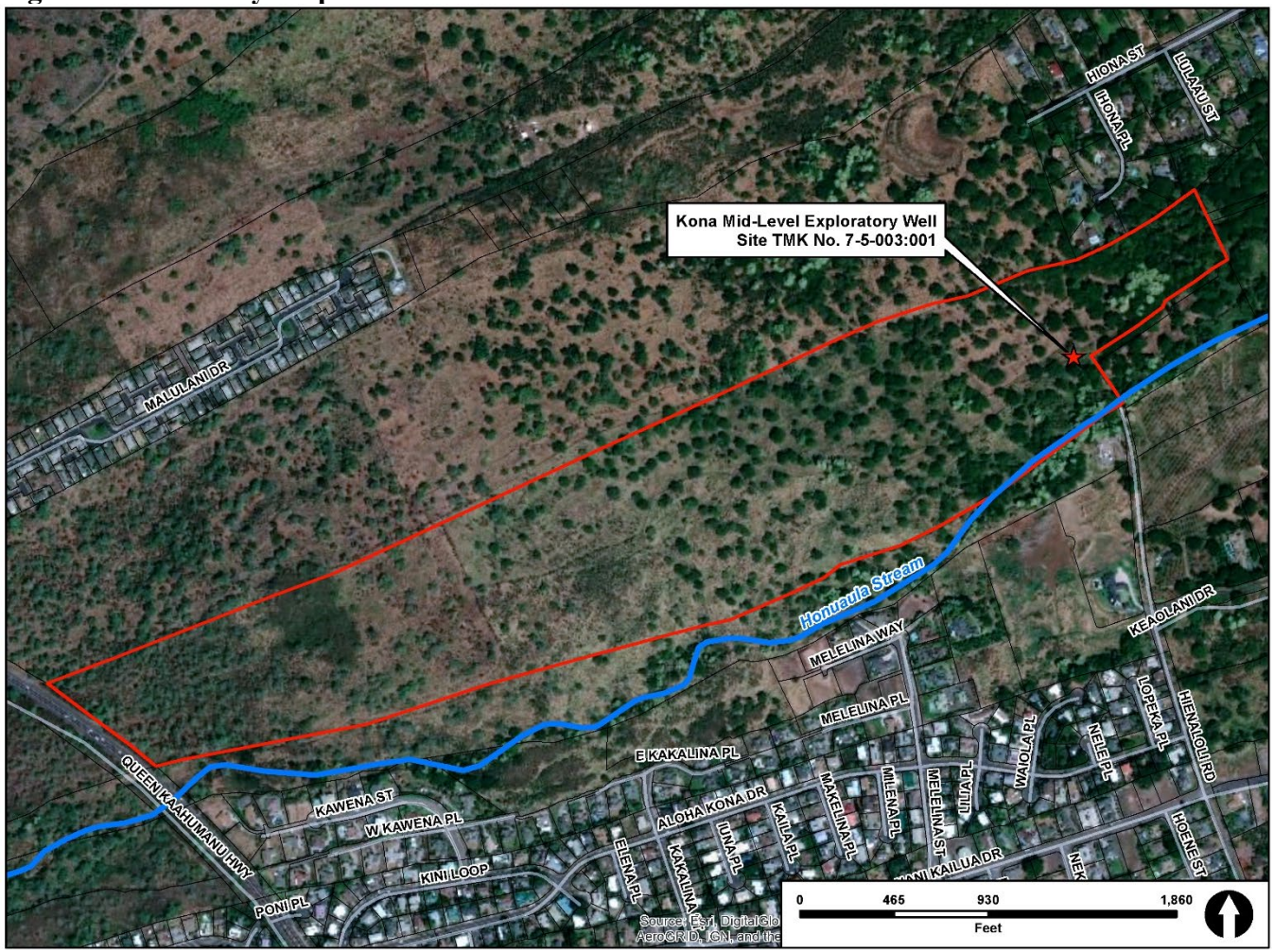
Thus, the commitment of county funds by DWS “trigger” the requirement for an Environmental Assessment (EA) pursuant to HRS Chapter 343 and the content requirements of its implementing regulations contained in Hawai‘i Administrative Rules (HAR), Title 11, Chapter 200.1. In addition, DWS may seek federal funding for the Project under the U.S. Environmental Protection Agency’s (EPA) Drinking Water State Revolving Fund (DWSRF) program administered by the State of Hawai‘i, Department of Health, Safe Drinking Water Branch. Because allocation of DWSRF funds would constitute a federal action, this EA has also been prepared pursuant to the National Environmental Policy Act (NEPA). It is intended to address all of the content required to comply with the Hawai‘i DWSRF program (see Section 4.8).

Figure 1.1 Location Map



Source: Planning Solutions, Inc. (2020)

Figure 1.2 Vicinity Map



Source: Planning Solutions, Inc. (2020)

1.2 PURPOSE OF THE PROPOSED ACTION

The purpose of the Project is to identify a potential source of reliable, high-quality potable water for use by DWS' North Kona Water System. According to DWS' 2006 *20-Year Water Master Plan* (2006), the North Kona Water System has the highest metered water consumption of any DWS water system and ranks second in the number of connections. The high rate of consumption in the North Kona Water System is attributed to the area's rapidly growing community and numerous resorts.

The sources of supply in the North Kona Water System are groundwater wells and a groundwater shaft (R.W. Beck, 2006). The distribution system is approximately bounded by Māmalahoa Highway and Queen Kaahumanu Highway from Keāhole Airport to the intersection of Māmalahoa Highway and Kuakini Highway. The North Kona Water System is not isolated; it is connected to the South Kona Water System. This water system is broken into three areas: Area I, Area II, and Kaloko Mauka. Rapid growth in the area served by this system requires continuous planning and development to ensure that water demands, water quality, operational requirements, and ongoing maintenance needs are met. Relevant aspects of the North Kona Water System are summarized in Table 1.1 below.

Table 1.1 Summary of the North Kona Water System

HDOH System ID	HI0000131
Connections	11,122
Average Production	11.4 MGD
Wells	13
Shaft Wells	1
Type of Water Treatment	Disinfection (Chlorination)
Operational Zones	56
Tanks	65
Booster Pump Stations	25
Pressure-Reducing Valves	84
Miles of Pipe	280
Source: *Hawai'i County Department of Water Supply 2018 Audit* (2018)	

1.3 NEED FOR THE PROPOSED ACTION

Table 1.2 summarizes the rapid growth in the resident population of the North Kona District since 1980. In its *Hawai'i County General Plan* (County of Hawai'i, 2005) the County of Hawai'i predicts that, under assumptions of moderate growth, the resident population of North Kona will increase to 42,275 by 2020. In retrospect, and in consideration of the population as of 2018, the actual number may be considerably higher. Consequently, the *General Plan* specifically calls for the development of additional capacity in the project area:

"11.2.4.7.2 Courses of Action (North Kona)
(a) Continue to pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and an efficient and economic system operation.
(b) Continue to evaluate growth conditions to coordinate improvements as required to the existing water system in accordance with the North Kona Water System Master Plan."

Consistent with these directives, the North Kona Mid-Level Exploratory Well is intended to address the concomitant increase in demand for drinking water by helping DWS evaluate a potential new source of potable water.

Table 1.2 Resident Population in North Kona: 1980-2016

Date	*Resident Population*	*Increase*
April 1, 1990	22,284	n/a
April 1, 2000	28,543	6,259
April 1, 2010	37,875	9,332
April 1, 2017	41,369	3,494

Source: Dept. of Business, Economic Development and Tourism (DBEDT), *2018 State of Hawai'i Data Book* (2017)

Currently, DWS relies on four drilled wells and one inclined shaft at Kahalu'u, and one well each at the following sites to supply potable water for the North Kona Water System: Hōlualoa, Keahuolū, Honokōhau, Keōpū, Wai'aha, Palani, Hualālai, Makalei Estates, and North Kalaoa. In order to satisfy the rising demand, DWS needs additional sources of potable water so that it can create greater reliability and reduce the load placed on the existing sources within the system.

1.4 PROJECT OBJECTIVES

The well is exploratory and designed to see if the fresh water at depth below the brackish basal lens can be developed as a source of drinking water supply. This possibility was first discovered with a deep monitor well (State No. 3858-001) and further evaluated with a second monitor well (State No. 3858-002). Both of these wells are on the State property which abuts the Komo property on its south side. If this fresh deep-water source can be developed as a source of supply for the Hawaii DWS, it would have far less operating cost and greater reliability than DWS' high-level wells arrayed along the mauka side of Māmalahoa Highway.

1.5 ORGANIZATION OF THIS REPORT

The remainder of this EA is organized as follows:

- Chapter 2 describes the proposed action in detail and outlines the alternatives analyzed in this EA, as well as other alternatives that were initially considered but ultimately rejected from further consideration.

- Chapter 3 characterizes the existing environment and analyzes the potential impacts on natural, cultural, and socioeconomic resources. It also outlines strategies for minimizing and mitigating unavoidable adverse effects.
- Chapter 4 discusses the Project's consistency with relevant plans, policies, and controls at the local, regional, state, and federal levels.
- Chapter 5 provides the justification for the Finding of No Significant Impacts (FONSI) by considering each individual significance criterion with respect to the proposed Project.
- Chapter 6 and Chapter 7 identify the references cited and the parties consulted, respectively, during preparation of this EA.

Chapter 2: DESCRIPTION OF THE PROJECT AND ALTERNATIVES

HAR §11-200.1 contains the Department of Health's (DOH) environmental impact rules and content requirements. Section §11-200.1-8, HAR defines the assessment processes for "agency actions" such as the North Kona Mid-Level Exploratory Well Project. Among other things, it requires that alternatives to the proposed action be addressed in an EA.

In accordance with that requirement, DWS has considered various alternatives before choosing the proposed Project as the appropriate course of action. This process consisted of: (*i*) defining the objectives for the undertaking described in Section 1.4; (*ii*) identifying possible alternative means of achieving those objectives; and (*iii*) evaluating each potential alternative with respect to the Project's objectives. This chapter briefly describes the process that was followed and the alternatives that were determined to be appropriate to address in this EA.

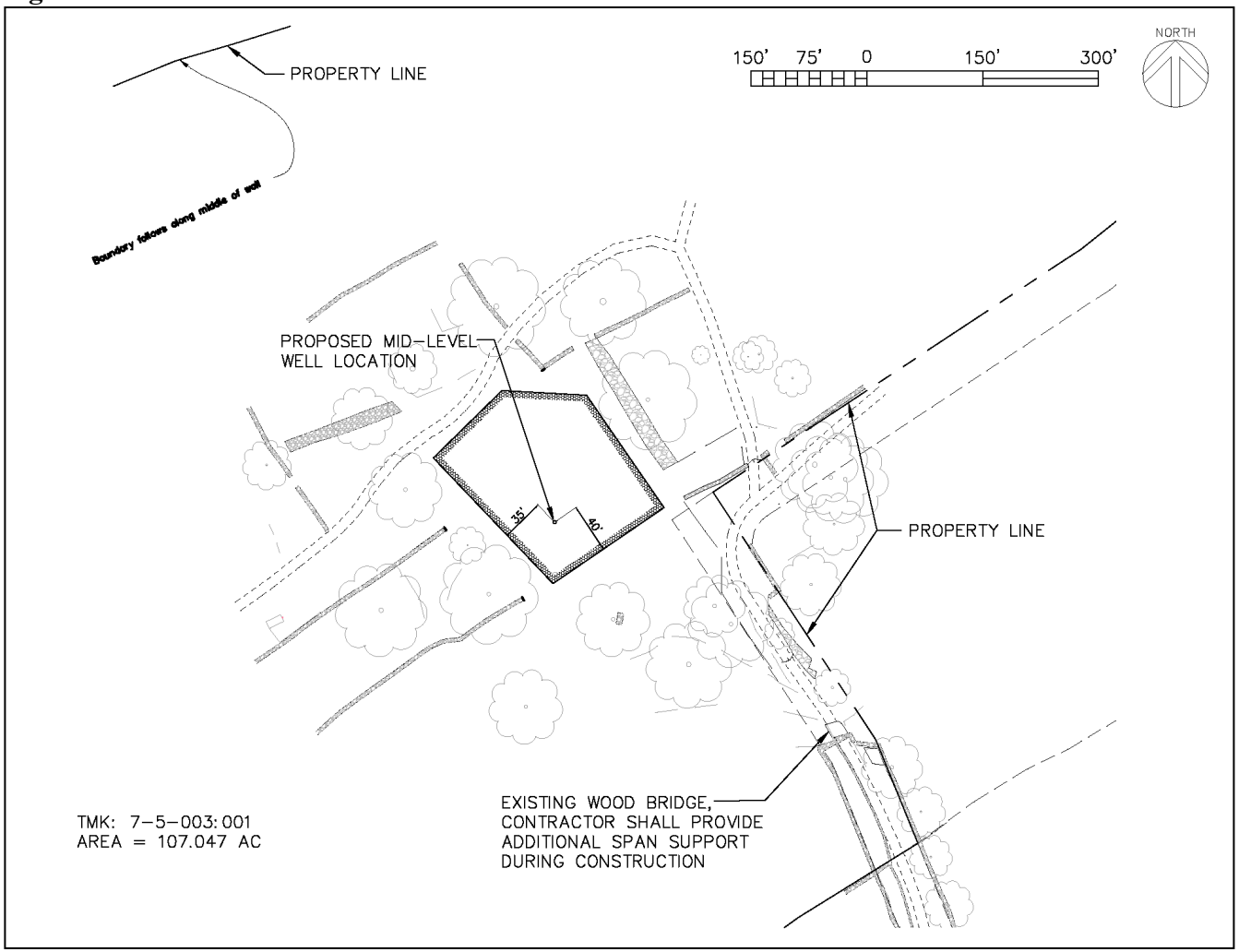
2.1 DESCRIPTION OF THE PROPOSED ACTION

DWS proposes to construct a new exploratory well in a pasture on TMK No. 7-5-003:001 in the Honua‘ula ahupua‘a, North Kona District of the Island of Hawai‘i. If DWS obtains all of the necessary permits and approvals, construction of the proposed Project will include drilling, casing, and pump testing the well to determine it if its yield is adequate and the quality of the water is suitable for use as drinking water. Should the exploratory well be determined to be a viable source of water and if agreements can be reached with the property owner, DWS will pursue the approvals necessary to convert the well into a production facility, including preparation of an EA. However, this EA covers only the exploratory well. Figure 2.1 provides an overall site plan; Figure 2.2 provides a closeup of the site. Figure 2.3 contains photographs depicting existing conditions in the vicinity of the proposed exploratory well. Figure 2.4 provides a section view of the proposed well. Details concerning the site preparation, well drilling, pump installation, and testing are provided below.

2.1.1 SITE PREPARATION

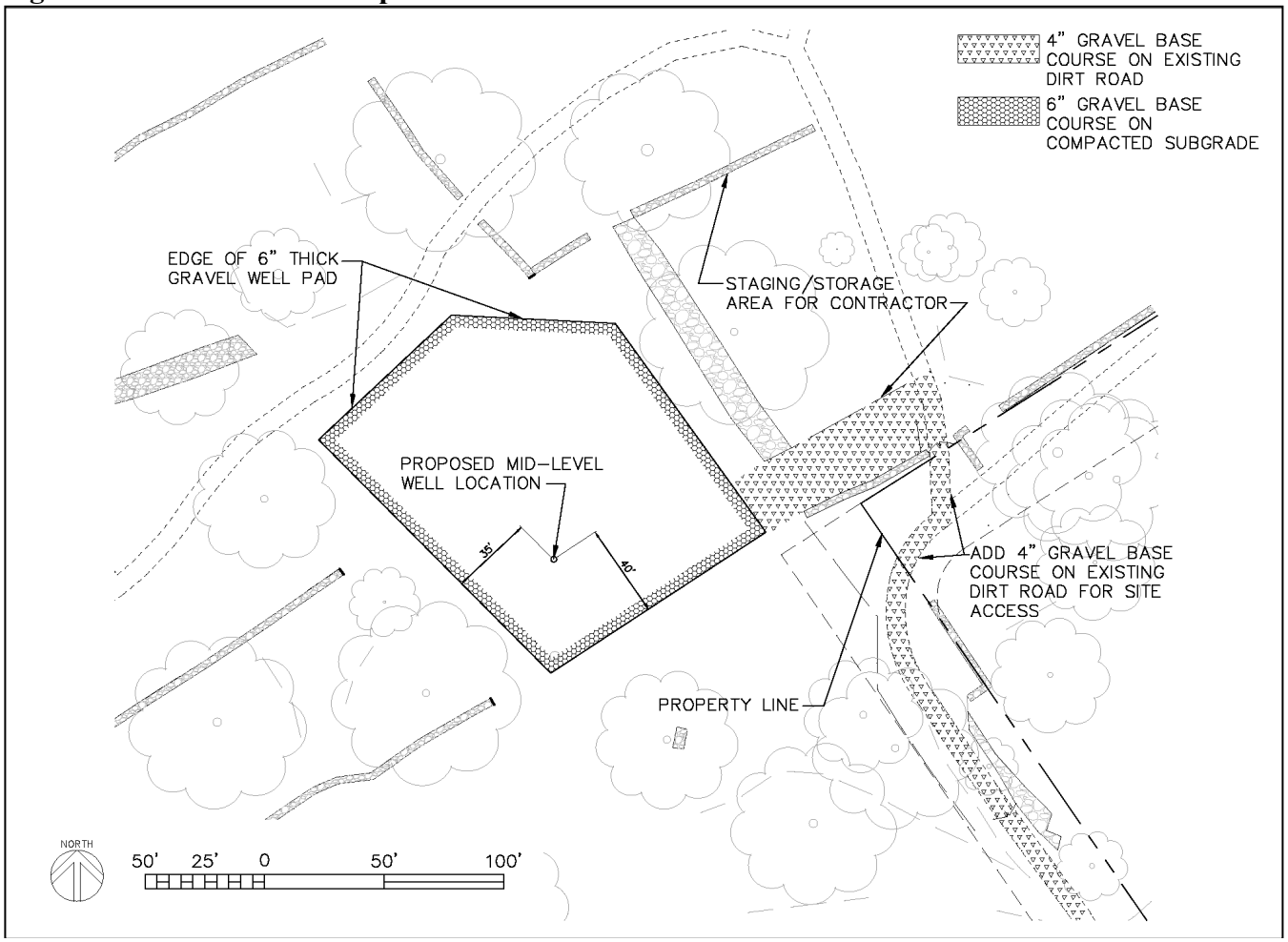
DWS would drill the well on a right-of-entry obtained from the property owner, Komo Brothers, LLP. The site that would be prepared for drilling would be approximately 140 feet by 110 feet, an area of about 0.38 acres. One banyan tree, 355 feet of rock wall, and 81 feet of barbed wire fence would be removed. The site would primarily consist of embankment using 3,356 cubic yards of fill.

Figure 2.1 General Site Plan



Source: TNWRE (2020)

Figure 2.2 Site Plan Closeup



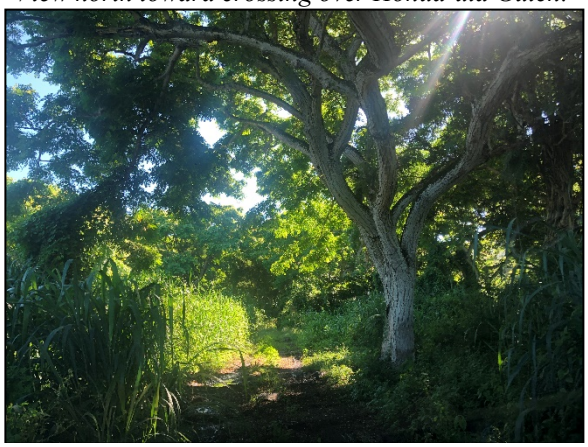
Source: TNWRE (2020)

Figure 2.3 Photographs of Existing Site Conditions

View north toward access gate off Hienaloli Road.

View north toward crossing over Honua'ula Gulch.

Typical view north of access drive.



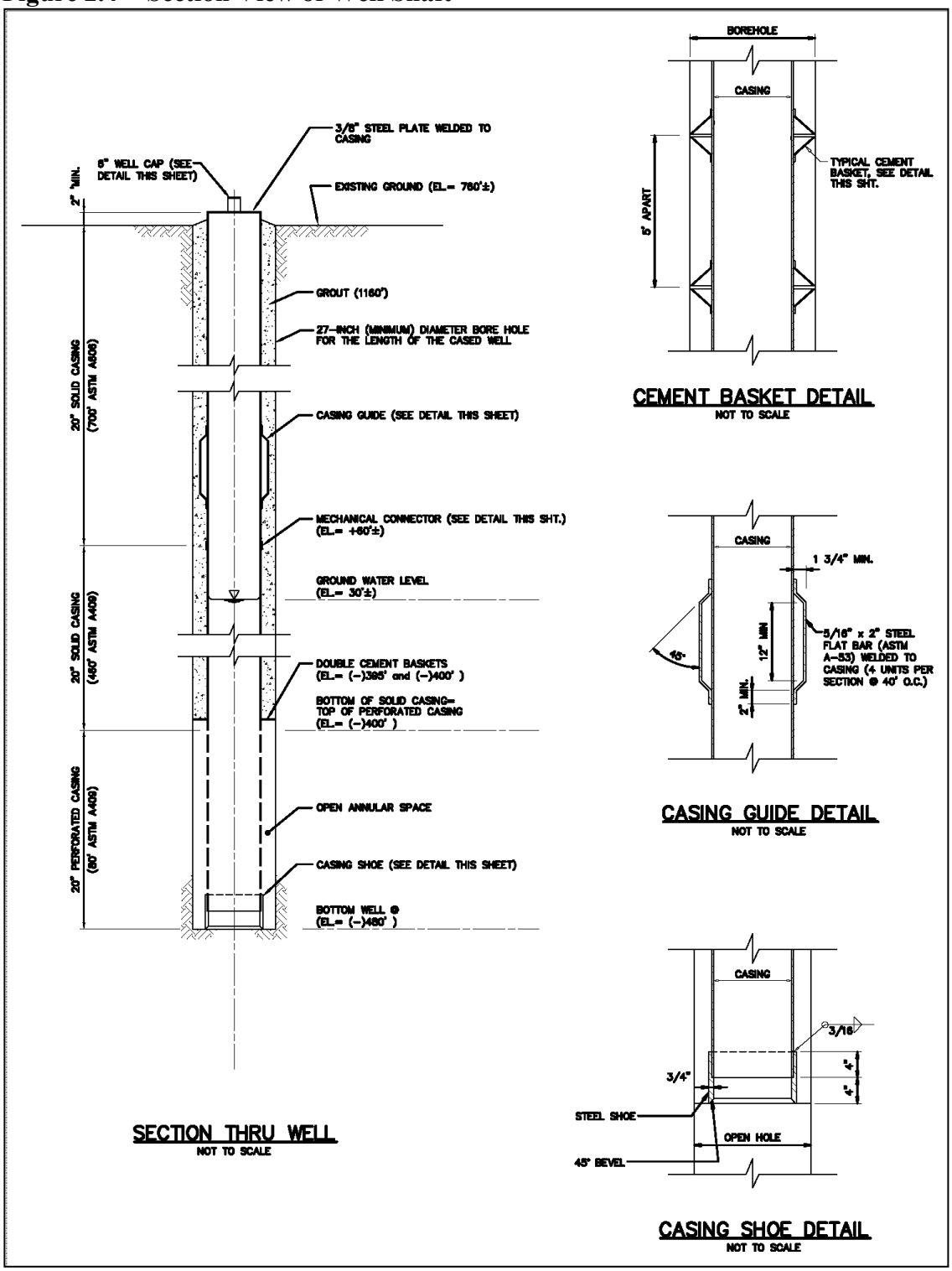
View north in the vicinity of the exploratory well site.

View east from vicinity of exploratory well site.

View north from exploratory well site.

Source: LaGrande Biological Consulting (2020)

Figure 2.4 Section View of Well Shaft



Source: TNWRE (2020)

2.1.2 WELL DRILLING AND TESTING

As the well is highly exploratory, its construction and pump testing will be done in the following sequence:

- Initially, a 12-inch diameter pilot borehole would be drilled from a ground level of 760 feet +MSL until the fresh water is encountered at an expected depth on the order of 400 feet -MSL (i.e., approximately 1,160 feet below ground).
- Drilling will then proceed into the fresh groundwater body of sufficient depth to provide satisfactory yield, perhaps to 475 or 500 feet -MSL.
- A video log would be made to monitor the operation and identify the location to install an inflatable packer for an open hole pump test.
- An open hole pump test would be run, pumping water exclusively from the freshwater zone below the packer with a submersible pump.
- If the open hole pump test results warrant development as a production well, the pilot borehole would be reamed to 27-inch diameter, 20-inch solid casing would be installed to isolate the draft from the fresh water zone at depth, and final, permit-required step and constant rate pump tests would be run to establish the well's hydraulic capacity and long term yield.
- If fresh water at depth is not encountered or if the pilot borehole pump tests demonstrate an insufficient amount of supply, then the pilot borehole would be sealed according to the requirements of the State Commission on Water Resource Management (CWRM) and the project would end at that point.

Table 2.1 summarizes the dimensions of the proposed North Kona Mid-Level Exploratory Well.

Table 2.1 Tentative Dimensions of Proposed North Kona Mid-Level Exploratory Well

Description	*Dimension*
Basic Well Parameters	
Casing Diameter (in.)	20
Ground Elevation (+MSL)	760
Total Well Depth (ft.)	1,240
Elev. At Bottom (-MSL)	-480
Solid Casing	
Length Below Ground (ft.)	1,160
Elevation at Bottom (-MSL)	-400
Perforated Casing	
Length (ft.)	80
Elev. At Bottom (-MSL)	-480
Open Hole	
Diameter (in.)	27
Length	80
Static Water Level	
Depth Below Ground (ft.)	730
Elev. (+MSL)	30
Source: TNWRE (2020)	

2.2 PROJECT SCHEDULE

Table 2.2 provides the preliminary schedule for the North Kona Mid-Level Exploratory Well Project.

Table 2.2 Preliminary Project Schedule

Task	*Approximate Duration*	*Estimated Completion Date*
Completion of HRS Chapter 343 Review	4 months	1/1/2021
Well Construction Permit Review	4 months	5/1/2021
Bid Solicitation	3 months	8/1/2021
Bid Evaluation, Contracting, Notice to Proceed	4 months	12/1/2021
Well Construction and Testing	12 months	12/1/2022
Source: TNWRE (2020)		

2.3 PROJECT COST

The proposed Project has been authorized by DWS and is identified as DWS Job No. 2018-1101/EWO No. 2019-014. The order-of-magnitude cost for construction of the proposed North Kona Mid-Level Exploratory Well Project is approximately $1.8 million, in 2020 dollars.

2.4 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES

Title 11, Chapter 200.1, HAR contains the DOH environmental review rules. HAR §11-200.1-8-1 deals with agency actions such as the North Kona Mid-Level Exploratory Well Project. It requires that, for actions not exempt, the applicant must consider the environmental factors and available alternatives and disclose those in an EA or Environmental Impact Statement (EIS). HAR §11-200.1-18 establishes the process for preparation of an EA. Among the requirements listed, HAR §11-200.1-18(d)(7) requires the identification and analysis of impacts of alternatives considered during project planning.

As sources for its North Kona water system, DWS has basal wells in the Keauhou area and wells on the mauka side of Māmalahoa Highway from Kalaoa on the north to Wai‘aha on the south which draw high-level groundwater. Use of the basal wells is restricted by salinity issues and their use should preferentially be reduced. Further, there are no other sites within the system where fresh basal groundwater can be developed.

All of DWS’ wells along and above Māmalahoa Highway tap high-level groundwater with deep set submersible pumps and motors. These have proven to be short-lived, unreliable, and very costly to remove, replace, and reinstall. Further, power costs of operation, due to pumping lifts in excess of 1500 feet, are very high. While it would be possible to install additional high-level wells at great cost, DWS has determined that the risk of success with the proposed Mid-Level Well is worthwhile to pursue. If successful, pumping lifts on the order of 750 feet would be possible, cutting operating costs by more than half. Further, the shallower setting of pumps and reduced horsepower requirements would provide substantially greater reliability and longer useful lives of pumps and motors.

2.5 ALTERNATIVES ADDRESSED IN DETAIL

2.5.1 PROPOSED ACTION: NORTH KONA MID-LEVEL EXPLORATORY WELL PROJECT

This alternative consists of implementation of the Proposed Action as described in Section 2.1. The planning team has concluded that building and testing the exploratory well at that site and on its present timeline would best achieve the Project objectives summarized in Section 1.4, assisting DWS in maintaining an adequate, reliable, and affordable supply of drinking water for customers using the North Kona Water System. Thus, DWS believes that the proposed Project represents the preferred course of action.

2.5.2 NO ACTION ALTERNATIVE

The No Action Alternative consists of not implementing the North Kona Mid-Level Exploratory Well Project as described in Section 2.1. Under the No Action Alternative, DWS would not:

- Construct an exploratory well in North Kona;
- Identify means to reduce the load on the existing water sources in the North Kona Water System; or
- Build additional redundancy into the system.

According to DWS' *20-Year Water Master Plan* (R.W. Beck, 2006) the area served by the North Kona Water System is projected to have the fastest growth in the county, and that identifying additional sources for supply and developing system redundancy are priorities.

In addition, the existing North Kona Water System consists of four pumps at the Kahalu'u Shaft, four Kahaluu drilled wells, the Hōlualoa Well, and six wells above Māmalahoa Highway. The six wells above Māmalahoa Highway tap into high-level groundwater; the remaining wells draw from the basal lens of groundwater. The high-level well pumps have an unfortunate history of limited pump and/or motor life. Consequently, as many as three of the six high-level wells have been out of service at the same time. The basal wells have salinity issues which restrict their available supply. New well sources, which address these limitations, are needed to produce a consistent supply of high-quality potable water.

For these reasons, DWS has concluded that the No Action Alternative is not a viable alternative and would meet neither the project objectives summarized in Section 1.4 nor the recommendations of the DWS' *20-Year Water Master Plan*. It is included in this EA to fulfill the content recommendations of HRS Chapter 343 and HAR §11-200.1. It also provides a baseline against which to measure the potential environmental and social impacts of the Proposed Action.

2.6 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

2.6.1 ALTERNATIVE LOCATIONS

To develop a similar exploratory well at an alternative location, DWS would need to identify a site within the North Kona Water System service area that possesses the necessary water resources, accessibility, and other characteristics appropriate to the development of the proposed exploratory well. Also, it could ultimately serve as an appropriate location for the development

of a production well with water storage and other ancillary facilities, should the exploratory effort prove successful. In addition, DWS would need to obtain use and occupancy rights to any potential alternative site through easement, lease, or purchase. This process may be time consuming and its outcome uncertain.

There are technical considerations that constrain selection of alternative sites. In analyzing alternative locations for a potential well, DWS has considered high-level locations above Māmalahoa Highway. However, wells above Māmalahoa Highway have a Total Dynamic Head (commonly referred to as "TDH") ranging from 1,480 feet at the Hualālai Well to 1,760 feet at the QLT Well, with large capacity submersible motors. These have proven to be unreliable sources for the DWS system. An alternative to increase reliability is to drill a second well at each site and to install lesser capacity pumps and motors in both wells at each site, a strategy DWS is currently experimenting with at its Wai'aha Well and Reservoir facility.

However, if successful, the North Kona Mid-Level Exploratory Well offers significant advantages over the construction of new high-level wells. The cost of powering pumps is directly correlated with pump lift (i.e., the greater the lift, the greater the cost of pumping). The pump lift required at the North Kona Mid-Level Exploratory Well site is approximately 750 feet, in comparison with to the pump lift required for the high-level well sites, which are between 1,480 and 1,760 feet. This offers a substantial savings to DWS which is passed on to its customers. Along with offering savings related to the cost of pumping, another advantage is related to reliability. A line shaft pump at the proposed mid-level exploratory well site will have far less stress placed on it, and is likely to have a longer, more reliable service life, than the deep-set submersible pumps required for high-level wells above Māmalahoa Highway.

Because use of an alternative location has the potential to delay or inhibit DWS' ability to achieve the project objectives summarized in Section 1.4, DWS has concluded that a similar exploratory well project at an alternative location is unlikely to offer any clear advantages that would make it a more desirable alternative to the Proposed Action.

2.6.2 DELAYED ACTION

According to DWS' *20-Year Water Master Plan*, "significant growth is anticipated in several of DWS' water systems, particularly North Kona." Consequently, DWS has identified priorities for future source development, the most relevant of which include creating additional sources of supply for: (*i*) improved system operation; (*ii*) meeting increasing demand; (*iii*) creating system redundancy; and (*iv*) to meet emergency needs. Delaying the development of the North Kona Mid-Level Exploratory Well Project would not address these priorities.

In addition, there are no existing activities or conditions on the proposed site or in that area that would make delaying the North Kona Mid-Level Exploratory Well Project desirable or that would reduce any potential impacts. To the contrary, acting promptly would help ensure that that an adequate supply of drinking water remains available to the North Kona Water System for the foreseeable future. Finally, a Delayed Action would not achieve the objectives summarized in Section 1.4. Therefore, DWS has concluded that a Delayed Action alternative is not a viable alternative to the Proposed Action.

2.6.3 ENHANCED WATER CONSERVATION

The Proposed Action is not meant to promote any substantial increase in the demand for potable water, it is solely intended as an investigation of a potential future source for the North Kona Water System. If DWS intended to promote increased demand, it would develop the site into a production facility with water storage tank(s) immediately, thus maximizing capacity. While conserving water would theoretically decrease the demand placed on the existing capacity of the North Kona Water System, it would not address DWS' priorities for the system identified in Section 2.6.2. Neither would enhanced water conservation meet the objectives for the Project summarized in Section 1.4. Further, DWS has already requested extensive water conservation measures by its customers countywide and has concluded that it is very unlikely that further conservation measures could reduce demand for drinking water sufficiently to eliminate the justification for the Proposed Action.

2.6.4 ALTERNATIVE SCALE

Because the Proposed Project is, as discussed in Section 2.1, intended to be constructed solely as an exploratory well, it retains the potential to be implemented as a reduced scale alternative. If the exploratory effort returns indications that the quality or quantity of water available at this site is inadequate to meet the needs of DWS, subsequent development of the site into a production well could be postponed or canceled. Conversely, should the determination be made by DWS that the site is appropriate for development into a production well with associated storage and ancillary equipment, the Project could be developed into a larger scale facility than is currently called for under the Proposed Action as part of a subsequent undertaking.

Chapter 3: AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS

3.1 LAND USE

3.1.1 AFFECTED ENVIRONMENT

The Proposed Action (also identified as the "North Kona Mid-Level Exploratory Well Project" or "the Project") will occupy a portion of TMK No. 7-5-003:001 (see Figure 1.2). All of this parcel has been designated as being in the State of Hawai'i's Agricultural District and is zoned for agriculture by the County of Hawai'i. Relevant land use information for the parcel is summarized in Table 3.1 below. Figure 3.1 depicts the County of Hawai'i zoning boundaries present on the subject property and surrounding area. The parcel is currently in use as a cattle pasture and is relatively sparsely vegetated due to the grazing that occurs there. Access to the site is via Hienaloli Road, which ends at the gated driveway leading into the Project parcel. Despite the predominantly agricultural zoning in the area, many of the smaller parcels are primarily utilized for residential purposes.

Table 3.1 Summary of Relevant Land Use Information

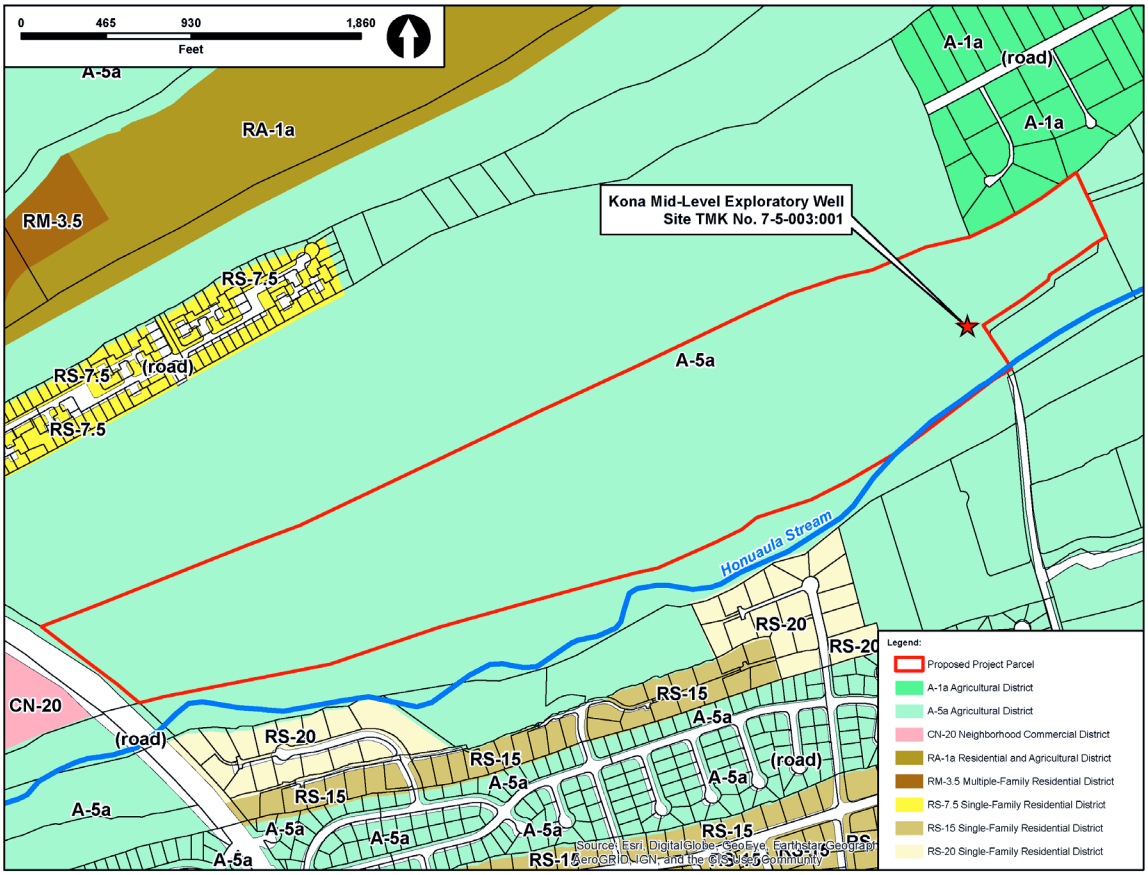
TMK No.	*Area*	*Owner*	*Land Use District*	*Zoning*	*Proposed Use*
7-5-003:001	107.04 ac.	Komo Brothers, LLP	Agriculture	A-5a	Exploratory Well Site
Source: Compiled by Planning Solutions, Inc. (2020)					

3.1.2 POTENTIAL IMPACTS AND MITIGATION

The construction and testing of the proposed exploratory well will not interfere with the ongoing agricultural activities (i.e., cattle grazing). Thus, the Proposed Action will have no significant impacts on land use on the parcel or in the surrounding community.

The No Action Alternative does not have the potential to affect land use in any way.

Figure 3.1 County of Hawai'i Zoning Boundaries



Source: Planning Solutions, Inc. (2020)

3.2 GEOLOGY, TOPOGRAPHY AND DRAINAGE

3.2.1 AFFECTED ENVIRONMENT

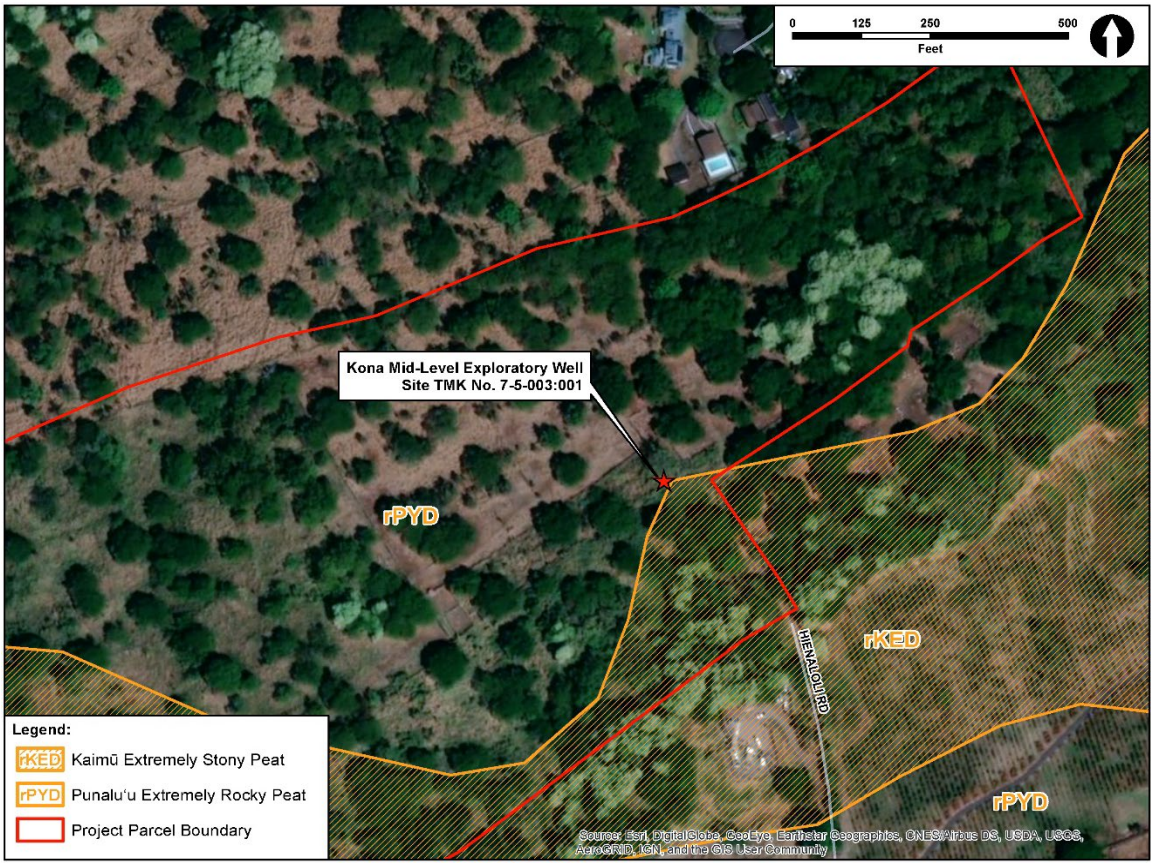
The Proposed Action is located on the western slope of Hualālai, a dormant volcano that rises to an elevation of 8,271 feet +MSL. The slopes of Hualālai consist of a veneer of geologically young (i.e., between 1,000 and 13,000 years old) lava flows, comprised primarily of alkali olivine basalts characteristic of the late stages of its eruptive activity (Macdonald, Abbott, and Peterson; 1983). The alkali veneer is largely un-dissected by erosion, although some local gullying has occurred on the older flows. The oldest surfaces on Hualālai are found in the Kailua-Kona vicinity and also the vicinity of Pu'u Wa'awa'a, to the northeast of the Project site. Hualālai's youngest rocks are from the 1800-1801 lava flows which erupted north of the proposed site from the Northwest Rift Zone. The Project site is located on lava flows older than 10,000 years, and the risk of lava flow is considered to be low.

The Project TMK No. 7-5-003:001 ranges from approximately 240 feet +MSL at Queen Ka'ahumanu Highway to approximately 850 feet +MSL at its upper boundary. The small pad and exploratory well which comprise the Proposed Action are at an approximate elevation of 760 feet +MSL (see Appendix A for a complete *Grading Plan*). The portion of the parcel where the Project is located is moderately sloped, with an average slope of 6.8 percent.

As shown in Figure 3.2 below, the U.S. Soil Conservation Service classifies the soil on the exploratory well site as Punaluʻu extremely rocky peat (rPYD), with slopes between 6 and 20 percent. In a representative profile, the surface layer is black peat about four inches thick. It is underlain by pahoehoe lava bedrock. This soil is medium acid. The peat is rapidly permeable, while the pahoehoe substrate has very slow permeability, although water may move rapidly through cracks. Runoff is slow, and the erosion hazard is slight. Roots are typically matted over the pahoehoe lava. This soil is typically best used for non-irrigated pastureland.

The access drive to the proposed exploratory well site is classified as Kaimū extremely stony peat (rKED), with slopes between 6 and 20 percent. In its representative profile, the surface layer is very dark brown extremely stony peat approximately three inches thick. It is underlain by fragmental ʻaʻā lava. This soil is neutral in reaction. Its permeability is rapid, runoff is slow, and its erosion hazard is slight. The soil is not suitable for cultivation, and is most commonly found in native woodland areas, but is sometimes used for pasture and orchards (e.g., macadamia, citrus, or papaya).

Figure 3.2 Soils in the Project Area



Source: Planning Solutions, Inc. (2020)

None of the soils affected by the Project have been classified by the State of Hawaiʻi, Department of Agriculture as Agricultural Lands of Importance to the State of Hawaiʻi (also known as ALISH). In addition, none of the land affected by the Proposed Action have been

identified as Important Agricultural Lands on maps maintained by the State of Hawai‘i’s Land Use Commission.

3.2.2 POTENTIAL IMPACTS AND MITIGATION

Construction of the Proposed Action will require modest amounts of clearing, grubbing, and grading over an area of approximately 0.53 acres. Grading and other land disturbance for the proposed Project would require 3,356 cubic yards (c.y.) of select fill required in order to create the needed embankment for a level well pad. The grading will modify the topography of the Project site, creating a flatter surface for the drill rig and pump needed to construct and test the exploratory well, but will not change the overall slope across the Project parcel. The exploratory well and pad will preclude the future use of the immediate area for agriculture unless and until the infrastructure and pad are removed. However, beyond the areas occupied by new infrastructure, the Proposed Action will have no effect on agriculture on the remainder of the Project parcel or adjacent areas.

DWS and its contractor(s) will comply with all applicable Hawai‘i County Code and building codes for the Project. Because the total disturbed area is less than one acre in size, DWS does not currently anticipate obtaining a National Pollutant Discharge Elimination System (NPDES) Notice of Intent – Construction (NOI-C) from the State of Hawai‘i, Department of Health, Clean Water Branch. It will, however, employ all Best Management Practices (BMPs) related to minimizing the potential for sediment entrained in storm water runoff during and after construction of the proposed North Kona Mid-Level Exploratory Well Project. These measures will ensure that the work will not lead to significant erosion or degradation of the existing drainage at the site. No significant impacts to the site geology, topography, or drainage will be caused by implementation of the Proposed Action. Finally, the Proposed Action will not substantially change exposure to geological hazards or bar the use of any significant geological resources.

The No Action Alternative does not have the potential to affect geology, topography, or drainage in any way.

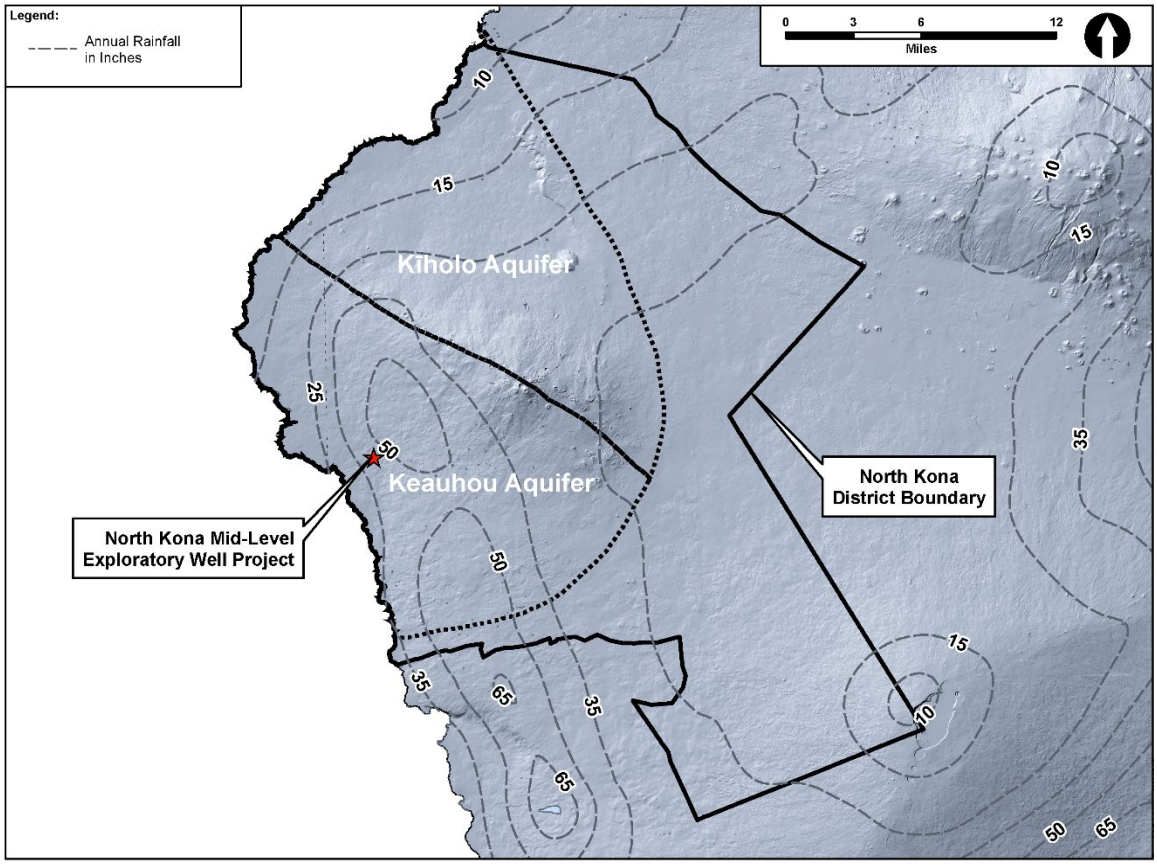
3.3 HYDROLOGY AND WATER RESOURCES

3.3.1 AFFECTED ENVIRONMENT

3.3.1.1 General Hydrology and Surface Water

According to *The Rainfall Atlas of Hawai‘i* (Frazier et al., 2016) rainfall on the western slopes of Hualālai between 2,000 feet +MSL and the summit is the principal source of groundwater recharge in the area of the Proposed Action. Average rainfall in the Keauhou Aquifer System ranges from less than 20 inches along the northwest coast to about 125 inches in the Kahalu‘u Forest Reserve. As shown in Figure 3.3 below, average annual rainfall ranges in the project vicinity can exceed 35 inches per year.

Figure 3.3 Rainfall



Source: Rainfall Atlas of Hawai‘i (2018)

According to the *Hawai‘i County Water Use and Development Plan Update* (DWS, 2017), Wai‘aha Stream, roughly a mile to the south, is the only perennial stream in the Keauhou Aquifer due to the high permeability of the basaltic lava flows from Mauna Loa and Hualālai volcanoes. However, there is one named intermittent drainageway that runs along the southern boundary of the Project parcel, identified as Honua‘ula Gulch (see Figure 1.2). In the wettest part of the rainbelt, a few small springs may occur, such as Wai‘aha Springs. The high permeability of soils in this area means that surface runoff enters the ocean only during substantial storm events. The few small springs which do occur, such as Wai‘aha Springs, occur as seepage of groundwater perched on soil and ash beds. Such springs, however, are minor and intermittent and suitable only for nominal needs. According to the State Commission on Water Resource Management (CWRM), the estimated groundwater recharge of the Keauhou Aquifer System from rainfall is 87 MGD. More recently, the USGS estimated that this recharge is actually 152 MGD (Engott, 2011).

3.3.1.2 Basal Water

Prior to 1990, only basal groundwater was known to occur in North Kona. Existing drilled wells at that time indicated that the basal lens extended approximately 1.5 to 4.5 miles inland from the coast, with a maximum head (i.e., water level elevation +MSL) of about four to five feet at Kahalu‘u and Hōlualoa.

3.3.1.3 High Level Water

In 1990, high-level groundwater was encountered almost simultaneously in the southern and northern regions of North Kona. On August 1, 1990, Keauhou Well 2 (State Well No. 3355-02), located 7 miles south of Kailua-Kona, encountered high-level groundwater at approximately 275 feet +MSL. Three weeks later DLNR's Kalaoa Well (Well No. 4358-01) encountered high-level groundwater at an elevation of 242 feet +MSL (later confirmed at 236 feet +MSL). These two exploratory wells were drilled at the then-unprecedented elevations of 1,620 +MSL and 1,800 feet +MSL, respectively. Less than a year later, in 1991, high-level groundwater was again discovered in the County's Honokōhau Well (Well No. 4158-02), located 2.5 miles north of the Keōpū Well. The Honokōhau Well (ground elevation of 1,675 feet +MSL) encountered groundwater at 109 feet +MSL.

By 1993, high-level groundwater had been found in a total of 14 wells, confirming that high-level groundwater is present *mauka* of Māmalahoa Highway from Kalaoa to Keʻei, a linear distance of 19 miles. The nature of the confining geologic structure or formation is considered to be conjectural at this time. Based entirely upon water levels in the 14 wells, the hydrologic discontinuity between the high-level and basal-water aquifers roughly aligns with Māmalahoa Highway, and the piezometric head in wells tapping the high-level groundwater ranges from 42 feet and 490 feet +MSL. These widely different water levels suggest compartmentalization in the high-level groundwater.

3.3.1.4 High Level Groundwater at Depth Beneath the Basal Lens

The monitor well at Keōpū, identified as State Well No. 3858-001, was actually completed in 2001 to a depth of -574 feet MSL. Completely unexpectedly, drilling ended up penetrating into fresh groundwater at a depth uncertain. The fresh water with a piezometric head in excess of 25 feet flowed upward and into the saline and basal groundwater bodies above.

To correct this uncontrolled discharge of fresh water into the overlying saline and brackish groundwater, the State commissioned work to: (*i*) identify the fresh water zone; (*ii*) seal the well back above the fresh water zone to convert it to a basal monitor well; and (*iii*) construct a nearby new well, identified as State No. 3858-002, to exclusively tap the fresh water body at depth.

From the ground elevation of 735 feet, this second well was completed to a depth of 1,210 feet (475 feet -MSL) with 10-inch solid casing and grouted annulus to a depth of 1,147 feet (412 feet -MSL), with an open hole for the 63 feet of depth below the casing. The piezometric head was approximately 30 feet above sea level. The well was pump tested for 48 hours at an average of 820 GPM in March 2018. The pump test established that a production well drawing from the fresh water at depth would be feasible at that location and that the water pumped was essentially identical to the high-level water pumped by DWS' high-level wells on the mauka side of Māmalahoa Highway.

3.3.1.5 Keauhou Aquifer System

The Keauhou Aquifer System delineated by the CWRM in 1990 comprises the southern half of the Hualālai Hydrologic Sector, which is defined by the exposed rocks of Hualālai Volcano

(Mink and Lau 1993).[1] The Keauhou Aquifer extends over the western and southwestern flank of Hualālai and the entire coastline from Mahaiʻula to Keikiwaha Point. Having been delineated prior to the discovery of high-level groundwater, the Keauhou Aquifer was described as a basal water system in the coastal area with the possibility of having high-level, dike-confined groundwater near the rift zones of Hualālai. The sustainable yield of the Keauhou Aquifer System was estimated by the CWRM to be 38 MGD, based on a recharge estimate of 87 MGD and assuming that the groundwater occurs as an unconfined basal lens.

The general direction of groundwater flow in the high-level aquifer was originally assumed to be directly seaward into the basal aquifer. The direction of groundwater flow in the basal aquifers is generally presumed to be oriented more or less directly toward the coastline where it becomes increasingly brackish.

The high-level groundwater of North Kona is of pristine quality, largely the result of recharge by high elevation rainfall and the lack of saltwater intrusion. The chloride content (a measure of freshness of Hawaiʻi's groundwater) in the high-level wells range between 3 and 10 mg/L, similar to the chloride content of high elevation rainfall.

3.3.1.6 Sustainable Yield

Rainfall and fog drip are the principal sources of recharge to the high-level and basal water components of the Keauhou Aquifer System Area. The CWRM estimated recharge to the Keauhou Aquifer System Area in 1990 to be 87 MGD, and, assuming an entirely unconfined basal aquifer, the sustainable yield for the area would be 38 MGD (CWRM, 2008). As noted above, a more recent study by the USGS using more sophisticated methods (Engott, 2011) estimates the recharge rate at 152 MGD. Thus, together with the now proven existence of high-level groundwater, the actual sustainable yield is considerably greater than 38 MGD.

At the present time, the total well pumpage in the Keauhou Aquifer System Area as a moving annual average is approximately 14 MGD (TNWRE, pers. comm., 2020). According to the *Hawaiʻi County Water Use and Development Plan Update*, DWS' projections for the future potable water demand in this aquifer system area ranges between 16.56 to 18.46 MGD by 2025 (Table 3-10, DWS, 2017). The existing wells near the Project site are listed in Table 3.2 below. These wells include municipal, industrial, and irrigation wells. As shown in this table, five of these wells are high level production wells.

[1] A Hydrologic Sector reflects an area with broad hydrogeological (subsurface) similarities while maintaining traditional hydrographic (surface), topographic, and historical boundaries. An aquifer system is an area within a Hydrologic Sector that is more specifically defined by hydrological and geological continuity among aquifers in the system.

Table 3.2 Existing Wells in the Project Vicinity

Well No.	*Well Name*	*Owner/User*	*Year Drilled*	*Elev. (ft +MSL)*	*Depth (ft.)*	*Static Head (ft. +MSL)*
3858-001	Kalaoa Keōpū Deep	CWRM	2001	736	1,310	2.5
3858-002	Keōpū II	CWRM	2017	736	1,193	28
3957-001	Keōpū Well A	DWS	1993	1,672	1,704	47
3957-002	Komo Monitor	DWS	1991	1,601	1,623	40
3957-004	Doutor Coffee I	Doutor Coffee Co.	2001	1,445	1,462	43
3957-005	Keōpū Well IV	HHFDC	2003	1,600	1,780	50.62
3959-001	Kamakana	Forest City Hawai‘i Kona, LLC	2011	542	995	3.4
4057-001	QLT	DWS	1994	1,762	1,787	187.8
4158-002	Honokōhau Deepwell	DWS	1991	1,675	1,735	109.5
4158-003	Palani Ranch Deepwell	DWS	2007	1,672	1,747	95.3
Source: TNWRE (2018)						

3.3.2 POTENTIAL IMPACTS AND MITIGATION

3.3.2.1 Surface Water

The Proposed Action does not involve any activities that would alter existing stream channels, wetlands, or other surface water bodies. The Project location is approximately one mile north of Wai‘aha Stream, the only perennial stream in the North Kona District. Earthmoving for the proposed well and pad will disturb moderate amounts of existing ground cover and create temporary potential for increased soil erosion in an area of approximately 0.38 acres. The DWS will require its contractor(s) to employ BMPs, as necessary, during construction to stabilize surface soils and prevent contaminants such as sediment, petroleum products, and debris from leaving the site via storm water runoff. They will also attempt to schedule earthwork during periods of minimal rainfall and to place permanent erosion control measures on lands denuded of vegetation as quickly as possible. In addition, the relatively high permeability and low runoff potential of the soils in the project area will limit the potential for storm water to transit offsite. Because the total disturbed area will not exceed one acre, DWS does not anticipate obtaining an NPDES NOI-C from the Department of Health, Clean Water Branch (see Section 3.3.2).

During tests of the exploratory well and pump, the well water produced will be discharged into an onsite disposal sump excavated for that purpose (see Section 2.1). The pump test will help to confirm the quality and quantity of water which may be available at the site. The disposal sump will be designed to contain the pump test water and allow it to percolate into the subsurface. The BMPs that the contractor will implement during design and construction of the drainage sump(s) will minimize the potential for sediment entrainment or contamination of these discharges and storm water runoff.

The No Action Alternative does not have the potential to affect surface water in any way.

3.3.2.2 Groundwater

If the pilot borehole pump test indicates that development of the completed well is warranted, final pump testing would be done after the borehole is reamed and the casing is installed and grouted into place. This testing may include pumping at a rate between 700 and 1,000 GPM for up to 96 hours continuously. The water level response in the confined freshwater body and the possible response in the overlying basal lens would be monitored, the latter with a sounding tube in the well's annular space. Based on previous testing of Well 3858-002, a response in the basal lens is not expected to occur.

The relatively short-term test is not expected to have any impact on groundwater availability as high-level groundwater or as basal groundwater. In addition, the brief withdrawal of groundwater which will occur during the pump test will not have any effect on any ground-water dependent wetlands or the Department of Hawaiian Home Lands' water reservations in the Keauhou Aquifer System Area, nor will it affect any public trust coastal resources or the traditional and customary native Hawaiian practices which rely upon them. Finally, while the location of the proposed exploratory well is not within the DWS Well Development Area shown on Figure 4-2 of the *Keauhou Aquifer System Water Use and Development Update* (DWS, 2017). If the DWS elects to develop this exploratory well into a production well at some later date, it may need to modify that.

The No Action Alternative does not have the potential to affect groundwater in any way.

3.4 POTENTIAL CONTAMINATION

3.4.1 AFFECTED ENVIRONMENT

Since the recharge areas of the Keauhou Aquifer System are on the slopes of Hualālai (see Section 3.3.1), the area is predominantly comprised of shrub and forest lands. Land uses in the immediate vicinity of the proposed Project site consist of a scattering of rural residential homes, minor agricultural endeavors, and vacant lands. None of these land uses are generators of major potential contaminants. No large-scale commercial agricultural operations, which may use significant quantities of pesticides and herbicides, are present in the area upslope from the Proposed Action, and the nearest landfill is in South Kohala more than 20 miles away. The nearest commercial and industrial facilities are concentrated in and around Kailua-Kona, approximately 1.5 miles away.

The County of Hawai'i does not have a wastewater collection system in the uplands of North Kona or along Māmalahoa Highway. Consequently, wastewater disposal in the region is primarily conducted using Individual Wastewater Systems (IWS). Historically, these predominantly consisted of cesspools. However, strict government regulations now prohibit the installation of new cesspools on the island, and as a result, homeowners are opting for septic tanks as an alternative. These IWSs collect and hold effluent, allowing the unit to separate and biodegrade the fluid before allowing it to decant by overflow into a leach field for disposal. Over time, these will eventually replace the existing cesspools as well. The stricter wastewater disposal regulation is designed to protect the watersheds as valuable recharge areas.

The Proposed Action is located above the Underground Injection Control (UIC) line established by the Department of Health. This line marks the area of the island wherein there

are strict limits on the types of injection wells that can be installed under a UIC Permit. Injection wells are typically used by individual wastewater treatment facilities to dispose of their treated wastewater effluent in ground pits. The UIC control line is about 0.5 miles downslope of the proposed Project area. This means that no injection wells can be installed close to the proposed Project.

As part of the pump testing process described in Section 2.1.2, the Project participants will work with DWS to test the water quality for potential contaminants.

3.4.2 POTENTIAL IMPACTS AND MITIGATION

Because of the location of the Proposed Action being far above the UIC line, the generally high quality of water produced by nearby wells, and the lack of potential sources of contaminants near the exploratory well site, no significant impacts due to contamination of the well water are anticipated.

Further, should the proposed well ever be converted into a production well as a source of potable water for the North Kona Water System, DWS or its contractor would prepare and submit an engineering report to the DOH identifying all potential sources of contamination and evaluate alternative control measures which could be implemented to reduce or eliminate potential contamination, including treatment of the water source. A water quality analysis is also required for all regulated contaminants and the results will be submitted as part of the engineering report to demonstrate compliance with all current drinking water standards.

The No Action Alternative does not have the potential to cause contamination of any kind.

3.5 BIOLOGICAL RESOURCES

3.5.1 AFFECTED ENVIRONMENT

In order to characterize the existing biological resources present on the site and assess any potential impacts implementation of the Proposed Action might have, a biologist from LeGrande Biological Surveys, Inc. conducted a biological survey of the site on July 24, 2020. The information in this section is drawn from the resulting report of findings*, Flora and Fauna Survey for North Kona Mid-Level Exploratory Well Project, Honua‘ula, North Kona, Hawai‘i Island*; the complete report is contained in Appendix B. The information and analysis contained in this section are drawn from that report.

The primary objectives of the field studies were to inventory the plants and animals located within the project area and in the near vicinity and provide a general description of the vegetation on the project site and access road, note animal species, and search for threatened and endangered species as well as species of concern. The federal and State of Hawai‘i listed species status follows species identified in the following referenced documents, Department of Land and Natural Resources (DLNR 1998, 2014); U. S. Fish and Wildlife Service (USFWS 2019).

Plants were inventoried during a pedestrian survey along the access road as well as the proposed area of impact. Notes were collected on plant associations and plant distribution, disturbances, topography, substrate types, exposure, drainage, and related factors. Ornamental

plants that are planted or used for landscaping or agricultural activities were not included in the species list but included in the discussion. Faunal surveys involved walking within the proposed project area and noting all bird species observed. Birds were identified by sight using the naked eye and 10x binoculars, and by songs and calls. Observations of mammals, amphibians, reptiles, and insects were made incidental to the avian vegetation survey. No effort was made to develop quantitative estimates of mammal populations within the project area.

The survey area included the dirt access driveway originating from Hienaloli Road, the project site itself, which includes the well site, and a contractor staging and storage area. The entire survey area is characterized by an alien, wet forest dominated by introduced (i.e., non-native) plant species. No rare native listed species of plants or animals were identified during the survey. Plant and wildlife habitats within the proposed project area have been highly modified by human activities, including the intentional and accidental introduction of alien species. Almost all of the plan and bird species observed within the subject property were noted during the present survey. The National Wetland Inventory has no mapped wetlands within the project area, excepting the intermittent stream that crosses the access road. There are no designated Critical Habitat units within the project area.

3.5.2 PROBABLE IMPACTS AND MITIGATION

The Proposed Action will not have any long-term detrimental effects on avian resources or plant resources in the area. None of the avian or terrestrial species observed at the proposed project site are listed as threatened or endangered by either the Federal government or the State of Hawai‘i.

The Hawaiian hoary bat (*Lasiurus cinereus semotus*), which is listed as endangered by the USFWS and the State of Hawai‘i, is known to occur in the general region and could forage or roost in the project area. Hawaiian hoary bats roost during the day in native and alien trees and other woody vegetation. During the bat breeding season (June through September), young bats may be left unattended in nursery trees while the adults are out foraging. If any woody vegetation taller than fifteen feet is to be trimmed during the proposed work, performing the work outside the bat breeding season would help to avoid killing or injuring young bats.

3.6 AIR QUALITY

3.6.1 AFFECTED ENVIRONMENT

Air quality in North Kona is generally good but is frequently degraded by the naturally occurring volcanic emissions from Kīlauea Volcano. The emissions are known locally as “vog,” a portmanteau of “volcanic fog”, and include carbon dioxide, particulate matter, and sulfur dioxide (SO_2). SO_2 is a colorless gas that easily combines with water vapor, forming sulfuric acid. Emissions of sulfur dioxide are commonly associated with the burning of fossil fuels such as coal or oil. However, on the Island of Hawai‘i, the principal source of SO_2 is Kīlauea Volcano. Under normal circumstances, the effects of this vog can be noticeable, but generally do not cause ambient air quality to exceed State of Hawai‘i or federal air quality standards.

According to the State of Hawai'i *Annual Summary of Air Quality Data 2018*, the most recent year for which comprehensive data was available, the daily averages at the DOH Special Purpose Monitoring Station in Kailua-Kona did not exceed a value of 0.053 parts per million (ppm) for SO_2 and 59 µg/m^3 for fine particulate matter ($PM_{2.5}$).[2] The State 24-hour standards for these pollutants are, respectively, 0.14 ppm and 35 µg/m^3. The elevated $PM_{2.5}$ reading—which occurred in May, 2018—was attributed to the volcanic eruption of the Kīlauea Volcano, beginning on May 3, 2018, and which led to substantial emissions of SO_2, hydrogen sulfide (H_2S), carbon dioxide (CO_2), and particulate matter. These emissions can cause breathing difficulties, irritation to the eyes, nose, and throat, and exacerbate existing conditions like pulmonary disorders. While more recent data was not available at the time this report was prepared, the subsidence of that volcanic activity makes it likely that ambient levels of $PM_{2.5}$ are currently substantially lower than they were in 2018.

3.6.2 POTENTIAL IMPACTS AND MITIGATION

Construction activities associated with the Proposed Action may result in short-term air quality impacts, including the generation of dust from soil excavation and emissions from construction vehicles and equipment. To mitigate these impacts, the contractor will be required to comply with the DOH Hawai'i Administrative Rules (HAR), Title 11, Chapter 60.1, "Air Pollution Control." Compliance with State regulations will require adequate measures to control fugitive dust by such methods as:

- Planning different phases of construction, focusing on minimizing the amount of dust generating materials and activities, centralizing on-site vehicular traffic routes, and locating potentially dusty equipment to areas of the least impact;
- Frequent watering of exposed dirt areas;
- Landscaping and rapid covering of bare areas, including slopes;
- Controlling of dust from unpaved access roads;
- Controlling dust from debris being hauled away from the Project site; and
- Constructing a dust barrier/fence.

Exhaust emissions from construction vehicles and the test pump are anticipated to have negligible impacts on air quality, as emissions would be relatively minor, readily dissipated, and brief. These factors, in combination with observance of the air pollution control measures described above, has led DWS to conclude that the Proposed Action will not have any significant impacts on local or regional air quality.

The No Action Alternative does not have the potential to affect air quality in any way.

[2] The special purpose stations on Hawai'i Island were established to monitor ambient air concentrations of $PM_{2.5}$ from volcanic emissions.

3.7 NOISE

3.7.1 REGULATORY CONTEXT

Hawai'i Administrative Rules, Title 11, Chapter 46, Section 4 (HAR §11-46-4) defines the maximum permissible community sound levels in dBA. These differ according to the kind of land uses that are involved, as defined by zoning district, and time of day (i.e., daytime or nighttime). These limits are shown in Table 3.3 below. Definitions of two technical terms used in this discussion are as follows:

- *A-Weighted Sound Level (dBA).* The sound level, in decibels, read from a standard sound-level meter using the "A-weighted network". The human ear is not equally sensitive in all octave bands. The A-weighted network discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear.
- *Decibel (dB).* This is the unit that is used to measure the volume of a sound.[3] The decibel scale is logarithmic, which means that the combined sound level of 10 sources, each producing 70 dB will be 80 dB, not 700 dB. It also means that reducing the sound level from 100 dB to 97 dB requires a 50 percent reduction in the sound energy, not a 30 percent reduction. Perceptually, a source that is 10 dB louder than another source sounds about twice as loud. Most people find it difficult to perceive a change of less than 3 dB.

The maximum permissible sound levels specified in HAR §11-36-4(b) apply to any excessive noise source emanating from within the specified zoning district. They are measured at or beyond the property line of the premises from which the noise emanates. Mobile noise sources, such as construction equipment or motor vehicles are not required to meet the 70 dBA noise limit. Instead, construction noise levels above these limits are regulated using a curfew system whereby noisy construction activity is not normally permitted during nighttime periods, on Sundays, and on holidays. Construction activities which could typically exceed the limits established for fixed machinery are normally allowed during the normal daytime work hours on weekdays, and on Saturdays using a system involving the issuance of construction noise permits.

[3] The sound pressure in decibels is equal to twenty times the logarithm to the base ten of the ratio of the pressure of the sound measured to a reference pressure of 20 micropascals, or 0.0002 dynes per square centimeter.

Table 3.3 Hawai‘i Administrative Rules §11-46 Noise Limits

Zoning District	*Noise Limit (in dBA)*	
	Daytime (7:00 a.m. to 10:00 p.m.)	*Nighttime (10:00 p.m. to 7:00 a.m.)*
Class A: Areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.	55	45
Class B: All areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C: All areas equivalent to lands zoned agriculture, country, industrial, or similar type.	70	70
Source: Hawai‘i Administrative Rules §11-46 Community Noise Control		

All of the parcels which would be affected by the Proposed Action are zoned for agriculture, which places it in Class C, the least restrictive for the purposes of noise limits. Consequently, a 70 dBA noise limit will apply to stationary noise sources.

3.7.2 AFFECTED ENVIRONMENT

No noise study was conducted during the planning of Proposed Action but based on measurements made in other similar areas on the island, ambient noise levels during regular trade wind weather is probably near 55 dBA. The predominant noise sources in the vicinity of the Project site are traffic from Queen Ka‘ahumanu Highway and surrounding neighbors engaged in agricultural activities. Other noise sources include wind, bird calls, and aircraft. The majority of the land above Queen Ka‘ahumanu Highway in the uplands of North Kona are undeveloped or in open space and do not harbor significant sources of noise-generating activity or noise sensitive activities.

3.7.3 POTENTIAL IMPACTS AND MITIGATION

Audible construction noise would be an unavoidable result of construction of the Proposed Action (i.e., the proposed pad and well). Transport, excavation, and other activities will also entail the use of trucks with backup alarms and excavators (e.g., backhoe), which can generate up to 84 dBA at a distance of 50 feet to prepare the well pad. Because the nearest residences are approximately 500 feet removed from the exploratory well site, some of this work will be audible.

Noise from operation of the construction equipment is expected to exceed the property line noise limits vis-à-vis adjacent agricultural and residential lots during portions of the project’s implementation. Because of this, the DWS or their contractor(s) anticipate seeking a Construction Noise Permit from the DOH Indoor and Radiological Health Branch, in accordance with the provisions of HAR §11-46. The implementing regulations for a DOH Construction Noise Permit stipulate that noisy construction activities do not occur during the nighttime, Sundays, and holidays. These permit procedures, which are routinely applied to noisy construction activities, are intended to minimize the adverse impacts to residences and other sensitive noise receptors.

The pilot borehole pump test would use a submersible pump and motor powered by a relatively quiet diesel generator. This test may be run for up to 24 hours. The final pump test, if conducted, would use a line shaft pump driven by a diesel engine. The nearest residence is approximately 500 feet away from the well site. A noise variance for the final pump test may be required.

Impacts associated with construction noise of the Proposed Action are not expected to affect public health or welfare, due in part to the fact that they will be temporary in nature and restricted to normally permitted work hours. To mitigate short-term construction-related noise impacts, the contractor(s) will comply with the provisions of HAR §11-46, "Community Noise Control". It will be the contractor(s)' responsibility to minimize noise by properly maintaining mufflers and other noise-attenuating equipment. If construction work is required during evenings, night, and weekend hours, a variance will be sought from the DOH.

Construction workers' vehicles traveling to and from the Project site will also increase traffic volumes on Queen Kaʻahumanu Highway and adjacent roadways used to the access the site, including Hienaloli Road. However, the addition of these relatively few construction workers required for the Project will increase total traffic noise levels by no more than a few tenths of a decibel, which are not noticeable. Consequently, construction worker vehicle-trips for the Proposed Action will not have a significant noise impact.

The No Action Alternative does not have the potential to generate noise of any kind.

3.8 NATURAL HAZARDS

3.8.1 FLOODING

The Federal Emergency Management Area (FEMA) has designated the entire area of the Proposed Action as being in Flood Zone X. This designation corresponds to areas that are subject to flooding from a potential 500-year flood or from a 100-year flood with flood levels of less than one foot. Areas designated as Zone X are outside of the 0.2 percent annual chance floodplain; because these areas are considered to have very low potential for flooding, no base flood elevations have been determined. Site planning for the well facilities has considered the location and extent of these identified flood zones.

3.8.2 VOLCANIC HAZARDS

The Proposed Action is located on the western flank of Hualālai, one of five prominent volcanoes on the Island of Hawaiʻi. The estimated lava production rate for Hualālai over the past 3,000 years is about 2 percent of the current rate for Kīlauea Volcano. The last volcanic eruption of Hualālai in the general Project area occurred in 1800 to 1801. Lavas emerged from the northwest volcanic rift zone at about the 1,600-foot elevation (in the vicinity of the Puhi-a-Pele Cinder Cone, just makai of Māmalahoa Highway), creating a flow that entered the ocean north of Keāhole Point.

The Lava Flow Hazard Map prepared by the Hawaiian Volcano Observatory of the USGS shows the island of Hawaiʻi in nine Lava Flow Hazard Zones (Zone 1 being the most hazardous and Zone 9 being the least), based on geologic criteria, including frequency of past lava flows and coverage, distance from eruptive vents, and topography that currently protects certain areas

from lava inundation. The summit of Mauna Loa and its rift zones as well as Kīlauea Crater and its rift zones are located in Zone 1. The Project site and the town of Kailua-Kona are located in Zone 4, a moderately rated hazardous zone. Thus, the likelihood of impacts to the Project facilities from lava flows is low.

3.8.3 EARTHQUAKES

Most earthquakes which occur in the State are localized around the Island of Hawaiʻi, and most are too small to be detected except by highly sensitive instrument. However, potentially destructive earthquakes do occur. The most powerful earthquake in Hawaiʻi on record occurred in 1868 beneath the Kaʻū District on the southeast flank of Mauna Loa, on the Island of Hawaiʻi. It had an estimated magnitude of between 7.5 and 8.1 and caused damage across all of Hawaiʻi Island.

Large earthquakes unrelated to volcanic activity also occur at irregular intervals on the island. At 7:07 a.m. on October 15, 2006, a relatively large earthquake registered a magnitude of 6.7 and caused more than $100 million dollars in damage. Numerous people suffered minor injuries, and over 1,100 buildings were damaged, in some cases extensively. Power outages occurred throughout the Hawaiian Islands. That earthquake was felt as intensity VII-VIII in northern and western Hawaiʻi. A tsunami wave with a height of 4 inches (10 cm) was recorded at Kawaihae Harbor.

More recently, on Friday, May 4, 2018, a magnitude 6.9 earthquake occurred with an epicenter near Fern Acres in Pāhoa on the east side of the island. This quake, associated with the eruption of Kīlauea Volcano, caused minor structural damage. Hawaii Electric Light Co., Inc. estimated that this quake temporarily knocked out electrical service to approximately 14,000 customers.

However, because the Proposed Action consists solely of a very low-profile well and pad, none of its features are susceptible to damage by all but the most severe seismic activity and will not increase the seismic vulnerability of the area.

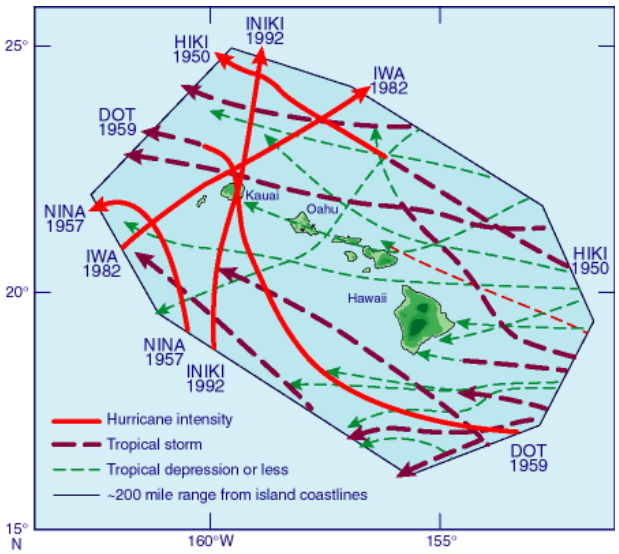
3.8.4 TSUNAMI

The Proposed Action is not located within a designated Flood Hazard Safety Area nor is it within a Tsunami Evacuation area (Pacific Disaster Center, 2018).

3.8.5 HURRICANES AND TROPICAL STORMS

While many hurricanes have passed near Hawaiʻi Island during the last 50 years, none have directly affected the Island of Hawaiʻi (Figure 3.4). However, on Friday, August 8, 2014, Tropical Storm Iselle landed on the eastern side of Hawaiʻi Island. It was the strongest tropical system to make landfall on the island since reliable records began in 1950. The storm made landfall just prior to 3:00 AM HST with sustained winds near 60 mph and higher gusts. A gust of 66 mph was observed at Volcano National Park, and a gust to 72 mph occurred at Oʻahu Forest National Wildlife Reserve (AccuWeather, 2014). Another tropical storm in 1958 reached sustained speeds of 30 knots with gusts of 45 knots near Hilo. In other areas of the island, as judged by damage, winds reached sustained speeds of at least 50 knots with gusts of 75 knots or more (CPHC, 2013).

Figure 3.4 Hurricane Tracks, 1950 to 2012



Source: U. Hawai‘i School of Ocean and Earth Science & Technology

No documented hurricanes have directly affected Hawai‘i Island, and all the tropical storms that have impacted the island have affected only the eastern, windward side of the island. The Project does not consist of any buildings or above-ground structures which could be vulnerable to hurricane-force winds. Thus, the likelihood of impacts to the Proposed Action from such storms is very low.

3.8.6 WILDFIRES

The Hawai‘i Wildfire Management Organization rates the area of the Proposed Action as being in a “Moderate Hazard Area” with respect to wildfires (HWMO 2014). The site plan provides adequate clearance around the proposed well and pad to keep them safe, should a wildfire pass through the area. In addition, the use of the Project parcel for cattle grazing tends to curtail vegetative cover and limit the availability of combustible fuel.

3.9 CLIMATE CHANGE AND POTENTIAL SEA LEVEL RISE

3.9.1 AFFECTED ENVIRONMENT

The global community of climate scientists has concluded that sea levels are currently rising and that this trend is expected to continue for the foreseeable future. The Intergovernmental Panel on Climate Change (IPCC) has predicted that: (*i*) the average temperature in the Hawaiian Islands is likely to increase by 0.5 to 1.5 °C or 0.9 to 1.7 °F by 2100, (*ii*) rainfall is likely to decrease by, at most, 10 percent, and (*iii*) sea level could rise between 0.26 to 0.98 m or 0.85 to 3.2 feet (Church et al., 2013; IPCC 2013). Given this likelihood, it is incumbent upon planners to look at the potential effects this trend could have on infrastructure and other development and examine ways in which project design can accommodate these changes.

3.9.2 POTENTIAL IMPACTS

The relatively small anticipated temperature change and modest predicted decrease in rainfall would not significantly affect the Proposed Action over its service lifetime. Because the Project involves infrastructure at 760 feet +MSL, well above sea level, a rise in average sea level even of 3.2 feet would not affect the Project design or have the potential to adversely impact Project-related infrastructure.

3.10 SCENIC RESOURCES

3.10.1 AFFECTED ENVIRONMENT

The existing visual character of the Project site can be described as undeveloped sloping land overgrown with dense vegetation and intersected with old ranching walls. The Project area cannot be seen from Queen Ka‘ahumanu Highway or other public vantage points due to intervening topographic and vegetation barriers. The Pacific Ocean and Kona coastline form the backdrop of views toward the makai lands from the site’s upper elevation.

3.10.2 POTENTIAL IMPACTS AND MITIGATION

The well and pad of the Proposed Action are modest in size, low-profile, and unobtrusive. They will not be visible from Queen Kaahumanu Highway or from Hienaloli Road, obscured by intervening topography and vegetation. View planes from properties in the vicinity toward the sea and mountains will not be affected.

The No Action Alternative does not have the potential to affect scenic resources of any kind.

3.11 ARCHAEOLOGICAL RESOURCES

3.11.1 CONTEXT AND METHODS

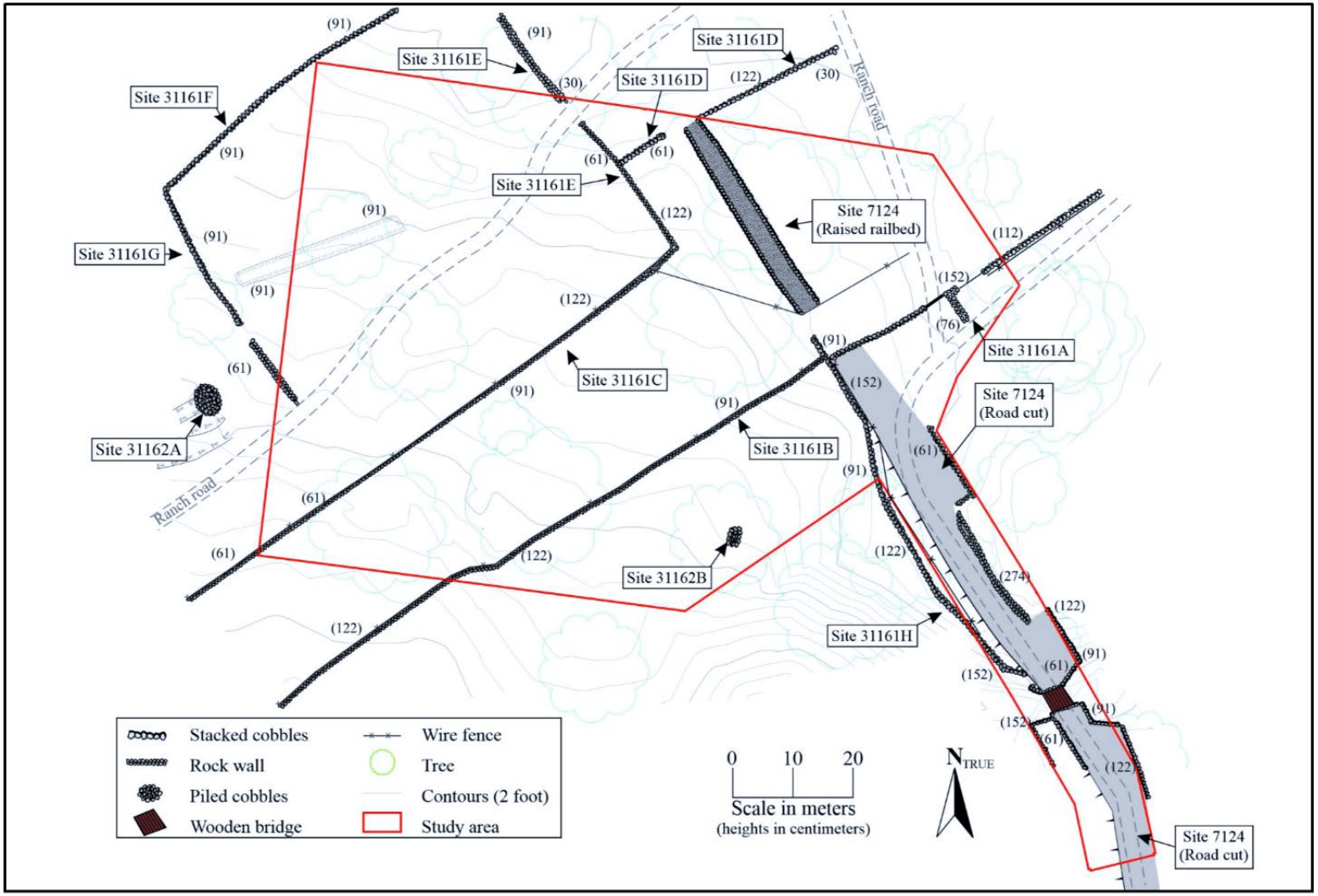
On behalf of DWS, and at the request of their hydrologic consultants TNWRE, ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of the Project site, a roughly 2.9-acre area comprising a portion of TMK No. 7-5-003:001. The result of this AIS, *An Archaeological Inventory Survey for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well, TMK: (3) 7-5-1:003 (por.), Honua‘ula Ahupua‘a, North Kona District, Island of Hawai‘i*, was submitted to the State Historic Preservation Division (SHPD) on August 11, 2020. The information and analysis in this section of the report is drawn from that AIS and associated correspondence. The AIS is included here as Appendix C of this EA. The survey area is shown in Figure 3.5.

As described in Section 2.1, the Proposed Action includes a drill pad site and an unpaved access road that will be improved by laying down gravel over the existing road surface. Within this area, the Project will include grubbing, grading, and drilling an exploratory well. No ground disturbance in the access road corridor from Hienaloli Road to the Project site is proposed, but steel plates will be lain across an existing wooden bridge to reinforce it. This AIS was conducted in support of the HRS, Chapter 343 environmental review process and SHPD’s HRS, Chapter 6E-8 review of the Proposed Action.

Fieldwork for the AIS was conducted on February 24 and March 3, 2020, by Genevieve Glannon, BA, ʻIolani Kaʻuhane, BA, and principal investigator Ben Barna, Ph.D. During the AIS, 100 percent of the ground surface of the Project area was visually inspected by field technicians walking transects oriented north-south with spacings no greater than 10 meters apart. Subsurface testing consisted of one test unit excavated to ascertain the function and age of one identified archaeological feature. No cultural material was collected from the ground surface or test excavations.

The AIS was undertaken in accordance with HAR, Title 13, §13-275 and was performed in compliance with the *Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports* contained in HAR, Title 13, §13-276. Compliance with the above standards is sufficient for meeting the initial historic preservation review requirements of both SHPD and the County of Hawaiʻi, Planning Department.

Figure 3.5 Archaeological Sites in the Project Area



Source: ASM Affiliates (2020)

3.11.2 SUMMARY OF FINDINGS

As a result of fieldwork conducted as part of the AIS, one previously-recorded and two newly-recorded archaeological sites were identified within the Project area. The locations of the identified sites relative to the Project area is presented in Figure 3.5. The characteristics of the three sites are summarized in Table 3.4 and described in further detail below. In addition to these three sites, a thorough search for the "old trail" depicted on *Registered Map No. 2358*, prepared in 1906 as part of a boundary survey, was made by clearing vegetation and walking transects spaced 3 meters apart. The ground surface showed signs of erosion and disturbance by pigs and other animals, but no physical evidence of the trail was observed.

Table 3.4 Archaeological Sites Recorded During AIS

Site No.	*Type*	*Function*	*Age*	*Description*
50-10-28-7214	West Hawaii Railroad	Transportation	20th Century	Portion of the railbed of the West Hawaii Railroad.
50-10-28-31161	Ranch Walls	Livestock Ranching	Historic	Complex of historic-era ranching walls.
50-10-28-31162	Complex	Agriculture	Historic/Pre-Contact	Complex of agricultural clearing mounds comprising two features.
Source: ASM Affiliates (2020)				

3.11.2.1 Site 50-10-28-7216

This site is the railroad bed of the former West Hawaii Railroad. A 160-meter-long discontinuous portion of the railroad bed extends through the proposed Project area. Within this area, the site consists of a 35-meter-long berm and approximately 130 meters of roadbed that has been cut across the prevailing slope. At the southern end of the Project area, a wooden bridge crosses the unnamed stream at the Hienaloli 1st Ahupuaʻa boundary. The wooden elements of the bridge are modern, but the bridge abutments are classified as "historic".

Site 7214 is historically significant for its association with the development of the sugar industry (Criterion a), as an excellent example of early 20th-century dry stone masonry construction (Criterion c), and for information yielded relative to the location, and construction materials and techniques used to build the railroad (Criterion d). Because the Proposed Action has been designed to avoid affecting Site 7124, and the site has been adequately documented by the current study, no further historic preservation work for the site is recommended at this time. The AIS concludes with the recommendation that, during future planning for the Hienaloli Road extension, the County of Hawaiʻi Planning Department, DLNR-SHPD, and the landowner work to consider potential rehabilitation of the portion of Site 7124 within the Project Area. It suggests that the site could be repurposed as a pedestrian and/or non-motor vehicle pathway as part of the new road's design.

3.11.2.2 Site 50-10-28-31161

Site 50-10-28-31161 is a complex of historic ranch walls located within and extending beyond the boundaries of the Proposed Action Eight core-filled wall segments (Features A-H) were

identified within the Project area. Sites 31161 is considered to be significant under Criterion d for the information it yielded relative to the extent and practice of livestock ranching on the Island of Hawai‘i. The site has been adequately documented within the Project area. No further work is recommended within the Project area for both of these sites.

3.11.2.1 Site 50-10-28-31162

Site 50-10-28-31162 is complex consisting of two remnant agricultural features (Features A and B) interpreted as clearing mounds most likely associated with 20th century livestock ranching. No physical evidence of the “old trail” was observed. Site 31162 is considered to be significant under Criterion d for the information it yielded relative to extent and practice of livestock ranching on the Island of Hawai‘i. The site has been adequately documented within the Project area. No further work is recommended within the area of the Proposed Action for both of these sites.

3.11.3 POTENTIAL IMPACTS AND MITIGATION

The recorded archaeological sites are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-275-6. 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.*

The portions of all three sites located within the Project area retained sufficient integrity in all categories to be evaluated for their historical significance. The significance and recommended treatment for the three recorded sites is presented in Table 3.5. Site 7214 is considered significant under Criteria a. and c. and Sites 31161 and 31162 are considered significant under Criterion d. No further work is recommended for Sites 31161 and 31162.

Table 3.5 Site Significance and Treatment Recommendations

Site No.	*Site Type*	*Temporal Affiliation*	*Significance*	*Previous Treatment*	*Recommended Treatment*
50-10-28-7214	West Hawaii Railroad	1906-1927	a, c	Preservation	Preservation
50-10-28-31161	Ranch Walls	20th Century	d	n/a	No further work
50-10-28-31162	Agricultural Features	Historic	d	n/a	No further work
Source: ASM Affiliates (2020)					

With regard to the remnant railroad bed, identified in the AIS as Site 7214, the archaeologists have recommended that it be preserved. See Appendix C for the complete AIS and a comprehensive discussion of the justification for the treatment recommendations for Site 7214.

3.12 CULTURAL IMPACT ASSESSMENT

3.12.1 REGULATORY CONTEXT

As discussed in Section 1.1, the expenditure of county funds for the Proposed Action subjects this action to the requirements of the Hawai‘i Environmental Policy Act (HEPA), as codified in HRS, Chapter 343. Among those requirements is preparation of a Cultural Impact Assessment (CIA) that is intended to inform this EA, and is prepared pursuant to Act 50 and in accordance with the Office of Environmental Quality Control’s (OEQC) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council of the State of Hawaii on November 19, 1997 (OEQC, 1997). Act 50, which was 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 Hawai’i’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.” Further, Articles IX and XII of the Constitution of the State of Hawai‘i impose on government agencies a duty to promote and protect the cultural beliefs, practices, and resources of native Hawaiians and other ethnic groups.

Pursuant to this requirement, TNWRE, on behalf of their client DWS, asked ASM Affiliates (ASM) to prepare a CIA for the Proposed Action. The resulting report, *A Cultural Impact Assessment for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well, TMK (3) 7-5-003:001 (por.), Honua‘ula Ahupua‘a, North Kona District, Island of Hawai‘i*, provides the basis for the information and analysis summarized in the following subsections. The complete CIA is included as Appendix D of this EA.

3.12.2 HISTORICAL OVERVIEW

A review of the culture-historical background material reveals that during Pre-contact times, Honua‘ula Ahupua‘a was part of the cultural landscape centered around the Kamakahonu-Kailua area, where royal centers were established and a massive agricultural field system was

developed along the slopes of Hualālai. Historic accounts written by both native historians and early missionaries between the years 1812-1844 revealed the presence of royal compounds, habitation sites, and a ceremonial heiau (possibly named Kapohonau) situated along coastal Honuaʻula. Traditional accounts trace occupation of this area from at least the 13th century with the rule of Pili-a-Kaʻaiea into the mid-19th century when the aliʻi Leleiohōkū laid claim to Pā O Papaʻula and Pā o Papa at the coast of Honuaʻula. The accounts also reflect the lifestyle changes brought about after the arrival of Europeans in 1778-79 and missionaries in 1820. Honuaʻula Ahupuaʻa itself figures prominently in Kona's missionary settler history, as it served as the main parsonage for the Thurston family who helped to establish Mokuʻaikaua Church located to the northwest of the Proposed Action in Keōpū Ahupuaʻa. The two-story Thurston family home was located makai of the Project area on the Honuaʻula-Hienaloli 1st Ahupuaʻa boundary.

By the mid-19th-century, the growing population of Westerners, convinced that the traditional Hawaiian land tenure practiced was not compatible with the newly established constitutional monarchy, encouraged the Mōʻī and his high-ranking chiefs to overhaul the traditional land tenure system. This culminated in the event known historically as the Māhele ʻĀina, which effectively established fee-simple ownership in the Hawaiian Islands. During the land division between the King and chiefs, Honuaʻula Ahupuaʻa was claimed by the chiefess Keahikuhi Kekauʻōnohi (also known as Mikahele or Miriam Kekauʻōnohi), who subsequently relinquished her interest and the land was retained as Government land. In addition, four individuals and one institution: (*i*) Pupule, (*ii*) Walawala, (*iii*) Wahineiki, (*iv*) the aliʻi Leleiohōkū; and (*v*) the American Board of Missions, were awarded a total of seven kuleana parcels in coastal Honuaʻula.

While most of the awarded parcels appear to have been for house lots, testimony collected during the land claim process indicates that some of the awardees had cultivated parcels. While the location of these cultivated parcels was not disclosed, general land use patterns for the Kona District at this time suggest that such cultivated plots were likely located mauka of the Proposed Action in the vicinity of Māmalahoa Highway. The land claims made by the aliʻi Leleiohōkū provides insight into a royal compound at the coast identified in the land claim documents as Pā o Papa and Pā o Papaʻula. Given that the Māhele ʻĀina codified preexisting land-use patterns were in place for several generations or more, this suggests that at least some, if not most, of the native people were still living according to the principles of the traditional ahupuaʻa system during this time.

In addition to the Land Commission Awards during the Māhele ʻĀina, the Hawaiian Kingdom government authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the Māhele ʻĀina at a cost of fifty cents per acre. Although the stated goal of the program was to enable native tenants to purchase land, it also allowed many foreigners to acquire large tracts of Government land. Excluding the kuleana parcels, the remaining lands of Honuaʻula were divided into two large land grants (Grant 1758 sold to George L. Kapeau and Grant 3148:4 sold to William P. Leleiohōkū, who also was awarded two kuleana parcels discussed above). The Proposed Action is within a portion of George L. Kapeau's 585-acre grant. As a descendant of a Maui chief, Kapeau was considered a kaukaualiʻi (lesser chief) and held various government positions.

In 1862, the Boundary Commission was authorized to settle and certify the boundaries for lands that were awarded by name only during the 1848 Māhele ʻĀina. Elder residents were brought into the hearings to give testimony about the known boundaries. While the Boundary Commission did not hold testimony to settle the boundaries of Honuaʻula, testimony was gathered for the adjacent ahupuaʻa of Hienaloli I and II.

A review of historic maps produced during the late 19th and early 20th century reveals changes in land use in the immediate vicinity of the Proposed Action. A Hawaiʻi Territory Survey map (see Figure 27 of Appendix D) produced in 1906 shows survey markers and a trail alignment extending in a mauka-makai direction along the southern boundary of the Project area. The map also depicts the presence of various introduced species in the vicinity of the Project area including guava, and monkeypod trees. While most of the testimony focuses on the lands of Hienaloli (written in the testimony as Hianaloli), some information specific to the Honuaʻula-Hienaloli 1st boundary is provided and only those portions have been analyzed in the present CIA. From these recollections of the elder residents, it is noted that the southwestern ahupuaʻa boundary was the site of an old heiau called Kapohonau, which may have been the "ancient fortification" first described by Ellis (1917:77) in 1823. Likewise, these accounts also depict the demographic changes in the Project area as a result of the increased missionary presence.

Shortly after the Boundary Commission held its hearings for the adjacent lands, it appears that the upper portion of Honuaʻula near the Government Road was parceled out into 50-acre lots. An undated Hawaiʻi Registered Map 25 (see Appendix D, Figure 29) map produced by S. C. Wiltse, who conducted much of his survey work between the 1860s and 1870s, shows seven lots, three of which are makai of the Government Road and the remaining four located mauka of the road.

During the early 20th century, as large swaths of land around the Hawaiian Island were transformed into vast plantations of sugarcane, the Kona Sugar Company set out to establish a marketable sugar industry in Kona. The rise of sugar plantations not only transformed the land but also the cultural tapestry of the islands as migrant laborers from various ethnic backgrounds developed into a massive plantation workforce. To facilitate the movement of cane to the mills, the West Hawaii Railroad Company built 11-miles of track in Kona, with the northernmost limit of the railroad extending into the Project area (see Section 3.11.2). After ten years of operation, the Kona Development Company and West Hawaii Railroad were sold to Tomekichi Konna, formerly of the Laupahoehoe Sugar Company, becoming the first sugar plantation to be owned by a Japanese immigrant. After the closure of the two companies in 1927, the railroad right of way was repurposed by the Government and became the Hienaloli-Kahului Road.

Around 1875, Henry N. Grenwell began grazing cattle in the Project vicinity and eventually established the 36,000-acre Greenwell Ranch. The northern section of the ranch, known at the time as Honokōhau Ranch and Hualālai Ranch, included about 20,000 acres, 4,000 of which were owned by the ranch. These lands included the Project area, which had been purchased by H. N. Greenwell as Grant 3100 (but originally sold as Grant 1758 to Kapeau). Stone walls and wire fences were used to divide the ranch land into paddocks.

By the 1940s, the parcel was owned by Kakuro Komo, who had emigrated from Hiroshima Prefecture, Japan to Hawaiʻi and worked for the Kona Development Company as a locomotive engineer. Around the 1920s, Komo leased land in the Keopū area for his home, a general store,

and coffee land, and eventually acquired additional properties, including the Project area. County of Hawai‘i tax records indicates that throughout the second half of the 20th century, about 108 acres of the property were used as pasture, which was leased to local ranchers. Aerial photography from 1965 and 1977 (see Appendix D, Figures 34 and 35) documents relatively little change to the Project vicinity. The land remained in use as cattle pasture, and as the aerial photographs show, was mainly kept grazed down with the exception of large trees. By 1977, a ranch road had been cleared makai of the Project area, and development had begun in Keōpū 3rd Ahupua‘a to the north, but appears to have changed little.

During preparation of the CIA, consultation was conducted with three individuals: Mr. Clarence Rapoza (the current lessee), Mr. Kenneth Komo (landowner), and Mr. Solomon Haleamau (former paniolo). All of the interviewees were identified as being born and raised in North Kona and as having in-depth knowledge of the Project area. Through the consultation process, the interviewees shared their knowledge about several known archaeological sites including the former railroad bed and ranching infrastructures such as walls and a nearby corral (see Section 3.11.2 and Figure 3.5). Aside from ranching activities, none of the consulted parties were aware of any past or ongoing traditional cultural practices in the Project site.

3.12.3 POTENTIAL IMPACTS AND MITIGATION

None of the consulted parties opposed the Proposed Action. In addition, none of the consulted parties were aware of any traditional or customary practices, beliefs, or resources associated with the Project site, including any burials in the area. However, as a precautionary measure, it is recommended that an archaeological monitor be present during any ground-disturbing activities. There is always the possibility that subsurface cultural remains may be encountered during construction of the Proposed Action. Consequently, the construction contract for the proposed work will require that in the event that any archaeological, historic, or cultural property including iwi (i.e., skeletal remains), are identified during earthmoving activities, the contractor will immediately cease work in the vicinity of the find, protect the area from additional disturbance, and contact SHPD for subsequent guidance.

As identified in the consultation portion of this study, two of the three interviewees expressed some degree of knowledge and attachment to the former railroad. The railroad was documented in the AIS conducted by Glennon and Barna (2020; see Section 3.11) as Site 7214 and recommended for preservation.

3.13 SOCIO-ECONOMIC ENVIRONMENT

3.13.1 AFFECTED ENVIRONMENT

The Proposed Action will occupy a portion of TMK No. 7-5-003:001 (see Figure 1.1). As discussed in Section 3.12, while some surrounding areas were used for more intensive agriculture, the Project site has been in continuous use as pastureland for cattle since 1875 and owned by Komo family interests since the 1920s. The site is located in the State of Hawai‘i’s Agricultural Land Use District, and the County of Hawai‘i has zoned the parcel Ag-5a Agricultural District (see Figure 3.1). Other than the agricultural and residential land uses discussed in Section 3.1.1, there are no significant commercial, industrial, or other economic activities in the Project’s immediate vicinity.

The Proposed Action is located within the Hōlualoa Census Tract 216.01. The median household income in this Census Tract is higher than the countywide average, and its unemployment rate is slightly lower. The Project area is not considered a low-income area. Table 3.6 summarizes relevant economic data for this area as of 2018. The 2020 COVID-19 pandemic and resulting economic slowdown has undoubtedly adversely affected socio-economic markers in the interim, but the numbers here reflect the most current data available.

Table 3.6 Summary of Economic Data for Census Tract 216.01

Resident population	9,136
Median household income	$85,811
Median family income	$83,419
Persons below the poverty level	8.6%
Families below the poverty level	6.7%
Civilian unemployment rate	3.0%
Population with a high school degree or higher	94.6%
Population with a bachelor's degree or higher	40.8%
Population who were foreign-born	15.5%
Population who speak a language other than English	16.7%
Median value for owner-occupied housing unit	$577,700
Source: U.S. Census Bureau, U.S. Census Bureau, American Community Survey 5-Year Estimates. (2018 Estimates)	

3.13.2 POTENTIAL IMPACTS AND MITIGATION

The proposed exploratory well and pad are allowable uses under the existing land use designations for the site, as discussed in Section 3.1, and will not conflict with or otherwise interfere with adjacent land uses or economic activity. The Proposed Action is compatible with, and intended to support, existing uses of the area and the plans which support them. Aside from the temporary and relatively modest construction employment and expenditures, the Project would not stimulate or otherwise promote population growth or economic activity. North Kona has been designated in the County of Hawai‘i’s *General Plan* as an area that can accommodate population growth. Thus, the Proposed Action is not anticipated to have any significant effect on the socio-economic environment of the area and no mitigation is required or recommended.

3.14 TRAFFIC

3.14.1 AFFECTED ENVIRONMENT

The proposed Project site is accessed via an unpaved, gated driveway from Hienaloli Road. Hienaloli Road is a two-lane, rural road serving the immediate locale. Traffic volume on this rural road can be categorized as low, and virtually all of the traffic along it can be categorized as residential or agricultural in nature.

3.14.2 POTENTIAL IMPACTS AND MITIGATION

Construction vehicles will marginally increase the volume of traffic along Hienaloli Road and other local roadways (e.g., Nani Kailua Drive). These impacts may be noticeable to residents along these roads, but will be short in duration, will occur only during the work day, and would

be limited to just a few vehicles transporting workers, equipment, and material. These additional volumes of traffic are insignificant in comparison with existing traffic volumes and would occur only during construction. Once the Proposed Action is operational, no regular traffic to or from the site would occur.

The No Action Alternative does not have the potential to generate any vehicular traffic of any kind.

3.15 UTILITIES AND PUBLIC INFRASTRUCTURE

3.15.1 AFFECTED ENVIRONMENT

Electrical Service. Electric service on Hawai‘i Island is provided by Hawai‘i Electric Light Co., Inc. There are no existing HELCO facilities at the proposed Project site. There are power lines (distribution and service circuit) along Hienaloli Road, adjacent to the gated access driveway.

Telecommunications. Telecommunications service on Hawai‘i Island is available from Hawaiian Telcom or Spectrum. There are no existing telecommunications facilities on the proposed Project site. There are communication cables on the poles along Hienaloli Road in the area.

Water Supply. The rural community in the Project vicinity is served by distribution lines that are part of the North Kona Water System. That system consists of high-level, mid-level, and shaft wells, storage tanks, and an interconnecting pipeline system serving DWS' customers from Keāhole to Keauhou.

Sanitary Wastewater. The County's sewer collection system currently services the town of Kailua-Kona, the coastal properties along Ali‘i Drive, several inland subdivisions between Kailua-Kona and Keauhou, and new development above Queen Ka‘ahumanu Highway, mauka of the County's Kealakehe Wastewater Reclamation Facility. However, the Project parcel currently has no connection to the County's sewer collection system.

Historically, unserved properties have used independent waste systems consisting primarily of cesspools in the past and septic tanks with leach fields recently to accommodate their wastewater disposal needs. As indicated in Section 3.4.1, government regulations no longer allow new cesspools and require an environmentally safer method of disposal to protect the area's watershed. Homeowners with cesspools may eventually be required to install septic tanks that collect and hold the effluent, allowing the system to separate and biodegrade the outflow before the liquid component is canted by overflow into a leach field for disposal. However, there is no independent wastewater system present on the Project parcel.

3.15.1 POTENTIAL IMPACTS AND MITIGATION

3.15.1.1 Electrical Service

The power requirements for construction of the Proposed Action will be provided by diesel generators. No new service connection will be required, no modifications to HELCO's

existing system are needed, and the Project will have no impact on HELCO's capacity to serve other customers on Hawai'i Island.

The No Action Alternative does not require electrical power of any kind.

3.15.1.2 Telecommunications

Neither the Proposed or No Action Alternative will require any telemetering equipment, Supervisory Control and Data Acquisition (SCADA) system, or other remote monitoring/control of any kind. No significant impact to telecommunications facilities or functions are anticipated as a result of either alternative evaluated in this report.

3.15.1.3 Water Supply

The Proposed Action is an exploratory well, intended to provide information that DWS can use to plan for the future stability and capacity of the North Kona Water System. It will not directly contribute to, or require withdrawals from, that system nor will it be interconnected to that system as part of the Proposed Action.

The No Action Alternative does not have the potential to affect the area water supply in any way.

3.15.1.4 Sanitary Wastewater

During construction activities, a portable sanitary toilet will be located on the site and serviced per provider recommendations. Once construction is complete, the Proposed Action will not produce sanitary wastewater, nor does it have the potential to adversely affect any sanitary wastewater systems in the area.

The No Action Alternative does not have the potential to produce sanitary wastewater to affect any sanitary wastewater systems in the area.

3.16 SOLID WASTE

3.16.1 AFFECTED ENVIRONMENT

The County of Hawai'i provides solid waste collection service in some urban areas. Where collection service is not provided, property owners or occupants hire private companies to haul their waste or self-haul their waste to the County's Pu'uanahulu Landfill in North Kona or to the County's transfer stations in Kailua, Keauhou, Ke'ei, Wailea, and Miloli'i. Most self-hauled wastes are taken to the transfer stations that are provided for use primarily from single-family residences. Other solid wastes, such as agricultural wastes, do not enter the county waste stream and are usually recycled at the source.

3.16.2 POTENTIAL IMPACTS AND MITIGATION

Solid waste generated for the Proposed Action, including construction debris, is expected to be minimal and have no noticeable effect on County solid waste disposal facilities. Construction contractors, notably, often re-use construction material for subsequent projects.

This economic use of supplies helps minimize solid waste disposal at the public landfills. Thus, no significant impact on solid waste facilities will be caused by the Proposed Action.

The No Action Alternative does not have the potential to generate solid waste or to affect any solid waste disposal facilities.

3.17 PUBLIC FACILITIES AND SERVICES

3.17.1 AFFECTED ENVIRONMENT

3.17.1.1 Police Services

The Proposed Action is located within the Hawai‘i County Police Department’s Kona District which is headquartered in Kealakehe. Substations are located in Captain Cook, Kailua-Kona, and Keauhou.

3.17.1.2 Fire and Emergency

A 24-hour fire station with fire, emergency medical service (EMS), and rescue capabilities is located in Kailua-Kona. In addition, fire stations with regular full-time fire and EMS services are located in Keauhou, Captain Cook, and at the Makalei Fire station. On-call volunteer services operate out of Kalaoa Mauka, Miloli‘i Village, and Kona Paradise Subdivision.

3.17.1.3 Medical Services

Kona Community Hospital, which serves West Hawai‘i, is a full-service hospital located in Kealakekua. Hospital services include acute inpatient medical/surgical, obstetrics, skilled nursing, intensive care, and outpatient surgery. Outpatient and ancillary services include a 24-hour emergency room, laboratory, radiology, pharmacy, occupational, physical, respiratory and speech therapy, and dietary services.

3.17.1.4 Public Education

The State of Hawai‘i’s public school system in Kona is comprised of the Konawaena and Kealakehe complexes. The Konawaena complex includes Konawaena High School, Konawaena Middle School, Konawaena Elementary School, Ho‘okena Elementary School, Honaunau Elementary School, Kahakai Elementary School, and Ke Kula O Ehunuikaimalino. The Kealakehe complex includes Kealakehe High School, Kealakehe Intermediate School, Kealakehe Elementary School, Hōlualoa Elementary School, and Waikoloa Elementary and Middle School.

3.17.2 POTENTIAL IMPACTS AND MITIGATION

The Proposed Action will be accessed by a driveway with a locked gate. The very low-profile well and pad will be entirely constructed out of non-flammable materials. No additional personnel will be hired by DWS to service the facility who could impact local police, fire, medical, or educational facilities. Thus, due to the purpose and function of the Proposed Action, adverse impacts to these public facilities and services are not anticipated.

The No Action Alternative does not have the potential to affect any public facilities or services.

3.18 CUMULATIVE IMPACTS

Construction and operation of the Proposed Action does not constitute a commitment to a larger action and are not intended to facilitate substantial population growth. Instead, the Project is intended to primarily confirm the availability of a viable source of potable water to serve the North Kona Water System.

3.19 MITIGATION

Table 3.7 summarizes the mitigation measures introduced in this chapter.

Table 3.7 Summary of Mitigation Measures

Section	*Topic*	*Committed Mitigation Measures*
§3.1	Land Use	n/a
§3.2	Geology, Topography, & Soils	Maintain existing patterns of, and avoid increases in, storm water runoff.
§3.3	Hydrology & Water Resources	Implement BMPs to as appropriate to minimize the potential for sediment entrainment or contamination of these discharges and storm water runoff.
§3.4	Potential Contamination	n/a
§3.5	Biological Resources	If any woody vegetation taller than fifteen feet is to be trimmed during the proposed work, performing the work outside the bat breeding season would help to avoid killing or injuring young bats
§3.6	Air Quality	n/a
§3.7	Noise	Adhere to HAR §11-46, including: (*i*) obtaining a Construction Noise Permit; and (*ii*) a Construction Noise Variance for the pump test procedure.
§3.8	Natural Hazards	Site plan provides adequate clearance around the proposed well and pad to keep them safe, should a wildfire pass through the area.
§3.9	Climate Change and Sea Level Ride	n/a
§3.10	Scenic Resources	n/a
§3.11	Archaeological Resources	DWS will have an archaeological monitor be present during any ground-disturbing activities.
§3.12	Cultural Impact Assessment	DWS will have an archaeological monitor be present during any ground-disturbing activities. If undocumented cultural properties are encountered, DWS will, at minimum: (*i*) immediately cease all wok in the area; and (*ii*) notify SHPD to assess impacts. As appropriate, further mitigation measures will be coordinated with SHPD.
§3.13	Socio-Economic Environment	n/a
§3.14	Traffic	n/a
§3.15	Utilities & Infrastructure	n/a
§3.16	Solid Waste	n/a
§3.17	Public Facilities & Services	n/a
Source: Compiled by Planning Solutions, Inc. (2020)		

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Chapter 4: RELATIONSHIPS TO PUBLIC AND LAND USE POLICIES

4.1 COUNTY OF HAWAI'I GENERAL PLAN

4.1.1 APPLICABLE GOALS, POLICIES AND RECOMMENDED ACTIONS

The DWS operates and maintains over twenty separate water systems on the Island of Hawai'i. The *2005 Hawai'i County General Plan* contains goals and policies concerning the development and operation of essential water supply facilities. The General Plan recognizes that water supply facilities are needed to support the patterns of development which the General Plan seeks to achieve. It makes planning for the location of utility facilities such as wells, reservoirs, and pumping stations an integral part of the land planning process.

The *2005 General Plan* identifies the following County policies with regard to public water systems that are relevant to the Proposed Action:

> *(a) Water system improvements shall correlate with the County's desired land use development pattern.*
>
> *(b) All water systems shall be designed and built to Department of Water Supply standards.*
>
> *(c) Improve and replace inadequate systems.*
>
> *(d) Water sources shall be adequately protected to prevent depletion and contamination from natural and man-made occurrences or events.*
>
> *(e) Water system improvements should be first installed in areas that have established needs and characteristics, such as occupied dwellings, agricultural operations and other uses, or in areas adjacent to them if there is need for urban expansion.*
>
> *(f) A coordinated effort by County, State and private interests shall be developed to identify sources of additional water supply and be implemented to ensure the development of sufficient quantities of water for existing and future needs of high growth areas and agricultural production.*

The *2005 Hawai'i County General Plan* identifies a number of actions to implement these policies in the North Kona District. Specifically, it directs DWS to continue to pursue groundwater source investigation, exploration and development in areas that would provide for anticipated growth and that would provide for an efficient and economic system operation. It also requires DWS to continue to evaluate growth conditions to coordinate improvements as required to the existing water system in accordance with the North Kona Water System Master Plan.

4.1.2 CONFORMITY WITH THE 2005 HAWAI'I COUNTY GENERAL PLAN

The Proposed Action is being constructed by DWS in response to the General Plan's policy for North Kona, that encourages groundwater source investigation for this region of the Island. The Proposed Action meets all applicable design standards and is compatible with existing uses in the surrounding area and allowable under existing state and county zoning and development regulations. Testing of the exploratory well will not produce substantial air or noise emissions that would disturb uses on adjacent properties. Thus, the Project is compatible with the *Hawai'i County Water Use and Development Plan Update* (2017) and the *County General Plan*.

4.2 COUNTY OF HAWAI'I ZONING ORDINANCE

The County zoning for the exploratory well site is Ag-5a Agriculture. Installation of the proposed well and pad are permitted uses in the state- and county-designated agricultural parcels (County Zoning Regulations, §25-4-11-9b) affected by the project. Thus, the Proposed Action is compatible with the County of Hawai'i Zoning ordinance.

4.3 KONA COMMUNITY DEVELOPMENT PLAN

The *Kona Community Development Plan*, adopted by the County in September 2008, translates the broad statements of the County's *General Plan* to specific actions as they apply to geographical areas of the region. Its vision for the future is:

> *A more sustainable Kona characterized by a deep respect for the culture and the environment and residents that responsively and responsibly accommodate change through an active and collaborative community.*

The Plan's goal for public facilities, infrastructure, and services is a community where the public infrastructure and facilities are sustainably built and maintained with innovation and pride, promote a sense of community, and support a quality of life where visitors and residents feel safe, healthy, and inspired.

As a utility and a component of required infrastructure, the Proposed Action is intended to support the planned development of Kona as provided for in the County's *General Plan Land Use Pattern Application Guide* and Kona's CDP *Official Kona Land Use Map*.

4.4 SPECIAL MANAGEMENT AREA

Under HRS Chapter 205A (Coastal Zone Management), the County is authorized to regulate land uses within the Special Management Area (SMA) of the island of Hawai'i. The SMA encompasses a defined area along the coast of the Big Island.

The Proposed Action is located outside of the SMA, and therefore, not subject to the SMA Rules and Regulations of the County of Hawai'i.

4.5 HAWAI'I STATE PLAN

The *Hawai'i State Planning Act* ("the Planning Act") has served as a guide for the long-range development of the state since its adoption into law in 1978 as HRS, Chapter 226. The Planning Act identifies goals, objectives, and policies for the state to: (*i*) provide a basis for determining priorities and allocating limited resources, such as public funds, services, human resources, land, energy, water, and other resources; (*ii*) improve coordination of federal, state, and county plans, policies, programs, projects, and regulatory activities; and (*iii*) establish a system for plan formulation and program coordination to provide for an integration of all major state and county activities. Of the 107 sections that comprise HRS Chapter 226, three are directly applicable to the Proposed Action, discussed below. For each section, the applicable objectives and policies are listed in italics, followed by a discussion of the Project compliance with them.

4.5.1 HRS §226-13 - OBJECTIVES AND POLICIES FOR THE PHYSICAL ENVIRONMENT – LAND, AIR, AND WATER QUALITY

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

> *(1) Maintenance and pursuit of improved quality in Hawai'i's land, air, and water resources.*
>
> *(2) Greater public awareness and appreciation of Hawai'i's environmental resources.*

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

> *(2) Promote the proper management of Hawai'i's land and water resources.*
>
> *(3) Promote effective measures to achieve desired quality in Hawai'i's surface, ground, and coastal waters.*
>
> *(6) Encourage design and construction practices that enhance the physical qualities of Hawai'i's communities.*
>
> *(7) Encourage urban developments in close proximity to existing services and facilities.*
>
> *(8) Foster recognition of the importance and value of the land, air, and water resources to Hawai'i's people, their cultures and visitors.*

The Proposed Action is intended to identify a potential new source of potable water that could contribute to DWS' North Kona Water System. While this Project will not increase the County's capacity to serve customers in the North Kona region, it will support thoughtful planning and management of the Island's water resources. No long-term detrimental impacts to the County's existing water supply system, or its land and water resources, are anticipated.

4.5.2 HRS §226-14 - OBJECTIVE AND POLICIES FOR FACILITY SYSTEMS – IN GENERAL

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

(b) To achieve the general facility systems objective, it shall be the policy of this State to:

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

The Proposed Action fully supports the objectives and policies for "facility systems" as set forth on HRS §26-14. It is also consistent with the County *General Plan*, *Kona Community Development Plan*, and the *Hawai'i County Water Use and Development Plan Update*. The Project will: (*i*) assist DWS in planning to accommodate the needs of the people of North Kona; (*ii*) encourage the development of facility systems in a prudent and thoughtful way; and (*iii*) ensure that appropriate facilities and capacity are planned well in advance of the community's explicit need. The proposed Project will be in a mid-level zone of the Keauhou Aquifer at approximately 760′ +MSL elevation where most other exploration has occurred at lower levels of 25′ to 460′ +MSL, potentially offering new opportunities to expand the capacity of DWS' North Kona Water System.

4.5.3 HRS §226-16 - OBJECTIVES AND POLICIES FOR FACILITY SYSTEMS – WATER

(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

> *(1) Coordinate development of land use activities with existing and potential water supply.*
>
> *(2) Support research and development of alternative methods to meet future water requirements well in advance of anticipated needs.*
>
> *(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.*
>
> *(5) Support water supply services to areas experiencing critical water problems.*

The County is pursuing the Proposed Action in order to investigate a potential future source of potable water, if needed, in advance of anticipated growth in the North Kona region.

4.6 STATE LAND USE LAW

The State Land Use District Maps, administered by the State Land Use Commission, designate the Proposed Action in the Agricultural District. The Agricultural District includes lands for the cultivation of crops, aquaculture, raising livestock, wind energy facility, timber cultivation, agriculture-support activities (i.e., mills, employee quarters, etc.) and land with significant potential for agriculture uses.

Uses permitted in the highest productivity agricultural categories are governed by statute. Uses in the lower-productivity categories – C, D, E or U – are established by the State Land Use Commission and include those allowed on A or B lands as well as those stated under HRS Section 205-4.5. The Project site is classified as D category. As a water system that will serve a public purpose, the proposed facilities are permitted uses in the Agricultural District (HRS §205-4.5(a)(7)).

4.7 STATE ENVIRONMENTAL POLICY

HRS 344-3(1) states that it shall be the policy of the State, through its programs, authorities, and resources to:

> *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawai'i.*

The Proposed Action supports this policy by investigating a potential source of potable water for the North Kona region. Other than the pump testing process, it will not make any sustained withdrawals from the Keauhou Aquifer and will not cause any damage to the environment or biosphere. It is intended to enrich DWS' understanding of water resources in the North Kona region and allowing it to plan for and accommodate anticipated growth in that area.

4.8 CROSS-CUTTING FEDERAL AUTHORITIES

The following sub-sections address the Proposed Action's relationship to other federal "cross-cutting" environmental, economic, social, and miscellaneous federal authorities as required by the State of Hawai'i's Drinking Water State Revolving Fund (DWSRF) program.

4.8.1 ENVIRONMENTAL POLICY AUTHORITIES

4.8.1.1 Archeological and Historic Preservation Act (16 U.S.C. § 469a-1) and National Historic Preservation Act (16 U.S.C. § 470)

As discussed in Section 3.11, the Project site is located in an area that has been used continuously for cattle grazing since 1875, and all archaeological or historical features have been surveyed and

evaluated. The AIS prepared for this Project (see Appendix C) has been submitted to SHPD for review and approval, and a copy of this EA will be provided to SHPD with a request for review and concurrence with DWS that the proposed Project will have no effect on historic properties. In addition, the CIA prepared for this Project (see Appendix D) has detected no evidence that the site is used for cultural purposes. Consequently, it is anticipated the EPA would issue a "no historic properties affected" determination.

4.8.1.2 Clean Air Act (42 U.S.C. § 7401)

As discussed in Section 3.6, air quality at the site of the Proposed Action is good. The site is in air quality attainment areas as defined by the State of Hawai'i's DOH in its EPA-approved Air Quality program. Only minor amounts of earthwork will be required for the Project. This, along with the relatively wet climate, means that fugitive dust will not be a significant problem during construction.

It is anticipated that diesel-powered construction equipment will be used to construct the proposed exploratory well and pad. Emissions from the diesel will slightly degrade air quality for the short period of time they are in operation. However, all applicable emission and ambient air quality standards will continue to be met. Normal operation of the proposed facilities will not produce on-site air emissions, will not alter airflow in the vicinity, and will have no other measurable effect on the area's micro-climate. Consequently, the Proposed Action complies with the provision of the Clean Air Act.

4.8.1.3 Coastal Zone Management Act (16 U.S.C. § 1451)

Enacted as Chapter 205A, HRS, the Hawaii Coastal Zone Management (CZM) Program was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. The CZM area encompasses the entire State, including all marine waters seaward to the extent of the State's police power and management authority, including the 12-mile U.S. territorial sea and all archipelagic waters.

The Hawai'i Coastal Zone Management Program focuses on ten policy objectives:

> *Recreational Resources. To provide coastal recreational opportunities accessible to the public and protect coastal resources uniquely suited for recreational activities that cannot be provided elsewhere.*
>
> *Historic Resources. To protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*
>
> *Scenic and Open Space Resources. To protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.*
>
> *Coastal Ecosystems. To protect valuable coastal ecosystems, including reefs, from disruption and to minimize adverse impacts on all coastal ecosystems.*
>
> *Economic Uses. To provide public or private facilities and improvements important to the state's economy in suitable locations; and ensure that coastal dependent development such as harbors and ports, energy facilities, and visitor facilities, are located, designed, and constructed to minimize adverse impacts in the coastal zone area.*
>
> *Coastal Hazards. To reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

> *Managing Development. To improve the development review process, communication, and public participation in the management of coastal resources and hazards.*
>
> *Public Participation. To stimulate public awareness, education, and participation in coastal management; and maintain a public advisory body to identify coastal management problems and provide policy advice and assistance to the CZM program.*
>
> *Beach Protection. To protect beaches for public use and recreation; locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion.*
>
> *Marine Resources. To implement the state's ocean resources management plan.*

Other key areas of the CZM program include: a permit system to control development within a Special Management Area (SMA) managed by the Counties and the Office of Planning; a Shoreline Setback Area which serves as a buffer against coastal hazards and erosion, and protects view-planes; and the Marine and Coastal Affairs. Finally, a Federal Consistency provision requires that federal activities, permits and financial assistance be consistent with the Hawai‘i CZM program.

The Proposed Action is located approximately one mile inland from the coastline. It does not involve the placement, erection, or removal of materials near the coastline. The type and scale of the activities that it involves typically do not have the potential to affect coastal resources. Finally, it is consistent with the CZM objectives that are relevant to a project similar in scope.

4.8.1.4 Endangered Species Act (16 U.S.C. 1531)

The Endangered Species Act (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended, provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the U.S. or elsewhere. The Act mandates that federal agencies seek to conserve endangered and threatened species and use their authorities in furtherance of the Act’s purposes. Provisions are made for listing species, as well as for recovery plans and the designation of critical habitat for listed species. The Act outlines procedures for federal agencies to follow when taking actions that may jeopardize listed species and contains exceptions and exemptions.

Section 3.5 of this EA describes existing biota on and around the Project site. The discussion documents the fact that there are no known rare or endangered species on or immediately around the site of the Proposed Action but that Hawaiian Hawks have been observed in the area. Hawaiian hoary bats may also be present in the area. Similarly, the site does not contain unique or valuable wildlife habitat. Consequently, a no listed species adversely affected determination is anticipated by the EPA. Copies of the EA have been provided to the U.S. Fish and Wildlife Service and to the State Department of Land and Natural Resources for review and comment, and any response from those agencies will be included in the Final EA.

4.8.1.5 Environmental Justice (Executive Order 12898)

The Environmental Justice Executive Order was issued in 1994 for the purpose of protecting low-income and minority residents of the United States from disproportionate exposure to environmental and health hazards. Section 1-101 of the Executive Order States:

> *To the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, each Federal agency shall make*

> *achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands.*

As discussed in Section 3.13, the Hōlualoa Census Tract 216.01 exhibits a median household income that is higher than the countywide average, and an unemployment rate that is slightly lower. The Project area is not considered a low-income area. The purpose of the Proposed Action is to determine a viable source of potable water that conforms to state and federal standards. The Project will not have adverse secondary environmental, economic, or social impacts, as discussed in detail in Chapter 3. Moreover, the state and federal regulations regarding safe drinking water are applicable to all water systems in Hawai‘i, irrespective of the economic or demographic characteristics of their residents. Thus, the proposed Project complies with this Executive Order.

4.8.1.6 Farmland Protection Policy Act (7 U.S.C. § 4201)

The U.S. Congress adopted the Farmland Protection Policy Act (FPPA) (Public Law 97-98) on December 22, 1981). The U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) has national leadership for administering the FPPA. The effective date of the FPPA rule (part 658 of Title 7 of the Code of Federal Regulations) is August 6, 1984.

The stated purposes of the FPPA are to:

- Minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.
- Assure that Federal programs are administered in a manner that, to the extent practicable, will be compatible with State, unit of local government, and private programs and policies to protect farmland.

“Farmland”, as used in the FPPA, includes prime farmland, unique farmland, and land of statewide or local importance. “Farmland” subject to FPPA requirements does not have to be currently used for cropland. The Proposed Action is not located on prime or unique farmland or other land of agricultural important to the State or County. As such, it is not subject to the FPPA. Furthermore, the area that would be affected is a small fraction of the agricultural land in the area. While implementation of the Project will require removal of some minor vegetation to accommodate construction of the exploratory well and pad, this will not impact continued agricultural use of the remaining portion of the parcel. The Project is intended to identify a potential future source of potable water to supply the North Kona community and is fully consistent with the FPPA.

4.8.1.7 Floodplain Management (Executive Order 11988 (1977), as Amended by Executive Order 12148 (1979))

Based on the latest available (December, 2001) Flood Insurance Rate Map for the area, the Project site lies outside a defined floodplain. The Proposed Action does not involve property acquisition, management, or construction within a 100-year flood plain (Zones A or V), and it does not involve a “critical action” within a 500-year flood plain. Consequently, it is consistent with applicable regulations and guidance relating to floodplain management.

4.8.1.8 Protection of Wetlands (Executive Order 11990 (1977), as Amended by Executive Order 12608 (1997))

There are no wetlands on or near the Project site. Neither are there food resources on the site that are important to wildlife that use wetlands elsewhere on the island. A copy of this EA will be provided to

the Pacific Island Eco-Region, U.S. Fish & Wildlife Service, and to the State Department of Land and Natural Resources to ensure adequate consideration of this topic in the environmental review for the Proposed Action.

4.8.1.9 Safe Drinking Water Act (42 U.S.C. § 300(f))

The Safe Drinking Water Act (SDWA) is the principal federal law that ensures the quality of Americans' drinking water. Under SDWA, the EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The Safe Drinking Water Act requires that all public water systems meet stringent water quality standards. These standards cover a long list of potential chemical, radiological and biological contaminants. The standards distinguish between surface water and groundwater sources, with the testing and monitoring requirements for surface water and groundwater under the direct influence (GWUDI) of surface water sources being far greater than those for groundwater sources.

Extensive testing of the water withdrawn from the well will be carried out by the DWS to determine if it is suitable for development as a potable water source.

The Safe Drinking Water Act also provides the impetus behind the development of regulatory protection of principal or sole source aquifers. Part C of this Law pertains specifically to the protection of underground sources of drinking water, including the establishment of regulations on the injection of materials into subsurface aquifers in those areas of the United States where only one aquifer (principal or sole source aquifer) exists. Section 1424(e) of PL 93-523 states:

> *(e) If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of the determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another Provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.*

As identified by the U.S. Environmental Protection Agency, Region IX Groundwater Office (http://www.epa.gov/OGWDW/swp/ssa/reg9.html), there are only two Sole Source Aquifers in Hawai'i. They are the Southern O'ahu Basal Aquifer on the Island of O'ahu and the Moloka'i Aquifer on the island of Moloka'i. There are no Sole Source Aquifers on the Island of Hawai'i where the Proposed Action is located.

4.8.1.10 Essential Fish Habitat Consultation Process Under the Magnuson-Stevens Fishery Conservation and Management Act (16 USC §1801)

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), which was reauthorized and amended by the Sustainable Fisheries Act (1996), requires the eight regional fishery management councils to describe and identify essential fish habitat (EFH) in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH. Congress defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The EFH guidelines under 50 CFR 600.10 further interpret the EFH definition as follows:

> *Waters include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; substrate includes sediment, hard bottom, structures underlying the waters, and*

> *associated biological communities; necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.*

The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Act support one of the Nation's overall marine resource management goals - maintaining sustainable fisheries. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding the potential effects of their actions on EFH. The Western Pacific Regional Fishery Management Council Website lists EFH areas in Hawai'i and the Pacific Islands (http://www.wpcouncil.org/maps.htm). All of the identified areas are offshore marine environments. The Proposed Action is located approximately one mile from the ocean and has no potential to impact any of the identified EFH areas.

4.8.2 ECONOMIC POLICY AUTHORITIES

4.8.2.1 Administration of the Clean Air Act and the Water Pollution Control Act with Respect to Federal Contracts or Loans (Executive Order 11738)

Requirement. This Executive Order prohibits the provision of Federal assistance to facilities that do not comply with either the Clean Water Act or the Clean Air Act unless the purpose of the assistance is to remedy the cause of the violation.

Compliance. As discussed in Sections 3.3 and 3.6, the Proposed Action will comply with applicable provisions of the Clean Air Act and Clean Water Act. Consequently, it is consistent with the intent of this Executive Order.

4.8.2.2 Demonstration Cities and Metropolitan Development Act of 1966, Public Law 89-754, as Amended (42 USC § 3331)

Requirement. In 1966, Congress enacted the Demonstration Cities and Metropolitan Development Act to ensure that federal grants were not working at cross-purposes. Section 204 of that act was significant in asserting federal interest in improving the coordination of public facility construction projects to obtain maximum effectiveness of federal spending and to relate such projects to area wide development plans. Section 204 requires that all applications for the planning and construction of facilities be submitted to an area wide planning agency composed of local elected officials for review and comment. To demonstrate compliance with this Act, the Hawai'i State Department of Health requires DWSRF assistance recipients to describe the proposed project's effect on local development plans.

Compliance. Section 4.1 of this report addresses this requirement by demonstrating the Proposed Action's consistency with the County of Hawai'i General Plan.

4.8.2.3 Procurement Prohibitions (Executive Order 11738, Section 306 of the Clean Air Act)

Requirement. This Executive Order requires recipients of Federal assistance to certify that they will not procure goods, services or materials from suppliers who are on the EPA's list of Clean Air Act violators.

Compliance. DWS will comply with this requirement in selecting contractors, construction materials, and other services for the Proposed Action.

4.8.2.4 Procurement Prohibitions (Section 508 of the Clean Water Act)

Requirement. This Executive Order requires recipients of Federal assistance to certify that they will not procure goods, services or materials from suppliers who are on the EPA's list of Clean Water Act violators.

Compliance. DWS will comply with this requirement in selecting contractors, construction materials, and other services for the Proposed Action.

4.8.2.5 Civil Rights Act of 1964, Title VI (42 USC §2000(d))

Requirement. This Act stipulates that no person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

Compliance. DWS will comply with this requirement in hiring contractors and other staff for the Proposed Action.

4.8.2.6 Equal Employment Opportunity (Executive Order 11246, as amended)

Requirement. This Executive Order requires all recipients of Federal contracts to include certain non-discrimination and "affirmative action" provisions in all contracts. The provisions commit the contractor or subcontractor to maintain a policy of non-discrimination in the treatment of employees, to make this policy known to employees, and to recruit, hire and train employees without regard to race, color, sex, religion and national origin.

Compliance. DWS will include these provisions in all contracts for the Proposed Action.

4.8.2.7 Minority Business Enterprise Development (Executive Order 12432)

Requirement. This Executive Order sets forth in more detail the responsibilities of Federal agencies for the monitoring, maintaining of data and reporting of the use of minority enterprises.

Compliance. DWS will comply with all applicable requirements pertaining to this Executive Order for the Proposed Action.

4.8.2.8 National Program for Minority Business Enterprise (Executive Order 11625)

Requirement. This Executive Order directs Federal agencies to promote and encourage the use of minority business enterprises in projects utilizing federal funds.

Compliance. DWS will comply with this Executive Order in selecting contractors, goods, and services for the Proposed Action.

4.8.2.9 National Women's Business Enterprise Policy and National Program for Women's Business Enterprise (Executive Order 12138)

Requirement. This Executive Order directs each department or agency empowered to extend Federal financial assistance to any program or activity to issue regulations requiring the recipient of such assistance to take appropriate affirmative action in support of women's business enterprises and to prohibit actions or policies which discriminate against women's business enterprises on the grounds of sex.

Compliance. DWS will comply with this Executive Order in selecting contractors, goods, and services for the Proposed Action.

4.8.2.10 Rehabilitation Act of 1973 (29 USC § 794)

Requirement. This Act stipulates that no qualified handicapped individual in the United States shall, solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.

Compliance. DWS will comply with this requirement for the Proposed Action.

4.8.2.11 Small Business Administration Reauthorization and Amendment Act of 1998 (Pub. L. 100-590, Section 129)

Requirement. This Amendment directs Federal agencies to promote and encourage the use of small business enterprises in projects utilizing federal funds.

Compliance. DWS will comply with this Act in selecting contractors, goods, and services for the Proposed Action.

4.8.2.12 Department of Veterans Affairs and Housing and Urban Development, and Agencies Appropriations Act (1993, Pub. L. 102-389)

Requirement. This Act requires the Administrator of the Environmental Protection Agency to ensure that at least 8 per centum of Federal funding for prime and subcontracts awarded in support of authorized programs, including grants, loans and contracts for wastewater treatment and for leaking underground storage tanks, be made available to businesses or other organizations owned or controlled by socially and economically disadvantaged individuals (within the meaning of Section 8(a)(5) and (6) of the Small Business Act (15 USC 637(a)(5) and (6)), including historically black colleges and universities.

Compliance. DWS will comply with applicable provisions of this Act in selecting contractors, goods, and services for the Proposed Action.

4.8.2.13 Disadvantaged Business Enterprise Rule (2008, 40 CFR Part 33)

Requirement. This Rule sets forth the responsibilities of entities receiving an identified loan under a financial assistance agreement capitalizing a revolving loan fund, for the monitoring, maintaining of data and reporting of the use of disadvantaged business enterprises (DBEs). It requires the Applicant to fully comply with 40 CFR Part 33, entitled "Participation by Disadvantaged Business Enterprises in Procurement Under Environmental Protection Agency (EPA) Financial Assistance Agreements" and ensure that all contracts funded by a DWSRF loan include a term or condition requiring compliance with 40 CFR Part 33. The Rule further stipulates that the applicant shall not discriminate on the basis of race, color, national origin, or sex in the performance of its contract and that the applicant carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements.

Compliance. DWS will comply with all applicable provisions of this rule for the Proposed Action, including timely completion and submission of the DBE Subcontractor Performance and Utilization Forms (respectively, EPA Forms 6100-3 and 6100-4), as appropriate.

4.8.3 MISCELLANEOUS AUTHORITIES

4.8.3.1 Debarment and Suspension (Executive Order 12549)

Requirement. Prior to the award of a consultant or construction contract, the Applicant (County) shall fully comply with Subpart C of 40 CFR Part 32, entitled "Responsibilities of Participants Regarding Transactions" and ensure that any lower tier covered transaction and subsequent lower tier transaction, includes a term or condition requiring compliance with Subpart C. The Applicant shall certify that the

General Contractor, Consultant, sub-consultants, subcontractors, and suppliers are not on the Excluded Parties List. The Applicant acknowledges that failing to disclose the information required under 40 CFR 32.335 may result in the delay or negation of payment, or pursuance of legal remedies, including suspension and debarment. The Applicant may access the Excluded Parties List System at http://epls.arnet.gov.

Compliance. DWS will include a condition in all contracts funded for the Proposed Action that would terminate the contract should the contractor be determined to be an Excluded Party under this Executive Order.

4.8.3.2 Uniform Relocation and Real Property Acquisition Policies Act (Pub. L. 91-646 (1971), as Amended, 42 USC 4601-4655)

Requirement. The Act establishes a policy for fair and equitable treatment of persons who are displaced from their homes, farms, or businesses to make way for a federally assisted project.

Compliance. No such displacements are anticipated for the Proposed Action. However, should any such displacements occur as a result of the Project, DWS will ensure that the affected parties would receive fair and equitable treatment consistent with this law.

4.8.3.3 Preservation of Open Competition and Government Neutrality towards Contractor's Labor Relations on Federal and Federally Funded Construction Projects (Executive Order 13202 (2001), as amended by Executive Order 13208 (2001))

Requirement. DWSRF assistance recipients must ensure that bid specifications, project agreements, and other controlling documents for construction contracts awarded after February 17, 2001 do not require or prohibit agreements with labor organizations. Further, DWSRF assistance recipients and any construction manager acting upon their behalf must not otherwise discriminate against bidders, offerors, contractors, or subcontractors for entering into, or refusing to enter into, agreements with labor organizations.

Compliance. DWS will comply with applicable provisions of this Act in selecting contractors, goods, and services for the Proposed Action and will include this provision in the specifications of all contracts funded for this Project.

4.9 OTHER PERMITS AND APPROVALS

In addition to the HRS, Chapter 343 environmental review that this EA is intended to satisfy, other permits and approvals required for implementation of the Proposed Action include: (*i*) HRS, Chapter 6E review; (*ii*) a Well Construction and Pump Installation Permit; (*iii*) a Community Noise Permit and/or Noise Variance; and (*iv*) a Grubbing, Grading, and Stockpiling Permit. In addition, if the Project is to be eligible for use of DWSRF funding, it will need to complete a Section 106, National Historic Preservation Act (NHPA) review in coordination with the Department of Health, Safe Drinking Water Act. Finally, if a dry well is to be constructed at the exploratory well site, an UIC Permit will also be required.

4.10 SUMMARY OF REQUIRED PERMITS AND APPROVALS

The following is a summary of the required permits and approvals for the construction of the proposed exploratory well and pad.

Table 4.1 Summary of Required Permits and Approvals

Permits/Approvals	*Approving Agency*
State of Hawai‘i	
HRS, Chapter 343 Review	Department of Water Supply
HRS, Chapter 6E Review	DLNR, State Historic Preservation Division
NHPA, Section 106 Review	DOH, Safe Drinking Water Branch
Well Construction & Pump Installation Permits	Commission on Water Resource Management
Underground Injection Control Permit	DOH, Safe Drinking Water Branch
Community Noise Permit	Indoor and Radiological Health Branch
County of Hawai‘i	
Grubbing, Grading Permit, Stockpiling Permit	County of Hawai‘i Department of Public Works
Source: Compiled by Planning Solutions, Inc. (2020)	

Chapter 5: DETERMINATION

This EA demonstrates that the Proposed Action will have no significant adverse impacts on the environment and that an Environmental Impact Statement is not warranted. Thus, DWS anticipates issuing a Finding of No Significant Impact (FONSI) for this Project. The following conclusions, and the reasoning which they are based on, demonstrate the Proposed Action will have no significant adverse impacts on the environment based on the thirteen significance criteria provided in HAR §11-200.1-13.

5.1 IRREVOCABLE COMMITMENT TO LOSS OR DESTRUCTION OF ANY NATURAL OR CULTURAL RESOURCE

Alternative plans were considered in determining the best concept for the proposed Project and associated facilities, including incorporating specific design modifications, to avoid or minimize impacts to both natural and manmade resources. The Proposed Action would not result in significant loss or destruction of the area's natural and cultural resources.

5.2 CURTAILS THE RANGE OF BENEFICIAL USES OF THE ENVIRONMENT

The Proposed Action will not curtail other uses on the project parcel (e.g., cattle grazing) nor will it interfere with the residential and agricultural uses of adjacent land.

5.3 CONFLICTS WITH THE STATE'S LONG-TERM ENVIRONMENTAL POLICIES OR GOALS AND GUIDELINES AS EXPRESSED IN CHAPTER 344, HRS, AND ANY REVISIONS THEREOF AND AMENDMENTS THERETO, COURT DECISIONS, OR EXECUTIVE ORDERS.

As demonstrated in Section 4.7, the Proposed Action is consistent with the state's long-term environmental policies and guidelines as expressed in HRS, Chapter 344.

5.4 SUBSTANTIALLY AFFECTS THE ECONOMIC OR SOCIAL WELFARE OF THE COMMUNITY OR STATE

The Proposed Action is very modest in scope and will not, as discussed in Section 3.13, substantially affect the economic or social welfare of the North Kona community or the State of Hawai'i. The proposed exploratory well is intended to help DWS plan for anticipated growth in North Kona by identifying a potential future source of potable water. The construction activity associated with the Proposed Action will utilize members of the existing labor force and make a minor contribution to the local economy, but no substantive effects—positive or negative—to the social or economic welfare of the community are anticipated.

5.5 SUBSTANTIALLY AFFECTS PUBLIC HEALTH

The Proposed Action would not result in the uncontrolled and/or unsupervised use of hazardous material or construction methodology that would detrimentally affect the area's public health and safety. Existing State DOH regulations are established to protect air and

water quality. Construction noise will be minimized through compliance with HAR Chapter §11-46, Community Noise Control.

5.6 SUBSTANTIAL SECONDARY IMPACTS, SUCH AS POPULATION CHANGES OR EFFECTS ON PUBLIC FACILITIES

The Proposed Action will not make sustained withdrawals from the Keauhou Aquifer, neither will it make any contributions to the North Kona Water System nor be interconnected with it. It is intended as a means to investigate a potential future source of potable water. As such, the Proposed Action will not have substantial secondary impacts such as unintended population changes or effects on public facilities.

5.7 INVOLVES A SUBSTANTIAL DEGRADATION OF ENVIRONMENTAL QUALITY

The Proposed Action will not result in any significant environmental impacts, will not occupy more land than it requires, and will not restrict access to other property. The new exploratory well will be unmanned so only periodic visitation will occur once the pump testing is complete. The proposed facilities will be designed to harmonize with the land, and the area's dense vegetation will continue to provide visual screens for the surrounding properties.

5.8 IS INDIVIDUALLY LIMITED BUT CUMULATIVELY HAS CONSIDERABLE EFFECT UPON THE ENVIRONMENT OR INVOLVES A COMMITMENT FOR LARGER ACTION

The current design of the Proposed Action articulated in Section 2.1 represents the complete facility. No expansion or additions are currently being planned. However, the potential does exist for this facility to be developed into a production well facility if circumstances justify this step. Should that occur, the production facility would be subject to its own environmental review process.

5.9 SUBSTANTIALLY AFFECTS A RARE, THREATENED, OR ENDANGERED SPECIES, OR ITS HABITAT

Field surveys of the area's existing natural resources indicate that no federal- or state-listed rare, threatened, or endangered wildlife or flora species will be negatively affected by the Proposed Action.

5.10 DETRIMENTALLY AFFECTS AIR OR WATER QUALITY OR AMBIENT NOISE LEVELS

The anticipated impacts associated with the Project's construction, such as fugitive dust, noise, and erosion and sedimentation, are temporary and very minor in scope. These impacts would be minimized by the implementation of BMPs and mitigation measures in accordance with applicable laws, statutes, ordinances, as well as rules and regulations of the federal, state, and county governments. Over the long term, the Proposed Action will not generate any impacts

to air quality, water quality, or ambient noise levels. The unmanned facility will have minimal human operations and no heavy machinery will be present on the property.

5.11 AFFECTS OR IS LIKELY TO SUFFER DAMAGE BY BEING LOCATED IN AN ENVIRONMENTALLY SENSITIVE AREA SUCH AS A FLOOD PLAIN, TSUNAMI ZONE, BEACH, EROSION-PRONE AREA, GEOLOGICALLY HAZARDOUS LAND, ESTUARY, FRESH WATER, OR COASTAL WATERS

The Proposed Action is located more than a mile from the shoreline. The Project will not affect or be affected by high surf and tsunami inundation. The Project site is not in a flood plain or flood zone and, although sloped, is not prone to erosion. The site is no more subject to geologic hazards than other properties in the region and the facilities will be designed to applicable earthquake standards.

5.12 SCENIC VISTAS AND VIEW PLANES IDENTIFIED IN COUNTY OR STATE PLANS OR STUDIES

The Proposed Action will be very low-profile and located more than 4,000 feet above Queen Ka‘ahumanu Highway and out of view from traveling motorists on any of the nearby County rights-of-way. As a result, no scenic vistas or view planes, as identified by public plans, will be adversely impacted.

5.13 REQUIRES SUBSTANTIAL ENERGY CONSUMPTION

Construction activities related to the Project will require some electrical power, which will be supplied by portable diesel generator. The Proposed Action will not place any additional demand on Hawai‘i Electric Light Co.’s island-wide electrical grid.

5.14 DETERMINATION

In view of the foregoing, DWS has concluded that the North Kona Mid-Level Exploratory Well Project would not have a significant adverse impact on the environment. Consequently, it is issuing a FONSI for the Proposed Action.

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Chapter 6: REFERENCES

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Chapter 7: CONSULTATION & DISTRIBUTION

7.1 PARTIES CONSULTED IN PREPARATION OF THE DRAFT EA

During the course of preparing this EA, DWS consulted with the parties listed in Table 7.1. DWS received written responses from the parties listed in Table 7.2. The complete text of the scoping letter and all responses received are provided following Table 7.2.

Table 7.1 Parties Consulted During Preparation of the Draft EA

Agencies, Organizations, and Individuals
ʻAha Moku Advisory Committee
County of Hawaiʻi, Planning Department
County of Hawaiʻi, Department of Public Works
Department of Hawaiian Home Lands
DLNR-Commission of Water Resource Management
DOH-Safe Drinking Water Branch, Environmental Management Division
DOH-Safe Drinking Water Branch, Hilo District Health Office
Komo Brothers, LLP
National Park Service, Kaloko-Honokōhau National Historic Park
Source: Compiled by Planning Solutions, Inc. (2020)

Table 7.2 Scoping Process Respondents

Agencies, Organizations, and Individuals
Hawaiʻi County Department of Public Works
Commission on Water Resource Management
Surfrider Foundation's Kona Kai Ea Chapter
National Park Service, Kaloko-Honokōhau National Historical Park
Source: Compiled by Planning Solutions, Inc. (2020)

PLANNING SOLUTIONS

July 29, 2020

Subject: Scoping Request for North Kona Mid-Level Exploratory Well Project
TMK No. 7-5-003:001
Honuaʻula Ahupuaʻa, North Kona, Hawaiʻi

Dear Sir or Madam:

The Hawaiʻi County Department of Water Supply (DWS) is responsible for the development, operation, and maintenance of the municipal water systems throughout the Island of Hawaiʻi. DWS is proposing to construct the North Kona Mid-Level Exploratory Well Project in North Kona, Hawaiʻi. The project will consist of: (*i*) site preparation, (*ii*) drilling and casing an exploratory well, and (*iii*) pumping and water quality testing in order to evaluate the well as a potential source of potable water for the North Kona Water System.

The well is intended to capitalize on the findings of the nearby State exploratory well Nos. 3858-001 and -002. It would tap into fresh groundwater lying approximately 400 feet below sea level and beneath the overlying basal lens and saline groundwater beneath the lens. If successful, the completed well will have a finished grade at the site of approximately 760′ above mean sea level (+MSL). The exploratory well will be drilled from that elevation to a depth of approximately 480′ -MSL, for a total well length of 1,240′. The borehole will have a minimum diameter of 27″. A solid steel casing with an inner diameter of 20″ would be installed in the upper 1,160′ with the remaining 80′ consisting of a 20″ diameter perforated steel casing. The annulus will be filled with 1,160′ of grout to a depth of approximately 400 -MSL. The exploratory well will be drilled and tested using portable, diesel-powered equipment.

The proposed North Kona Mid-Level Exploratory Well Project is located near the communities of Hōlualoa and Kailua-Kona in the Honuaʻula ahupuaʻa of the North Kona District, Island of Hawaiʻi (TMK No. 7-5-003:001) (see Attachment 1). The project is located on a private parcel owned by Komo Brothers, LLP. Currently, the area is in active use by a lessee as pastureland for cattle. Access to the site is via Hienaloli Road. If the proposed well produces water of adequate quantity and quality, DWS may eventually develop the exploratory well into a production well. However, only the exploratory well is currently planned, and any subsequent phases of work would be evaluated under a separate environmental review process.

The State has designated the project site as being in the Agricultural Land Use District and the County of Hawaiʻi has designated the site as being in the Ag-5a Agriculture District. The proposed exploratory well is a permitted use in the State and County agricultural districts (see Hawaiʻi County Zoning Regulations, §25-4-11-9b). The proposed site is located outside the 3.2-foot sea level rise exposure area and outside the County's designated Tsunami Evacuation Zone or any special flood hazard area.

This undertaking will require the use of county funds. The commitment of county funds by DWS "trigger" the requirement for an Environmental Assessment (EA) pursuant to Hawaiʻi Revised Statutes, Chapter 343 and the content requirements of its implementing regulations contained in

Hawaiʻi Administrative Rules (HAR), Title 11, Chapter 200.1. In addition, DWS may seek federal funding for the project under the U.S. Environmental Protection Agency's (EPA) Drinking Water State Revolving Fund (DWSRF) program administered by the State of Hawaiʻi, Department of Health, Safe Drinking Water Branch. Because allocation of DWSRF funds would constitute a Federal action, the EA will also be prepared pursuant to the National Environmental Policy Act (NEPA). In addition to the EA, grading, building, and other permits will be required prior to construction of this well project.

In order for the forthcoming EA to better address all concerns of the agencies, organizations, and individuals which may be affected by this potential project, DWS has prepared this letter and the attached map for your review and comment. At this time, we are seeking any input you may have regarding the project's purpose, potential alternatives, or any permits or approvals that may be required. In particular, we are interested in hearing about any resources or plans in the area that could be affected by the proposed exploratory well and any specific information you feel should be discussed and evaluated in the EA.

We would appreciate your response by August 30, 2020. Please respond either by regular mail to the address at the bottom of this letter, or by email at makena@psi-hi.com. We are also available to speak by phone at (808) 550-4538.

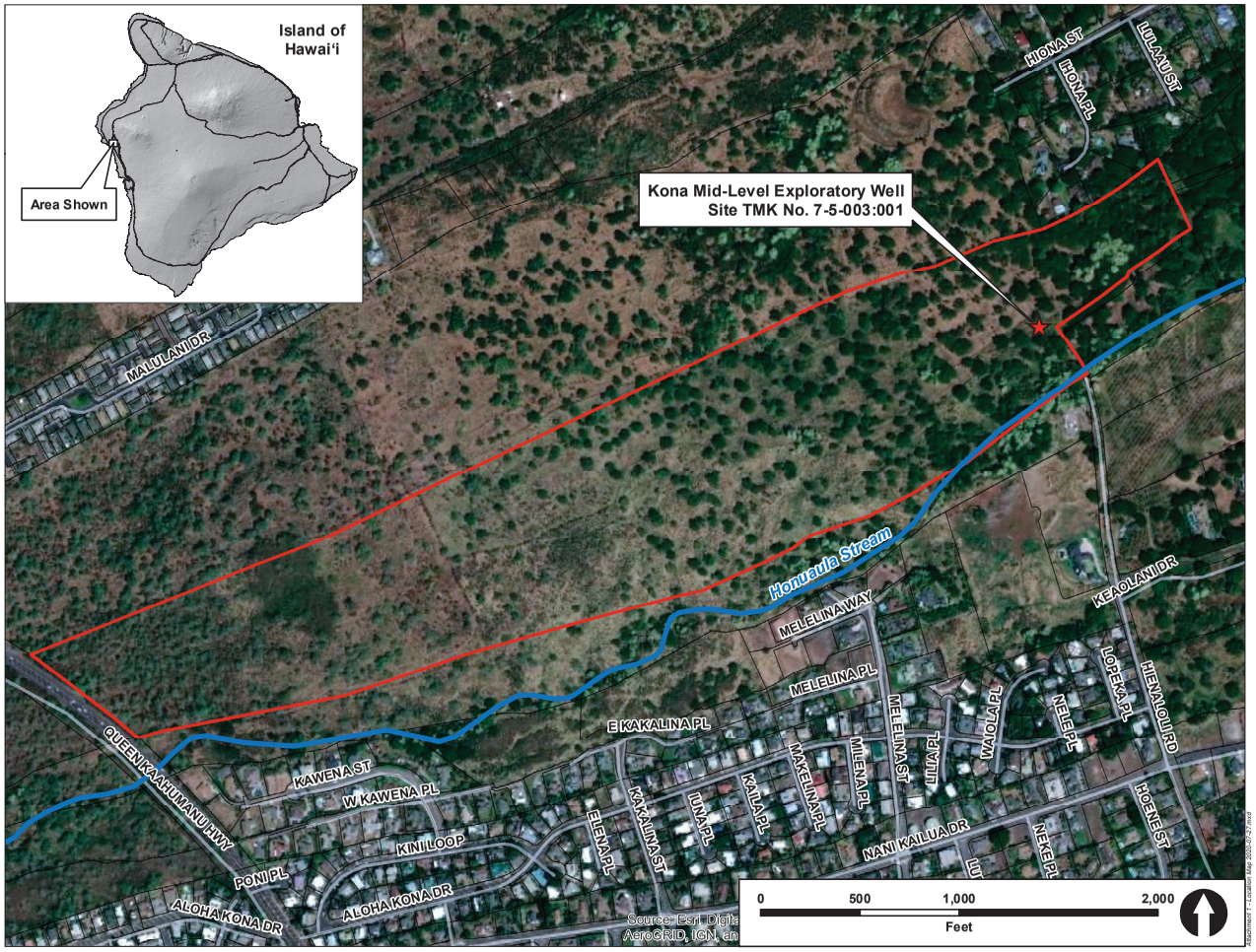
Sincerely,

Mākena White, AICP
Planner

Attachment:
Location Map

cc: Jason Killam, DWS (electronic only)
Tom Nance, TNWRE (electronic only)

Pacific Park Plaza, Suite 950 • 711 Kapiʻolani Boulevard • Honolulu, Hawaiʻi 96813-5213
Phone: 808-550-4483 • www.psi-hi.com



Attachment 1 - Location Map 2020-02-27.mxd

Harry Kim
Mayor

Roy Takemoto
Managing Director

David Yamamoto, P.E.
Director

Allan G. Simeon, P.E.
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
public_works@hawaiicounty.gov

August 17, 2020

Mākena White
Pacific Park Plaza, Suite 950
711 Kapiolani Boulevard
Honolulu, Hawai'I 96813-5213
(via email to: makena@psi-hi.com)

Subject: Environmental Assessment Early Consultation for North Kona Mid-Level Exploratory Well Project
Honua'ula Ahupua'a, North Kona, Hawai'i
TMK No. (3) 7-5-003:001

We have reviewed the request for early consultation for an Environmental Assessment and our comments are as follows:

1. Flood zone AE affects the subject parcels as designated by the Flood Insurance Rate Map (FIRM). New construction and substantial improvements shall comply with Chapter 27 – Floodplain Management – of the Hawaii County Code.
2. All development generated runoff shall be disposed of on-site and shall not be directed toward adjacent properties.
3. All earthwork and grading shall conform to Chapter 10 – Erosion and Sedimentation Control – of the Hawaii County Code.

Please provide us with a copy of the EA when it is completed for our review.

Should there be any questions concerning this matter, please feel free to contact Kyle Honda of our Kona Engineering Division office at 323-4854.

Kyle Honda
For Ben Ishii, Division Chief
Engineering Division

KH

Copy: Engineering Division - HILO/KONA, Planning Department - Hilo

County of Hawai'i is an Equal Opportunity Provider and Employer.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON

BRUCE S. ANDERSON, PH.D.
KAMANA BEAMER, PH.D.
MICHAEL G. BUCK
NEIL J. HANNAHS
WAYNE K. KATAYAMA
PAUL J. MEYER

M. KALEO MANUEL
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

August 24, 2020

REF: RFD.5428.8

TO: Makena White, AICP, Planner
Planning Solutions

FROM: M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management

SUBJECT: Scoping Request for North Kona Mid-Level Exploratory Well Project

FILE NO.: RFD.5428.8
TMK NO.: 7-5-003:001

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

[X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

[ ] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

[ ] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

[ ] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

[ ] 6. We recommend the use of alternative water sources, wherever practicable.

[ ] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

[ ] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

[X] 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

[X] 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

[ ] 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

[ ] 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

[ ] 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

[ ] 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

[ ] 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

[ ] 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

[X] OTHER: The DEA should include a discussion of the Keauhou Aquifer System Area (KASA), its sustainable yield, and how this well may contribute to proposed water demands that will draw upon the available sustainable yield. Since there is a Department of Hawaiian Home Lands reservation in the KASA, any potential use should explain how this reservation is protected. Prior to drilling this exploratory well, an approved well construction permit must be obtained. Please refer to the Commission's Water Resource Protection Plan for information on the Aquifer System Area: http://dlnr.hawaii.gov/cwrm/planning/hiwaterplan/wrpp/

If you have any questions, please contact Lenore Ohye of the Planning Branch at 587-0216 or W. Roy Hardy of the Regulation Branch at 587-0225.

From: Janice Glennie
To: Makena White
Cc: holly kersten
Subject: Scoping request for North Kona Mid-Level Exploratory Well; TMK No. 7-5-003:001
Date: Sunday, August 30, 2020 2:01:00 PM

Aloha,

I'm writing on behalf of the Surfrider Foundation's Kona Kai Ea chapter. Our group's mission is to protect and enjoy our seas and other waters.

Our members recently became aware of the request for a North Kona Exploratory Well Project at TMK 7-5-003:001. This proposal is a concern to us.

The draft WUDP, which was not adopted, asserts without any basis, that mid level wells have minimal if any impact on the basal aquifer. However, the science doesn't back proponent claims that increased pumping at this location will not impact surrounding ecosystems.

The draft unapproved plan recommended further investigation into mid-level water source. For this EA to be legally adequate, it's necessary that it clearly articulate that the well will not affect public trust resources along the coast, including those resources upon which native Hawaiian traditional and customary practices rely.

Mahalo for your consideration of our views on this subject related to the extraction and protection of Public Trust Resources.

Sincerely,
Janice Palma-Glennie
For Surfrider Foundation's Kona Kai Ea chapter

National Park Service
U.S. Department of the Interior

Kaloko-Honokōhau
National Historical Park

73-4786 Kanalani Street # 14
Kailua-Kona, Hawai'i 96740

808 329-6881 Phone
808 329-2597 Fax

Kaloko-Honokōhau

IN REPLY REFER TO:
L7621 (2020-2)

Mākena White, Planner
Planning Solutions
Pacific Park Plaza, Suite 950
711 Kapiolani Boulevard
Honolulu, Hawai'i 96813-5213

Dear Mr. White:

Thank you for the opportunity to provide input regarding the proposed North Kona Mid-Level Exploratory Well Project. The National Park Service provides input regarding resources that could be affected by the proposed exploratory well and specific information that should be discussed and evaluated in the Environmental Assessment.

The proposed site is located less than four miles from Kaloko-Honokōhau National Historical Park (National Park). The proposed exploratory well will tap fresh groundwater 480 ft below sea level and may eventually be developed into a production well for the Hawai'i County Department of Water Supply (DWS) North Kona Water System.

Resources within the National Park and surrounding community that could be affected by increased groundwater development include fishponds, anchialine pools, wetlands, and tidepools. These groundwater-dependent ecosystems provide habitat for culturally important and rare native plants and animals, including several endangered species. Preserving the health and maintenance of these public trust resources and uses of water is essential to the perpetuation of traditional Native Hawaiian culture and practices and the mission of the National Park.

Please address how increased groundwater development may affect these public trust resources and uses of water. Please consider the best available scientific and scholarly data and the scientific uncertainty regarding the inland, coastal and deep confined groundwater systems to support your assessment. Specific information to be considered regarding this issue includes the following publicly available information:

Oki, D.S., 2018. Modeling the groundwater flow-system of the Keauhou Area, Hawai'i. U.S. Geological Survey Presentation to the Hawaii Commission on Water Resource Management, April 17, 2018, Agenda Item C2. Available at: https://files.hawaii.gov/dlnr/cwrm/submittal/2018/sb20180417C2.pdf

Kelly, J.L. and C.R. Glenn, 2015. Chlorofluorocarbon apparent ages of groundwaters from west Hawai'i, USA. Journal of Hydrology 527: 355-366.

Tillman, F.D, Oki, D.S., and Johnson, A.G., 2014. Water-chemistry data collected in and near Kaloko-Honokōhau National Historical Park, Hawai'i, 2012–2014, U.S. Geological Survey Open-File Report 2014-1173.

Tillman, F.D., Oki, D.S., Johnson, A.G., Barber, L.B., Beisner, K.R., 2014. Investigation of geochemical indicators to evaluate the connection between inland and coastal groundwater systems near Kaloko-Honokōhau National Historical Park, Hawai'i, Applied Geochemistry 51: 278-292.

Also, please address how the proposed exploratory well comports with the approved Hawai'i County Water Use and Development Plan Update for the Keauhou Aquifer System Area, including the DWS Well Development Area depicted in Figure 4-2 of this plan.

Please contact Environmental Protection Specialist Jeff Zimpfer, Ph.D. at (808) 328-6881 x1500 or jeff_zimpfer@nps.gov if you have any questions.

Sincerely,

John Broward
Acting Superintendent

EXPERIENCE YOUR AMERICA
The National Park Service cares for special places saved by the American people so that all may experience our heritage.

The DWS has provided this EA to the parties listed in Table 7.3 with a request for review and comment.

Table 7.3 Preliminary Draft EA Distribution List

State Agencies	Elected Officials
Office of Environmental Quality Control (2 HC, 1 CD)	State Senator Dru Mamo Kanuha (District 3)
Department of Agriculture	State Senator Lorraine R. Inouye (District 4)
Department of Accounting and General Services	State Representative Richard Creagan (District 5)
Department of Business, Economic Development, and Tourism (DBEDT)	State Representative Nicole Lowen (District 6)
DBEDT – Hawai‘i State Energy Office	State Representative David A. Tarnas (District 7)
DBEDT – Office of Planning	Mayor Harry Kim
Department of Defense	County Councilmember Maile Medeiros David (District 6)
Department of Education	County Councilmember Rebecca Villegas (District 7)
Department of Hawaiian Home Lands	County Councilmember Karen Eoff (District 8)
DOH – Clean Air Branch	Kona Community Development Plan Action Committee
DOH – Safe Drinking Water Branch (O‘ahu & Hilo)	**Utility Companies**
DOH – Wastewater Branch	Hawaiian Telcom
Department of Human Services	Spectrum
Department of Labor and Industrial Relations	Hawaii Gas
DLNR	Hawaii Electric Light Co., Inc.
DLNR Commission on Water Resource Management	**Libraries and Depositories**
DLNR State Historic Preservation Division	Hawai‘i State Library Hawai‘i Documents Center
Department of Transportation – Highway Division	Kailua-Kona Public Library
Hawai‘i Housing Finance and Development Corp.	Kealakekua Public Library
Office of Hawaiian Affairs	**New Media**
County of Hawai‘i	West Hawai‘i Today
Planning Department (1 HC, 1 CD)	Hawai‘i Tribune Herald
Department of Water Supply	**Other**
Department of Public Works	‘Aha Moku Advisory Council
Department of Research and Development	Komo Brothers, LLP
Department of Environmental Management	National Park Service, Kaloko-Honokōhau National Historic Park
Department of Parks & Recreation	
Hawai‘i Fire Department	
Hawai‘i Police Department	
Department of Finance	
Department of Housing	

Source: Compiled by Planning Solutions, Inc. (2020)

7.2 DISTRIBUTION OF THE FINAL EA

The notice of availability of the *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* was published by the Office of Environmental Quality Control in the September 23, 2020 edition of *The Environmental Notice*. The 30-day comment period for the DEA ended on October 23, 2020. Table 7.4 lists the parties that submitted written comments on the project. The DWS is providing a copy of the Final Environmental Assessment to each of the organizations and individuals listed below. Copies of all comments received, and the responses provided, are reproduced at the end of this chapter.

Table 7.4 Comments on the Draft Environmental Assessment

No.	*Commenter*	*Organization*
1	n/a	DOH Clean Air Branch
2	Director Jade T. Butay	Hawai‘i Department of Transportation
3	Chief Paul K. Ferreira	Hawai‘i County Police Department
4	Deputy Director M. Kaleo Manuel	Commission on Water Resource Management
5	Branch Chief Dean Minakami	Hawai‘i Housing and Finance Development Corp.
6	Division Chief Ben Ishii	Hawai‘i County Department of Public Works
7	Gordon C. Heit, Land Agent	DLNR Land Division
8	Acting Superintendent John Broward	Kaloko-Honokōhau National Historical Park
9	Chief Engineer Carty Chang	DLNR Engineering Division
10	Janice Palma-Glennie	Surfrider Foundation Kona Kai Ea Chapter
11	Administrator Kenneth G. Madsen II	Hawai‘i Department of Education
12	Trails Specialist Jackson Bauer	Na Ala Hele
13	Loke Aloua	n/a
Source: Compiled by Planning Solutions, Inc. (2020)		

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Comment No. 1

Standard Comments for Land Use Reviews
Clean Air Branch
Hawaii State Department of Health

If your proposed project:

Requires an Air Pollution Control Permit

You must obtain an air pollution control permit from the Clean Air Branch and comply with all applicable conditions and requirements. If you do not know if you need an air pollution control permit, please contact the Permitting Section of the Clean Air Branch.

s

Includes construction or demolition activities that involve asbestos

You must contact the Asbestos Abatement Office in the Indoor and Radiological Health Branch.

Has the potential to generate fugitive dust

You must control the generation of all airborne, visible fugitive dust. Note that construction activities that occur near to existing residences, business, public areas and major thoroughfares exacerbate potential dust concerns. It is recommended that a dust control management plan be developed which identifies and mitigates all activities that may generate airborne, visible fugitive dust. The plan, which does *not* require Department of Health approval, should help you recognize and minimize potential airborne, visible fugitive dust problems.

Construction activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. In addition, for cases involving mixed land use, we strongly recommend that buffer zones be established, wherever possible, in order to alleviate potential nuisance complaints.

You should provide reasonable measures to control airborne, visible fugitive dust from the road areas and during the various phases of construction. These measures include, but are not limited to, the following:

a) Planning the different phases of construction, focusing on minimizing the amount of airborne, visible fugitive dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Providing an adequate water source at the site prior to start-up of construction activities;
c) Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimizing airborne, visible fugitive dust from shoulders and access roads;
e) Providing reasonable dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Controlling airborne, visible fugitive dust from debris being hauled away from the project site.

If you have questions about fugitive dust, please contact the Enforcement Section of the Clean Air Branch

Clean Air Branch (808) 586-4200 cab@doh.hawaii.gov	Indoor Radiological Health Branch (808) 586-4700

April 1, 2019

PLANNING SOLUTIONS

November 23, 2020

Ms. Marianne Rossio, P.E.
Clean Air Branch
Department of Health
State of Hawai'i
2827 Waimano Home Road, Room 130
Pearl City, Hawai'i 96782-1487

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Ms. Rossio,

Thank you for your October 8, 2020 message concerning the Hawai'i County Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response.

We appreciate the information you provided in your *Standard Comments for Land Use Reviews* regarding permitting and management practices required for the project. DWS understands that it must comply with all applicable rules, regulations, and statutes.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Makena

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

Comment No. 2

DAVID Y. IGE
GOVERNOR

JADE T. BUTAY
DIRECTOR

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

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

IN REPLY REFER TO:
DIR 0901
HWY-PS 2.4128

October 9, 2020

Mr. Makena White, AICP
Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, Hawaii 96813

Dear Mr. White:

Subject: Draft Environmental Assessment
North Kona Mid-Level Exploratory Well Project
North Kona, Hawaii
Tax Map Key No.: (3) 7-5-003:001 (portion)

Thank you for your letter dated September 22, 2020 requesting comments on the subject document. The Hawaii County Department of Water Supply proposes to construct an exploratory well in North Kona to determine if the location would be a suitable long-term source of potable water. The project involves site preparation, drilling and casing the well, pumping the water, and water quality testing. The total project duration is estimated to be one year. Subsequent permanent well construction would require additional environmental impact review.

The project site would occupy 0.38 acres of the 107-acre privately-owned parcel, currently used for cattle grazing. The western boundary of the parcel is adjacent to Queen Kaahumanu Highway (State Route 11); however, there is no direct access to the parcel from the State highway. The nearest route from Queen Kaahumanu to the project site would begin at the intersection with Nani Kailua Drive (County jurisdiction).

The Hawaii Department of Transportation (HDOT) has reviewed the Draft Environmental Assessment and anticipates the project would have no adverse impact to State highways. Note that an HDOT permit is required to operate or transport oversize and/or overweight vehicles and loads over State highways.

If you have any questions, please contact Jeyan Thirugnanam, Systems Planning Engineer, Highways Division, Planning Branch at (808) 587-6336 or by email at jeyan.thirugnanam@hawaii.gov. Please reference file review number PS 2020-146.

Sincerely,

JADE T. BUTAY
Director of Transportation

PLANNING SOLUTIONS

November 23, 2020

Mr. Jade T. Butay, Director
Department of Transportation
State of Hawai'i
869 Punchbowl Street
Honolulu, Hawai'i 96813-5097

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Butay,

Thank you for your October 9, 2020 letter (Reference No. DIR 0901 HWY-PS 2.4128) concerning the Hawai'i County Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Exploratory Well Project* (DEA). We appreciate the time that you and your staff spent reviewing the DEA and preparing your response.

We appreciate your confirmation that your Department anticipates no adverse impact to State highways as a result of this project. In addition, DWS acknowledges that a permit from your Department is requires to operate or transport oversize and/or overweight vehicles and loads over State highways.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

Comment No. 3

Harry Kim
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado, Jr.
Deputy Police Chief

County of Hawai'i
POLICE DEPARTMENT
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

October 6, 2020

Mākena White, AICP
Planning Solutions, Inc.
711 Kapi'olani Boulevard, Suite 950
Honolulu, Hawai'i 96813

Dear Mr. White:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT FOR THE NORTH KONA MID-LEVEL EXPLORATORY WELL PROJECT, HONUA'ULA AHUPUA'A, NORTH KONA, ISLAND OF HAWAI'I

The above-referenced Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project has been reviewed and we offer no comments at this time.

Should you have any questions or concerns, please contact Captain Gilbert Gaspar Jr., Commander of the Kona District, at (808) 326-4646, extension 299.

Sincerely,

PAUL K. FERREIRA
POLICE CHIEF

R. Wagner

ROBERT WAGNER
ASSISTANT POLICE CHIEF
AREA II OPERATIONS

GG/jaj
20HQ0807

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November 23, 2020

Chief Paul K. Ferreira
Police Department
County of Hawai'i
349 Kapi'olani Street
Hilo, Hawai'i 96720-3998

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Chief Ferreira,

Thank you for your October 6, 2020 letter concerning the Department of Water Supply's *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you and your staff spent reviewing the DEA and preparing your response.

We understand that your Department has no comments at this time. A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

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Phone: 808-550-4483 • www.psi-hi.com

Comment No. 4

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON

KAMANA BEAMER, PH.D.
MICHAEL G. BUCK
ELIZABETH A. CHAR, M.D.
NEIL J. HANNAHS
WAYNE K. KATAYAMA
PAUL J. MEYER

M. KALEO MANUEL
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

October 20, 2020

REF: RFD.5428.8

Makena White, AICP
Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, Hawai 96813

Aloha Mr. White:

Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project
Honuaula Ahupuaa, North Kona

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

☐ 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

☐ 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

☐ 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☒ 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

☐ 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

☐ 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

☐ 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER: The proposed location is approximately 600 feet away from the existing Commission deep monitor wells Keopu 1 & 2 (3856-001 & 002, respectively). This well, if turned into a production well could negatively impact the utility of the deep confined monitor well Keopu 2 though it might not affect the shallower basal monitor well Keopu 1. Pump tests would help to verify this. Should the well have negative impacts on the utility of either or both deep monitor wells from the pump test results then staff will recommend to the Commission to deny any future pump installation to protect the integrity of these existing monitor wells. Further, should such a result come to fruition or pump tests show that the well will not be productive enough for the Hawaii Department of Water Supply (HDWS) needs, then keeping this well for a third monitor well in this location should be considered as an alternative to sealing.

HDWS has developed a draft Water Use and Development Plan for the Keauhou Aquifer System Area that discusses the relatively recent discovery of a deep fresh water aquifer below salt water, and recommends further investigation of this deep aquifer as a potential source to replace the basal sources that supply makai areas. The proposed exploratory well will aid in this investigation.

The hydrogeology of the region is complex and the well may encounter perched, basal, high level, or deep fresh water aquifers. If the well is proposed to be developed, pumping tests would be required to determine any impacts to other existing wells or public trust purposes, and the DEA for the installation of the pump should identify any traditional and customary practices occurring in the area, the impacts on such practices, and any mitigative measures.

If you have any questions, please contact W. Roy Hardy of the Regulation Branch at 587-0225 or Lenore Ohye of the Planning Branch at 587-0216.

Ola i ka wai,

M. KALEO MANUEL
Deputy Director

cc: County of Hawaii, Department of Water Supply
Department of Land and Natural Resources, Land Division
Tom Nance Water Resource Engineering (TNWRE)

PLANNING SOLUTIONS

November 23, 2020

Mr. M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Manuel,

Thank you for your October 20, 2020 letter (Ref. No. RFD.5428.8) concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your comments. To simplify your review, we have reproduced your individual comments in italics and then provided our response.

Comment 1:

A Well Construction Permit(s) is (are) require before the commencement of any well construction work.

Response: DWS understands that it will need to obtain a Well Construction Permit from the Commission on Water Resource Management (CWRM) prior to construction of the North Kona Mid-Level Exploratory Well and before any ground water withdrawals are made from it.

Comment 2:

The proposed location is approximately 600 feet away from the existing Commission deep monitor wells Keopu 1 & 2 (3856-001 & 002, respectively). This well, if turned into a production well could negatively impact the utility of the deep confined monitor well Keopu 2 though it might not affect the shallower basal monitor well Keopu 1. Pump tests would help to verify this. Should the well have negative impacts on the utility of either or both deep monitor wells from the pump test results then staff will recommend to the Commission to deny any future pump installation to protect the integrity of these existing monitor wells. Further, should such a result come to fruition or pump tests show that the well will not be productive enough for the Hawaii Department of Water Supply (HDWS) needs, then keeping this well for a third monitor well in this location should be considered as an alternative to sealing.

Response: If testing of the proposed Mid-Level Exploratory Well demonstrates that development of a production well at this site is warranted, there are two possible outcomes with regard to the CWRM's Keōpū 2 Deep Monitor Well (No. 3858-002). One of these possibilities is that the piezometric head in the exploratory well is different than in CWRM's monitor well and that no drawdown is detected in CWRM's monitor well. This would suggest that the deep fresh water is apparently compartmentalized as has been demonstrated to be the case in the high-level wells above Māmalahoa Highway. In this case, the utility of the CWRM's deep monitor well would in no way be affected.

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Phone: 808-550-4483 • www.psi-hi.com

The second possible outcome is that the piezometric heads in both wells are similar and that a water level response in the CWRM's monitor well may have been recorded in response to pumping the North Kona Mid-Level Exploratory Well. This information would be important in the interpretation of the areal extent and sustainable supply of the freshwater compartment tapped by both wells. This would not be an adverse impact to the utility of the CWRM's monitor well. Rather, the monitor well would be positioned to provide additional information regarding this resource should the Mid-Level Exploratory Well ultimately be put into production..

An October 9, 2020 Zoom presentation of an offshore geophysical study, to which a number of CWRM staff members were in attendance, indicated that the deep freshwater body may be a significant resource for future well development. As such, mid-level wells could be developed at far less cost than wells at higher elevation above Māmalahoa Highway and possibly have less impact on the basal lens. Regardless of either of the two outcomes described above, the utility of the CWRM's deep monitor well would not be compromised and may provide substantial information in interpreting this potentially valuable resource going forward.

In the event that the North Kona Mid-Level Exploratory Well is not suitable for development as a production well, the Department of Water Supply would consider leaving it as a monitor well. However, that would require approval of the landowner and require an agreement for CWRM's access for monitoring to be negotiated with the landowner.

Comment 3:

HDWS has developed a draft Water Use and Development Plan for the Keauhou Aquifer System Area that discusses the relatively recent discovery of a deep fresh water aquifer below salt water, and recommends further investigation of this deep aquifer as a potential source to replace the basal sources that supply makai areas. The proposed exploratory well will aid in this investigation.

Response:

Thank you for your confirmation that the proposed North Kona Mid-Level Exploratory Well will serve as a valuable investigative tool for assessing the quality and quantity of ground water in the Keauhou Aquifer System Area.

Comment 4:

The hydrogeology of the region is complex and the well may encounter perched, basal, high level, or deep fresh water aquifers. If the well is proposed to be developed, pumping tests would be required to determine any impacts to other existing wells or public trust purposes, and the DEA for the installation of the pump should identify any traditional and customary practices occurring in the area, the impacts on such practices, and any mitigative measures.

Response:

The DWS understands that, should the proposed exploratory well ever be developed into a production well, pump tests will be required to assess any potential impacts it may have on other existing wells and public trust resources. In that event, DWS will prepare an Environmental Assessment dedicated to the development and ongoing use of the production well that addresses these potential impacts, including, and to the extent practicable within the framework established by HRS, Chapter 343 and its implementing regulations, possible impacts on traditional and customary practices and any measures which could mitigate them.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Comment No. 5

DAVID Y. IGE
GOVERNOR

DENISE ISERI-MATSUBARA
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
HAWAII HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX: (808) 587-0600

IN REPLY REFER TO:
20: DEV/163

October 20, 2020

Makena White, AICP
Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, Hawaii 96813

Dear Ms. White:

Subject: Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well
Honuaula ahupua, North Kona, Island of Hawaii

The Hawaii Housing Finance and Development Corporation (HHFDC) supports the North Kona Mid-Level Exploratory Well (Project) proposed by the Department of Water Supply (DWS). Since Kamakana Villages, HHFDC's master planned community on 272 acres, is located in North Kona, in the same Keauhou Aquifer as the Project, HHFDC is supportive of DWS' effort of exploring potential sources of reliable potable water.

Should you have any questions please contact Ms. Sery Berhanu, Housing Development Specialist, at 587-0546 or by email at sergut.berhanu@hawaii.gov.

Sincerely,

Dean Minakami

Dean Minakami
Development Branch Chief

PLANNING SOLUTIONS

November 23, 2020

Mr. Dean Minakami, Development Branch Chief
Hawai'i Housing Finance and Development Corporation
Department of Business, Economic Development & Tourism
State of Hawai'i
677 Queen Street, Suite 300
Honolulu, HI 96813

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Minakami,

Thank you for your October 20, 2020 letter (Reference No. 20:DEV/163) concerning the Department of Water Supply's *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and preparing your response.

Thank you also for expressing your support for the proposed exploratory well. DWS believes the project will serve as a valuable tool to explore potential sources of potable water in the Keauhou Aquifer System Area.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Makena

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

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Phone: 808-550-4483 • www.psi-hi.com

Comment No. 6

Harry Kim
Mayor

Roy Takemoto
Managing Director

David Yamamoto, P.E.
Director

Allan G. Simeon, P.E.
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
public_works@hawaiicounty.gov

October 21, 2020

Mākena White
Pacific Park Plaza, Suite 950
711 Kapiolani Boulevard
Honolulu, Hawai'I 96813-5213
(via email to: makena@psi-hi.com)

Subject: Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project
Honua'ula Ahupua'a, North Kona, Hawai'i
TMK No. (3) 7-5-003:001

We have reviewed the Draft Environmental Assessment and our comments are as follows:

1. Work is being proposed to improve an existing dirt road to the property through Flood zone AE as designated by the Flood Insurance Rate Map (FIRM). All proposed work within Flood zone AE shall comply with Chapter 27 – Floodplain Management – of the Hawaii County Code.
2. All development generated runoff shall be disposed of on-site and shall not be directed toward adjacent properties.
3. All earthwork and grading shall conform to Chapter 10 – Erosion and Sedimentation Control – of the Hawaii County Code.
4. Please revise Table 4.1 on page 4-14 to show that the County of Hawai'i Department of Public Works is the approving agency for grubbing, grading and stockpiling permits.

Please provide us with a copy of the EA when it is completed for our review.

Should there be any questions concerning this matter, please feel free to contact Kyle Honda of our Kona Engineering Division office at 323-4854.

For Ben Ishii, Division Chief
Engineering Division

KH

Copy: Engineering Division - HILO/KONA, Planning Department - Hilo

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November 23, 2020

Mr. Ben Ishii, Division Chief
Engineering Division
Department of Public Works, County of Hawai'i
State of Hawai'i
101 Pauahi Street, Suite 7
Hilo, Hawai'i 96720-4224

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Ishii,

Thank you for your October 21, 2020 letter concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response. To simplify your review, we have reproduced your comments in italics, followed by our response.

Comment 1:

Work is being proposed to improve an existing dirt road to the property through Flood zone AE as designated by the Flood Insurance Rate Map (FIRM). All proposed work within Flood zone AE shall comply with Chapter 27 - Floodplain Management - of the Hawaii County Code.

Response: Thank you for this information. DWS understands that all development within Flood Zone AE must comply with the Hawai'i County Code (HCC), Chapter 27 – Floodplain Management, and plans for the project are being prepared with this in mind.

Comment 2:

All development generated runoff shall be disposed of on-site and shall not be directed toward adjacent properties.

Response:

DWS understands that all runoff generated by the development must be disposed of on-site and not directed toward adjacent properties. Accordingly, the well water produced during the pump tests will be discharged into the onsite disposal sump (see Section 3.3.2.1). The disposal sump will be designed to hold a discharge volume adequate to allow all water produced by the pump test to percolate into the subsurface without discharging to surrounding soil or offsite. Runoff resulting from natural rainfall will continue to follow its existing course.

Comment 3:

All earthwork and grading shall conform to Chapter 10 - Erosion and Sedimentation Control - of the Hawaii County Code.

Response:

As indicated in Section 3.2.2 of the report, DWS understands that all earthwork and grading conducted as part of the North Kona Mid-Level Exploratory Well Project must conform with HCC, Chapter 10 – Erosion and Sedimentation Control.

Comment 4:

Please revise Table 4.1 on page 4-14 to show that the County of Hawai'i Department of Public Works is the approving agency for grubbing, grading and stockpiling permits.

Response:

Thank you for drawing our attention to the need for this revision. The County of Hawai'i Department of Public Works will be identified as the approving agency for grubbing, grading, and stockpiling permits in the Final Environmental Assessment (FEA).

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Comment No. 7

DAVID Y. IGE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 30, 2020

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)
X Historic Preservation (DLNR.Intake.SHPD@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment for the Proposed **North Kona Mid-Level Exploratory Well Project**
LOCATION: Honua'ula Ahupua'a, North Kona, Island of Hawaii; TMK: (3) 7-5-003:001
APPLICANT: Planning Solutions, Inc. on behalf of County of Hawaii, Department of Water Supply

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **October 21, 2020.**

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on The Environmental Notice in the middle of the page.)

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: _____
Print Name: GORDON C. HEIT
Division: Land Division
Date: 10/16/20

Attachments
cc: Central Files

PLANNING SOLUTIONS

November 23, 2020

Mr. Gordon C. Heit, District Land Agent
Land Division – Hawai'i District
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, HI 96809

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Heit,

Thank you for your October 16, 2020 memorandum concerning the Department of Water Supply's *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the informing us that the DLNR Land Division – Hawai'i District has no objections to this project at this time.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

National Park Service
U.S. Department of the Interior

Kaloko-Honokōhau
National Historical Park

73-4786 Kanalani Street # 14
Kailua-Kona, Hawai'i 96740

808 329-6881 Phone
808 329-2597 Fax

Kaloko-Honokōhau

IN REPLY REFER TO:
L7621 (2020-4)

October 23, 2020

Mākena White, Planner
Planning Solutions
Pacific Park Plaza, Suite 950
711 Kapiolani Boulevard
Honolulu, Hawai'i 96813-5213

Dear Mr. White:

Thank you for the opportunity to provide input on the **Draft Environmental Assessment for the proposed North Kona Mid-Level Exploratory Well Project**. The proposed site is located less than four miles from Kaloko-Honokōhau National Historical Park. The proposed exploratory well will tap fresh groundwater 480 ft below sea level and may eventually be developed into a production well for the Hawai'i County Department of Water Supply (DWS) North Kona Water System. Resources within the National Park and surrounding community that could be affected by increased groundwater development include fishponds, anchialine pools, wetlands, and tidepools. These groundwater-dependent ecosystems provide habitat for culturally important and rare native plants and animals, including several endangered species. Preserving the health and maintenance of these public trust resources and uses of water is essential to the perpetuation of traditional Native Hawaiian culture and practices and the mission of the National Park.

Review Comments

1. Section 1.3, Page 1-6. In describing the need for the proposed action, the draft EA states "In order to satisfy the rising demand, DWS needs additional sources of potable water so that it can create greater reliability and reduce the load placed on the existing sources within the system." The NPS supports efforts to redistribute pumping from groundwater wells in the area of the park, specifically the Honokohau, Palani, and Hualalai Wells in the DWS North Kona System. It is our hope that this exploratory well, if developed into a production well, can be used to redistribute pumping mauka of the park, as well as to assist DWS in maintaining an adequate, reliable, and affordable supply of drinking water for North Kona. One option for formalizing this commitment is attaching Special Conditions to the well permit to explicitly identify sustainable levels of pumping in environmentally or culturally sensitive areas of the aquifer system. Please address whether DWS is open to considering this option for the North Kona Mid-Level Well.

2. Section 2.1.2, Page 2-6. The draft EA indicates that the decision to convert this exploratory well into a production well will be based upon the results of the open hole pump test results – "If the open hole pump test results warrant development as a production well, the pilot borehole would

be reamed to 27-inch diameter, 20-inch solid casing would be installed to isolate the draft from the fresh water zone at depth, and final, permit-required step and constant rate pump tests would be run to establish the well's hydraulic capacity and long term yield."

But the draft EA also states "If the proposed well produces water of adequate quantity and quality, DWS may then pursue the approvals needed to develop the exploratory well into a production well … only the exploratory phase of the Project is the subject of this Environmental Assessment (EA); any subsequent phases of work would be evaluated in a separate environmental review process." (Page 1-1); and "If the DWS elects to develop this exploratory well into a production well at some later date, it may need to modify [the 2017 Water Use and Development Plan Update]" (Page 3-9).

Therefore, it is not clear if the decision to convert the exploratory well into a production well will be based upon the short-term pump test results or if this decision will be informed by a separate EA and/or updated water use and development plan. Please clarify what information will be used by DWS to determine if and when to convert the exploratory well into a production well, including when DWS will pursue a Pump Installation Permit from the Commission on Water Resource Management.

Additionally, the NPS requests that results of well drilling and testing be made publicly available, so that the information can be used to better understand the hydrologic properties of the aquifers in this area. These data will be important to understanding the nature and extent of the confined freshwater system in the North Kona area. Important information would include the geologic log of the test borehole, the borehole video survey, and the results of step and constant rate yield and drawdown testing.

Finally, while pump test results will provide an adequate point-in-time estimate of production capacity, these results should not be relied upon to establish a long-term yield.

3. Section 2.6.1, Page 2-10. This section (Alternative Scale) should be numbered 2.6.4. Also, the text states "…the Project could be developed into a larger scale facility than is currently called for under the Proposed Action as part of a subsequent undertaking." This statement indicates that if the proposed well is found to be productive, this site could be developed at a significantly larger scale than may be currently envisioned. At increased scale, the potentially affected resources may change dramatically. Please provide a constraint on the upper limit of potential production for this site.

4. Section 3.3.1.4, Page 3-6. In regard to the discovery of deep freshwater at depth, please note that on April 17, 2018, Delwyn Oki of the USGS Pacific Islands Water Science Center presented the results of two- and three-dimensional numerical groundwater models funded by the NPS for the Keauhou area to CWRM (available at: https://files.Hawaii.gov/dlnr/cwrm/submittal/2018/sb20180417C2.pdf).

   During the public meeting, Dr. Oki explained that existing information and modeling are consistent with some degree of hydrologic connection between the high-level and coastal freshwater-lens (or basal) groundwater systems and the upward discharge of deep freshwater into the coastal freshwater-lens system.

   Dr. Oki also demonstrated how the three-dimensional model was used to quantify the effects of groundwater withdrawals on salinity and freshwater discharge in Kaloko-Honokōhau National

Historical Park. A report documenting the models and results has been prepared and is in USGS review. This information should be considered when the direct and cumulative effects of converting the proposed exploratory well into a production well are assessed.

5. Section 3.3. The text states "According to the State Commission on Water Resource Management (CWRM), the estimated groundwater recharge of the Keauhou Aquifer System from rainfall is 87 MGD. More recently, the USGS estimated that this recharge is actually 152 MGD (Engott 2011)" (Page 3-5); and "As noted above, a more recent study by the USGS using more sophisticated methods (Engott 2011) estimates the recharge rate a 152 MGD" (Page 3-7).

   The USGS recharge rate of 152 million gallons per day is based upon rainfall during the period 1916-1983. The USGS study by Engott (2011) also estimated mean annual recharge for the Keauhou Aquifer System ASA for the period 1984-2008; estimates from the Kona-area submodel documented by Engott (2011) was 106 million gallons per day. This information was provided to Keith Okamoto of DWS in a letter from the USGS dated May 7, 2015. The EA should be revised to clarify the time period for the recharge rates and should include the more recent recharge rate of 106 million gallons per day.

6. Section 3.3.1.6, Page 3-7. The discussion on Sustainable Yield implies that a higher recharge rate indicates higher levels of pumping can be sustained without causing adverse effects. This view does not recognize that groundwater pumping at any level reduces groundwater levels and/or discharge from the aquifer system and may affect non-consumptive public trust uses of water that rely upon groundwater.

   For example, the USGS recognizes that availability of fresh groundwater for human use in Hawaii is constrained by the degree to which the impacts of withdrawal—such as lowering of the water table, saltwater intrusion, and reduction in the natural discharge to springs, streams, wetlands, and submarine seeps—are deemed acceptable (USGS Scientific Investigations Report 2015-5164 available at: https://pubs.er.usgs.gov/publication/sir20155164).

   The Commission on Water Resource Management also recognizes that the current Sustainable Yield for the Keauhou Aquifer System Area does not explicitly account for the groundwater discharge needs of groundwater-dependent ecosystems and recommended a pilot program to develop an adaptive management plan for these resources in Kaloko-Honokōhau National Historical Park (CWRM 2019 Water Resources Protection Plan Update, Appendix F, Page 9).

   The location, depth and pumping rate of a well, and the ability of the aquifer materials to store and transmit water, are the factors that determine where and when the effects of groundwater pumping will be observed. Ultimately, the withdrawal of any volume of water from an aquifer results in a reduction of natural discharge by an equal amount as the withdrawal, regardless of the rate of recharge to the aquifer. More detailed discussions of concepts relating to the effects of groundwater pumping and sustainability include *The Water Budget Myth Revisited: Why Hydrogeologist Model* by Bredehoeft et al. (2002 Groundwater, vol. 40, No. 4) and *Streamflow Depletion by Wells* by Barlow and Leake (USGS Circular 1376, page 39). This information should be considered when the sustainability of converting the proposed exploratory well into a production well is assessed.

7. Section 3.3.1.6, Page 3-7. The draft EA states that "According to the Hawaii County Water Use and Development Plan Update DWS' projections for the future potable water demand in this aquifer system area ranges between 15.5 to 16.8 MGD by 2025 (DWS, 2010)." However, DWS'

March 2017 Water Use and Development Plan Update for the Keauhou Aquifer System Area states that DWS estimated anticipated water demand in the Keauhou Aquifer System Area to be 28.07 million gallons per day. It is not clear why the 2017 Update (available at https://www.hawaiidws.org/wp-content/uploads/2018/06/Combined-Ph-1-2-Keauhou-20170510_w-Appendix-final.pdf) is not referenced in the draft EA for the most recent water demand information.

There are also several other references to the "Hawaii County Water Use and Development Plan Update" in the draft EA without a citation. The 2017 Update is referenced as the "Keauhou Aquifer System Water Use and Development Update" on Page 3-9 but does not include a citation. The EA should clarify whether the 2010 or 2017 Update is being referenced and include citations to the plans.

8. 3.3.2.1, Page 3-8. The draft EA states "The Proposed Action does not involve any activities that would alter existing stream channels, wetlands, or other surface water bodies." However, although wetlands are often bodies of surface water, they are generally fed from a groundwater source and therefore groundwater withdrawals do have the potential to impact wetland resources. The draft EA should consider potential impacts to groundwater-dependent wetlands.

9. Section 3.3.2.2, Page 3-9. The draft EA states "Based on previous testing of Well 3858-002, a response in the basal lens is not expected to occur." It is not clear from this statement if monitoring of water levels in Well 3858-001 occurred during the testing of Well 3858-002 and if evidence of hydraulic connection was observed. If no evidence of hydraulic connection was observed during monitoring, then this does not prove that the confining unit(s) between the basal aquifer and the high level groundwater found below it are impermeable, only that the connection between the two was not observed within the 48-hour time period of the pump test. Also, results of this monitoring should be mentioned in Section 3.3.1.4.

   Geologic features termed "confining layers" have a reduced hydraulic conductivity compared to the aquifer units below and/or above them but are themselves not impermeable. Water can and does move vertically between aquifers through confining layers, and drawdown from pumping can also propagate through them. However, these effects may be delayed in comparison to the response of the pumped aquifer. The USGS details this concept in more detail in Circular 1376 (Page 46). This information should be considered when the direct and cumulative effects of converting the proposed exploratory well into a production well are assessed.

10. Section 3.3.1.1, Page 3-4. The reference "(Frazier et al., 2016)" does not discuss groundwater recharge in the area of the Proposed Action. The draft EA should be revised to clarify that this reference discusses rainfall.

11. Figure 1.3, Page 1-4. This figure appears to show the location of the proposed Waiaha Well B and not the entirety of the North Kona Water System as described in the text.

Please contact Environmental Protection Specialist Jeff Zimpfer, Ph.D. at (808) 328-6881 x1500 or jeff_zimpfer@nps.gov if you have any questions.

Sincerely,

John Broward

John Broward, Acting Superintendent

PLANNING SOLUTIONS

November 23, 2020

Mr. John Broward, Acting Superintendent
Kaloko-Honokōhau, National Historic Park
National Park Service
U.S. Department of the Interior
73-4786 Kanalani Street, #14
Kailua-Kona, HI 96740

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Broward,

Thank you for your October 23,'2020 letter [Reference No. L7621 (2020-4)] concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response. To simplify your review, we have reproduced your comments in italics, followed by our response.

Comment 1:

Section 1.3, Page 1-6. In describing the need for the proposed action, the draft EA states "In order to satisfy the rising demand, DWS needs additional sources of potable water so that it can create greater reliability and reduce the load placed on the existing sources within the system." The NPS supports efforts to redistribute pumping from groundwater wells in the area of the park, specifically the Honokohau, Palani, and Hualalai Wells in the DWS North Kona System. It is our hope that this exploratory well, if developed into a production well, can be used to redistribute pumping mauka of the park, as well as to assist DWS in maintaining an adequate, reliable, and affordable supply of drinking water for North Kona. One option for formalizing this commitment is attaching Special Conditions to the well permit to explicitly identify sustainable levels of pumping in environmentally or culturally sensitive areas of the aquifer system. Please address whether DWS is open to considering this option for the North Kona Mid-Level Well.

Response: The mission of the DWS is to provide its customers with an adequate and continuous supply of safe drinking water in a financially responsible manner. As such, it is not the function of the DWS to identify sustainable levels of pumping or to identify environmentally or culturally sensitive areas of the aquifer system. Although DWS believes that these types of designations are the purview of the Commission on Water Resource Management (CWRM) and would be most appropriately addressed by them, the DWS will work cooperatively with CWRM towards these goals. Also, based on the limited information that is currently available, DWS believes that this is an opportunity to accomplish some of these goals while adding resiliency to the public water system.

Comment 2:

Section 2.1.2, Page 2-6. The draft EA indicates that the decision to convert this exploratory well into a production well will be based upon the results of the open hole pump test results - "If the open hole pump test results warrant development as a production well, the pilot borehole would

be reamed to 27-inch diameter, 20-inch solid casing would be installed to isolate the draft from the fresh water zone at depth, and final, permit-required step and constant rate pump tests would be run to establish the well's hydraulic capacity and long term yield."

But the draft EA also states "If the proposed well produces water of adequate quantity and quality, DWS may then pursue the approvals needed to develop the exploratory well into a production well ... only the exploratory phase of the Project is the subject of this Environmental Assessment (EA); any subsequent phases of work would be evaluated in a separate environmental review process." (Page 1-1); and "If the DWS elects to develop this exploratory well into a production well at some later date, it may need to modify [the 2017 Water Use and Development Plan Update]" (Page 3-9).

Therefore, it is not clear if the decision to convert the exploratory well into a production well will be based upon the short-term pump test results or if this decision will be informed by a separate EA and/or updated water use and development plan. Please clarify what information will be used by DWS to determine if and when to convert the exploratory well into a production well, including when DWS will pursue a Pump Installation Permit from the Commission on Water Resource Management.

Additionally, the NPS requests that results of well drilling and testing be made publicly available, so that the information can be used to better understand the hydrologic properties of the aquifers in this area. These data will be important to understanding the nature and extent of the confined freshwater system in the North Kona area. Important information would include the geologic log of the test borehole, the borehole video survey, and the results of step and constant rate yield and drawdown testing.

Finally, while pump test results will provide an adequate point-in-time estimate of production capacity, these results should not be relied upon to establish a long-term yield.

Response: As noted throughout the DEA, the DWS will make the determination regarding whether or not the proposed exploratory well merits conversion into a production well based on a number of factors. These include, but are not limited to, the: (*i*) quality and quantity of water available from this source, as determined by the exploratory pump tests; (*ii*) the sustainability of the yield; and (*iii*) demand for potable water in the Keauhou Aquifer System Area.

If it decides that it believes that establishing a production well is appropriate, the Department will prepare an Environmental Assessment (EA) evaluating the potential impacts of developing a production well at this location. The findings of that EA, together with the information gathered via the exploratory well, will be used to inform the decision-making process. Because of the dynamic and varied factors driving such a determination, it would be premature for DWS to state when, or even if, it will seek a Pump Installation Permit from the Commission on Water Resource Management (CWRM) at this time. The DWS will factor into consideration any potential future plans to develop a production well at the North Kona Mid-Level Exploratory Well site, in coordination with CWRM, and the Department of Health, when determining whether or not a modification to its *Water Use and Development Plan* is warranted. In any event, data from the well drilling and pump testing will be made publicly available as part of the Well Completion Report that will be filled with CWRM.

Comment 3:

3. Section 2.6.1, Page 2-10. This section (Alternative Scale) should be numbered 2.6.4. Also, the text states "... the Project could be developed into a larger scale facility than is currently called for under the Proposed Action as part of a subsequent undertaking." This statement indicates that if the proposed well is found to be productive, this site could be developed at a significantly larger scale than may be currently envisioned. At increased scale, the potentially affected resources may change dramatically. Please provide a constraint on the upper limit of potential production for this site.

Response: First, thank you for noting this section-numbering error in the DEA. It has been corrected and the change will be reflected in the forthcoming Final Environmental Assessment (FEA) for the project.

Second, the discussion in this section is intended to acknowledge the possibility of the DWS converting the proposed North Kona Mid-Level Exploratory Well into a production well facility at some, as yet undetermined, future date. If and when it decides to do so, the DWS will prepare an EA for a production well which will clearly state the proposed withdrawal (i.e., pumping) rate and fully explore the potential impacts of constructing and operating an appropriately sized production well and support infrastructure on this site. Until the pump test results are available from the exploratory well and additional design and environmental studies are completed, DWS does not have the information needed to establish an upper limit on the amount of water that would be pumped from a production well if one were to be developed on the North Kona Mid-Level Exploratory Well site. Such information would, of course, be provided in the EA that it would prepare if one or more production well(s) is ever proposed for this location.

Comment 4:

4. Section 3.3.1.4, Page 3-6. In regard to the discovery of deep freshwater at depth, please note that on April 17, 2018, Delwyn Oki of the USGS Pacific Islands Water Science Center presented the results of two- and three-dimensional numerical groundwater models funded by the NPS for the Keauhou area to CWRM (available at: https://files.Hawaii.gov/dlnr/cwrm/submittal/2018/sb20180417C2.pdf).

During the public meeting, Dr. Oki explained that existing information and modeling are consistent with some degree of hydrologic connection between the high-level and coastal freshwater-lens (or basal) groundwater systems and the upward discharge of deep freshwater into the coastal freshwater-lens system.

Dr. Oki also demonstrated how the three-dimensional model was used to quantify the effects of groundwater withdrawals on salinity and freshwater discharge in Kaloko-Honokohau National Historical Park. A report documenting the models and results has been prepared and is in USGS review. This information should be considered when the direct and cumulative effects of converting the proposed exploratory well into a production well are assessed.

Response: DWS will consider all relevant data, including Dr. Oki's report, when it becomes available.

Comment 5:

Section 3.3. The text states "According to the State Commission on Water Resource Management (CWRM), the estimated groundwater recharge of the Keauhou Aquifer System from rainfall is 87 MGD. More recently, the USGS estimated that this recharge is actually 152 MGD (Engott 2011)" (Page 3-5); and "As noted above, a more recent study by the USGS using more sophisticated methods (Engott 2011) estimates the recharge rate a 152 MGD" (Page 3-7).

The USGS recharge rate of 152 million gallons per day is based upon rainfall during the period 1916-1983. The USGS study by Engott (2011) also estimated mean annual recharge for the Keauhou Aquifer System ASA for the period 1984-2008; estimates from the Kona-area submodel documented by Engott (2011) was 106 million gallons per day. This information was provided to Keith Okamoto of DWS in a letter from the USGS dated May 7, 2015. The EA should be revised to clarify the time period for the recharge rates and should include the more recent recharge rate of 106 million gallons per day.

Response: The DWS acknowledges receipt of this letter from the USGS, dated May 7, 2015. We note that, whether the Engott figure of 152 MGD or the 106 MGD you cite is used, both figures are far greater than the 87 MGD recharge currently used by CWRM, and which DWS operates within.

Comment 6:

Section 3.3.1.6, Page 3-7. The discussion on Sustainable Yield implies that a higher recharge rate indicates higher levels of pumping can be sustained without causing adverse effects. This view does not recognize that groundwater pumping at any level reduces groundwater levels and/or discharge from the aquifer system and may affect non-consumptive public trust uses of water that rely upon groundwater.

For example, the USGS recognizes that availability of fresh groundwater for human use in Hawaii is constrained by the degree to which the impacts of withdrawal-such as lowering of the water table, saltwater intrusion, and reduction in the natural discharge to springs, streams, wetlands, and submarine seeps-are deemed acceptable (USGS Scientific Investigations Report 2015-5164 available at: https://pubs.er.usgs.gov/publication/sir20155164).

The Commission on Water Resource Management also recognizes that the current Sustainable Yield for the Keauhou Aquifer System Area does not explicitly account for the groundwater discharge needs of groundwater-dependent ecosystems and recommended a pilot program to develop an adaptive management plan for these resources in Kaloko-Honokohau National Historical Park (CWRM 2019 Water Resources Protection Plan Update, Appendix F, Page 9).

The location, depth and pumping rate of a well, and the ability of the aquifer materials to store and transmit water, are the factors that determine where and when the effects of groundwater pumping will be observed. Ultimately, the withdrawal of any volume of water from an aquifer results in a reduction of natural discharge by an equal amount as the withdrawal, regardless of the rate of recharge to the aquifer. More detailed discussions of concepts relating to the effects of groundwater pumping and sustainability include The Water Budget Myth Revisited: Why Hydrogeologist Model *by Bredehoeft et al. (2002 Groundwater, vol. 40, No. 4) and* Streamflow Depletion by Wells *by Barlow and Leake (USGS Circular 1376, page 39). This information should be considered when the sustainability of converting the proposed exploratory well into a production well is assessed.*

Response: Thank you for this information. The DEA evaluates the potential environmental impacts associated with the North Kona Mid-Level Exploratory Well Project. There is no credible evidence that the well construction activity and short-duration pump tests that are proposed as part of the exploratory well project have the potential to affect groundwater flows to the point where groundwater-dependent ecosystems would be affected. However, if the results of pump tests of the proposed exploratory well lead DWS to determine that it is prudent to proceed with development of a production well at this location, it will prepare an EA assessing the impacts associated with constructing and operating a production well. At that time, DWS will consider all available information and analysis in preparing its evaluation of impacts, including the sources you have indicated.

Comment 7:

Section 3.3.1.6, Page 3-7. The draft EA states that "According to the Hawaii County Water Use and Development Plan Update DWS' projections for the future potable water demand in this aquifer system area ranges between 15.5 to 16.8 MGD by 2025 (DWS, 2010)." However, DWS' March 2017 Water Use and Development Plan Update for the Keauhou Aquifer System Area states that DWS estimated anticipated water demand in the Keauhou Aquifer System Area to be 28.07 million gallons per day. It is not clear why the 2017 Update (available at https://www.hawaiidws.org/wp-content/uploads/2018/06/Combined-Ph-1-2-Keauhou-20170510_w-Appendix-final.pdf) is not referenced in the draft EA for the most recent water demand information.

There are also several other references to the "Hawaii County Water Use and Development Plan Update" in the draft EA without a citation. The 2017 Update is referenced as the "Keauhou Aquifer System Water Use and Development Update" on Page 3-9 but does not include a citation. The EA should clarify whether the 2010 or 2017 Update is being referenced and include citations to the plans.

Response: Thank you for drawing our attention to the lack of clarity about this reference. We have revised the FEA to clearly reference Table 3-10 of the *2017 Keauhou Aquifer System Water Use and Development Update* and providing DWS' projections for the future potable water demand in this aquifer system area, which ranges between 16.56 and 18.46 MGD by 2025 (Table 3-10, DWS, 2017).

Comment 8:

3.3.2.1, Page 3-8. The draft EA states "The Proposed Action does not involve any activities that would alter existing stream channels, wetlands, or other surface water bodies." However, although wetlands are often bodies of surface water, they are generally fed from a groundwater source and therefore groundwater withdrawals do have the potential to impact wetland resources. The draft EA should consider potential impacts to groundwater-dependent wetlands.

Response: The potential for impacts to wetlands has been addressed in Section 3.3.2.1 of the DEA. Further, as discussed in Section 3.5.1, the USFWS' National Wetland Inventory has no mapped wetlands on or near the project area, excepting the intermittent stream that crosses the access road.

While DWS understands that wetlands are often fed by groundwater sources, there do not appear to be any wetlands in proximity to the project with the potential to be affected by constructing the proposed

exploratory well. Because pump testing of the North Kona Mid-Level Exploratory Well Project involves only very limited withdrawals (i.e., pumping at a rate between 700 and 1,000 GPM for up to 96 hours continuously), its operation is similarly devoid of the potential to have a measurable effect on wetlands.

Comment 9:

Section 3.3.2.2, Page 3-9. The draft EA states "Based on previous testing of Well 3858-002, a response in the basal lens is not expected to occur." It is not clear from this statement if monitoring of water levels in Well 3858-001 occurred during the testing of Well 3858-002 and if evidence of hydraulic connection was observed. If no evidence of hydraulic connection was observed during monitoring, then this does not prove that the confining unit(s) between the basal aquifer and the high level groundwater found below it are impermeable, only that the connection between the two was not observed within the 48-hour time period of the pump test. Also, results of this monitoring should be mentioned in Section 3.3.1.4.

Geologic features termed "confining layers" have a reduced hydraulic conductivity compared to the aquifer units below and/or above them but are themselves not impermeable. Water can and does move vertically between aquifers through confining layers, and drawdown from pumping can also propagate through them. However, these effects may be delayed in comparison to the response of the pumped aquifer. The USGS details this concept in more detail in Circular 1376 (Page 46). This information should be considered when the direct and cumulative effects of converting the proposed exploratory well into a production well are assessed.

Response:

The Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project addresses the potential impacts of constructing and conducting tests of an exploratory well on the identified site. Assessment of the impacts related to a possible future development of a production well at that location is beyond the scope of the EA for the exploratory well. However, please rest assured that if and when the DWS concludes that it believes it is appropriate to establish a production well at that location it will include all relevant information when it prepares the environmental documentation that is needed. That document will consider all available information and analysis to assess the direct and cumulative effects of converting the proposed exploratory well into a production well as you have requested.

Comment 10:

Section 3.3.1.1, Page 3-4. The reference "(Frazier et al., 2016)" does not discuss groundwater recharge in the area of the Proposed Action. The draft EA should be revised to clarify that this reference discusses rainfall.

Response: The reference you cite reads as follows in the DEA:

"According to The Rainfall Atlas of Hawai'i *(Frazier et al., 2016) rainfall on the western slopes of Hualālai between 2,000 +MSL and the summit is the principal source of groundwater recharge in the area of the Proposed Action."*

The DWS believes that it is clear from this passage, from Frazier et al., 2016, is clearly referencing rainfall, drawn from a text devoted to that subject. Because rainfall is the primary source of groundwater recharge,

DWS believes it is both reasonable and appropriate to preface the discussion with a discussion of rainfall and requires no further clarification.

Comment 11:

Figure 1.3, Page 1-4. This figure appears to show the location of the proposed Waiaha Well B and not the entirety of the North Kona Water System as described in the text.

Response: Figure 1.3, depicting the North Kona Water System, is drawn from DWS' 2006 20-Year Water Master Plan (R.W. Beck, 2006) and is an accurate portrayal of the water system at that time. Wai'aha Well B was added to the map to reflect the fact that DWS is currently adding it to its system. To avoid confusion, the figure has been removed from the FEA.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Comment No. 9

DAVID Y. IGE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

September 30, 2020

FROM: **MEMORANDUM**

~~TO:~~ **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
__Office of Conservation & Coastal Lands
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)
X Historic Preservation (DLNR.Intake.SHPD@hawaii.gov)

TO: ~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Draft Environmental Assessment for the Proposed **North Kona Mid-Level Exploratory Well Project**
LOCATION: Honua'ula Ahupua'a, North Kona, Island of Hawaii; TMK: (3) 7-5-003:001
APPLICANT: Planning Solutions, Inc. on behalf of County of Hawaii, Department of Water Supply

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit any comments by **October 21, 2020.**

The DEA can be found on-line at: http://health.hawaii.gov/oeqc/ (Click on The Environmental Notice in the middle of the page.)

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: [signature]
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Oct 22, 2020

Attachments
cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Draft Environmental Assessment for the Proposed North Kona Mid-Level Exploratory Well Project
Location: Honua'ula Ahupua'a, North Kona, Island of Hawaii
TMK(s): (3) 7-5-003:001
Applicant: Planning Solutions, Inc. on behalf of County of Hawaii, Department of Water Supply

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM), which can be viewed on our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4896.

Signed: [signature]
CARTY S. CHANG, CHIEF ENGINEER

Date: Oct 22, 2020

PLANNING SOLUTIONS

November 23, 2020

Mr. Carty S. Chang, Chief Engineer
Engineering Division
Department of Land and Natural Resources
State of Hawai'i
P.O. Box 621
Honolulu, Hawai'i 96809

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Chang,

Thank you for your October 22, 2020 letter concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response.

We are grateful for the guidance you have provided regarding flood hazard areas and the National Flood Insurance Program, which is consistent with information in the DEA. Site planning for the exploratory well facilities has considered the location and extent of these identified flood zones.

More specifically, as noted in Section 3.8.1 of the DEA, the entire area of the proposed action is in Flood Zone X. This designation corresponds to areas that are subject to flooding from a potential 500-year flood or from a 100-year flood with flood levels of less than one foot. Areas designated as Zone X are outside of the 0.2 percent annual chance floodplain; because these areas are considered to have very low potential for flooding, no base flood elevations have been determined.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Makena

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

Comment No. 10

Re: North Kona Exploratory Well Project at TMK 7-5-003:001

October 23, 2020

Aloha,

I'm testifying again on behalf of the Surfrider Foundation's Kona Kai Ea Chapter. Our group's mission is to protect and enjoy our seas and other waterways.

The draft EA that I received is lacking from our point of view. As I stated in my comments for the scoping request for the North Kona mid-level exploratory well, the draft WUDP, which was never adopted, asserts without any basis, that mid-level wells won't have impact on the basal aquifer. The draft unapproved plan recommended further investigation into the mid-level source.

For the EA to be legally adequate it must clearly articulate affirmatively that the well will not harm Public Trust Resources along the coast, including those upon which Native Hawaiian cultural practices depend.

My concerns were not addressed in the Draft EA. Please address them in the EA.

Mahalo and sincerely,

Janice Palma-Glennie

For Surfrider Foundation's Kona Kai Ea chapter

PLANNING SOLUTIONS

November 23, 2020

Ms. Janice Palma-Glennie
Surfrider Foundation's Kona Kai Ea Chapter
P.O. Box 4849
Kailua-Kona, Hawai`i 96745

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Ms. Palma-Glennie,

Thank you for your October 23, 2020 email concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your comments. To simplify your review, we have reproduced them in italics, followed by our response.

Comment:

The draft EA that I received is lacking from our point of view. As I stated in my comments for the scoping request for the North Kona mid-level exploratory well, the draft WUDP, which was never adopted, asserts without any basis, that mid-level wells won't have impact on the basal aquifer. The draft unapproved plan recommended further investigation into the mid-level source.

For the EA to be legally adequate it must clearly articulate affirmatively that the well will not harm Public Trust Resources along the coast, including those upon which Native Hawaiian cultural practices depend.

My concerns were not addressed in the Draft EA. Please address them in the EA.

Response: DWS shares your concern regarding adverse impacts to public trust resources along the coast, including those used for traditional and customary purposes by native Hawaiians. However, DWS believes that the detailed discussion of hydrology, including groundwater in the basal aquifer and potential impacts to it as a result of the proposed action, contained in Section 3.3.2.2 of the DEA do adequately address your concerns. Based on the information and analysis in the DEA, DWS concluded that the construction and pump-testing of the proposed exploratory well does not have the potential to adversely affect any public trust coastal resources or the traditional and customary native Hawaiian practices which rely upon them.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

Comment No. 11

DAVID Y. IGE
GOVERNOR

DR. CHRISTINA M. KISHIMOTO
SUPERINTENDENT

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

OFFICE OF FACILITIES AND OPERATIONS

October 20, 2020

Makena White, AICP
Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, Hawaii 96813

Re: Draft Environmental Assessment of the North Kona Mid-Level Exploratory Well Project, Honuaula Ahupuaa, North Kona, TMK 7-5-003: Por.001

Dear Mr. White:

The Hawaii State Department of Education (HIDOE) has the following comments for the proposed North Kona Mid-Level Exploratory Well project (Project) located at TMK 7-5-003: Por. 001.

The proposed Project will not impact HIDOE schools or facilities.

The HIDOE would like to clarify that the Kona schools are part of the State of Hawaii public school system. There is no separate Kona public school system. The following schools should be added to the Konawaena Complex: Kahakai Elementary and Ke Kula O Ehunuikaimalino. In the Kealakehe Complex Kahakai Elementary should be deleted and Waikoloa Elementary and Middle School should be added.

Thank you for the opportunity to comment. Should you have questions, please contact Robyn Loudermilk of the Facilities Development Branch, Planning Section, at 784-5093 or via email at robyn.loudermilk@k12.hi.us.

Respectfully,

Kenneth G Masden II
Public works Administrator
Planning Section

KGM:rll

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

PLANNING SOLUTIONS

November 23, 2020

Mr. Kenneth G. Masden, II
Public Works Administrator
Planning Section
Department of Education, State of Hawai'i
P.O. Box 2360
Honolulu, Hawai'i 96804

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Masden,

Thank you for your October 20, 2020 letter concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response. To simplify your review, we have reproduced your comments in italics, followed by our response.

Comment 1:

The proposed Project will not impact HIDOE schools or facilities.

Response: We appreciate your confirmation that the proposed action will not impact any of the Department's schools or other facilities.

Comment 2:

The HIDOE would like to clarify that the Kona schools are part of the State of Hawaii public school system. There is no separate Kona public school system. The following schools should be added to the Konawaena Complex: Kahakai Elementary and Ke Kula O Ehunuikaimalino. In the Kealakehe Complex Kahakai Elementary should be deleted and Waikoloa Elementary and Middle School should be added.

Response: Thank you for this information. Section 3.17.1.4 of the *Final Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (FEA) will incorporate the information you have provided.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Makena

Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Pacific Park Plaza, Suite 950 • 711 Kapi'olani Boulevard • Honolulu, Hawai'i 96813-5213
Phone: 808-550-4483 • www.psi-hi.com

Comment No. 12

NĀ ALA HELE
Hawai'i Trail & Access System

October 23, 2020

TO: Mr. Keith Okamoto, P.E.
Hawai'i County Department of Water Supply
c/o
Mr. Makena White
Planning Solutions, Inc.

FROM: Jackson Bauer, Trails and Access Specialist V
Nā Ala Hele Trails and Access Program, DOFAW, DLNR

SUBJECT: Comments to Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well.

The Nā Ala Hele Trails and Access Program within the Division of Forestry and Wildlife, Department of Land and Natural Resources, thanks you for the opportunity to comment on the subject Draft Environmental Assessment.

While no archaeological evidence of trails was observed by your archaeological inventory survey, there are several records of a major *mauka-makai* trail that goes through this project area. This is seen in 1929 USGS maps (Figure 18 of your AIS) and in the 1906 Registered Map No. 2358, where the alignment is described by the surveyor George Wright as an "old trail" (figure 17 of your AIS). Our data and analysis concur with your findings that the trail alignment is likely placed along the south-eastern portion of the project area. Likely it passed between the south-eastern *iwi* wall (site 31161B) and the *ahu* site 31162B (also corroborating with the alternate interpretation of that site on page 38 of the AIS). (See Exhibit A.) The trail is also likely to qualify as a government-owned trail per the Highways Act of 1892.

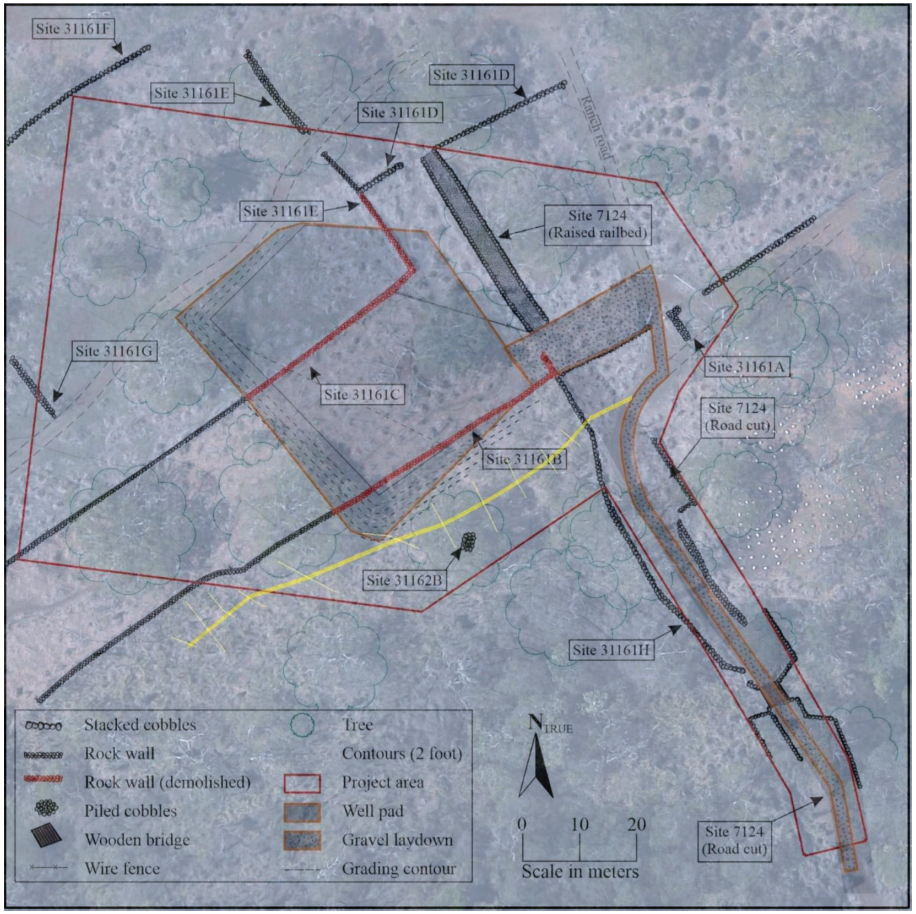
As such, it is imperative that access across this trail is not obstructed by this project's impacts. While there are currently no plans for the State to develop this trail for public use, it is in the best interest of the Public Trust as a State-owned trail to not impede on that possibility, should the means and community will deem public access to be developed. Please update all project maps in the Final Environmental Assessment to reflect the alignment of this trail. I'd be happy to work with you to assist in determining this mapped alignment.

It is also our standard recommendation to allow for a 30-ft no grading/no construction buffer on both sides of trails. This is consistent with archaeological buffers and pedestrian view-sheds nation-wide. See the attached Exhibit B, "Hawaii Island Guidelines for the Treatment of Historic Hawaiian Trails." In the future, project engineers and consultants should consult with our office in the early stages of a project to proactively plan around and/or incorporate trail and access features.

Thank you for the opportunity to provide comments on the subject Draft Environmental Assessment. Please feel free to contact me at 808-657-8041 or jackson.m.bauer@hawaii.gov to discuss any questions or comments you may have.

Cc: State Historic Preservation Division
Land Division, DLNR

EXHIBIT A



Overlay of Figure 15 of the subject project's AIS and satellite imagery. Note the yellow alignment of the *mauka-makai* Honua'ula Trail as depicted on Registered Map 2358 and USGS 1929 Kailua Map. This yellow line was deduced from the perpendicular yellow line segments that show changes in the topography lines that are characteristic of road or trail beds.

Exhibit B

HAWAI`I ISLAND GUIDELINES FOR THE TREATMENT OF HISTORIC HAWAIIAN TRAILS (SUBJECT TO REVISION)

(ADOPTED BY NĀ ALA HELE'S HAWAI`I ISLAND ADVISORY COUNCIL ON MAY 10, 2005. REVISIONS APPROVED ON MAY 23 and NOVEMBER 14, 2012, JANUARY 16, 2013, and April 1, 2020. PHOTOS UPDATED ON JANUARY 20, 2012 and March 22, 2020)

PURPOSE OF THESE GUIDELINES*: The Nā Ala Hele Hawai`i Island Advisory Council recognizes the need to establish guidelines for consistent treatment of historic Hawaiian trails when developments occur adjacent to them (see Appendix A: "Ancient, Historic, and Old Government Trails and Roads in Hawaii: A Summary of Pertinent Law."). Many historic Hawaiian trails are owned in fee simple by the State of Hawai`i. While each situation poses unique circumstances and every case requires individual consideration, certain guiding principles can be agreed-upon. It is hoped that these guidelines will help with NAH Council decision-making and take some of the guess work out of the process for the Council, developers, State and County agencies and the public.* ***This is a working document that is subject to revision, as we find ways to improve upon it. Please check with the Nā Ala Hele Hawai`i Island program to make sure you are using the most current version.***

If the Historic Hawaiian Trail Is Under State Jurisdiction, Consultation with the Nā Ala Hele Hawai`i Island Advisory Council Is Highly Recommended

The Hawai`i Statewide Trail and Access System, known as Nā Ala Hele (NAH), is part of the Department of Land & Natural Resources' Division of Forestry and Wildlife. The program is required to establish advisory councils to solicit advice and assistance in the implementation of the statewide trail and access system. For more information on NAH, visit their website at https://dlnr.hawaii.gov/recreation/.

The Assessments of Trail Values by Nā Ala Hele's Hawai`i Island Program, Archaeologists, & State Historic Preservation Division (SHPD) Can Differ

Archaeological surveys and recommendations for site treatments are reviewed and approved by SHPD. SHPD's assessment of the value of a historic trail is based on its physical condition, archaeological integrity, and cultural significance. A trail's archaeological value (and SHPD's preservation recommendation) is influenced by its present-day state of preservation and whether it is an integral part of a larger complex that is to be preserved.

Hawai`i Island's NAH assessment of the value of a historic trail involves more than its current physical condition. In its assessment of trail values, NAH also considers these factors:

1. evidence that the trail historically existed by examining archaeological reports, historic maps, historic accounts, early surveyors' notes, land deeds, boundary testimonies, and/or cultural impact assessments,
2. whether the trail potentially connects to other trails to form more lengthy routes, and
3. the public purpose served in preserving the trail.

NAH may also recommend "land banking" of trails deemed to have public value when resources are lacking to open them to public use.

Trail Relocation and/or Destruction

It is the Hawai`i Island NAH Advisory Council's (hereinafter "Council") policy that no relocation or destruction of historic trails be approved. Any such decision is done on a case-by-case basis, and many factors must be considered. Assessment of the trail's values (see previous section) is done, and council members may visit the subject area as part of decision-making. Council meetings are open to the public, and public opinion re: trail relocation and/or destruction is considered. Cultural experts, the State's Department of the Attorney General, and NAH's abstractor may need to be consulted. If the development project is receiving federal funds, a Section 106 assessment is required to fully assess and mitigate the development's potential impacts on historic and cultural sites (See Relevant Laws on the last page of this document). Planners, landowners and/or developers are encouraged to contact the Council early in the planning process. This can prevent misunderstandings, premature expenditures, and potentially costly delays.

Trail Restoration, Buffers, and Maintenance

Trail Erosion

When the trail is located in an area vulnerable to potential erosion, provisions for trail relocation in the event of trail erosion should be included in all trail-related agreements and approvals. This is to ensure that the negotiated trail will be usable forever. Water diversion techniques, i.e. waterbars, may need to be employed if water runoff is occurring or potential for soil erosion is present. Information on "Best Management Practices" (BMPs) to prevent or correct erosion problems is available through Nā Ala Hele.

← Hikers are using the relocated trail. The original trail has been eroding away.

Photo taken between Waikoloa and Mauna Lani Resorts.

The trail has been seriously eroded by wave action, and encroaching vegetation makes walking precarious. →
Photo taken at Waiulua Bay in Waikoloa Resort.

Trail Width

Trail widths vary. There are no standard widths. Sometimes widths are apparent through direct trail observation and archaeological studies. Trail widths can change over time if their use transitioned from

walking purposes to other modes of transportation, i.e., horseback, carts, etc. Sometimes widths are specified in land deeds, historic maps, or in County permit documents when trail easements are required.

Buffer Widths

Buffer widths vary. There are no standard widths. The council recommends widths of a minimum of thirty -feet, as measured from the trail's outside edges. This also applies to relocated and restored trails. Buffer widths are determined on a case-by-case basis and consideration is given to the archaeological integrity of the subject trail, view planes, surrounding environment, land uses, land ownership, and nearby natural and cultural features. The Council should be consulted early in the planning process to prevent misunderstandings, premature expenditures, and potentially costly delays.

When buffer widths are too narrow, the experience of "walking in the footsteps" of those who created the trails is lost.

Photo taken in Hualālai Resort where buffers are not being cleared, and thorny bougainvillea is allowed to grow into the trail.

Many present-day Hawaiians can trace their ancestors to villagers who relied upon these trails for their daily survival. Excessively narrow buffers take away from the authenticity of the experience, and damage the feeling of open space and broad landscape in which the trails belong. Adequate buffers and appropriate buffer treatments are essential to the historic trail experience.

Photo taken in Hualālai Resort. Historic trail is being smothered by poorly controlled vegetation.

Photo taken in 49 Black Sand Beach Subdivision in Mauna Lani Resort. Natal plum plants within the narrow buffer are thorny and spreading into the trail.

These examples help to illustrate why it is recommended that no landscaping be done within trail buffers. The trail itself should be kept clear of vegetation.

Photo taken in Kohala Waterfront Subdivision

Photo taken in `Ōuli, South Kohala

Past buffer widths have been shown to be inadequate. The Council's revised buffer width is hereby increased to a minimum of thirty-feet, as measured from the trail's outside edges.

Photo taken in Waikoloa Resort. Trail is the Alanui Aupuni (government road)– built circa. 1860s-1870s. The orange flagging denotes what a thirty-foot wide buffer looks like.

Photo taken in Waikoloa Resort. Orange arrows point to orange flagging denoting the 30-foot wide buffers.

Buffer Treatments

Whether in its original historic condition or a realigned/restored historic trail, no construction should be allowed within the buffers (including utilities, foundations, rock walls of any height, and swimming pools), and the natural, existing terrain and grade should be maintained throughout the buffers. Roads should not be located within trail buffers, unless a breach is approved.

It is recommended that no landscaping be done within trail buffers. Choosing native plants naturally growing in the area, or known to have historically grown there, is the most practical approach, requiring minimal watering and special care. Be careful not to plant noxious weeds that are naturally occurring, such as fountain grass. Thorny and poisonous plants (i.e., bougainvillea and oleander) should also be avoided. Avoid plants that could become invasive, i.e., extensive root systems, exotic ground covers, or prolific seed producers. Certain plants can pose a safety hazard or result in undue maintenance requirements, such as plants that drop large leaves and/or fruits (e.g., coconuts). Avoid plants that are likely to lean or encroach into the trail's buffer. Only hand-clearing within the buffers should be permitted at any time. Responsibility for the maintenance of the breaches and buffers should be clearly detailed in formal agreements.

Laying hazardous obstructions within the trail tread and buffers, no matter how temporary, is an obviously unwise practice.

Photo taken in Hualālai Resort

Breaches

The number and width of breaches should be minimized. The original location of the trail should be restored within the breach, using materials that mimic the historic trail surface. In this manner the breached section will be connected to the original trail on either side. Review of planned breaches by the Council is recommended. Planners and developers are encouraged to request time on Council agendas for that purpose. Additionally, since many historic and ancient trails are still owned by the State of Hawai`i (see Appendix A), easements for the purpose of breaching trails may need to be purchased through the Board of Land and

Natural Resources. Again, consulting with NAH early will prevent misunderstandings, premature expenditures, and potentially costly delays.

← This is the recommended breach surface treatment. It resembles the authentic historic surface while enabling road use.

Photo taken in Waikoloa Resort

← The reddish, smooth cobblestone appearance of this surface treatment is artificial and does not resemble any historic Hawaiian trail surface.

Photo taken in Waikoloa Resort

Treatments Outside of Buffers

Surroundings immediately adjacent to trail buffers greatly influence the trail experience. When trails are near the shoreline, structures (including walls and fences) *ma kai* (seaward) of the trails are discouraged to protect view planes and the historic ambiance. In some locations the natural lava "skin" may be the best choice if earth moving equipment has not already damaged the natural lava surface.

Plant surveys done prior to the area's development can help to identify naturally occurring plants, including plants that were historically in the area. Council members may be able to suggest resource people and sources for native plant materials.

Adjacent Historic, Cultural & Natural Sites and Interpretive Signs

Opening a trail to public use can potentially impact sensitive historic, cultural and natural sites adjacent to the trail. State Historic Preservation Division (SHPD) will often require preservation plans showing how potential impacts of public use will be mitigated. In addition impacts to native Hawaiian customary and traditional rights and practices, and the alleviation of those impacts need to be addressed in trail management.

Burials require special protection. Hawai`i Island's Burial Council (through SHPD) should be consulted for guidance. Certain cultural and natural sites may need to be closed to the public. It is recommended that those concerns be brought to the Council for recommendations and referrals.

It is essential to educate people about the significance of and proper behavior around trails and sensitive sites nearby. Signage can be effective in this regard. Interpretive signage planned for trails and adjacent sites should be reviewed by the Council and SHPD if historic sites are present.

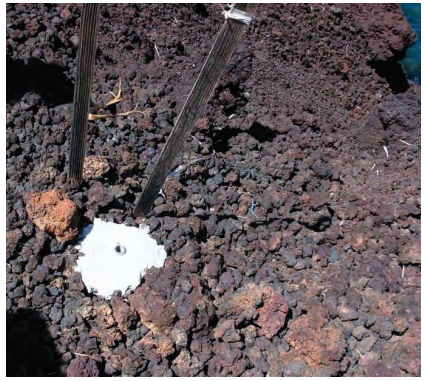


Photo taken in 49 Black Sand Beach Subdivision

Property pins (especially if set in concrete) that denote parcel boundaries, impact the aesthetic appearance, diminish the integrity of historic sites, and are a potential safety hazard. It is recommended (and is allowed under contemporary surveying practices) to place an offset "witness post," at a nominal distance away from the actual boundary corner and indicate on the official survey map record, the distance and angle that the actual corner is located, away from the offset "witness post." This practice meets the legal requirements of identifying the property corner, as well as protecting the integrity of the historic site."

Spray paint used to mark a property boundary in the historic trail's kerbing. This is defacing of a historic site in a National Park. →

Photo taken in Kauleolī, South Kona

Signage should be maintained, attractive and not confusing. Check if standardized signage has been adopted for the particular area.

Photo taken in Hualālai Resort

Signage clutter should be avoided.

Photo taken at `Ōhai`ula Beach

Consolidated signage on one sign post is recommended.

Photo taken at Paniau in Puakō

Public Access Management

Historic Hawaiian trails are a special case because traditionally those trails were in use 24 hours/day. The Council supports continuing that practice for historic trails and routes that (1) are connected to a public road or other historic trails or (2) lead to or follow the shoreline. The Council recognizes that situations may arise in which control of public access is necessary. NAH can assist with balancing security, resource protection, etc. concerns with community access needs.

How to Contact the Hawai`i Island NAH Program and NAH Advisory Council

The Division of Forestry and Wildlife - Nā Ala Hele office can be reached at (808) 974-4221. This contact can connect you to whoever is the current chairperson of the NAH Advisory Council. You can request to be on the agenda for the Council's public meetings.

Links to Relevant Laws

- HRS Chapter 198D is the law that governs the Nā Ala Hele Program. It was first established in 1988.
https://www.capitol.hawaii.gov/hrscurrent/Vol03_Ch0121-0200D/HRS0198D/

- HRS Chapter 6E is Hawai`i's Historic Preservation Law.
https://www.capitol.hawaii.gov/hrscurrent/Vol01_Ch0001-0042F/HRS0006E/

- "Ancient, Historic, and Old Government Trails and Roads in Hawaii: A Summary of Pertinent Law"
https://dlnr.hawaii.gov/recreation/files/2013/09/Highways-Act-Summary.pdf

- For more information on Section 106 Reviews see:
36 CFR PART 800 – PROTECTION OF HISTORIC PROPERTIES: Section 106 Reviews:
https://www.achp.gov/protecting-historic-properties/section-106-process/introduction-section-106

APPENDIX A

Ancient, Historic, and Old Government Trails and Roads in Hawaii
A Summary of Pertinent Law

Hawaii, unlike any other State in the U.S., was originally a sovereign nation - a kingdom. There were certain preexisting laws that were passed on and incorporated into what became laws of the U.S. Territory, and then ultimately, of the State. In relation to trails, the following two citations describe the legal tools used by the Na Ala Hele Program to identify and possibly claim public ownership of specific features:

The Highways Act of 1892

In October of 1892, Queen Liliuokalani approved law that determined that the ownership of all public highways and the land, real estate and property of the same, shall be in the Hawaiian Government in fee simple. The definition of public highway includes all existing trails at the time "or hereafter opened, laid out or built by the Government, or by private parties, and dedicated or abandoned to the public as a highway, are hereby declared to be public highways." Furthermore, "All public highways once established shall continue until abandoned by due process of law".

Chapter 264-1(b), Hawaii Revised Statutes (HRS)

The following HRS furthers the intent of the Highways Act:

All trails, and other nonvehicular rights-of-way in the State declared to be public rights-of-way by the Highways Act of 1892, or opened, laid out, or built by the government or otherwise created or vested as nonvehicular public rights of way at any time hereafter, or in the future, are declared to be public trails. A public trail is under the jurisdiction of the State Board of Land and Natural Resources - unless it was created by or dedicated to a particular county, in which case it shall be under the jurisdiction of that county. All State trails once established shall continue until lawfully disposed of pursuant to Chapter 171, HRS.

What this means

If the State can document the existence of a trail prior to 1892, and the feature has not been disposed of pursuant to Chapter 171, the State may claim the trail. This applies even if the trail does not currently exist on the ground physically - in many instances trail sections have been destroyed over time due to various land uses or natural process. While a landowner may not adversely possess State land, the burden of proof is upon the State to document ownership. This can be adverse to adjacent private landowners, and may create the necessity for legal action.

Prior to promotion for public use, a necessary (and sometimes costly) step is to reconcile the historic documentation with an on-the-ground metes and bounds survey.

It is imperative to confirm that the identified trail is the same alignment that was originally in existence prior to 1892. Trail routes can migrate over time for numerous reasons, creating legal challenges to the application of the laws cited above. Other necessary steps include the creation of a cultural survey and management plan, and then establishing a trail restoration, maintenance and signage program.

PLANNING SOLUTIONS

November 23, 2020

Mr. Jackson Bauer, Trails and Access Specialist
Nā Ala Hele Trails and Access Program,
Division of Forestry and Wildlife
Department of Land and Natural Resources, State of Hawai'i
19 E. Kawili Street
Hilo, Hawai'i 96720

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Mr. Bauer,

Thank you for your October 23, 2020 letter concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response. To simplify your review, we have reproduced your comments in italics, followed by our response.

Comment 1:

While no archaeological evidence of trails was observed by your archaeological inventory survey, there are several records of a major mauka-makai trail that goes through this project area. This is seen in 1929 USGS maps (Figure 18 of your AIS) and in the 1906 Registered Map No. 2358, where the alignment is described by the surveyor George Wright as an "old trail" (figure 17 of your AIS). Our data and analysis concur with your findings that the trail alignment is likely placed along the south-eastern portion of the project area. Likely it passed between the south-eastern iwi wall (site 31161B) and the ahu site 31162B (also corroborating with the alternate interpretation of that site on page 38 of the AIS). (See Exhibit A.) The trail is also likely to qualify as a government-owned trail per the Highways Act of 1892.

As such, it is imperative that access across this trail is not obstructed by this project's impacts. While there are currently no plans for the State to develop this trail for public use, it is in the best interest of the Public Trust as a State-owned trail to not impede on that possibility, should the means and community will deem public access to be developed. Please update all project maps in the Final Environmental Assessment to reflect the alignment of this trail. I'd be happy to work with you to assist in determining this mapped alignment.

Response: The limited documentary evidence of this trail and its location, as represented on these two historic maps and described in the sources referenced in the AIS, do seem to support the assertion that a foot trail existed in or near the project site prior to 1892. Thank you for noting that the trail is also likely to qualify as a government-owned trail per the Highways Act of 1892.

The interpretation of the trail's alignment shown in Exhibit A of your comment letter is deduced from, "changes in the topography lines that are characteristic of road or trail beds," interpreted from the 2-foot topographic contour lines represented on a map in the Archaeological Inventory Survey (AIS). Nā Ala Hele's (NAH) interpretation of the alignment veers noticeably toward the southwest corner of the proposed well pad.

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Phone: 808-550-4483 • www.psi-hi.com

During preparation of the AIS, ASM Affiliates (ASM) staff members made two visits to the project area. The topography they observed in the field is not as limiting as the NAH interpretation of the trail suggests. Hence, they firmly believe that if a precisely defined trail ever existed in the proposed project area, it could have been located anywhere in the roughly 90-foot wide corridor between the rock wall and the steep terrain leading to the gulch. Assuming that the rock mound (Site 31162B) identified in this area is a cairn or ahu marking the trail, then ASM would interpret the hypothetical centerline of the trail corridor to be located closer to the rock mound, making the trail pass more than 30 feet from the well pad.

Comment 2:

It is also our standard recommendation to allow for a 30-ft no grading/no construction buffer on both sides of trails. This is consistent with archaeological buffers and pedestrian view-sheds nationwide. See the attached Exhibit B, "Hawaii Island Guidelines for the Treatment of Historic Hawaiian Trails." In the future, project engineers and consultants should consult with our office in the early stages of a project to proactively plan around and/or incorporate trail and access features.

Response:

Given the lack of a physical trail visible on the ground, ASM's interpretation of the centerline passing close to the rock mound (Site 31162B) would allow for a trail corridor that provides sufficient buffer on either side of the trail. The 30-foot recommendation is noted and appreciated.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

Makena

Makena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Comment No. 13

TO: Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, Hawaii 96813 United States

Hawaii County Department of Water Supply
345 Kekuanaoa Street, Suite 20
Hilo, Hawaii 96720 United States

DATE: October 23, 2020

FROM: Loke Aloua
PO Box 584
Kailua-Kona, HI 96740

RE: North Kona Mid-Level Exploratory Well Project

To whom it may concern,

I am writing this letter in response to the "Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)." ***Upon review of the document I conclude that it is inadequate and have the following questions***:

- What are the impacts to ground water dependent ecosystems and species? What monitoring is in place for documentation?
- What are the impacts to threshold levels for native species and their reproduction cycles? What monitoring is in place for documentation?
- What are the impacts to groundwater distribution to near shore and coastal ecosystems? What monitoring is in place for documentation?
- What are the impacts to traditional and customary practices? What assessments have been conducted to ensure that public trust in water resources is maintained, protected, and enhanced? How might water extraction activities irreparably alter ecosystems and cultural practices?
- What consultation processes have taken place with the Aha Moku Councils and where is documentation?
- What are the impacts of mid-level wells on basal aquifer and supporting scientific research for such claims?

- What are the impacts of climate change and drought on recharge rates and water trends? How do these plans align with those proposed in Drought Planning listed in the Water Resource Protection Plan (2019)?
- How does this plan align with the guidelines listed in the Water Resource Protection Plan (2019) regarding existing and future demands? What reassessments and/or reviews of land use planning and development in conjunction with water availability have been completed or are underway by the Hawaiʻi Department of Water Supply?

Based on my experience as a kamaʻāina and kiaʻi loko it is in my opinion that it is more likely than not a significant, adverse impact will occur as a result of this project and an EIS should be prepared. This more intensive assessment will provide a holistic view of the project's impacts. The aquifer cannot sustain capitalistic driven, created, and centered water plans. Long term management of water resources that places equal value on the environment, public trust of water resources, impacts to cultural practices, and actual projections of long term water availability given climatic disasters are needed. Please conduct an EIS for a more thorough investigation.

Mahalo,

Loke Aloua

PLANNING SOLUTIONS

November 23, 2020

Ms. Loke Aloua
P.O. Box 584
Kailua-Kona, Hawai'i 96740

Subject: Draft Environmental Assessment (DEA) for the North Kona Mid-Level Exploratory Well Project

Dear Ms. Aloua,

Thank you for your October 23, 2020 letter concerning the Department of Water Supply's (DWS) *Draft Environmental Assessment for the North Kona Mid-Level Exploratory Well Project* (DEA). We appreciate the time you spent reviewing the DEA and offering your response. To simplify your review, we have reproduced your comments in italics, followed by our response.

Comment 1:

Upon review of the document I conclude that it is inadequate and have the following questions:

Response: Mahalo for expressing your opinion. Because you have not provided any information regarding the basis for your conclusion that the DEA is inadequate, it is not possible for the DWS to address this assertion.

Comment 2:

What are the impacts to ground water dependent ecosystems and species? What monitoring is in place for documentation?

Response: The DEA contains a detailed discussion of biota on and near the project site, and includes the complete *Flora and Fauna Survey for North Kona Mid-Level Exploratory Well Project, Honua'ula, North Kona, Hawai'i Island* as Appendix B. The conclusion of that survey report is that the proposed exploratory well will not have any adverse impact on area biota.

The proposed project is approximately one mile north of Wai'aha Stream, the only perennial stream in the North Kona District and, as stated in Section 3.3.2.1, does not involve any activities that would alter existing stream channels, wetlands, or other surface water bodies. The withdrawal rate and duration of the pump-testing that would be conducted are far too limited for it to alter groundwater flow in any substantial way. In light of these findings, DWS believes that the proposed exploratory well does not have the potential to impact groundwater dependent ecosystems. The pump tests that are planned will be carefully monitored to provide detailed information regarding such things as the amount of drawdown at different pumping rates, the rate of recovery following the termination of pumping, and the quality of the water that is obtained. This information will allow the DWS to determine if it is appropriate to seek to establish a production well facility at this location.

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Comment 3:

What are the impacts to threshold levels for native species and their reproduction cycles? What monitoring is in place for documentation?

Response: The proposed exploratory well will be drilled and pump tested for a period of no more than 96 hours to assess the extent of the water resource. The small amount and short duration of the planned pumping is such that it does not have the potential to adversely affect native species. Because of this, monitoring will be limited to that described in Section 2.1.2 of the DEA.

Comment 4:

What are the impacts to groundwater distribution to near shore and coastal ecosystems? What monitoring is in place for documentation?

Response: As stated in Section 3.3.2.2., the relatively brief exploratory well test is not expected to affect groundwater discharge into the ocean or impact groundwater distribution in nearshore areas that might affect coastal ecosystems. Consequently, the only monitoring will be as referenced above.

Comment 5:

What are the impacts to traditional and customary practices? What assessments have been conducted to ensure that public trust in water resources is maintained, protected, and enhanced? How might water extraction activities irreparably alter ecosystems and cultural practices?

Response: The DWS, as part of the planning for the proposed North Kona Mid-Level Exploratory Well Project, worked with ASM Affiliates to prepare a Cultural Impact Assessment (CIA). The resulting report, *A Cultural Impact Assessment for the Exploratory Phase of the Department of Water Supply Honua'ula Mid-level Well, TMK (3) 7-5-003:001 (por.), Honua'ula Ahupua'a, North Kona District, Island of Hawai'i*, provides the basis for the information and analysis summarized in Section 3.12 of the DEA. The complete report is also included as Appendix D of the DEA. None of the parties consulted during preparation of the CIA opposed the proposed exploratory well. In addition, none of the consulted parties were aware of any traditional or customary practices, beliefs, or resources associated with the Project site, including any burials in the area. Consistent with recommendations contained in the CIA, DWS will ensure that the construction contract for the exploratory well project provides for an archaeological monitor to be present during earthwork activities. It will also require that in the event that any archaeological, historic, or cultural property including iwi (i.e., skeletal remains), are identified during earthmoving activities, the contractor will immediately cease work in the vicinity of the find, protect the area from additional disturbance, and contact SHPD for subsequent guidance.

Comment 6:

What consultation processes have taken place with the Aha Moku Councils and where is documentation?

Response: During preparation of the DEA, on July 29, 2020 a scoping letter was sent to the 'Aha Moku Advisory Committee, along with several other agencies, organizations, and individuals, requesting their review and comment. This scoping process and recipients are addressed in Section 7.1 and Table 7.1 of the DEA. No response to the scoping letter was received from the 'Aha Moku Advisory Committee. For documentation, a copy of the consultation letter and all responses received were included at the end of Chapter 7 of the DEA.

Comment 7:

What are the impacts of mid-level wells on basal aquifer and supporting scientific research for such claims?

Response: The potential impacts to the basal aquifer resulting from implementation of the North Kona Mid-Level Exploratory Well Project, and the supporting scientific data upon which the impact analysis is based, are addressed in Section 3.3 of the DEA.

Comment 8:

What are the impacts of climate change and drought on recharge rates and water trends? How do these plans align with those proposed in Drought Planning listed in the Water Resource Protection Plan (2019)?

Response: Climate change as it relates to the proposed North Kona Mid-Level Exploratory Well Project is addressed in Section 3.9 of the DEA. The Intergovernmental Panel on Climate Change (IPCC) has predicted that: (*i*) the average temperature in the Hawaiian Islands is likely to increase by 0.5 to 1.5 °C or 0.9 to 1.7 °F by 2100, (*ii*) rainfall is likely to decrease by, at most, 10 percent, and (*iii*) sea level could rise between 0.26 to 0.98 m or 0.85 to 3.2 feet (IPCC, 2013). These trends will make themselves felt over decades and will not have a significant effect impact of the proposed exploratory well project.

With regard to the *Water Resource Protection Plan Update* (WRPPU, 2019), the proposed exploratory well is representative of the type of long-range water resource planning called for in Section 1.2 of that report. The Commission on Water Resource Management, which prepared that WRPPU, has acknowledged in their October 20, 2020 letter commenting on the DEA that further investigation of the deep aquifer as a potential source to replace basal sources is needed, and that the proposed exploratory well will aid in this investigation.

Comment 9:

How does this plan align with the guidelines listed in the Water Resource Protection Plan (2019) regarding existing and future demands? What reassessments and/or reviews of land use planning and development in conjunction with water availability have been completed or are underway by the Hawai'i Department of Water Supply?

Response: Section 1.3 of the WRPPU (2019) identifies thirteen Policies that are intended to guide decision-making regarding water resource planning and management. *Guiding Policy 7* states that, "Comprehensive

water resources planning is needed for proper management and protection of the resource." As noted throughout the DEA, the North Kona Mid-Level Exploratory Well Project is investigative in nature and intended to help DWS evaluate a potential source of potable water for the North Kona region. It does not involve any sustained withdrawals from the Keauhou Aquifer and will not damage the environment or biosphere. It is intended to enrich DWS' understanding of water resources in the North Kona region and allowing it to plan for and accommodate anticipated growth in that area. The project's consistency with all relevant plans, policies, and controls is provided in Chapter 4 of the DEA.

Comment 10:

Based on my experience as a kama'āina and kia'i loko it is in my opinion that it is more likely than not a significant, adverse impact will occur as a result of this project and an EIS should be prepared. This more intensive assessment will provide a holistic view of the project's impacts. The aquifer cannot sustain capitalistic driven, created, and centered water plans. Long term management of water resources that places equal value on the environment, public trust of water resources, impacts to cultural practices, and actual projections of long term water availability given climatic disasters are needed. Please conduct an EIS for a more thorough investigation.

Response: The DWS has prepared the DEA and forthcoming Final Environmental Assessment (FEA) pursuant to Hawai'i Revised Statutes, Chapter 343 and its implementing regulations contained in Hawai'i Administrative Rules, Title 11, Chapter 200.1. Based on the evaluation documented in the DEA, DWS believes that the proposed North Kona Mid-Level Exploratory Well Project will have no significant adverse impacts on the environment based on the thirteen significance criteria provided in HAR §11-200.1-13. A complete discussion of each criterion and the project's consistency with them is contained in Chapter 5 of the DEA. In view of the foregoing, it anticipates issuing a Finding of No Significant Impacts for the project rather than preparing an EIS.

A copy of the FEA will be provided to you when it becomes available. In the meantime, if you have any questions or concerns in the future regarding this project, please contact me at (808) 550-4538.

Sincerely,

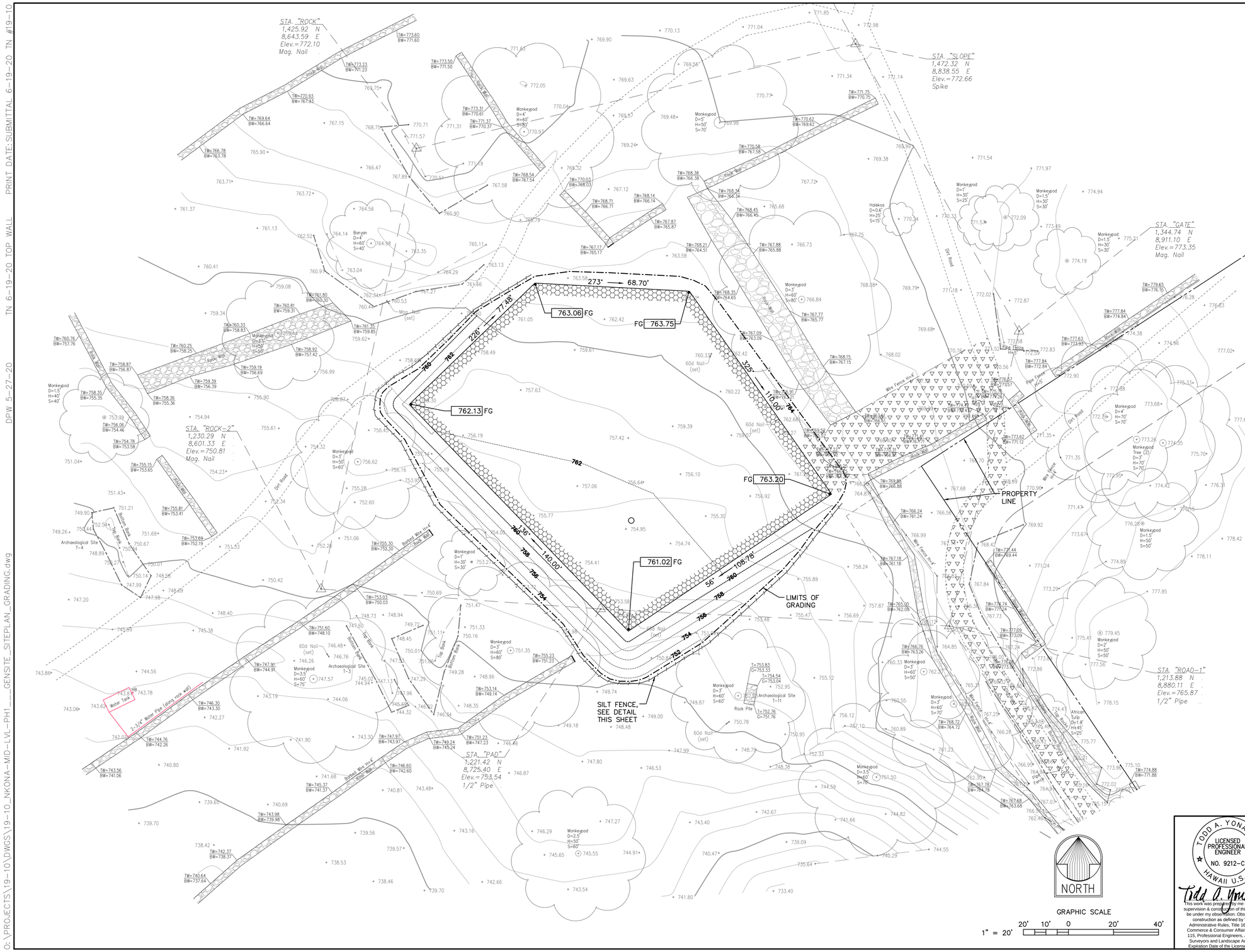
Mākena

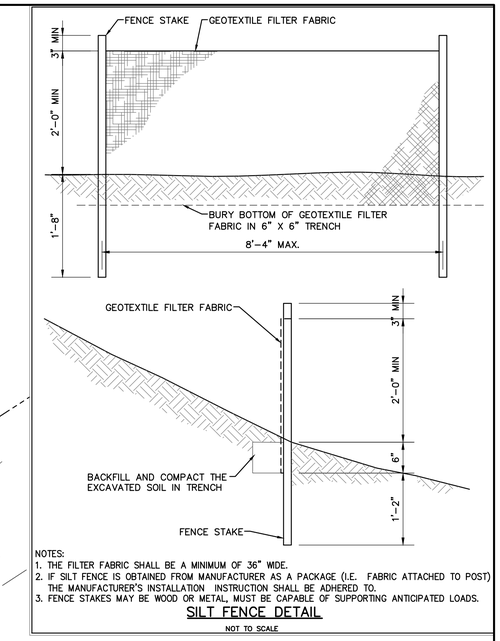
Mākena White, AICP
Planner

cc: Jason Killam, DWS (via electronic mail only)
Greg Fukumitsu, TNWRE (via electronic mail only)

Appendix A. Grading Plan

DPW 5-27-20 TN 6-19-20 TOP WALL PRINT DATE:SUBMITTAL 6-19-20 TN #19-10





NOTES:
1. THE FILTER FABRIC SHALL BE A MINIMUM OF 36" WIDE.
2. IF SILT FENCE IS OBTAINED FROM MANUFACTURER AS A PACKAGE (I.E. FABRIC ATTACHED TO POST) THE MANUFACTURER'S INSTALLATION INSTRUCTION SHALL BE ADHERED TO.
3. FENCE STAKES MAY BE WOOD OR METAL, MUST BE CAPABLE OF SUPPORTING ANTICIPATED LOADS.

SILT FENCE DETAIL

NOT TO SCALE

ESTIMATED EARTHWORK QUANTITIES
(FOR ENGINEERING PURPOSES ONLY)

EXCAVATION = 1.0 CY
EMBANKMENT = 3356 CY
TOTAL GRADED AREA= 0.53 AC

LEGEND:

- 4" GRAVEL BASE COURSE ON EXISTING DIRT ROAD
- 6" GRAVEL BASE COURSE ON COMPACTED SUBGRADE
- SILT FENCE
- LIMITS OF GRADING

REVISION	DATE	DESCRIPTION	BY	APPROVED BY	APPROVED DATE

TODD A. YONAMINE
LICENSED PROFESSIONAL ENGINEER
NO. 9212-C
HAWAII U.S.A.

This work was prepared by me or under my supervision & construction of this project will be under my observation. Observation of construction as defined by "Hawaii's Administrative Rules, Title 16, Dept. of Commerce & Consumer Affairs, Chapter 115, Professional Engineers, Architects, Surveyors and Landscape Architects." Expiration Date of the License: 4-30-22

DEPARTMENT OF WATER SUPPLY
COUNTY OF HAWAII

PROJECT: NORTH KONA MID-LEVEL DEEP WELL DEVELOPMENT - PHASE 1

GRADING PLAN

JOB NO. 2018-1101 / EWO NO. 2019-014

SHEET C-5 OF . SHEETS

O:\PROJECTS\19-10\DWGS\19-10_NKONA-MID-LVL-PH1____GENSITE_SITEPLAN_GRADING.dwg

Appendix B. Biological Survey Report

Report of Findings

Flora and Fauna Survey for
North Kona Mid-Level Exploratory Well Project, Honuaula, North Kona, Hawaii Island

Prepared for:
Planning Solutions, Inc.
Pacific Park Plaza, Suite 950
711 Kapiolani Boulevard
Honolulu HI 96813

Prepared by:
LeGrande Biological Surveys, Inc.

August 2020

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INTRODUCTION

This report includes the findings of a plant and animal inventory conducted at the proposed North Kona Mid-Level Exploratory Well Project on the Island of Hawaii in Honuaula, North Kona [approximately .5 acres of portion of TMK: (3) 7-5-003:001]. The primary objectives of the field studies were to inventory the plants and animals located within the project area and in the near vicinity and provide a general description of the vegetation on the project site and access road, note animal species, and search for threatened and endangered species as well as species of concern. The federal and State of Hawaiʻi listed species status follows species identified in the following referenced documents, Department of Land and Natural Resources (DLNR 1998, 2014); U. S. Fish & Wildlife Service (USFWS 2019).

SITE DESCRIPTION

The project area includes the dirt access road originating from the end of the paved portion of Hienaloli Road, the project site itself which includes the Mid-Level Well location, and an area for staging and storage for the contractor. The entire area is characterized by an alien wet forest dominated by introduced (non-native) plant species.

Principal soil types within the study area include Kainaliu Silty Clay Loam [221], and Kainaliu-Waiaha Complex [227]. (NRCS, 2020). Photographs of the project area are found in Appendix A.

SURVEY METHODS

This study was conducted by biologist Maya LeGrande (LeGrande Biological Surveys Inc.). Prior to conducting fieldwork, the biologist reviewed existing scientific literature, older environmental impact assessments and statements, biological survey reports, topographic maps and images, and engineering drawings relevant to the proposed project. Field data was collected on July 24, 2020.

Plants were inventoried during a pedestrian survey along the access road as well as the proposed area of impact. Notes were collected on plant associations and plant distribution, disturbances, topography, substrate types, exposure, drainage, and related factors. Ornamental plants that are planted or used for landscaping or agricultural activities were not included in the species list but included in the discussion.

Faunal surveys involved walking within the proposed project area and noting all bird species observed. Birds were identified by sight using the naked eye and 10x binoculars, and by songs and calls. Observations of mammals, amphibians, reptiles, and insects were made incidental to the avian vegetation survey. No effort was made to develop quantitative estimates of mammal populations within the project area.

SURVEY RESULTS

Vegetation

Prior to conducting fieldwork, we reviewed the U.S. Fish and Wildlife database (USFWS 2010a) in order to determine if any Threatened or Endangered taxa are known to reside within the study area or in close proximity.

A total of 65 plant species were observed within the survey area. These species are listed in Appendix B. Sixty-four of the 65 species observed, or over 98%, are not naturally occurring in Hawaii. None of the plant species observed are listed as a threatened or endangered species, or a species of concern (U.S. Fish and Wildlife Service, 2015) within the study area.

Open Pasture

The project site is currently utilized for ungulate (cow) pasture. Dominated by grassy areas for foraging with sections of thick shrub vegetation. Tree species scattered in or around the edges of the pastures include, monkeypod (*Samanea saman*), Christmas berry (*Schinus terebinthifolius*), Chinese banyan (*Ficus macrocarpa*), and koa haole (*Leucaena leucocephala*). Grass species include Guinea grass (*Panicum maximum*), kikuyu (*Pennisetum clandestinum*), California grass (*Brachiaria mutica*) and elephant grass (*Pennisetum purpureum*). Other trees observed in the area include, mango (*Mangifera indica*), octopus tree (*Schefflera actinophylla*), and white mulberry (*Morus alba*).

Access Road

The access road originates at the end of the paved portion of Hienaloli Road. There are a total of four gates to cross through and a wooden bridge (see description below 'Intermittent Stream'). The roadway is dominated by overgrown Guinea grass, monkey pod trees, African tulip (*Spathodea campanulata*), and wild bean (*Macroptilium lathyroides*). The only native plant was liana climbing through trees along the roadside. Hoi kuahiwi (*Smilax melastomafolia*) is a relatively common widespread native plant found on all of the main Hawaiian Islands.

Intermittent Stream

The intermittent stream that transects the access road does not appear to have a designated name. Sometimes referred to as the Kailua-Kona Stream (DLNR, 2007). A basic wooden bridge is in place for vehicular crossing. Vegetation on the banks of the stream include large stands of elephant grass, castor bean (*Ricinus communis*), bitter melon (*Momordica charantia*), coffee (*Coffea arabica*), Mysore thorn (*Caesalpinia decapetala*), spiny amaranth (*Amatranthus spinosa*), koa haole (*Leucaena leucocephala*), and Chinese violet (*Asystasia gangetica*).

Wildlife

A total of 8 bird species were observed on the proposed project site during the site visit, of which all are alien (non-native) (Table 1).

No endangered waterbirds were observed, and no wetland habitat was found that would be suitable for waterbirds. The stream bed at the crossing was dry during the survey date.

The endemic Hawaiian short-eared owl or *pueo* (*Asio flammeus sandwichensis*) occupy a variety of habitats and are most common in open habitats including grasslands and shrublands, often in urban areas. It is a ground nesting species, and thus sensitive to land clearing activities. Its key habitat requirements are difficult to determine due to a lack of historical population data. Pueo were not observed, but it is possible that it could occasionally use the grassy habitat in this area.

Table 1. Birds Observed Within the proposed project site during site visit on July 24, 2020

The following list is an inventory of the bird species observed at the proposed project site. It is possible that additional introduced bird species are present in the area and might be seen with greater survey effort. The names are arranged in generally accepted phylogenetic order and named in accordance with the American Ornithologists Union Checklist (2005).
Status codes:
X=Alien species introduced to the Hawaiian Islands by humans, intentionally or accidentally.

SCIENTIFIC NAME	COMMON NAME	STATUS
GALLIFORMES-PHEASANTS		
Lophura leucomelanos	Kalij pheasant	X
COLUMBIDAE – PIGEONS AND DOVES		
Geopelia striata	Zebra dove	X
ZOSTEROPIDAE – WHITE-EYES		
Zosterops japonicas	Japanese white eye	X
STURNIDAE – MYNAS AND STARLINGS		
Acridotheres tristis	Common Myna	X
PSITTACIFORMES-PARAKEET		
Psittacara mitratus	mitred parakeet	X
RINGILLIDAE – FINCHES		
Haemorhous mexicanus	House Finch	X
Paroaria coronate	Red-crested Cardinal	X
ESTRILDIDAE – WAXBILLS AND MANNIKINS		
Lonchura oryzivora	Java Sparrow	X

Indian mongoose (*Herpestes a. auropunctatus*) were observed within the survey area. Norway rats (*Rattus norvegicus*), Polynesian rats (*Rattus exulans hawaiiensis*), Roof rats (*Rattus r. rattus*), and European house mice (*Mus domesticus*) most likely also inhabit the project area although none were observed during our surveys. Both the feral pigs (*Sus scrofa*) and cattle (*Bos taurus*) were observed frequently in the project area. These introduced mammals are known to have detrimental impacts upon populations of native wildlife, and also serve as a means of passive transport for propagules of invasive and noxious plants.

DISCUSSION & RECOMMENDATIONS

The results of the fieldwork represent a one-time snapshot of the wildlife and plants inhabiting the survey area. As such, these data cannot be considered a definitive list of all species that

utilize habitats within the project area. Many species are diminutive and cryptic in nature making observation difficult. Other species are nocturnal and/or may use the area infrequently depending upon season, weather, interaction with other species, and dynamic changes in their populations. However, when considered together with the results of historical surveys, we can compile a reasonably accurate description of the environment and biota of the project area.

Plant and wildlife habitats within the proposed project area have been highly modified by human activities, including the intentional and accidental introduction of alien species. Almost all of the plant and bird species observed within the subject property are introduced. No regulated wetlands or other areas of environmental concern were noted during the present survey. The National Wetland Inventory (NWI) (2020) has no mapped wetlands within the project area, excepting the intermittent stream that crosses the access road. There are no designated Critical Habitat units within the project area.

The proposed well project should have no long term detrimental effects on the avian resources of the area. None of the bird species observed at the proposed project are listed as endangered or threatened.

The Hawaiian hoary bat (*Lasiurus cinereus semotus*), which is listed as endangered by the U.S. Fish and Wildlife Service and the State of Hawaii, is known to occur in the general region and could forage or roost in the project area. Hawaiian hoary bats roost during the day in native and alien trees and other woody vegetation. During the bat breeding season (June-September), young bats may be left unattended in nursery trees while the adults are out foraging. If any woody vegetation taller than about 15 feet is to be cut during the proposed work, performing the work outside the bat breeding season would help to avoid killing or injuring young bats.

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APPENDIX A- SITE PHOTOGRAPHS

Figure 1. Second gate on access road (first gate at end of Hienaloli Road) coffee farm at left.

Figure 2. Third gate on access road. Monkey pod, Guinea grass, and bitter melon along roadsides.

Figure 3. Fourth gate along access road project area, staging and storage, and well site.

Figure 4. Basic wooden bridge spans stream along access road.

Figure 5. Guinea grass, monkey pod, and koa haole are prevalent near the staging and storage area (to right).

Figure 6. Looking towards well site area. Same vegetation as the rest of the project site.

APPENDIX B: PLANT SPECIES LIST

The following checklist is an inventory of all the plant species observed within the proposed North Kona Mid-Level Exploratory Well project site. The plant names are arranged alphabetically by family and then by species into each of three groups: Pteridophytes, Monocots and Dicots. The taxonomy and nomenclature of the Ferns and Fern Allies follow Palmer (2002), flowering plants (Monocots and Dicots) are in accordance with Wagner *et al*. (1990), Wagner and Herbst (1999) and Staples and Herbst (2005). Recent name changes are those recorded in the Hawaii Biological Survey series (Evenhuis and Eldredge, eds., 1999-2002). For each species, the following name is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:

   E= Endemic= native to the Hawaiian Islands and nowhere else.

   P = Polynesian species introduced to Hawaii in the course of Polynesian migrations prior to western contact.

   X=introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact, that is Cook's arrival in the islands in 1778

SCIENTIFIC NAME	COMMON NAME	STATUS
PTERIDOPHYTES		
POLYPODIACEAE		
Phymatosorus grossus (Langsd.&Fisch.) Brownlie	laua`e	X
MONOCOTS		
ARECACEAE		
Cocos nucifera L.	coconut	P
CYPERACEAE		
Kyllinga nemoralis (J.R.Forst. & G.Forst.) Dandy ex Hutch. & Dalziel	kili o'opu	X
PLANTAGINACEAE		
Plantago major L.	common plantain	X
POACEAE		
Axonopus compressus (Sw.) P.Beauv.	carpet grass	X
Brachiaria mutica (Forssk.) Stapf	California grass	X
Cenchrus ciliaris L.	buffelgrass	X
Chloris barbata (L.) Sw.	swollen fingergrass	X
Chloris gayana Kunth	Rhodes grass	X
Cynodon dactylon (L.) Pers	manienie	X

Digitaria insularis (L.) Mez ex Ekman	sourgrass	X
Eragrostis tenella (L.) P.Beauv. Ex Roem.&Schult.		X
Melinus repens (Willd.) Zizka	natal redtop	X
Panicum maximum L.	Guinea grass	X
Pennisetum clandestinum	kikuyu	*X*
Pennisetum purpureum Schumach	elephant grass	X
Sporobolus indicus (L.) R.Br.	west indian dropseed	X
SMILACEACEAE		
Smilax melastomifolia Sm.	hoi kuahiwi	E

DICOTS

ACANTHACEAE		
Asystasia gangetica (L.) T. Anderson	Chinese violet	X
AMARANTHACEAE		
Amaranthus spinosus L.	spiny amaranth	X
Amaranthus viridis L.	slender amaranth	X
ANACARDIACEAE		
Mangifera indica L.	mango	X
Schinus terebinthifolius Raddi	Christmas berry	X
ARALIACEAE		
Schefflera actinophylla (Endl.) Harms	octopus tree	X
ASTERACEAE		
Ageratum houstonianum Mill.	maile honohono	X
Bidens alba (L.) DC. var. *radiata* Ballard ex Melchert	beggar tick	X
Pluchea carolinensis (Jacq.) G. Don	sourbush	X
Tridax procumbens (L.)	coat buttons	X
Verbesina encelioides (Cav.) Benth. & Hook	golden crown-beard	X
BEGONIACEAE		
Begonia hirtella Link	begonia	X
BIGNONIACEAE		
Spathodea campanulata P.Beauv.	African tulip	X
BRASSICACEAE		
Lepidium virginicum L.	pepperwort	X
CARYOPHYLLACEAE		
Drymaria cordata var. *pacifica* M.Mizush.	pipili	X
COMMELINACEAE		
Commelina diffusa Burm.f.	honohono	X
CONVOLVULACEAE		
Ipomoea obscura (L.) Ker Gawl.		X
CUCURBITACEAE		
Momordica charantia L.	bitter melon	X

EUPHORBIACEAE		
Euphorbia heterophylla L.	kaliko	X
Euphorbia hirta (L.) Millsp.	hairy spurge	X
Euphorbia hypercifolia (L.) Millsp.	graceful spurge	X
Ricinus communis L.	castor bean	X
FABACEAE		
Caesalpinia decapetala (Roth) Alston	Mysore thorn	X
Chamaecrista nictitans (L.) Moench	partridge pea	X
Crotalaria incana L.	fuzzy rattlepod	X
Crotalaria pallida Aiton	smooth rattlepod	X
Desmanthus pernambucanus (L.) Thell.	slender or virgate mimosa	X
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X
Indigofera hendecaphylla Jacq.	creeping indigo	X
Leucaena leucocephala (Lam.) de Wit	koa haole	X
Macroptilium lathyroides (L.) Urb.	wild bean	X
Samanea saman (Jacq.) Merr.	Monkeypod	X
Senna pendula var. *advena* (Vogel) H.S.Irwin&Barneby	pendant senna	X
LAMIACEAE		
Leonotis nepetifolia (L.) R.Br.	lion's ear	X
MALVACEAE		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X
Malva parviflora L.	cheese weed	X
Sida rhombifolia L.		X
MORACEAE		
Ficus microcarpa L.f.	Chinese banyan	X
Morus alba L.	white mulberry	X
OXALIDACEAE		
Oxalis corniculata L.	yellow wood sorrel	X
PASSIFLORACEAE		
Passiflora edulis Sims	lilikoi, passion fruit	X
PHYTOLACCACEAE		
Rivina humilis L.	coral berry	X
PROTEACEAE		
Macadamia sp.	Macadamia	X
RUBIACEAE		
Coffea Arabica L.	Arabian coffee	X
Morinda citrifolia L.	noni	P
RUTACEAE		
Murraya paniculata (L.) Jack	mock orange	X

Appendix C. Archaeological Inventory Survey

Archaeological Inventory Survey for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well

TMK: (3) 7-5-003:001 (por.)

Honua‘ula Ahupua‘a
North Kona District
Island of Hawai‘i

DRAFT VERSION

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ASM Project Number 34190.00

An Archaeological Inventory Survey for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well

TMK: (3) 7-5-1:003 (por.)

Honua‘ula Ahupua‘a
North Kona District
Island of Hawai‘i

ASM affiliates

EXECUTIVE SUMMARY

At the request of Tom Nance Water Resource Engineering, on behalf of their client the State of Hawai‘i Department of Water Supply, ASM Affiliates (ASM) conducted an archaeological inventory survey (AIS) of a of a roughly 2.9 acre project area comprising a portion of TMK: (3) 7-5-003:001 within Honua‘ula Ahupua‘a, North Kona District, Island of Hawai‘i. The project area includes a drill pad site and an unpaved access road that will be improved by laying down gravel over the existing road surface. Within this area, the proposed project will include grubbing, grading, and drilling a test well. No ground disturbance in the access road corridor along Hienaloli road, but steel plates will be lain across an existing wooden bridge. The current AIS was conducted in support of environmental documentation being prepared to comply with Hawai‘i Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division’s (DLNR-SHPD) HRS Chapter 6E-8 review of the proposed project.

Fieldwork for the current study was conducted on February 24 and March 3, 2020, by Genevieve Glennon, B.A., ‘Iolani Ka‘uhane, B.A., and Benjamin Barna, Ph.D. (Principal Investigator). A total of 40 person-hours were expended during the fieldwork. During the archaeological field survey, the entire (100%) ground surface of project area was visually inspected by field technicians walking transects oriented north-south, spaced at no more than 10 meters apart. A thorough search for an “old trail” depicted on historic maps was made by clearing vegetation and walking transects oriented perpendicular to the depicted trail route and spaced 3 meters apart. Subsurface testing consisted of one test unit (TU-1) excavated to ascertain the function and age of one identified archaeological feature. No cultural material was collected from the ground surface or test excavations.

Site 50-10-28-7124 is the railroad bed of the former West Hawaii Railroad. A 160-meter-long discontinuous portion of the railroad bed extends through the current project area. Within the project area, the site consists of a 35-meter-long berm and approximately 130 meters of roadbed that has been cut across the prevailing slope. At the southern end of the project area, a wooden bridge crosses the unnamed stream at the Hienaloli 1st Ahupua‘a boundary. The wooden elements of the bridge are modern, but the bridge abutments are Historic. Site 50-10-28-31161 is a complex of Historic ranch walls located within and extending beyond the boundaries of the current project area. Eight core-filled wall segments (Features A-H) were identified within the current project area. Site 50-10-28-31162 is complex consisting of two remnant agricultural features (Features A and B) interpreted as clearing mounds most likely associated with twentieth century livestock ranching. No physical evidence of the “old trail” was observed.

Site 7214 is historically significant for its association with the development of the sugar industry (Criterion a), as an excellent example of early 20th-century dry stone masonry construction (Criterion c), and for information yielded relative to the location, construction materials, and construction techniques used to build the railroad (Criterion d). Because the current project has been designed to avoid affecting Site 7124, and the site has been adequately documented by the current study, no further historic preservation work for the site is recommended *at this time within the current project area*. In the long term, however, it is recommended that future development planning for the extension of Hienaloli Road involve discussions among the County of Hawai‘i Planning Department, DLNR-SHPD, and the landowner work to consider the potential for rehabilitation of the portion of Site 7124 within the current project area as a pedestrian and/or non-motor vehicular component of the new road’s design.

Sites 31161 and 31162 are considered to be significant under Criterion d for the information they yielded relative to extent and practice of livestock ranching on the Island of Hawai‘i. The sites have been adequately documented within the current project area. No further work is recommended within the current project area for both of these sites.

Construction of the well pad would require dismantling portions of Features B, C, and E of Site 31161 (Historic rock walls), thus the results of the current study support a determination of effect of “Effect, with proposed mitigation.” The proposed mitigation consists of the documentation of Sites during the current study.

This study was undertaken in accordance with Hawai‘i Administrative Rules (HAR) 13§13–275 and was performed in compliance with the *Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports* as contained in HAR 13§13–276. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawai‘i Planning Department.

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1. INTRODUCTION

At the request of Tom Nance Water Resource Engineering, on behalf of their client the State of Hawai‘i Department of Water Supply, ASM Affiliates (ASM) conducted an archaeological inventory survey (AIS) of a of a roughly 2.9 acre project area comprising a portion of TMK: (3) 7-5-003:001 within Honua‘ula Ahupua‘a, North Kona District, Island of Hawai‘i (Figures 1 and 2). The project area (Figure 3) includes a drill pad site and an unpaved access road that will be improved by laying down gravel over the existing road surface (Figure 4). Within this area, the proposed project will include grubbing, grading, and drilling a test well. No ground disturbance in the access road corridor along Hienaloli road, but steel plates will be lain across an existing wooden bridge. The current AIS was conducted in support of environmental documentation being prepared to comply with Hawai‘i Revised Statues (HRS) Chapter 343 and expected permitting applications in anticipation of the Department of Land and Natural Resources-State Historic Preservation Division’s (DLNR-SHPD) HRS Chapter 6E-8 review of the proposed project.

This study was undertaken in accordance with Hawai‘i Administrative Rules (HAR) 13§13–275 and was performed in compliance with the *Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports* as contained in HAR 13§13–276. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawai‘i Planning Department. This report contains background information describing the location and environment of the project area, a culture-historical context for the project area, and a summary of the previous archaeological work conducted in the vicinity. This is followed by an explanation of the survey methods, detailed descriptions of the encountered historic properties, along with interpretation, significance evaluations, and proposed treatment recommendations for the identified sites. Also presented are recommendations concerning the determination of the effect that the proposed development will have on those sites.

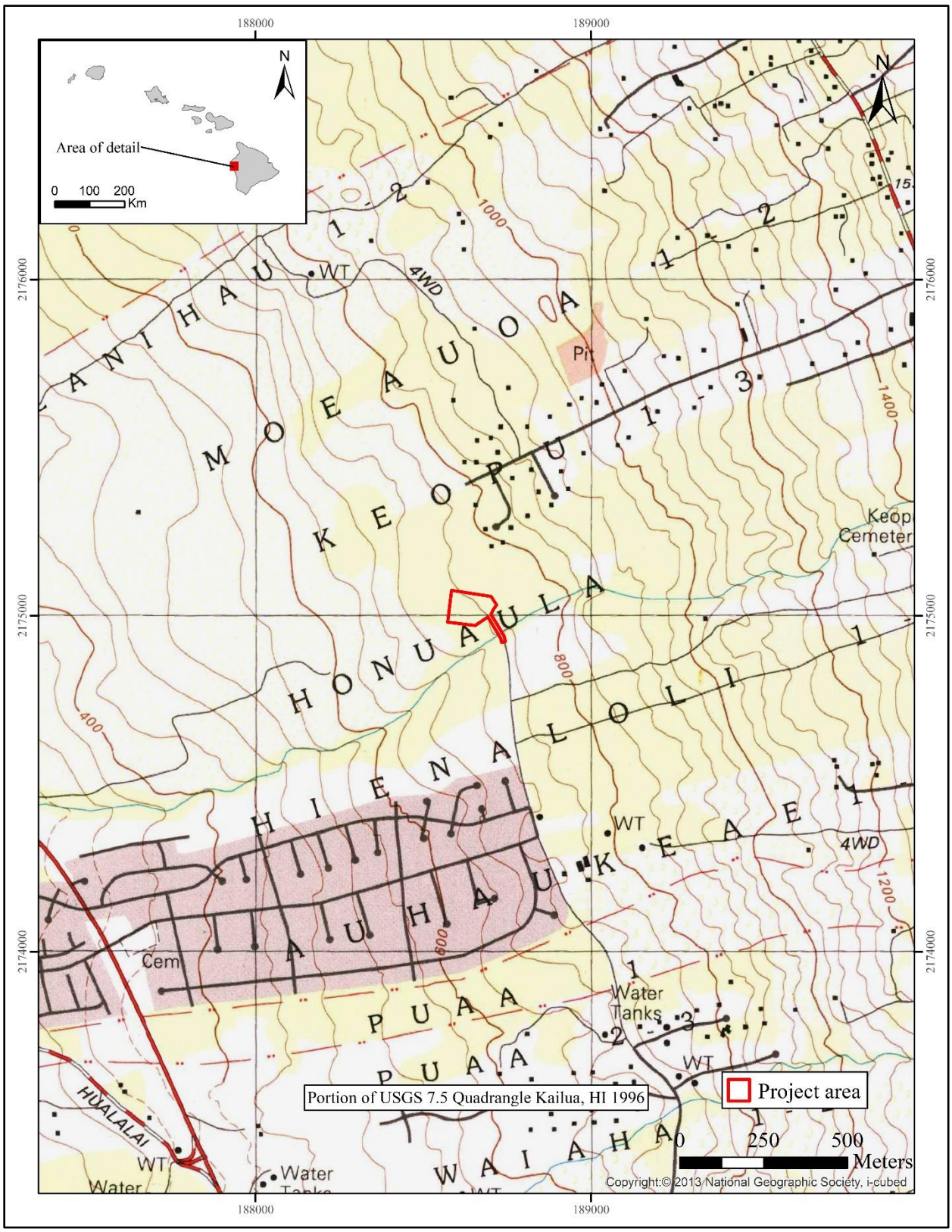

Figure 1. Project area location.

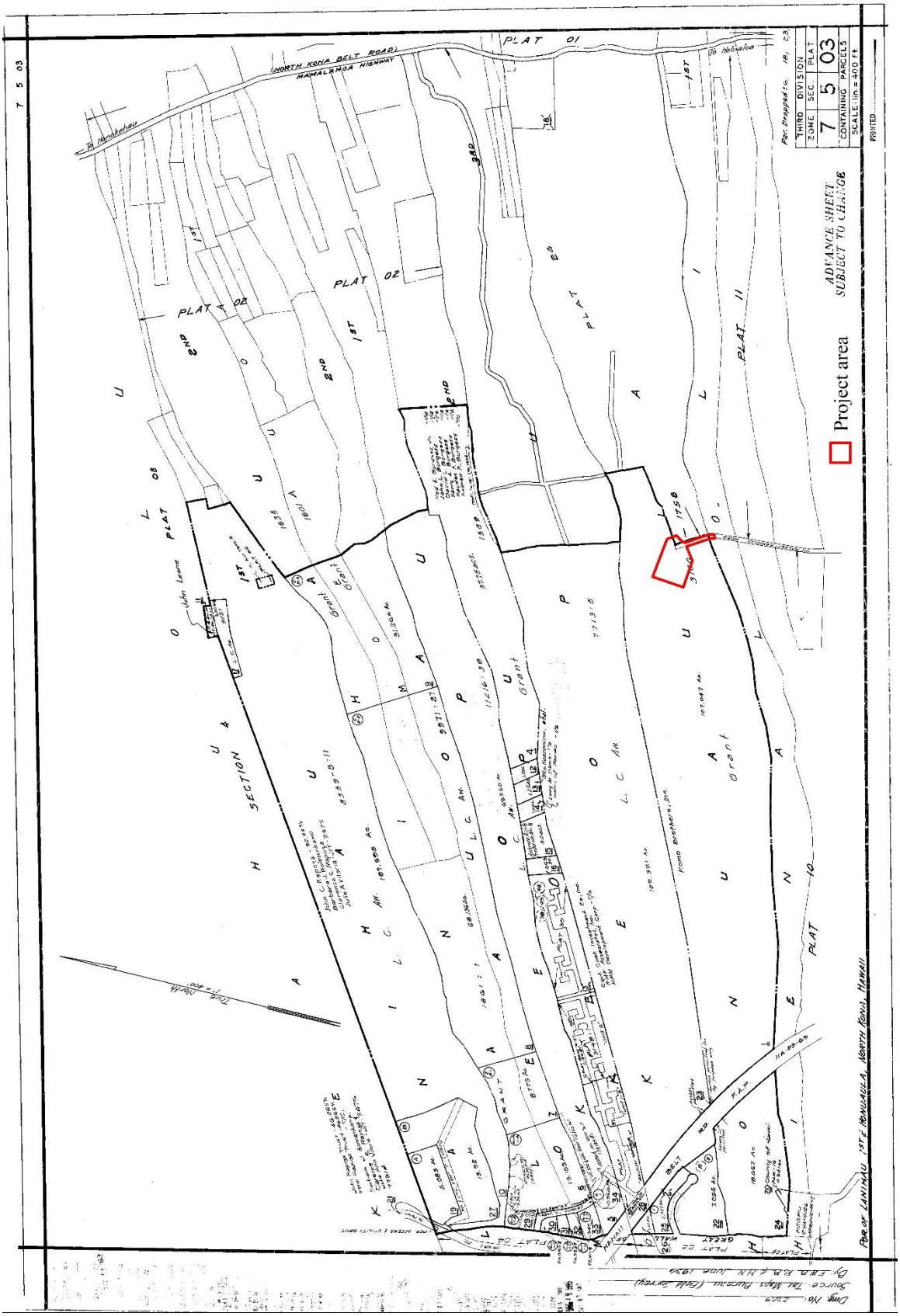

Figure 2. Tax Map Key (3) 7-5-003 showing location of current project area.

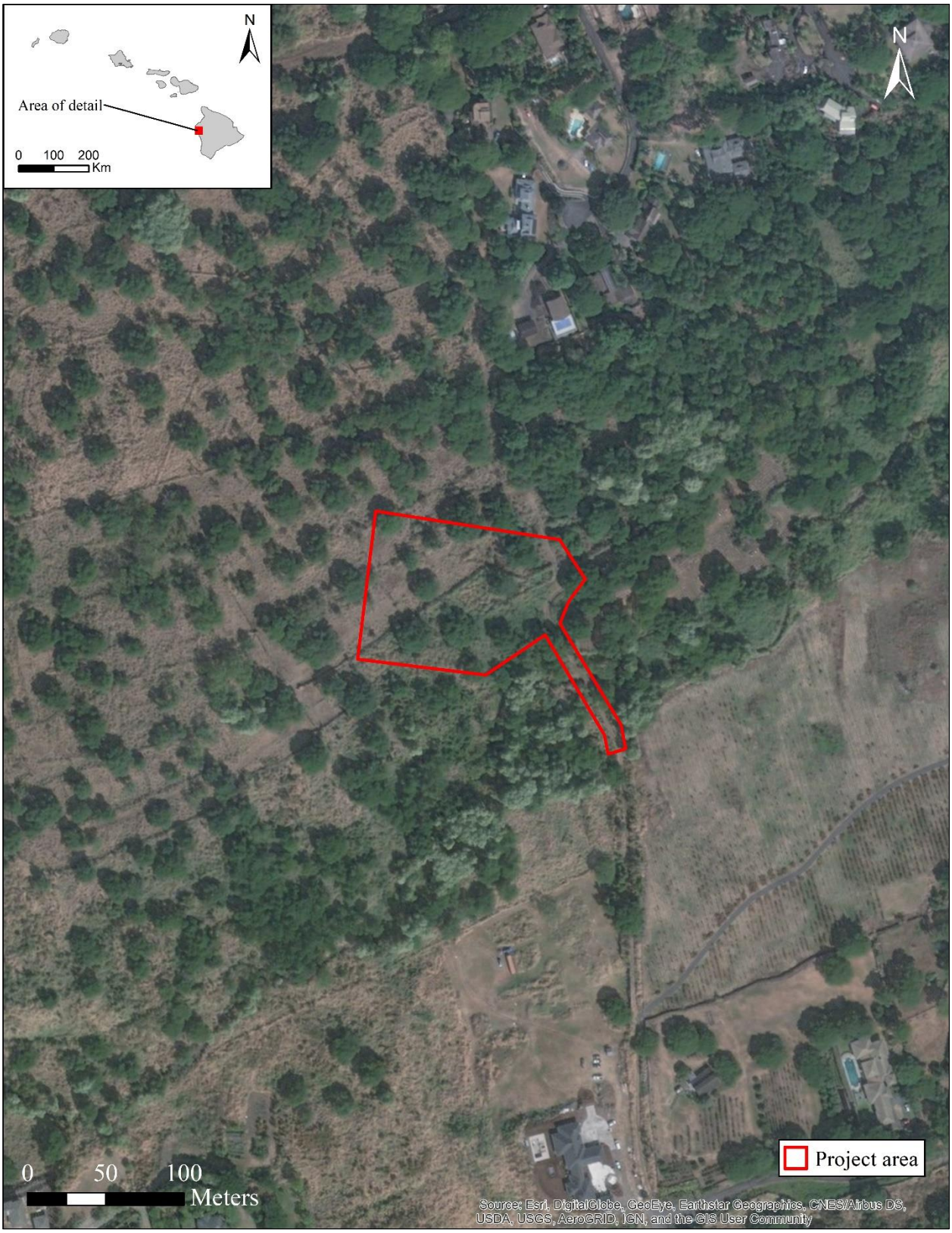

Figure 3. Recent satellite image of the project area.

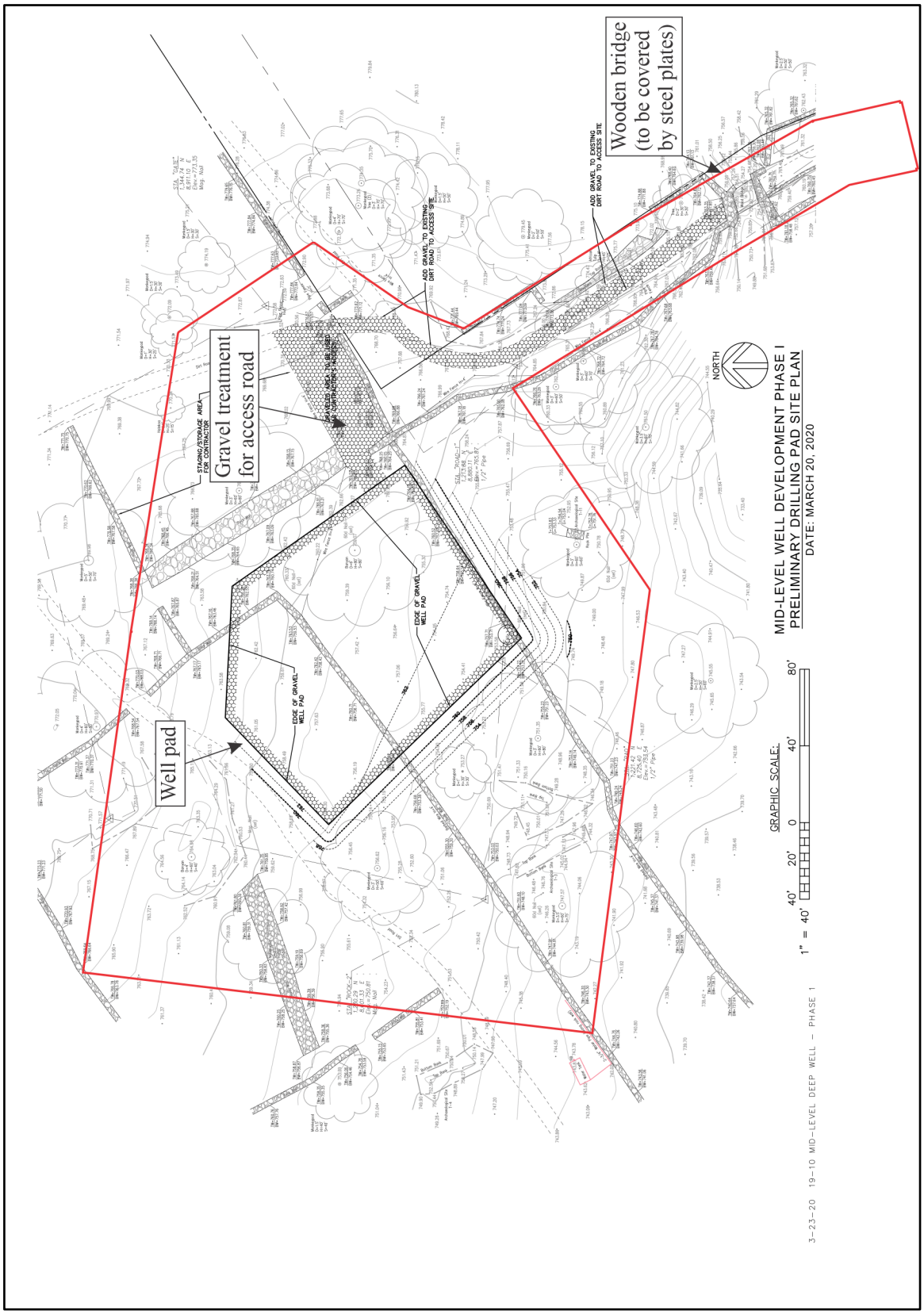

Figure 4. Grading plan with project area outlined in red and key elements of the project indicated.

PROJECT AREA DESCRIPTION

The current project area comprises 2.9 acres of cattle pasture located at about 760 feet (231 meters) elevation on the western flank of Hualālai Volcano, 1.6 miles (2.6 kilometers) inland from Kailua Bay (see Figure 1). Rock walls and wire fences divide the project area into paddocks (Figure 5, see Figure 3). Topography in the project area slopes moderately to the west (*makai*) and the gently rolling terrain is punctuated by occasional *pāhoehoe* bedrocks outcrops and *mauka-makai* trending inflationary lobes. Surface geology in the project area (Figure 6) consists of *pāhoehoe* lava flows that emanated from Hualālai Volcano between 11,000 and 30,000 years ago (Sherrod et al. 2007). Two soil units (Figure 7) are mapped in the project area. The majority of the project area is mapped as Kainaliu-Waiaha Complex, 10 to 20 percent slopes. The Kainaliu component is described as a moderately deep, well-drained silty clay loam formed in basic volcanic ash. The Waiaha component consists of shallow, well-drained cobbly medial silt loam formed in basic volcanic ash over lava flows. The southern end of the project area containing the existing road is mapped as Kainaliu silty clay loam, 10 to 20 percent slopes; however, this portion of the project area contains a graded road flanked on its *mauka* side by bedrock outcrops. Soil depths observed in cattle wallows within the project area indicate that soil depths tend to be relatively shallow. A general smoothness of the ground surface suggests that the project area had been cleared in the past, probably to facilitate its use as pasture. The extreme southern end of the project area includes a wooden bridge (Figure 8), which crosses over a gulch.

Mean annual rainfall in the project area is 49 inches (1,264 mm), with the majority of rainfall occurring between March and September (Giambelluca et al. 2014). Temperatures are relatively moderate, averaging 69°F (20.5C). Vegetation in the current project area is characterized as introduced pasture grassland, dominated by Guinea grass (*Megathyrsus maximus*) in the majority of the project area, which is used as cattle pasture (Figures 9 and 10). An exception to this is the southernmost portion of the project area (Figure 11), which is overgrown with weedy vines (e.g., *pilau maile*, *Paederia foetida*) and stunted Guinea grass. Trees in the project area include monkey pod (*Pithecellobium saman*) and *Ficus* sp.

Figure 5. Photograph of project area, view to southwest.

Figure 6. Geology in the vicinity of the project area.

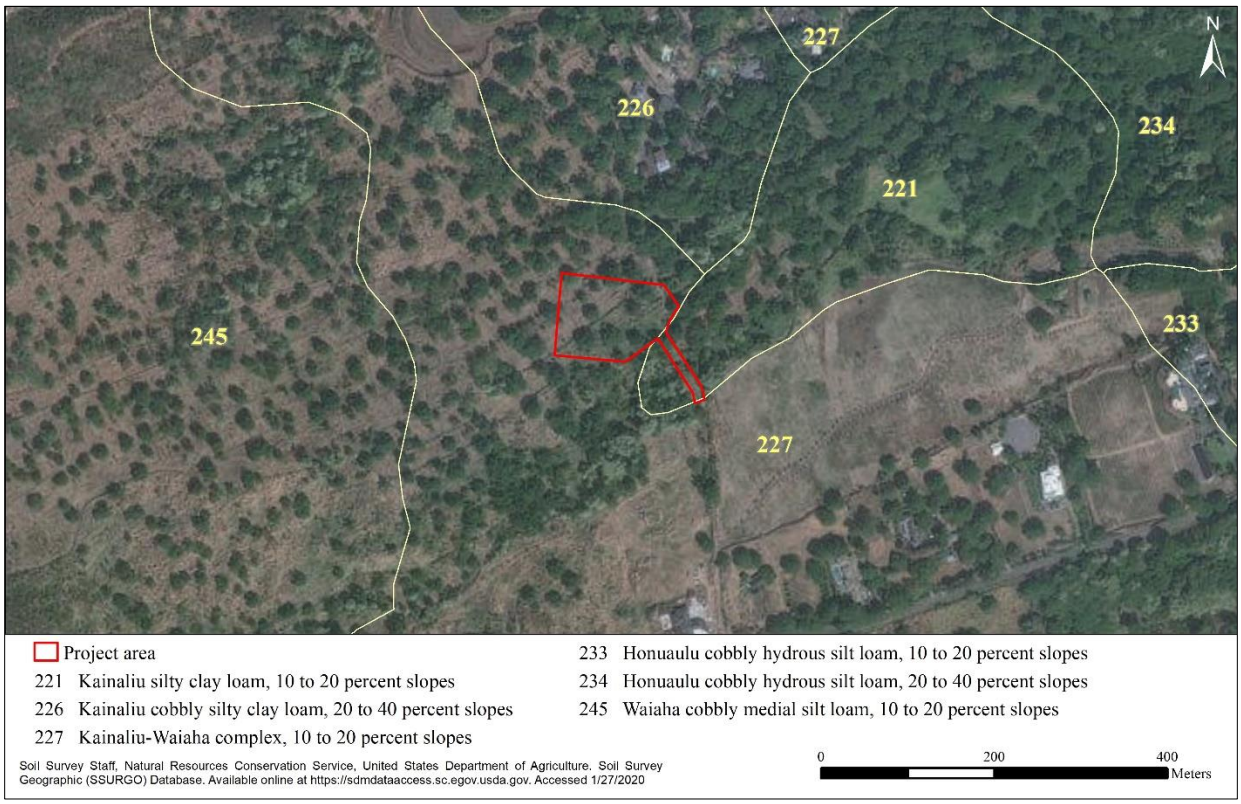

Figure 7. Soils in the current project area.

Figure 8. Wooden bridge located in the extreme southern end of the project area, view to the northwest.

Figure 9. Cattle pasture in the project area, view to the west.

Figure 10. Cattle pasture in the project area, view to the west.

Figure 11. Ungrazed southern portion of the project area, view to west.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the North Kona region that includes specific information regarding the known history of Honua‘ula Ahupua‘a and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the project area.

CULTURE-HISTORICAL CONTEXT

While the exact timing of the initial settlement of Hawai‘i Island remains unclear, recent research (Kirch 2011) suggests that there was no place settled in the Hawaiian Islands prior to about A.D. 1000. What is more clear, based on radiocarbon data, is that by A.D. 1200 large scale settlement was occurring, and steadily increasing until the time of Western contact (A.D. 1778). Early settlement likely occurred from the Marquesas and Society Islands (Tatar 1982). In these early times, Hawai‘i’s inhabitants were primarily engaged in subsistence level agriculture and fishing (Handy et al. 1991). This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *‘aumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Over a period of several centuries, areas with the richest natural resources became populated and perhaps even crowded, and the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). The first inhabitants of Hawai‘i Island probably focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Kirch 1985). This habitation was concentrated along the shoreline and lowland slopes, and informal agricultural fields were probably situated in areas with higher rainfall. Communities shared extended familial relations and there was an occupational focus on the collection of marine resources. Over a period of several centuries as the areas with the richest natural resources became populated and there was an increasing separation of the chiefly class from the common people. Soon, large areas of Hawai‘i were controlled by a few powerful chiefs. There is little indication that much activity was taking place in Kona during the first, 100 or so years of Hawaiian prehistory. It is likely that windward residents did travel to the Kona coast for resource extraction purposes (Cordy 1995), and by A.D., 1200 permanent habitation was beginning in Kona (Cordy 1981, 1995; Schilt 1984).

The period between A.D. 1200 and 1650 was characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification (Kirch 1985). Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. *Heiau* building flourished during this period as the traditional religion became more complex and embedded in a sociopolitical climate of territorial competition. The concept of the *ahupua‘a* was established during the A.D. 1400s, adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua‘a* varied in shape and size and typically included all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). The *ahupua‘a* were further divided into smaller sections such as the *‘ili*, *mo‘o ‘āina*, *paukū ‘āina*, *kīhāpai*, *ko‘ele*, *hakuone*, and *kuakua* (Hommon 1986; Pogue 1978).

Entire *ahupua‘a,* or portions of the land were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali‘i-‘ai-ahupua‘a* (chief who controlled the *ahupua‘a* resources). The *ali‘i-‘ai-ahupua‘a* in turn answered to an *ali‘i ‘ai moku* (chief who claimed the abundance of the entire district). The chiefs of these land units gave their allegiance to a territorial chief or *mō‘ī* (king). Thus, *ahupua‘a* resources supported not only the *maka‘āinana* and *‘ohana* who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resources management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources. Also, in communities with long-term royal residents, there was a strict adherence to divisions of labor (with occupational specialists).

The Hawaiian population had expanded rapidly throughout the first few centuries of the new millennium (Kirch 2011), and by the fourteenth century inland elevations were being turned into dryland agricultural fields. In Kona where there were no regularly flowing streams to the coast, access to potable water (*wai*), was of great importance and played a role in determining the areas of settlement. Traditional and historic narratives abound with descriptions

and names of water sources, and also record that the forests were more extensive and extended further seaward than they do today. These forests not only attracted rains from the clouds and provided shelter for cultivated crops, but also in dry times drew the *kēhau* and *kēwai* (mists and dew) from the upper mountain slopes to the low lands (Rechtman 2001). Because of its geographical location coupled with the lack of perennial streams, agriculture in Kona relied primarily on rainfall. Pukui (1983:232) documents several *ʻōlelo noʻeau* (Hawaiian proverbs) for Kona that capture the importance of observing nature for signs of rain. In one example, Pukui (1983:232) states:

> *Māmā Kona i ka wai kau mai i ka maka o ka ʻōpua*.
> Kona is lightened in having water in the face of the clouds.
> Kona is relieved, knowing that there will be no drought, when the clouds promise rain.

In addition to observing the elements for signs of rain, the ancient horticulturalists also invoked certain deities to encourage rainfall and promote abundance. It is therefore not unusual that the Kona region is synonymous with the deity Lono, who was considered the "rain maker" and closely associated with fertility (Handy et al. 1991:273). Lono was often identified with the southern coast of Hawaiʻi Island, and according to Kalokuokamaile, a native of Kona, temples dedicated to Lono were established throughout Kona to invoke rain and fertility. Lono was also embodied in dark rain clouds brought on by the southerly (*kona*) storms. Mythology permeated agricultural pursuits as well as other facets of daily life. In traditional myths, it is believed that Lono migrated from the south and landed in Kona where he introduced several food plants, such as *kalo* (taro), *ʻuala* (sweet potato), *uhi* (yams), *kō* (sugar cane), *maiʻa* (banana) and *ʻawa* (kava). According to (Handy et al. 1991:273):

> The most highly developed agricultural area of the island of Hawaii was the *ʻokana*, or major land division, of Kona. It was here, at Kealakekua (The-Path-of-the-God) that Lono the rain god is said to have lived anciently, bringing to the people the first cultivated plants. The beautiful development of plantations here, which so impressed the early explorers, is dealt with in our description of Kona. Not only was this an area of intensive cultivation, but offshore from Kailua, the historic seat of ruling *aliʻi*, and as far south as Hoʻokena there extends one of the two finest fishing areas in these islands.

In the 1920s-1930s, (Handy et al. 1991), assisted by Mary Kawena Pukui, conducted extensive research and field interviews with elder native Hawaiians. In lands of North and South Kona, they recorded native traditions describing agricultural practices and rituals associated with rain and water collection. Primary in these rituals and practices was the lore of Lono—a god of agriculture, fertility, and the rituals for inducing rainfall:

> The sweet potato and gourd were suitable for cultivation in the drier areas of the islands. The cult of Lono was important in those areas, particularly in Kona on Hawaiʻi…there were temples dedicated to Lono. The sweet potato was particularly the food of the common people. The festival in honor of Lono, preceding and during the rainy season, was essentially a festival for the whole people, in contrast to the war rite in honor of Ku which was a ritual identified with Ku as god of battle. (Handy et al. 1991:14)

THE KONA FIELD SYSTEM

The current project area is situated near the northern extent of what is termed the Kona Field System (KFS) (Newman 1970) (Figure 12). This dryland agricultural complex has been understood to be a nearly continuous series of agricultural fields covering approximately 34,350 acres from Kaū Ahupuaʻa in the north to Hoʻokena in the south, with an altitudinal range of 0-2,500 meters (Horrocks and Rechtman 2009) from the coastline to the forested slopes of Hualālai (Cordy 1995). Near Kealakekua Bay, the KFS was first described by (Soehren and Newman 1968), and was nominated for placement on the Hawaiʻi Register of Historic Places by (Newman 1974). A large portion of this system, which has also been determined eligible for inclusion in the National Register of Historic Places (Rechtman et al. 2003), is designated in the Hawaiʻi Register as Site 50-10-37-6601. Modelling of environmental constraints on rain-fed agriculture by (Ladefoged et al. 2009) and (Lincoln and Ladefoged 2014) suggests a more extensive (about 38,300 acres) but less continuous area of cultivation within the field system (Figure 13) with cultivation generally restricted to lava flows older than 4,000 years in age.

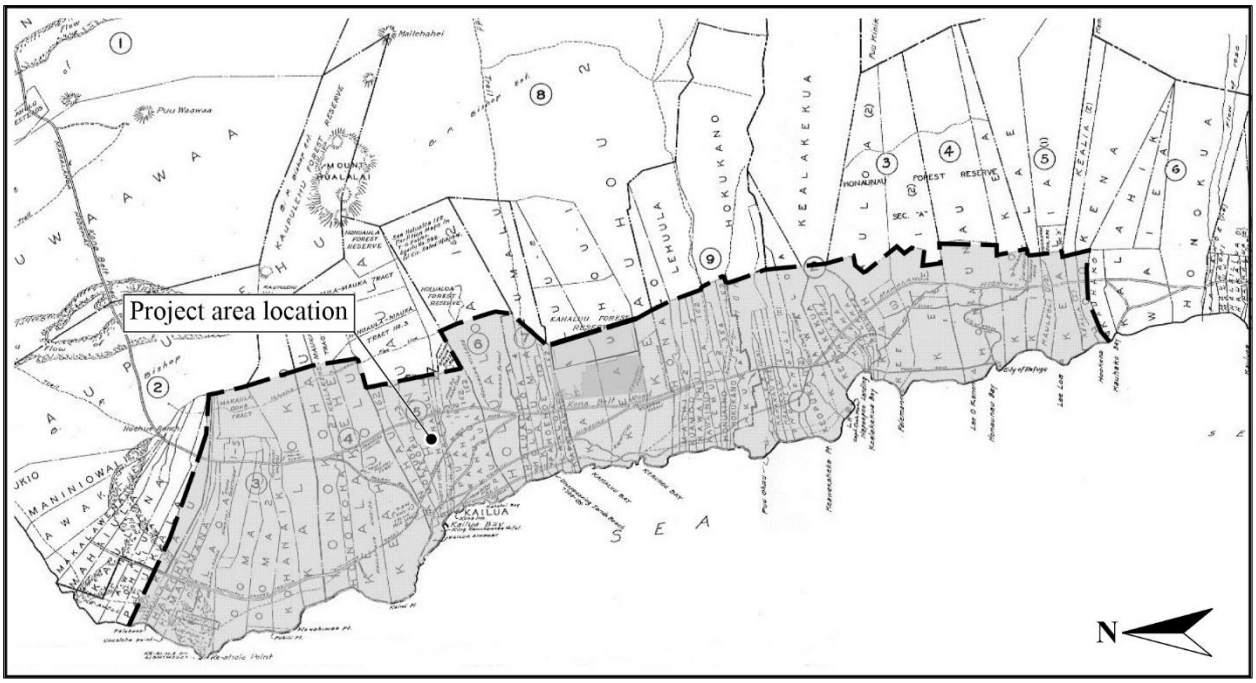

Figure 12. Geographical extent of the Kona Field System (after Newman 1970).

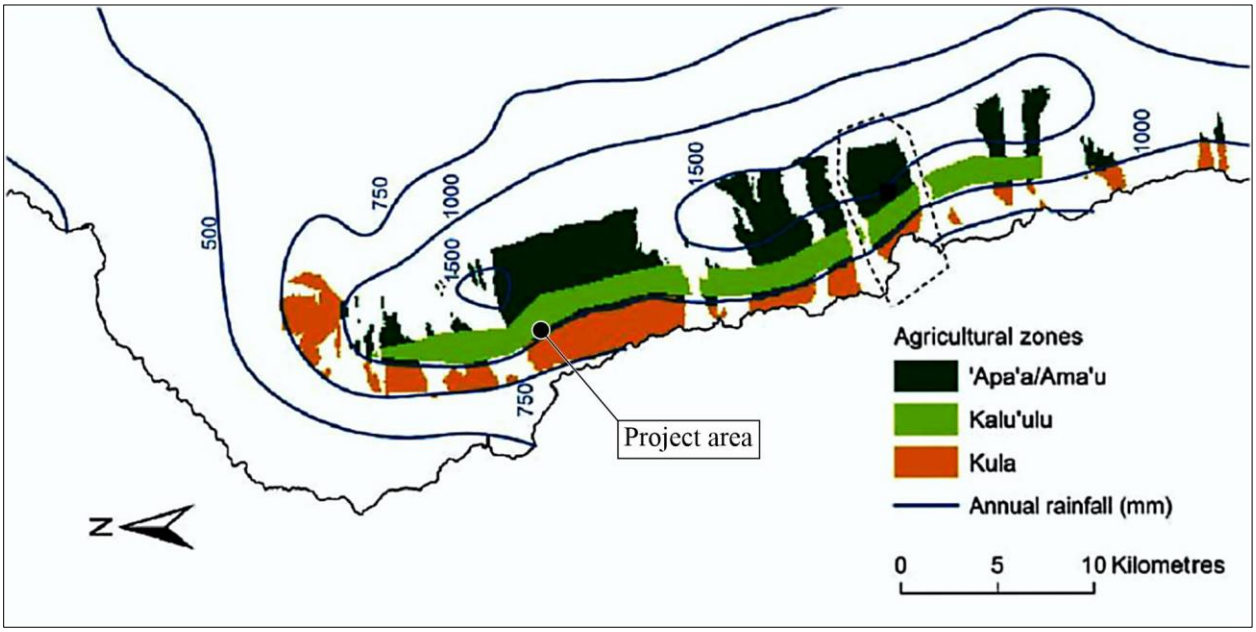

Figure 13. Modeled Kona Field System gardening zones (after McCoy et al. 2017:73).

The basic characteristics of this agricultural/residential system as presented in (Newman 1970) have been confirmed and elaborated on by ethnohistorical investigations (Kelly 1983) and archaeological research (e.g., Allen 2001; Burtchard 1995; Cordy et al. 1991; Kawachi 1989; Rechtman et al. 2001; Schilt 1984; Soehren and Newman 1968). Summaries are offered by Allen (2001), Cordy (1995, 2000), and Kirch (1985). Kona Field System agricultural fields are characterized by a network of long field walls that extend in a *mauka-makai* direction. These walls are known by several names, all of which share a similar concept of the skeleton of the land, such as *kuaiwi* or back bone (Allen 2004), and are a prominent feature of the landscape within the *ʻāpaʻa* and *kaluʻulu* zones (Cordy 1995; Newman 1970). Handy and Handy (1991:151) provide the following additional description of this concept, stating:

> *Iwi* (bone) or *iwi kuamoʻo* (backbone) was the term applied to the line of rocks and refuse thrown up along the side of *moʻo ʻaina*, or *kihapai* in clearing. These *iwi* or *iwi ʻaina* demarked the boundaries of plantations and arable holdings, and hence were also called *palena*, or bounds. They were not mere rubbish heaps, but for example on Hawaii, served for planting sugar cane round about the field of dry taro in upland Kona, Kaʻu, and Kohala… In upland Kona they may be seen today buried in woods or occasionally bounding taro plantations still utilized.

Kuaiwi were a by-product of land clearing and rock removal from the planting areas that also defined field boundaries. *Kuaiwi* are oriented *mauka-makai* with shorter, perpendicular connecting segments. Specific fields are thus marked by the rectangular pattern created by the *kuaiwi* and cross-walls. The cross-walls function as soil traps and retaining features, creating terrace-like areas to enhance planting. *Kuaiwi* can also function to move water downslope in a controlled manner, ensuring optimal distribution of the available runoff water (Rechtman et al. 2003). Their presence seems to indicate the transition from the scattered planting mounds and terraces of the *kula* zone to the formalized walled field systems found in the *ʻāpaʻa* and *kaluʻulu* zones (Cordy 1995). The distribution of soils suitable for agriculture determines, in part, the locations of the formal walled fields, and there is a direct relationship between suitable soils and older lava flows (Lincoln et al. 2014). Consequently, areas of young lava flow at elevations associated with the *ʻāpaʻa* and *kaluʻulu* zones do not always have *kuaiwi* (Burtchard 1995; Hammatt et al. 1987; Haun et al. 1998; Rechtman et al. 2003). Situated between the *kuaiwi* were other traditional Hawaiian planting features are present such as mounds, terraces, modified outcrops, and platforms. The Kona Field System is generally considered a dryland complex, however, water control features, such as ʻ*auwai* and modified waterholes, have been documented in areas where intermittent streams were present (Allen 1984; Clark et al. 2003; Kawachi 1989; Schilt 1984).

Subsequent research and reinterpretation (e.g., Allen 1984; Burtchard 1995; Cordy 1995; Haun et al. 1998; Kawachi 1989; Kelly 1983; Kirch 1985; Rechtman et al. 2001; Wolforth 1999) have painted a more realistic picture of the development of collections of agricultural fields, widely distributed over time and space, into a loosely affiliated sociopolitical system. In other words, the fields expanded under the influence of individuals and small groups as the populations of North and South Kona increased. As the Hawaiian sociopolitical system became more centralized, more of the agricultural produce found its way (through tribute) into the same coffers, but the fields continued to function independent of one another (Rechtman et al. 2001). Cordy (2000:257-258) describes the fields of Kona, albeit within the context of the Kona Field System, thusly:

> Generally, it appears that the Kona field system gradually formed, with small clearings in the wetter uplands and some use of the *kula*, beginning in some *ahupuaʻa* ca. A.D. 1000, and in others as late as the A.D. 1400's. Then over time – with growing populations, the chiefly centers, and other factors – the fields gradually expanded and intensified. This appears likely to have taken place at different times in different *ahupuaʻa*. By the end of the A.D. 1700's, the fields of all these lands could be seen by the European visitors as one big complex of near continuous fields…Also these were fields of individual communities with considerable variation and differences in extent…The archaeological sites remaining probably number in the thousands.

And, as (Rechtman et al. 2001:370) adds:

> The historically observed and archaeologically documented patterns of cultivation within the agricultural fields of Kona perhaps reflect a common cultural or societal mental construct that has developed in response to centuries of experimentation under the varied geomorphic and climatic conditions of the area, but the concept of an agricultural system (with respect to defining the agricultural practices over a broad region) suggests that from one end of the region to the other (from Kaloko to Hoʻokena) the agricultural features were either temporally, functionally, or synergistically interrelated. Clearly this was not the case; that the products of these agricultural fields may have ended up (through tribute) in the same coffers tells us more about the workings of a sociopolitical system than it does about an agricultural one.

Hawaiians traditionally used four terms to describe the major vegetation zones (Table 1, see Figure 13). These terms were used to define and segregate space within the *ahupuaʻa* and later, to delineate land claim boundaries during the *Māhele*. The zones are bands of vegetation, roughly parallel to the coast, corresponding to changes in elevation, rainfall, and flora. The current project area is situated at an elevation which places it within the upper range of what has been termed the *kaluʻulu* zone and encroaches slightly into the *ʻāpaʻa* zone. The *kaluʻulu* zone ranges between sea level and 500 feet (roughly 152 meters) above sea level, with an average annual rainfall of 100 to 135 centimeters. Within the *kaluʻulu* zone, crops such as breadfruit (*ʻulu*), sweet potato (*ʻuala*), and paper mulberry (*wauke*), were predominantly cultivated. The *ʻāpaʻa* zone, situated just above the *kaluʻulu* zone, ranges between 1000-2500 feet

(300-750 meters) above sea level, and has mean annual rainfall that ranges between 140 to 200 centimeters. Traditionally, dryland cultivation of taro (*kalo*), *ʻuala*, sugar cane (*kō*), and ti (*kī*) dominated this zone. Archaeologically, the transition from the *kaluʻulu* zone to the *ʻāpaʻa* zone has been difficult to distinguish and appears to have similar settlement and site patterns as the *ʻāpaʻa* zone (Cordy 1995). There are also archaeological indications of temporary and permanent habitations within the ʻ*āpaʻa* zone although these are infrequently recorded (Barrera 1991; Burtchard 1995; Haun et al. 1998; Kaschko and Rosendahl 1987). Early European visitors to Kona recorded sparse habitation at higher elevations within the fields, especially the use of temporary field houses. Burial and ceremonial areas are rare in the upper elevations (Kawachi 1989).

Table 1. Traditional Hawaiian vegetation zone classification.

Zone	*Approx. Elevation Limits**	*Agricultural Uses*
Kula	Sea level – 500	Sweet potato, paper mulberry, gourds
Kaluʻulu	500-1000	Breadfruit, sweet potato, paper mulberry
ʻĀpaʻa	1000-2500	Taro, sweet potato, sugar cane, ti
ʻAmaʻu	2500-4000	Banana, plantain

***feet above sea level.**

The archaeological record contributes to our understanding of how the Kona Field System developed over time. Precisely how the record is interpreted is reflected in the various chronologies proposed for the system (Allen 2004; Athens et al. 2007; Burtchard 1995; Cordy 1995; Haun et al. 1998; Hommon 1986; Kirch 2010; Major 2001; McCoy et al. 2017; Schilt 1984; Tomonari-Tuggle 2006; Weisler and Kirch 1985) The chronology and terminology outlined by (Haun et al. 1998) is used in the present discussion, and the chronological summary below is abstracted from (Rechtman et al. 2001) updated with information from recent studies cited within the text.

The Kona Field System was not brought to Kona as a fully developed system; but rather, it reflects a developmental adaptation to the area likely associated with the evolving sociopolitical structure and increasing population in Kona. The first inhabitants of Hawaiʻi Island focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Weisler and Kirch 1985). To date, there is no archaeological evidence for occupation of the Kona region during the initial stage of colonization. There is also little indication that during the subsequent period, Early Expansion, much activity was taking place in Kona (Burtchard 1995). Through the first half of the Early Expansion Period, permanent habitation was still concentrated on the windward side. It is likely that windward residents traveled to the leeward Kona coast to procure resources (Cordy 1995). By the latter half of the Early Expansion Period, permanent habitation was beginning in Kona (Cordy 1981, 1995; Schilt 1984). Habitation was concentrated along the shoreline and lowland slopes, and informal fields were probably situated in areas with higher rainfall.

Agricultural fields and habitation areas expanded across the slopes and coastal area of Hualālai during the Late Expansion Period (Burtchard 1995; Cordy 1995). The earliest fields may have been located in the southern portion of the system (Schilt 1984), with new fields expanding northward over time (Haun et al. 1998). It is likely that during the initial stages of the Intensification Period (A.D. 1400 to 1600) the construction of the extensive formal walled fields began in the more fertile *ʻāpaʻa* zone, marking the emergence of the Kona Field System. The development of the fields may in part be a by-product of the need to extract more subsistence resources from an increasingly limited agricultural base. The reasons for doing so continue to be debated. Radiocarbon data suggest that the population in Kona increased dramatically during this period (Burtchard 1995; Haun et al. 1998; Schilt 1984). Allen (2004) describes the expansion of the field system into the less-fertile lands below the *ʻāpaʻa* zone as a way for households to insure themselves against variance in agricultural production. Based on new radiocarbon samples obtained from Kealakekua, McCoy et al. (2017:71) modify that view, suggesting that "early efforts to increase production beyond the household level were a type of a bet-hedging strategy, and that what we see in the later period is an extension of that trend, but with demands and decision-making reorientated from the household level to the political elite."

Using the major vegetation zones outlined in Table 1 combined with the age of the geological substrate to estimate settlement densities and land-use in this area, Honuaʻula was probably very similar to the many other surrounding *ahupuaʻa* of the Kona Field System. Population was likely concentrated in the lower part of the *kula* zone where one would expect to find agricultural plots, permanent habitations, chiefly residences, and ceremonial centers. As one moves away from the coast, permanent habitation becomes less frequent and temporary field shelters more common. Agriculture, bird hunting, and plant gathering were practiced at the middle and upper elevations. This pattern of land-use persisted into the early Historic Period, but with the introduction of new crops and rapid population loss in the early 1800s, major changes were well underway.

HISTORY AFTER WESTERN CONTACT

In 1778, Captain James Cook arrived in the islands, anchoring first in Waimea, Kaua‘i. Several months later, in 1779, he returned from the northwest coast of North America and anchored in Kealakekua Bay, setting in motion Hawai‘i’s engagement with the Western world. The first historically-documented period begins with Cook’s arrival and ends with King Kamehameha’s death in 1819. The end of this period also sees the overthrow of the old religion, which took place when Liholiho, Kamehameha’s heir, failed to reinstate the traditional *kapu* laws and won a battle against the supporters of the old religion at Kuamo‘o, along the southern coastline of Keauhou. Early historical accounts emphasize that modern day Kailua Town was a significant political seat and population center during this period. Settlement and subsistence practices within the Kona Field System continued to operate much as it had prehistorically through the first few decades of the historic era (Handy et al. 1991). Beginning with the arrival of Western missionaries shortly after the battle at Kuamo‘o, the second quarter of the 19th century (A.D. 1820-1847) was a time of profound social change in Hawai‘i. Liholiho moved his court to O‘ahu, so the burden of resource procurement for the chiefly class lessened considerably on the Island of Hawai‘i. However, some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods for trade to the early Western visitors. Introduced crops, such as yams, coffee, melons, potatoes, maize, beans, figs, oranges, guavas, and grapes (Wilkes 1856) were grown specifically for trade with Westerners. Other commodities, especially sandalwood, were collected to purchase Western goods, often to the detriment of agricultural pursuits. The arrival of the missionaries to Hawai‘i in the 1820s brought further changes to the social and religious systems of the islands. Disease and other pressures decimated the Hawaiian population. With the guidance of Euro-American missionaries and merchants, the Hawaiian social, political, and economic systems were increasingly westernized throughout the remainder of the century leading up to the overthrow of the monarchy and annexation by the United States. This process of Westernization included changes to land tenure, which in turn affected the usage of the lands of the Kona Field System, including the project area in Honua‘ula Ahupua‘a.

In May of 1819, Kamehameha died at his royal residence at Kamakahonu in Kailua-Kona after naming his son ‘Iolani Liholiho (Kamehameha II) heir to his kingdom (Kamakau 1992). As traditional custom dictated, following the death of a prominent chief, it was customary to relax all *kapu* that maintained social order. Thus, following Kamehameha’s death, a period of *‘ai noa* (free eating) was observed along with the relaxation of other *kapu*. It was the responsibility of the new ruler and *kahuna* (priest) to conduct the proper rituals and ceremonies to reinstate all *kapu*. Immediately upon the death of Kamehameha I, Liholiho was sent away to Kawaihae to keep him safe from the impurities brought about from the death of his father. However, Liholiho’s attempts to reinstate the long-standing *kapu* system were futile and the future of the *kapu* system stood in a state of uncertainty. *Kuhina Nui* (Premier), Ka‘ahumanu (the wife of Kamehameha and the *hānai*, or adoptive, mother of Liholiho) and his biological mother Keōpūolani lured the young chief back to Kona and the *kapu* system was symbolically abolished when Liholiho ate in the presence of his mothers and wandered about the women’s house (Kamakau 1992). While he may have done so during a time when he had not yet reinstituted the eating *kapu*, other chiefs present appear to have thought otherwise, and word spread that the *kapu* had been abandoned. Following an unsuccessful uprising led by Kekuaokalani, caretaker of the war god Kūka‘ilimoku meant to reinstate the *kapu*, Ka‘ahumanu 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 (Auna 1822; Kamakau 1992).

In October of 1819, just five months after the death of Kamehameha, the first American Protestant missionaries aboard the Brig. *Thaddeus* left Boston, Massachusetts and by March 30th, 1820, they sailed to Kawaihae on the northwest coast of Hawai‘i Island (Hawaiian Mission Children's Society 1901). After receiving permission from Liholiho and his council of chiefs, the missionaries were permitted to remain in the kingdom on a trial basis for a year (Kelly and Barrère 1980). Having arrived to find a society whose chiefs had just overturned the socio-religious system, the missionaries quickly set out to develop relationships with Hawaiian nobility with the intent of establishing mission stations around the islands that would help advance their efforts to spread the Christian gospel, beliefs, and lifeways.

In 1823, British missionary William Ellis (1827), along with members of the American Board of Commissioners for Foreign Missions (ABCFM), circuited Hawai‘i Island in search of suitable locations for mission stations and churches. After departing Kailua, Ellis and his party, which included their native guide Makoa, made their way south along the coast, passing through the area of Honua‘ula. There, Ellis noted gardens and fields cultivated with potatoes and other vegetables on the hill sides. On their return trip to Kailua, Ellis (1827:43) and his party explored a “celebrated cavern in the vicinity called Raniakea [Laniākea],” situated near the boundary of Honua‘ula and Hienaloli 1st *makai* of . Nearby, he also visited the remains of what must have been an ancient *pu‘ukaua* and *pu‘uhonua* (fortification and refuge). Census data recorded by the visiting missionaries in 1823 suggest that at the time there lived “a population of

not less than 20,000 inhabitants along a 30-mile stretch of the Kona coast, including 3,000 at Kailua itself" (Kelly and Barrère 1980:18). Most of the population was concentrated along the coast, with another belt of residence situated about two miles inland in the area *mauka* of the project area.

Two other missionaries, the Reverend Asa and Lucy Goodale Thurston, were among those who arrived in Kailua-Kona on the *Thaddeus* in 1820. After spending time in Honolulu, in November of 1823, the couple moved to Kailua. Under the direction of Governor Kuakini, the Thurstons initiated the construction of Mokuʻikaua Church in Keōpū Ahupuaʻa, northwest of the project area. Two years later, they were provided with some land near the Honuaʻula-Hienaloli boundary to establish a parsonage. Asa and Lucy Thurston built their home near Laniākea Cave within Honuaʻula Ahupuaʻa. In a journal entry written by Mrs. Lucy Thurston regarding the cave, she explains:

> The name of the cave is Laniakea, signifying the broad heavens. As it enclosed in our premises, the natives were quick to give the name to our establishment, so that it has become universally known as Laniakea. (Thurston 1882:85)

By 1837, following a succession of thatched dwellings, a two-story wooden house was constructed (Thurston 1882); and as can be seen in a ca.1840 sketch (Figure 14) of the property by Persis Thurston (daughter of Asa and Lucy), several thatched structures also remained. This image also depicts the various bands of vegetation at the time, which correlate to elevational changes within the Kona Field System within the *ahupuaʻa* of Hienaloli and Honuaʻula. Using georeferencing technology, the approximate location of the study area was identified on the Thurston sketch, however, it falls just outside and along the border of the image (see Figure 14). The Thurston sketch proved to be in good alignment with the natural features of the landscape, and accurately depicts the boundaries of the various vegetative zones, and, as suggested by the sketch (see Figure 14) the approximate project area is located within the *kaluʻulu* zone. Lucy Thurston also commented on the back county of Kailua noting that:

> Along the coast for two miles back, it is sterile; but there is a belt that is very rich, about a mile wide at the foot of the mountain, which is dotted here and there with kukui, breadfruit and orange, all splendid trees; of smaller growth, pine apple [*sic*], sugar cane, arrowroot, taro and potatoes. Above this fertile belt is quite a width of forest, after which the bare sides of the mountain rise to a peak. It stands towards the rising sun. These distant scenes of the mountain, and perpetual verdure of forest and vegetation, are ever to be enjoyed. (Thurston 1882:82-83)

Another glimpse of the lands around the current project area during this period is provided by Commodore Charles Wilkes of the U.S. Exploring Expedition. Wilkes (1845:94-95) noted that despite a lack of rain, the land was quite productive:

> Rain seldom falls on the coast except in showers, and a rainy day once in the year is looked upon as something remarkable. This, together with the absence of all dew, prevents the existence of much cultivation; it affords, nevertheless, a coarse vegetation, sufficient to pasture a few hundred goats; but, a mile back from the shore, the surface is covered with herbage, which maintains cattle, &c.; and two miles in the interior there is sufficient moisture to keep up a constant verdure.
>
> Here, in a belt half a mile wide, the bread-fruit is met with in abundance, and above this the taro is cultivated with success. At an elevation of between two and three thousand feet, and at the distance of five miles, the forest is first met with. The trees of this are suitable for building timber, and boards and shingles are made of them. The products of this portion of Kona are the same as before described.

Figure 14. Sketch of the Thurston Residence and the landscape drawn by Persis Thurston in 1827 (reproduced in Forbes 2014).

The Māhele *ʻĀina* of 1848

Beginning in 1848, the *Māhele ʻĀina*, traditionally a process by which lands were divided and redistributed, became the vehicle for determining ownership of native lands. During the *Māhele* of 1848, land interests of the *Mōʻī* (King Kamehameha III), the high and low ranking *aliʻi*, and the *konohiki*, were defined, and all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and Konohiki Lands. The chiefs and *konohiki* were required to present their claims to the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to receive awards for lands provided to them by Kamehameha III. During the *Māhele* of 1848, Honuaʻula was claimed by the chiefess Keahikuni Kekauʻōnohi (also known as Mikahele or Miriam Kekauʻōhoni). She subsequently relinquished her interest and the land and returned it to the *Mōʻī*, who retained it as Government land (Buke Māhele 1848; Soehren 2004).

All lands awarded during the *Māhele* were subject to the rights of the native tenants therein, who could claim, and acquire title to, *kuleana* parcels comprising any portion of lands that they physically occupied, actively cultivated, or had improved. On August 6, 1850, the *Kuleana* Act (also known as the Enabling Act) was passed, clarifying this process (Garavoy 2005). The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (LCAws.) (Chinen 1958). Native tenants wishing to make a claim to their lands were required to register in writing with the Land Commission, who assigned a number to each claim, and that number (the Native Register) was used to track the claimant through the entire land claims process. The holder of a LCAw. could obtain a Royal Patent Grant from the Minister of the Interior upon payment of the commutation fee (Barrère 1994). Four individuals and one institution were awarded a total of seven LCAw. parcels within Honuaʻula (Table 2). All but one of these were located within 0.25 miles of the coast, *makai* of modern-day Kuakini Highway (Figure 15). The exception was LCAw. 387, which was awarded to the American Protestant Mission and included the Thurston residence at Laniākea. No *kuleana* claims were made for the *mauka* portions of Honuaʻula near the project area.

Table 2. Land Commission Awards within Honua‘ula Ahupua‘a

LCAw. No.	*Awardee Name*	*No. of parcels awarded*	*‘Ili name*	*Royal Patent No.*	*Award Year*	*Acres*
387	American Board of Missions	2	n/a	1600 & 1930	1855	6.74
3279	Walawala	1	n/a	8324	1919	0.43
3755	Wahineiki	1	n/a	8539	1961	0.41
10735	Pupule	1	Ililoa	n/a	n/a	1.4
9971	Leleiohoku	3	Pa o Papaula and Pa o Papa	6693	1875	2.84

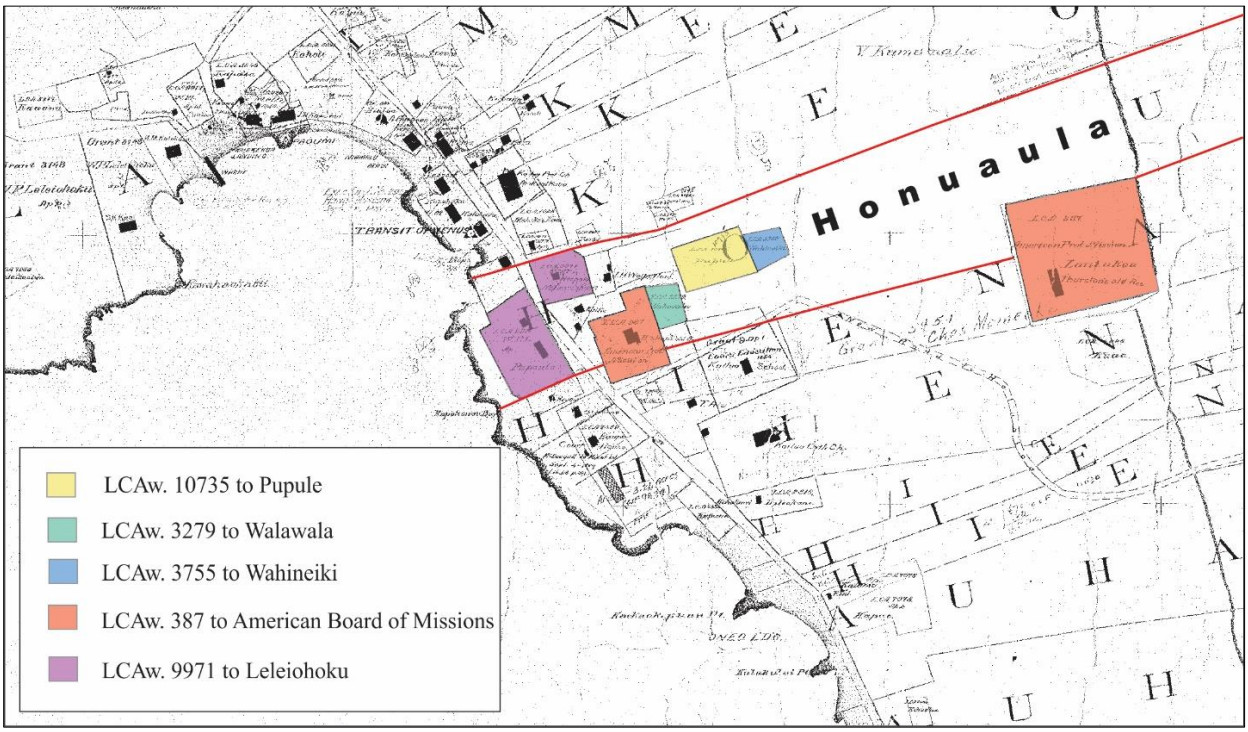

Figure 15. Portion of Hawai‘i Registered Map No. 1676 showing the LCAw. in Honua‘ula Ahupua‘a.

Government Land Grants in Honua‘ula

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*. 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 this 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 the Government Lands. Excluding the parcels previously awarded by the Land Commission, the *ahupua‘a* of Honua‘ula was divided into two large land grants. In May of 1855, G. L. Kapeau purchased 585 acres of land in Honua‘ula, extending *mauka* (east) of the Kuakini Wall to *mauka* most boundary of the *ahupua‘a* (Figure 16). Kapeau descended from a Maui chief and was considered a *kaukauali‘i* (lesser chiefs or nobles in service to the *Ali‘i Nui*) (Osorio 2002) He was also one of the first Native Hawaiians to receive a western education at the missionary school Lahainaluna where he graduated in 1837. He then served in the House of Nobles under Kauikeaouli (Kamehameha III) from 1848 to 1855, and was appointed deputy Governor of Hawai‘i Island under Governor William Pitt Leleiōhoku (Osorio 2002). Leleiōhoku purchased Grant 3148:4. which encompassed approximately 98.48 acres of land *makai* of the Kuakini Wall (see Figure 16) in April of 1875. At some point, G.L. Kapeau’s land was returned to the government, and was later sold to Kuakamauna in 1865 as Grant 3100.

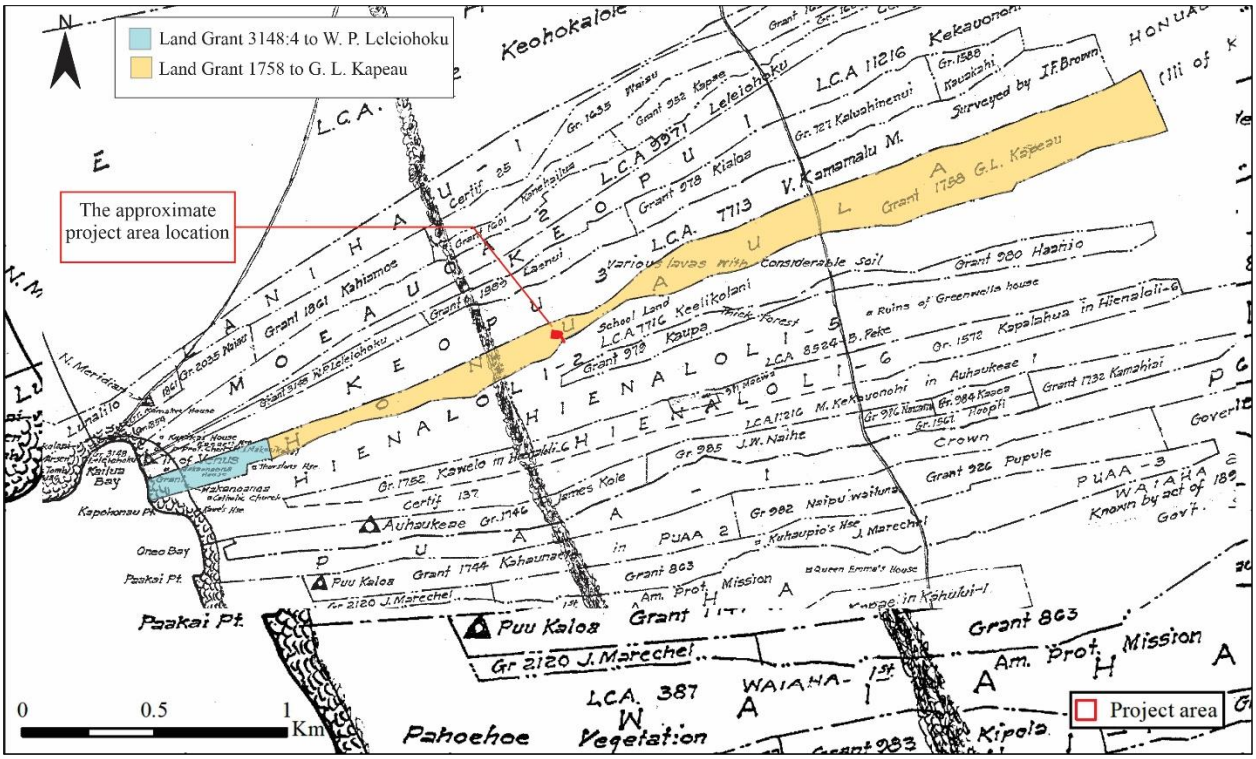

Figure 16. A portion of Hawai‘i Registered Map No. 1280 with the project area and Government Land Grant 1758 to G. L. Kapeau indicated (after Emerson n.d.).

Boundary Commission Testimony

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of all the *ahupua‘a* that had been awarded solely by name as a part of the *Māhele ‘Āina*. Subsequently, in 1874, the Boundary Commission was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents who typically learned of the boundaries from an elder relative or neighbor. The boundary information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and simultaneously transcribed by the courts into English. Testimony for an individual *ahupua‘a* would be brought before the Boundary Commission, and the boundaries surveyed later by Government employed surveyors. In some cases, the Boundary Commission relied on existing *kuleana* and Land Grant surveys to establish the boundaries for that *ahupua‘a*. In other cases, boundary surveys on adjacent *ahupua‘a* were used. Because Honua‘ula Ahupua‘a was divided into several LCAw. and two Government Land Grants, no oral testimony was taken for its boundaries. Its southern boundary, however, was described in testimony provided by two native tenants, named Haleokane and Kaukalio, for the adjacent Hienaloli 1st and 2nd Ahupua‘a in 1874:

> Haleokane [k.] sworn.
>
> I was born at Hianaloli, North Kona, Hawaii but do not know when (is rather an old man). Kapohonau is the boundary at the sea shore between Hianaloli 1st and Honuaula said place is an old heiau. Thence mauka to Thurstons yard at the Kohala end of the house. A few Kaheka (Kailua) at the shore, but no sea…
>
> The north corner of Hienaloli 1st on the boundary of Honuaula is at Kokomo, the kahawai [stream] bathing place.
>
> Kaukalio [k] sworn.
>
> I was born on Oahu but have lived on Keopu North Kona Hawaii for over twenty years. I have had charge of Hianaloli 1st and Hianaloli 2nd for about three years and know a part of the boundaries. Aipu and old kamaaina of the land, now gone to Maui pointed them out to me. Kapohonau is the boundary at shore between Honuaula and Hianaloli. Thence the boundary runs along the wall on iwi aina, on the Kohala side of Aepu’s house, thence mauka through Montgomery’s premises. The boundary line running on the Kohala side of the house… (Boundary Commission 1874:379-380)

The southern boundary of Honuaʻula is described in part to follow a wall on an *ʻiwi ʻaina* as it ascends *mauka*. No other details are given in the description, however. The *Palapala Sila Nui* (Royal Patent Grant) documents for both Leleiōhoku's and Kapeau's grant parcels are equally silent with respect to landmarks, providing only metes and bounds information.

A survey conducted to document the boundaries of Hienaloli 1st and 2nd in 1906, however, produced a map depicting several landmarks in the vicinity of the current project area. Conspicuous landmarks such as the Government Road, the stream, and the boundaries of the *kuleana* parcels at the coast are shown in their correct locations. Annotations made to the map also depict the Hienaloli Road right-of-way that is discussed below. While physical landmarks are depicted correctly, the boundary between Hienaloli 1st and Honuaʻula is drawn to the north of its actual location (the actual boundary is drawn as a rock wall interpreted by surveyor George Wright as approximating the Hienaloli 1st and 2nd boundary). In the vicinity of the current project area (Figure 17), the map shows a portion of an "old trail" paralleling the north side of the (mis-surveyed) boundary between Honuaʻula and Hienaloli 1st. As the trail approaches from the southwest, it passes a small cluster of monkeypod (*Pithecellobium saman*) trees, and then crosses through the current project area. A survey marker consisting of a "+" carved into solid rock is indicated on the south side of the trail, near or just outside the current project area's eastern boundary. On the map, the trail continues toward the northeast for approximately 120 meters, then turns toward the north.

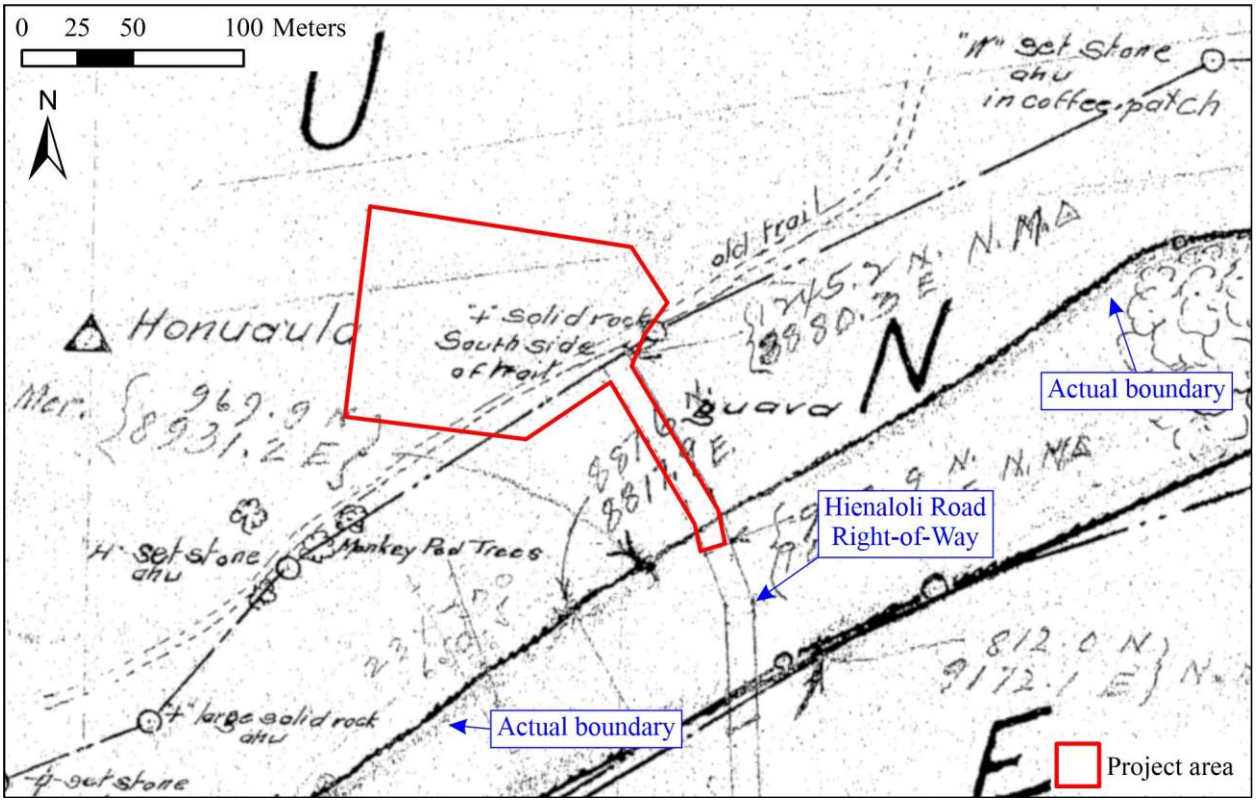

Figure 17. Portion of Registered Map No. 2358 (after Wright 1906).

The Kona Sugar Company and the West Hawaii Railroad

The creation of private property also culminated in a deviation away from the traditional *mauka*-to-*makai* management of whole *ahupuaʻa*, as certain industries infiltrated into large swaths of land. Among these was commercial sugarcane cultivation. In 1876, the Kingdom of Hawaiʻi and the United States of America ratified a reciprocity treaty that guaranteed a duty-free market for Hawaiian sugar and led to heavy investment of land and capital into sugarcane plantations. With successful plantations established in the wetter and more agriculturally fertile lands of the island, attempts were made to spread the industry into the drier, less suitable hillsides of North and South Kona. The Kona Sugar Company was incorporated in 1898, having leased to 1,300 acres of land formerly held by the Waiaha Sugar Company (which had been created only two years before) and an additional 2,000 acres located 6 to7 miles to the south in Onouli, South Kona (Kona Historical Society 1998; The Hawaiian Star 1898). The company's mill was

situated south of Kailua Village near Wai‘aha Stream (Figure 18). Beginning in 1901, a 7-mile long narrow-gauge railroad was built to haul cane to a flume feeding the mill. The company also constructed a reservoir and flume near the mill, but water proved inadequate for cane production, and financial troubles forced the company into receivership in 1902 (The Honolulu Advertiser 1902).

The assets of the company were purchased in1906 by two companies formed by James Castle and Associates, the Kona Development Company and the West Hawaii Railroad Company (Condé and Best 1973; Dorrance and Morgan 2000; Hilo Tribune 1906). The Kona Development Company operated as a cooperative, purchasing cane from independent homestead farmers and hauling it to the company’s mill (Dorrance and Morgan 2000). The railroad was operated by the West Hawaii Railroad Company, which worked to extend the line to the south along the old plantation road (Hawaii Herald 1909). By 1914, eleven miles of the railroad was in operation and leased by the Kona Development Company for hauling the company’s sugar (Honolulu Star-Bulletin 1914). The railroad was described as a public carrier, but primarily functioned to haul the plantation’s cane to the mill.

After ten years of operation, the Kona Development Company and the West Hawaii Railroad Company were sold to a corporation headed by Tomekichi Konno, formerly of the Laupahoehoe Sugar Company (Hilo Daily Tribune 1915; Siddall 1921:241). This was the first sugar plantation to be owned outright by a company headed by a Japanese immigrant. The two companies continued to cultivate sugarcane and operate the railroad. In 1921, the company reported its maximum production of 4,219 tons of sugar, but five years later the plantation closed (Dorrance and Morgan 2000). On April 18, 1927, torrential rains caused a massive flood that destroyed the sugar mill (The Honolulu Adverstiser 1927a). The plantations assets were ultimately purchased by a sugar syndicate based in Manila. The company’s trustee, R. Burton Hind had the mill and railroad dismantled and shipped to the Philippines (The Honolulu Adverstiser 1927b).

The railroad right of way was repurposed by the government as the Hienaloli-Kahului Road. A survey of the road right-of-way was conducted in 1932 (Figures 19 and 20). Maps created for this survey record the presence of a road, symbolized by a pair of dashed lines, already in use along the former railroad. Within the current project area, this new road turns *mauka* at the northern end of the government’s road Parcel 1 (see Figure 19).

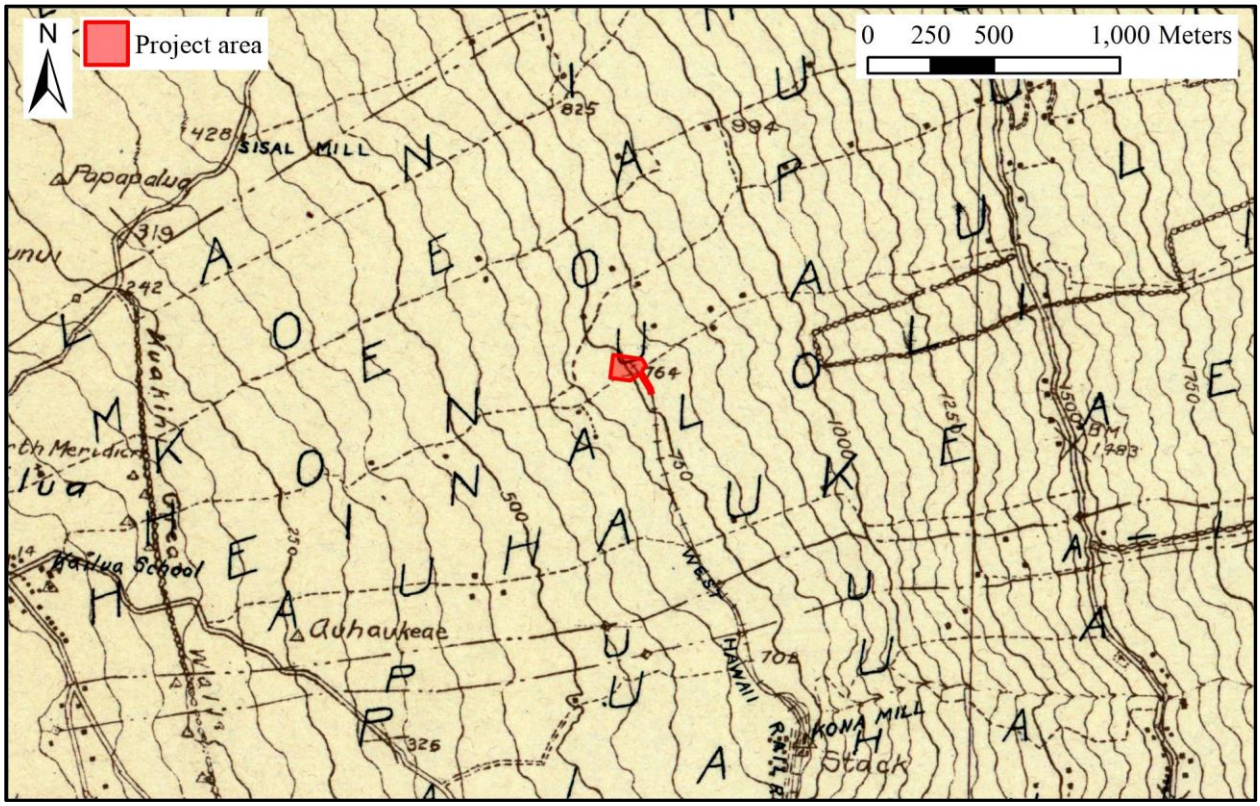

Figure 18. Portion of 1923 USGS Kailua Quadrangle with the West Hawai‘i Sugar Company’s railroad and mill indicated south of the current project area.

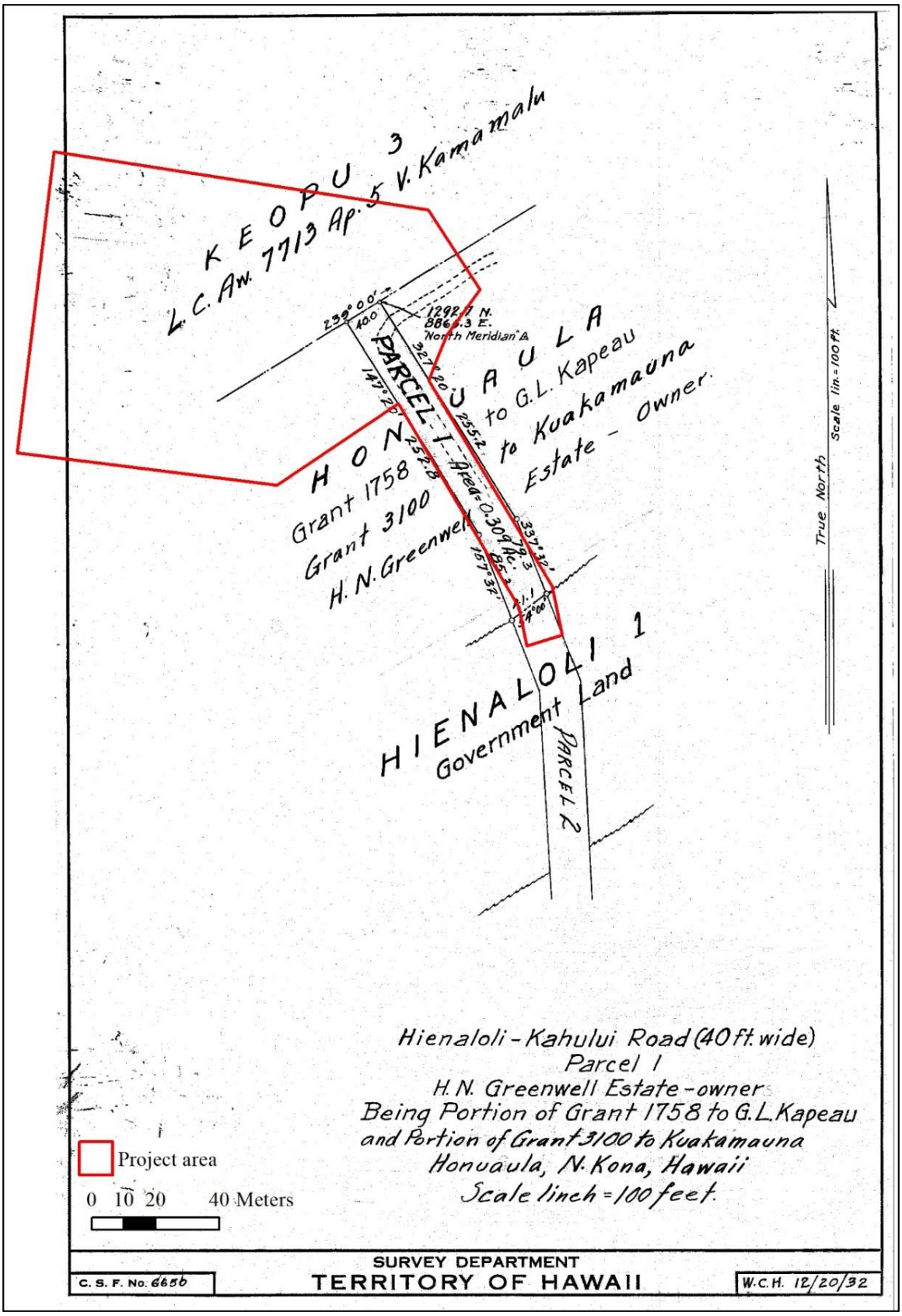

Figure 19. Map of Hienaloli-Kahului Road right of way, Parcel 1 (Territory of Hawaii 1932).

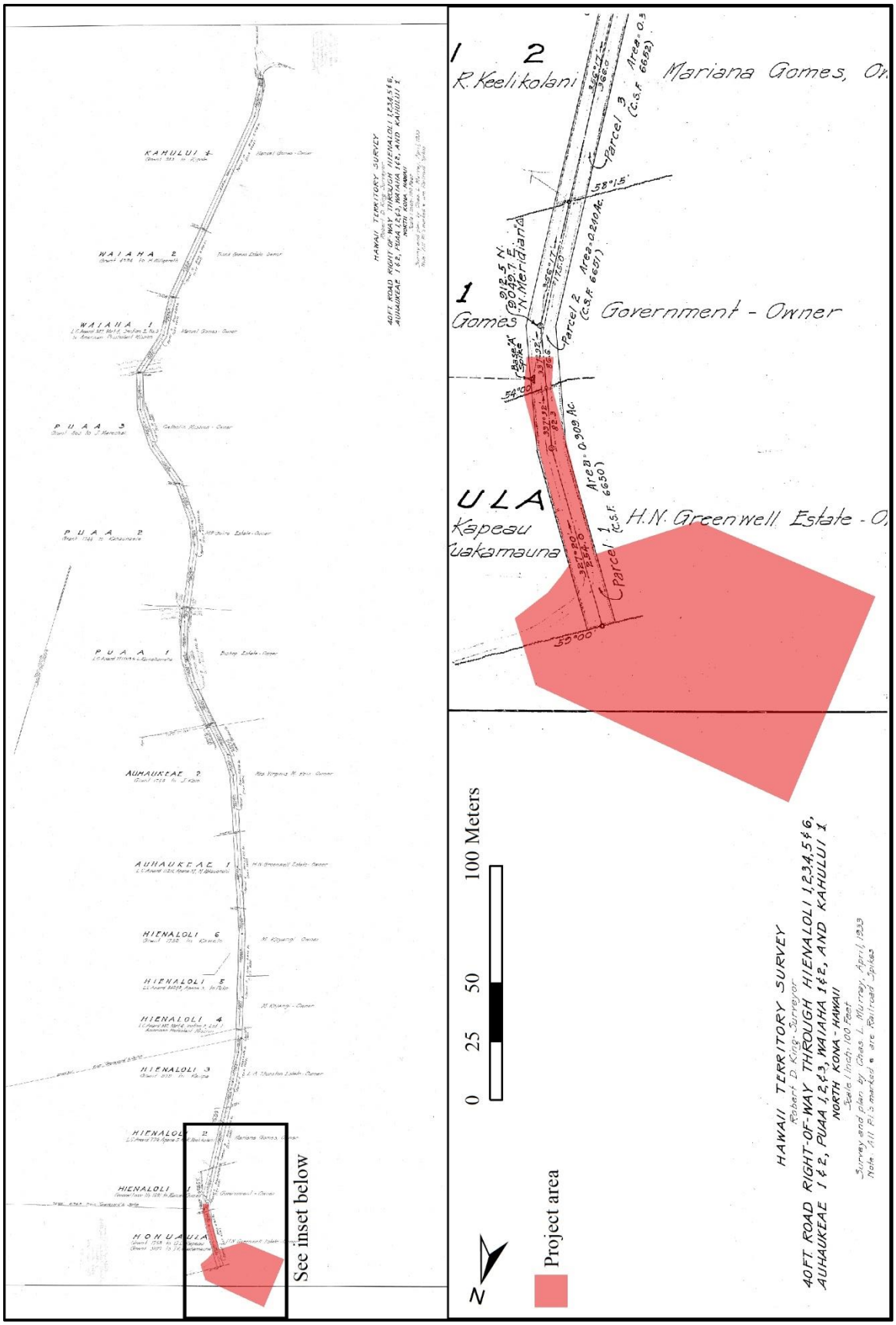

Figure 20. Current project area relative to the Hienaloli-Kahului Road right-of-way (Murray 1933).

Ranching

Although it contained the northern terminus of the railroad that served Kona's sugar plantation, the land surrounding the current project area was not suitable for sugarcane cultivation. Instead, it became part of the vast grazing lands found throughout the *kalu'ulu and 'āpa'a* zones of North and South Kona. Henry N. Greenwell began grazing cattle around 1875, establishing what would grow into the 36,000-acre Greenwell Ranch in North and South Kona (Henke 1929). Greenwell got his start in Hawai'i in 1850 by operating a store in Kailua, and later establishing another in Kealakekua in 1870. Greenwell was a successful farmer of oranges, and promoter of Kona coffee. The ranch began as a dairying operation. Upon H. N. Greenwell's death in 1891, the ranch was run by his son William H. Greenwell. After the annexation of Hawai'i by the United States in 1898, increased beef prices spurred a switch in emphasis away from dairying (Henke 1929). When William H. Greenwell died in 1927, the three sections of the ranch were distributed among three of his sons, with their mother Elizabeth controlling all three sections as a single unit until her death in 1934 (Springer and Greenwell 1992). The northern section of the ranch, known at the time as Honokōhau Ranch and Hualālai Ranch, included about 20,000 acres, 4,000 of which were owned by the ranch. These lands included the current project area, which had been purchased by the H. N. Greenwell as Government Grant 3100 (the land originally sold as Grant 1758 to Kapeau appears to have become Government Land prior to this). Stone walls and wire fences were used to divide the ranch land into paddocks.

By the 1940s, the parcel was owned by Kakuro Komo, who had emigrated from Hiroshima Prefecture, Japan to Hawai'i and worked for the Kona Development Company as a locomotive engineer for the sugar plantation in the early 1900s (Nishimoto 1991). Around the 1920s, Komo leased land in North Kona for his home, a general store, and coffee land, and eventually acquired additional properties, including the current project area. County of Hawai'i tax records indicate that throughout the second half of the twentieth century, about 108 acres of the property were used as pasture, which was leased to local ranchers. Aerial photography (Figure 21) from this period documents relatively little change to the project area vicinity. The land remained in use as cattle pasture, and as the aerial photographs show, was mainly kept grazed down with the exception of several trees. By 1977, a ranch road had been cleared *makai* of the project area, and development had begun in Keōpū 3rd Ahupua'a to the north, but the current project area appears to have changed little.

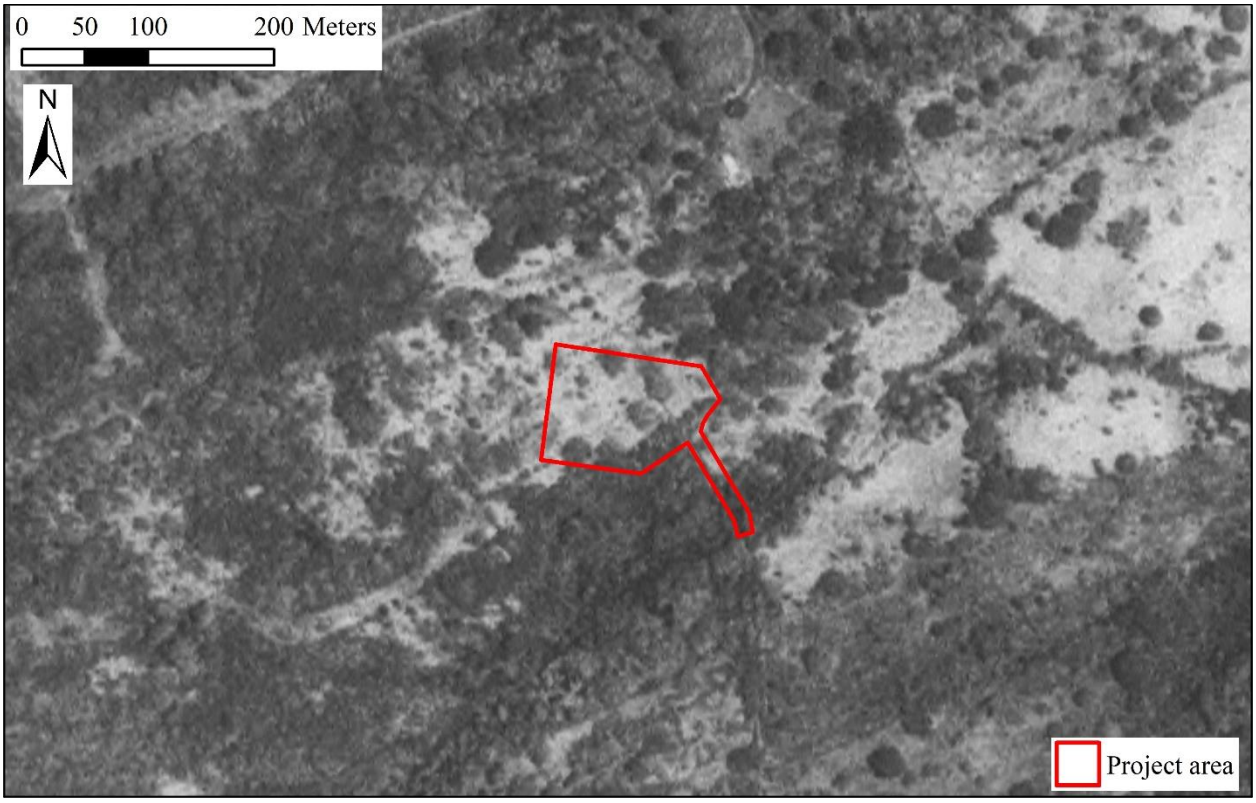

Figure 21. Aerial imagery of the project area vicinity in 1977 (Hawaii Statewide G. I. S. Program 2017).

PREVIOUS ARCHAEOLOGICAL STUDIES

Most of the archaeological studies conducted in Honua‘ula Ahupua‘a have been concentrated in the *kula* and coastal zones of the Kona Field System (Bonk 1985; Elmore and Kennedy 2000; Hammatt 1997; Haun 2000b; Schilt 1984; Soehren 1979). These studies collectively reveal a pattern of precontact land use consisting of temporary and permanent habitation, limited agriculture, marine exploitation, landscaping, and burials within the coastal areas (Bonk 1985; Elmore and Kennedy 2000; Hammatt 1997; Haun 2000a; Rechtman et al. 2005; Schilt 1984; Soehren 1979). Furthermore, these studies indicate that habitation and burial activities continued to occur in this area into the historic period and the 20th Century. Few previous studies have occurred within the *‘āpa‘a* zone in Honua‘ula (Barna and Rechtman 2014; Haun and Henry 2001b, 2002b; Haun et al. 2005; Rosendahl 1991), and none have occurred within the *kalu‘ulu* zone, in which the current project area is located. However, studies within the *kalu‘ulu* zone of the Kona Field System have been conducted in the Ahupua‘a of Keōpū and Hienaloli which neighbor Honua‘ula to the north and south. The following discussion focuses on relevant studies (Table 3) that have been carried out within the *kalu‘ulu* and *‘āpa‘a* Kona Field System zones in Honua‘ula Ahupua‘a and the neighboring *ahupua’a* of Keōpū and Hienaloli.

Table 3. Previous studies conducted within Honua‘ula and neighboring *ahupua‘a*

Year	Author	Ahupua‘a	Elevation	Type of Study
1991	Rosendahl	Honua‘ula	1,540-1,750	Inventory
1996	Devereux et al.	Hienaloli 1st	1,200-1,250	Inventory
1996	Henry et al.	Hienaloli 3rd and 4th	750-1,450	Inventory
2000c	Haun	Hienaloli 2nd	1,300-1,480	Inventory
2000b	Haun and Henry	Hienaloli 1st and 2nd	750-1,480	Inventory
2000a	Haun and Henry	Hienaloli 1st and 2nd	750-1,480	Data Recovery
2001a	Haun and Henry	Hienaloli 2nd – 5th	750-1,480	Inventory
2001b	Haun and Henry	Honua‘ula and Keōpū 3rd	1,605-2,305	Inventory
2004	Haun et al.	Honua‘ula and Keōpū 3rd	1,605-2,305	Data Recovery
2005	Haun et al.	Honua‘ula and Keōpū 3rd	1,605-2,305	Data Recovery
2006	Johnson and Wolforth	Keōpū 3rd	220-840	Inventory
2008	Clark et al.	Hienaloli 1st	1,440-1,780	Inventory
2014	Rechtman	Hienaloli 1st	1,440	Inventory
2014	Barna and Rechtman	Hienaloli 1st	1,440	Data Recovery
2015	Rechtman and Barna	Keōpū 2nd	1,125-1,225	Inventory

Relevant previous studies conducted within Honua‘ula

Within the *‘āpa‘a* zone of Honua‘ula, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey (AIS) (Rosendahl 1991) of a proposed well site and access corridor located to the east (*mauka*) of the project area. Rosendahl (1991) observed that the area had been extensively disturbed by historic ranching and agriculture. Agricultural terraces, bulldozer cuts, old road grades, cattle walls, and paddocks were observed, and Rosendahl (1991:2) concluded that “some of the agricultural terraces may be part of the Kona Field System” including “remnants of *kuaiwi*.”

In 2002, the area inventoried by Rosendahl (1991) was included in an AIS (Haun and Henry 2001b) conducted by Haun and Associates of a larger 200-acre parcel (TMK:(3) 7-5-001: 044). Twenty-nine sites and 86 features dating from the precontact to early historic period were identified during their survey. Precontact features included modified outcrops, mounds, walls, terraces, and two burials; these were associated with temporary and permanent habitation, agriculture, storage, and burial practices were identified. Historic sites included ranch walls for livestock control, a historic trail segment, and a water tank. A large agricultural complex (Site 50-10-28-22978) was interpreted to have been used from the Precontact period until the nineteenth century. Many culturally sterile lava tubes were observed within their project area. In 2002 a burial treatment plan Haun and Henry (2002a) for the two burials (Sites 50-10-28-22957 and 22977) was prepared. Data recovery was conducted to mitigate impacts to seven sites (Haun et al. 2004), followed by supplemental archaeological data recovery at four features of Site 22978 (the large agricultural complex) (Haun et al. 2005). Data recovery concluded that agricultural pursuits, habitation and livestock control/ranching were occurring within at these sites.

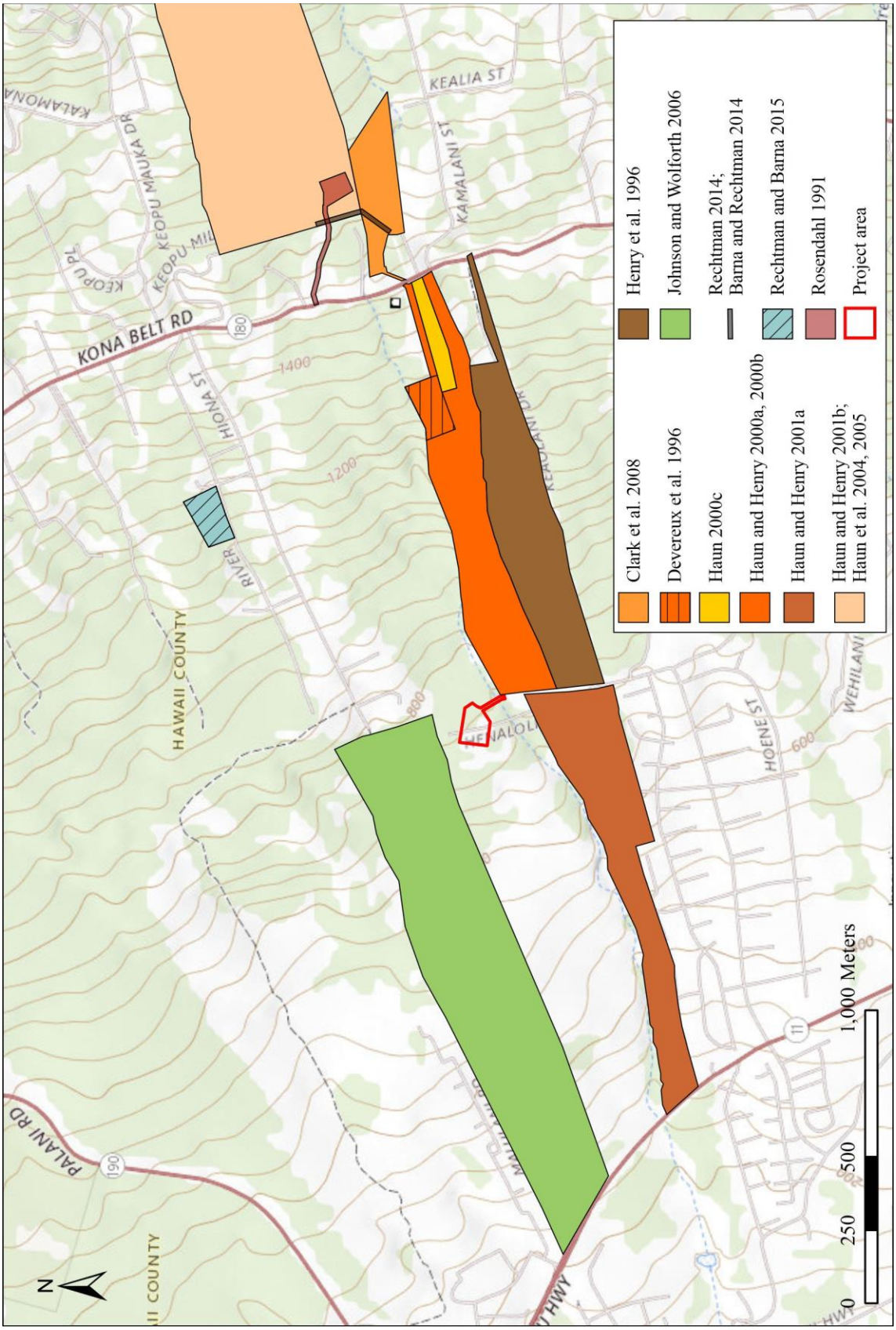

Figure 22. Previous archaeological studies in the vicinity of the current project area.

Previous studies conducted within the neighboring lands of Hienaloli

In 1996, PHRI conducted an AIS (Henry et al. 1996) of a roughly 50-acre parcel (TMK: (3) 7-5-11:002) located southwest of the current project area within Hienaloli 3 and 4, within the *kalu'ulu* zone of the KFS (see Figure 22). As a result of the survey nine archaeological sites were recorded on the parcel. The sites included two agricultural complexes (Sites 50-10-28-18658 and 18661), two Historic boundary walls (Sites 18659 and 18660), three Precontact habitation enclosures (Sites 18662, 20689, and 20691), a Precontact platform interpreted as a men's house (Site 20690), and a platform used for Precontact habitation (Site 18663). One of the agricultural complexes (Site 18658) was interpreted as being used during Historic times. It contained 20 features including 15 mounds, 3 walls, an alignment, and a terrace. The other agricultural complex (Site 18661) was interpreted as being used during Precontact and Historic times. It contained 131 features including 21 mounds, 60 terraces, 4 modified outcrops, 11 enclosures, 34 walls, and one feature that was bulldozed beyond recognition. Both agricultural sites were interpreted as being part of the Kona Field System. In addition to the recording of surface features, forty shovel test pits were excavated in the vicinity of surface features within identified sites, revealing a partially disturbed, Precontact cultural deposit that extended to a depth of 0.15 meters below ground surface. Cultural debris recovered from the test pits included volcanic glass flakes, charcoal, a stoneware ceramic fragment, and a metal nail

In 1996, Cultural Surveys Hawai'i conducted an AIS (Devereux et al. 1996) of a five-acre parcel in (TMK): (3)-7-5-011:004 in Hienaloli 1, located to the southwest of the current project area and within the *'āpa'a* zone (see Figure 22). Three sites were identified within their project area. These consisted of two historic cattle walls (Sites 50-10-28-5084 and 20846) and a complex of agricultural features (Site 20847). Agricultural features recorded within Site 20847 include seven *kuaiwi* walls and eight terraces. The complex was organized into 11 agricultural plots/fields that were bounded by the *kuaiwi* and terraces. Mechanical clearing had occurred on the property.

In 2000, Haun & Associates conducted an AIS (Haun and Henry 2000b) of a roughly 56-acre property (TMKs: (3) 7-5-11:003, 004 and 024) located southeast of the current project area within Hienaloli 1 and 2 (see Figure 22). Eight archaeological sites containing a total of thirty-nine features were identified. The sites included five Historic ranch walls (Sites 50-10-28-5085, 18659, 20846, 21878, and 21879), a railroad bed (Site 7214), a *heiau* (Site 21880), and an agricultural complex (Site 21881). The agricultural complex contained thirty-two features including mounds, modified outcrops, *kuaiwi*, platforms, and terraces concentrated in areas least affected by mechanical clearing. Haun and Henry (2000b) suggested that Site 21880 was probably a small agricultural *heiau* based on its setting, and that it was likely built and used sometime between A.D. 1400 and 1600. As a result of the inventory survey Site 21881 was recommended for data recovery, Site 21880 was recommended for preservation, and the remaining sites were recommended for no further work. Haun and Henry (2000a) later conducted data recovery excavations at Sites 21848 and 21881. The data recovery consisted of seven mechanical trenches that bisected five terraces and one *kuaiwi*. The results of the data recovery suggested that "initial agricultural use of the area began in the early 1400s with the formation of *kuaiwi* [sic] followed by the construction of terraces within a few decades", and that "the agricultural features probably continued in use until at least the early to mid-1800s" (Haun and Henry 2000a:ii).

In 2000, Haun & Associates conducted an AIS (Haun 2000c) of TMK: (3) 7-5-11:023 (por.) in Hienaloli 1 and 2, located to the southeast of the current project area within the *'āpa'a* zone (see Figure 22). The survey identified one site (Site 50-10-28-21848) with 17 features within the boundaries of LCAw. 10406. The features consisted of a modern house, a probable animal pen, an enclosure, and an enclosing wall with a series of subdividing walls and a terrace forming at least ten formal agricultural fields. Land Commission testimony for the parcel indicated that the property was used for the cultivation of taro, sweet potatoes, and coffee during the early to middle 1800s. As a result of the survey Site 21848 was recommended for data recovery, which was completed on selected features (Haun and Henry 2000a).

In 2001, Haun & Associates conducted an AIS (Haun and Henry 2001a) of a 51-acre project area (TMKs: (3)7-5-010: 052, 065, and 066) in Hienaloli 2-5 Ahupua'a, located to the southwest of the current project area (see Figure 22). The survey identified 22 sites and 134 features consisting of modified outcrops, mounds, walls, terraces, and *kuaiwi*. No *kuaiwi* were observed within the *kalu'ulu* zone of their project area, however this was explained to likely have resulted from recent mechanical clearing. In addition to Precontact and early Historic agricultural features, Historic ranch infrastructure dating from the mid-1800s to 1900s was recorded, including numerous walls, a water tank and an enclosure. A 220-meter-long section of The West Hawai'i Railway Company railroad bed, Site 50-10-28-7124, was identified along eastern boundary of their project area, where it was in use as Hienaloli Road.

In 2008, Rechtman Consulting, LLC completed an AIS (Clark et al. 2008) of a roughly 17-acre portion of TMK: (3) 7-5-13:022 located to the southeast of the project area (see Figure 22). Five sites were recorded within the roughly 17-acre project area. The sites included four core-filled ranching/boundary walls (Sites 50-10-28-20754, 20755,

20757, and 20758) and a terrace and wall (Site 20759). A 1 x 1-meter test unit was excavated at Site 20759 revealing a soil deposit, but only modern cultural material. As a result of the Clark et al. (2008) study, Sites 20754, 20755, 20757, 20758, and 20759 were to be significant under Criterion d for information yielded relative to past use of the project area. In 2014, ASM Affiliates prepared an update (Rechtman 2014) to the Clark et al. (2008) AIS. As a result, two previously undocumented *kuaiwi* (Site 22975 Features B and C) and a Historic Period roadway (Site 22974 Feature B) were recorded. All three sites were assessed as significant under Criterion d for the information that they yielded. This was followed by data recovery of the two *kuaiwi* features (conducted at the request of DLNR-SHPD), which produced radiocarbon samples that placed the building of the features in the late A.D. 1600s or early A.D. 1700s, toward the end of the construction of the larger agricultural complex (Barna and Rechtman 2014).

Previous studies conducted within the neighboring lands of Keōpū

In 2006, Scientific Consultant Services Inc. conducted an AIS (Johnson and Wolforth 2006) of 125 acres located on TMK: (3) 7-5-003:023 north of the current project area (see Figure 22) within the upper *kula* and *kalu'ulu* zones of the KFS. Twenty-eight sites were recorded, including Precontact agricultural and habitation sites as well as Historic Period ranching, animal husbandry and trails. The majority of these features were categorized as agricultural and included soil and rock filled terraces, mounds, modified outcrops, and *kuaiwi*. Other site types included platforms, walkways, pavements, ranch walls, and enclosures. No further work was recommended for the agricultural sites, activity areas, and animal pens, temporary habitation and platform mounds of unknown function. Of particular relevance is Site 50-10-28-24870, a complex of 84 agricultural and ranching features located within the *kalu'ulu* zone at roughly at the same elevation as the current project area. (Johnson and Wolforth 2006) note a relative absence of non-agricultural features within Site 24870, suggesting that permanent or temporary residency did not occur at this particular elevation. Permanent habitation features were observed at lower elevations in the *kula* lands. Site 24870 also included 24 Historic walls associated with livestock ranching. Johnson and Wolforth (2006) indicate that the locations of the majority of the ranch walls within Site 24870 appear to correspond with earlier *kuaiwi*, suggesting that the walls were built by modifying *kuaiwi*.

In 2015, ASM Affiliates conducted an AIS (Rechtman and Barna 2015) of a previously-disturbed, roughly 5-acre parcel located on TMK: (3) 7-5-002:033 north of the current project area (see Figure 22). As a result of the surface survey, only three previously unrecorded sites, each a Historic Period boundary wall, were recorded.

3. PROJECT AREA EXPECTATIONS

After initially settling the coast, North Kona's inhabitants developed agricultural fields in upland areas to support their growing populations. The area of dryland agricultural fields has been termed the Kona Field System, which reached its greatest extent in the late 1700s (Cordy 1995; Schilt 1984). Early written accounts (King 1784; Menzies 1920) describe these fields at elevations similar to the current project area, and archaeological studies at elevations similar to those of the current project area have documented agricultural fields interspersed with habitation features (Haun 2000c; Haun and Henry 2000a, 2000b; Henry et al. 1996; Johnson and Wolforth 2006). Thus, Precontact agricultural features that may have been present within the current project area include typical Kona Field System elements such as *kuaiwi*, mounds, modified outcrops, enclosures, and terraces; other feature types may have included habitation platforms or enclosures. *Mauka-makai* trails are also common near *ahupua'a* boundaries. Recent satellite imagery (see Figure 3) indicates the potential for linear field system features (e.g., *kuaiwi* and cross-slope terraces), but, as discussed below, these features have most likely been modified by twentieth century livestock ranching activities.

During the nineteenth century, with the shift to a market economy and a western-style of land ownership in Hawai'i, populations shifted from the Kona coast to the upland areas (Cordy 1995; Ellis 2004). As the century progressed, traditional agriculture practices were largely abandoned as sugarcane plantations, coffee farms, and, in the current project area, cattle ranching became the dominant economic activities. Livestock ranching required the clearing of pasture and the creation of pens and paddocks. Throughout North and South Kona, pens and paddocks in former Kona Field System lands were built with core-filled rock walls. The existing Kona Field System features, such as *kuaiwi* and cross-slope terraces, were convenient sources of material for building these walls. Satellite imagery of the current project area (see Figure 3) suggests that this occurred in the project area. Attempts at sugar and coffee cultivation elsewhere in North Kona led to the construction of the West Hawai'i Railroad (SIHP 50-10-28-7124). The northern terminus of this railroad appears in the vicinity of the current project area on historic maps (see Figure 18). After removal of the railroad in 1927 Hienaloli Road, which provides access to the current project area, was built on the railroad bed after the tracks were removed. Lastly, an "old trail" is depicted in the project area on a map drawn in 1906 (see Figure 17).

4. FIELDWORK

Fieldwork for the current study was conducted on February 24 and March 3, 2020, by Genevieve Glennon, B.A., ʻIolani Kaʻuhane, B.A., and Benjamin Barna, Ph.D. (Principal Investigator). A total of 40 person-hours were expended during the fieldwork.

FIELD METHODS

During the archaeological field survey, the entire (100%) ground surface of project area was visually inspected by field technicians walking transects oriented north-south, spaced at no more than 10 meters apart. A thorough search for the "old trail" depicted in Figure 17 was made by clearing vegetation and walking transects oriented perpendicular to the depicted trail route and spaced 3 meters apart. When archaeological features were encountered, their positions were plotted on a map of the current project area using a handheld tablet computer connected to an EOS Arrow 100 GNSS receiver with sub-meter accuracy running ESRI's Collector application (set to the NAD 83 Zone 5 North). Areas of previous disturbance, conspicuous landforms, and vegetation patterns were also mapped and compared against a topographic map of the project area created by surveyors at R.M. Towill corporation. Identified features located within the current project area were then cleared of vegetation, photographed (both with and without a meter stick for scale), depicted on a scaled drafted plan map, and described using standardized feature record forms. Sites that were located near, but outside the current project area, were cleared of vegetation, photographed (both with and without a meter stick for scale), and described using standardized feature record forms; scaled plan view drawings were not made of features located outside the project area.

Subsurface testing consisted of one test unit (TU-1) excavated to ascertain the function and age of one identified archaeological feature. The test unit was dug by hand according to observed stratigraphic layers. All depths were measured relative to an elevation datum established for the test unit. Excavated matrix was passed through 1/8 inch mesh screen to collect material and segregate it by context. Level Record Forms were completed for each excavated context. Plan view and profile drawings were completed during the course of excavation. Soils were described in detail using standard USDA soil descriptions and Munsell colors. The test unit was photographed before, during, and after excavation to document the progress of the excavation and any features that may be encountered.

No cultural material was collected from the ground surface or test excavations.

FINDINGS

As a result of the fieldwork for the current study, one previously-recorded and two newly-recorded archaeological sites were identified within the project area (Table 4). Site 50-10-28-7124 is a portion of the railbed of the West Hawaii Railroad. Site 50-10-28-31161 is a complex of historic ranching walls. Site 50-10-28-31162 is a complex of agricultural clearing mounds comprising two features. The locations of the identified sites relative to the current project area is presented in Figure 23. The sites are described in detail below.

A thorough search for the "old trail" depicted in Figure 17 was made by clearing vegetation and walking transects oriented perpendicular to the depicted trail route and spaced 3 meters apart. The ground surface showed signs of erosion and disturbance by pigs and other animals, but no physical evidence of the trail was observed.

Table 4. Archaeological sites recorded during the current study.

SIHP Site Number	*Type*	*Function*	*Age*
50-10-28-7214	West Hawaii Railroad	Transportation	20th Century
50-10-28-31161	Ranch walls	Livestock Ranching	Historic
50-10-28-31162	Complex	Agriculture	Historic/Precontact

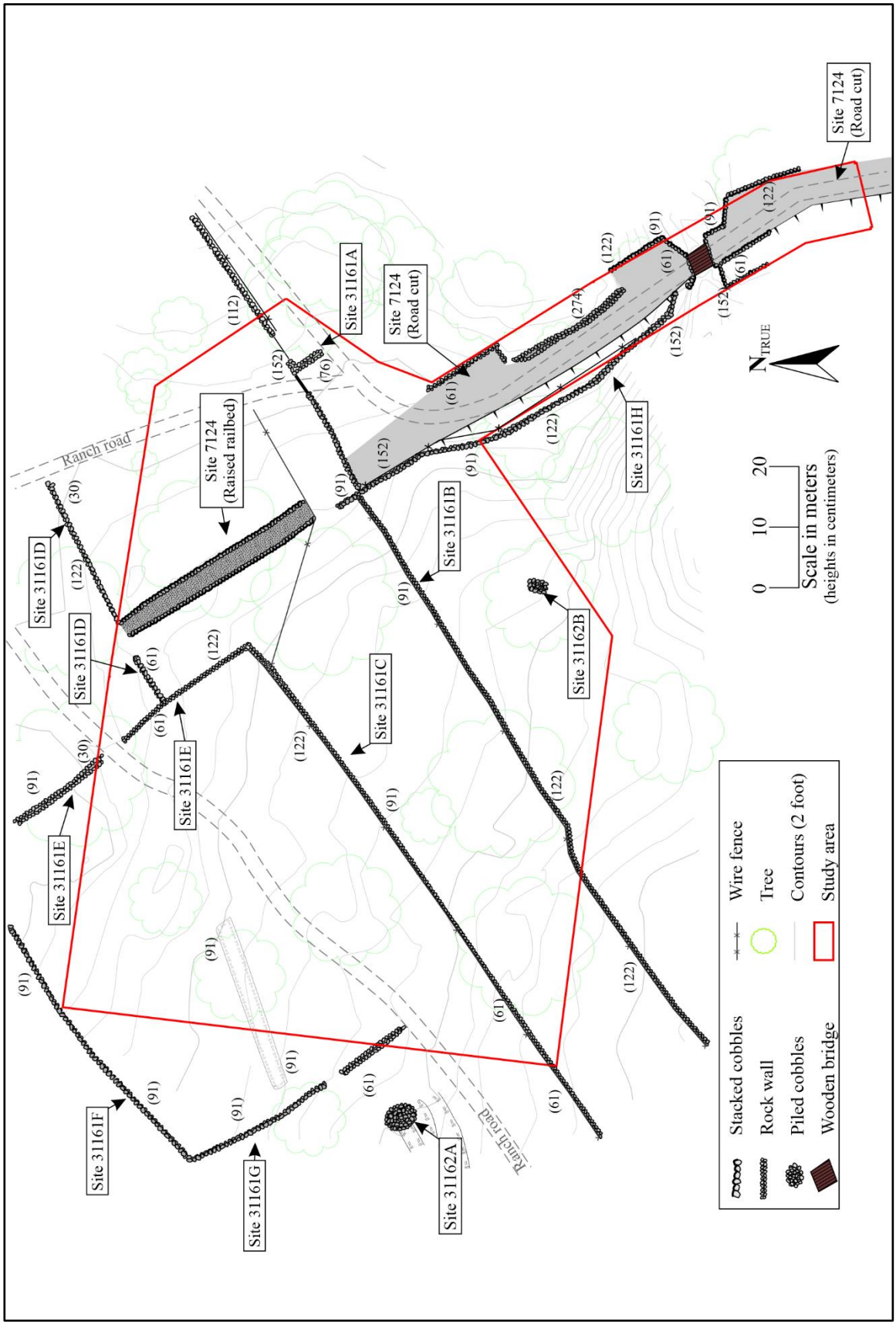

Figure 23. Site location map.

Site 50-10-28-7124

Site 7124 is the railroad bed of the former West Hawaii Railroad. A 160-meter-long discontinuous portion of the railroad bed extends through the current project area. Within the project area, the site consists of a 35-meter-long berm and approximately 130 meters of roadbed that has been cut across the prevailing slope. At the southern end of the project area, a wooden bridge crosses the unnamed stream at the Hienaloli 1st Ahupuaʻa boundary. The wooden elements of the bridge are modern, but the bridge abutments are Historic.

The railroad berm (Figure 24) comprises the northern terminus of Site 7124. From the northern boundary of the project area, the berm extends 35 meters toward the southeast. It measures 3 meters (10 feet) wide across the top and 3.3 meters (11 feet) wide at its base. It stands an average of 112 centimeters (3 feet 8 inches) tall above its western (downslope) side and 75 centimeters (2 feet 5 inches) tall above its eastern (upslope) side The berm is faced with large *pāhoehoe* cobbles that are stacked 4-5 rocks tall on the western side and 3 rocks tall on the eastern side. Both ends of the railbed are slightly deteriorated. Additionally, a wire fence extends perpendicularly across the southern end of the rail bed. No rails, spikes, ties, or other hardware was observed on the berm.

There is a breach measuring approximately 3 meters wide between the southern end of the berm and the road cut portion of the site. South of this breach, the railbed resumes toward the south. This portion of the railroad bed manifests only as a road cut that extends across the prevailing slope. The cut measures between 7.5 and 12 meters wide. On the *mauka* side of the cut there are retaining walls built of stacked basalt cobbles ranging in size from medium cobbles to small boulders. There is no retaining wall below the *makai* side of the roadcut in the project area, except near the bridge abutments. The surface of the roadbed is packed soil on top of gravel and cobbles. No ties, rails, spikes, or other hardware associated with the railroad were observed in this portion of the site.

The Historic elements of the bridge near the southern end of the project area are limited to its abutments. The abutments are constructed of small angular basalt boulders set in concrete. Portions of the abutments have been repointed with concrete. In some places along the upper portions of the abutment walls, the rocks are loose. The north abutment measures 2.1 meters tall by 4.20 meters wide. It wraps around the *makai* side of the roadbed for an additional 3.80 meters and around the *mauka* side for 4.60 meters. The south abutment measures 2.7 meters tall by 3.9 meters wide at its top and 7 meters wide at its base. It wraps around the *makai* side of the roadbed for 2.7 meters and around the *mauka* side for 1.6 meters.

Figure 24. Site 7214 West Hawaii Railroad railbed, view to the northeast.

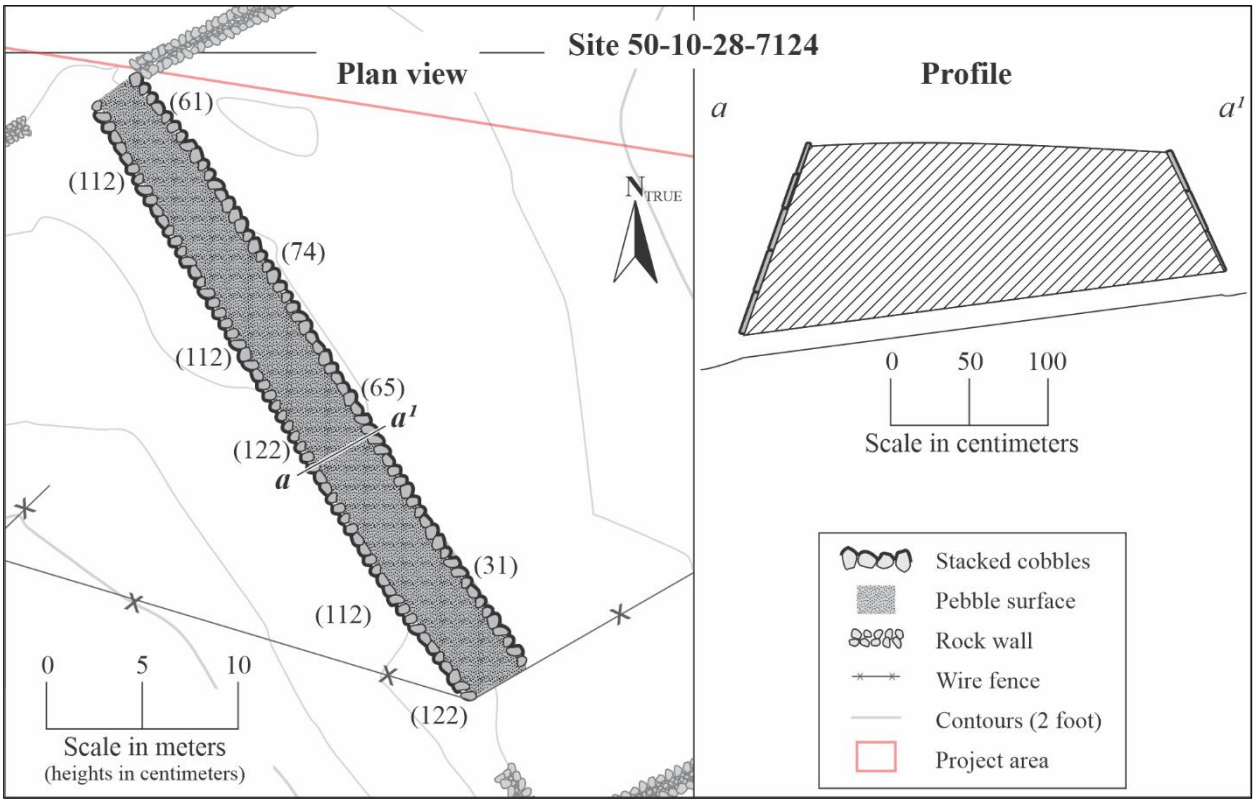

Figure 25. Site 7214 West Hawaii Railroad railbed plan view and profile.

Figure 26. Site 7241 West Hawaii Railroad Bed, view to the southwest.

Site 50-10-28-31161

Site 31161 is a complex of Historic ranch walls located within and extending beyond the boundaries of the current project area (see Figure 23). Portions of the site located outside the current project area have not been documented by the current study. Eight wall segments (Features A-H) were identified within the current project area. All of the wall segments are core-filled. The stacked outer edges are constructed of small subangular basalt boulders, and the inner fill material consists of small to large basalt cobbles. In general, all of the wall segments are in good condition with a few collapsed portions. Guinea grass has partially overgrown several segments of the walls.

Feature A (Figure 27) is a freestanding wall segment located on the northern end of the project area. It extends off the northern end of Feature B, at a modern gate. The wall averages 120 centimeters tall by 70 centimeters wide and extends for a total of 8.24 meters toward Hienaloli Road.

Feature B (Figure 28) is a freestanding wall segment that begins at Hienaloli Road and extends through the project area towards the southwest. Within the current project area, the wall measures 144 meters long and between 57 and 77 centimeters wide, standing between 73 and 110 centimeters tall. There is a modern gate on the *mauka* end. A barbed wire fence extends along northwestern side of the wall. The wall is partially collapsed in few places, and is partially overgrown with guinea grass. It abuts Feature H on both the *mauka* and *makai* sides of that feature. The portion of this wall east of Feature H is notable because it extents across the alignment of Site 7124 (see Figure 23), indicating that it post-dates 1927, when the railroad was dismantled.

Feature C (Figure 29) is a freestanding wall segment extending through the project area towards the southwest. Its *mauka* end is located about 50 meters *makai* of Hienaloli Road, and within the current project area the wall measures about 140 meters long and between 60 and 75 centimeters wide, standing 70 to 110 centimeters tall. The *mauka* end of the wall is connected to Feature A by a modern hog wire and barbed wire fence. A barbed wire fence also extends along the northwestern side of the wall.

Feature D (Figure 30) is a freestanding wall segment extending from Hienaloli Road into the current project area, where it abuts Feature E (Figure 32). This wall segment measures 43meters long by 75 centimeters wide, standing 110 centimeters tall. Outside the project area, the wall has been breached by Hienaloli road.

Feature E (Figure 31) is a freestanding wall that crosses into the project area through its northern boundary. Within the project area, Feature E measures 29 meters long by 75 centimeters wide and 110 centimeters tall. Feature D abuts this wall at its *mauka* side approximately 10 meters southeast of the project area boundary (see Figure 32).

Feature F is a freestanding wall (Figure33) located near the northern boundary of the project area. The wall measures 68 meters long by 120 centimeters wide, standing 90 centimeters tall. The portion of the wall within the project area is badly tumbled and in poor condition.

Feature G is a freestanding wall (Figure 34) located near the northwestern corner of current project area. The wall extends through the current project area for 45 meters (oriented northwest to southeast) and for another 12 meters outside of it. There are three totally collapsed areas along the wall. Where it is intact, the wall is 75 centimeters wide and 75 centimeters tall. The wall abuts Feature F at its northern end.

Feature H is a freestanding wall (Figure 35) located along the on the western side of Site 7124 (the West Hawai‘i Railroad). It is constructed of stacked basalt boulders with cobble fill. Within the current project area, the wall extends for 57 meters and measures 110 centimeters wide by 130 centimeters tall. Portions of the wall have collapsed, and it is overgrown with guinea grass and weedy vines. The wall is truncated at its northern end (about 4 meters north of Feature B) where clearing (bulldozing) has also breached the Site 7214 railroad bed. Feature H does not resume to the north of this truncated end. A hog wire fence extends along the eastern edge of the wall. As the wall extends to the south, the distance between it and the former railroad bed decreases until the wall essentially becomes a retaining wall.

Figure 27. Site 31161 Feature A, view to the west.

Figure 28. Site 31161 Feature B, view to the southeast.

Figure 29. Site 31161 Feature C, view to the southeast.

Figure 30. Site 31161 Feature D, view to the northwest.

Figure 31. Site 31161 Feature E, view to the southwest.

Figure 32. Site 31161 intersection of Features D and E, view to the west.

Figure 33. Site 31161 Feature F, view to the northwest.

Figure 34. Site 31161 Feature G, view to the southwest.

Figure 35. Site 31161 Feature H, view to the southeast.

Site 50-10-28-31162

Site 31162 is complex consisting of two remnant agricultural features (Features A and B) most likely associated with twentieth century livestock ranching. Feature A (Figure 36) is a large clearance mound located near the western end of the project area. It measures 6.0 meters (east-west) by 3.6 meters (north-south) and stands between 50 and 70 centimeters tall. It contains small to large basalt cobbles loosely piled on broken *pāhoehoe* bedrock, with a surface accumulation of soil. *Koa haole* saplings are growing in the mound.

Feature B is a rectangular mound (Figure 37) that measures 2.7 meters long (north to south) by 1.4 meters wide and stands stacked about two rocks tall located on the southern edge of the project area. It was constructed of small boulders outlining roughly rectangular area and filled with medium to small subangular cobbles. A single test unit (TU-1) was excavated into the mound to ascertain its function. TU-1 measured 50 centimeters wide by 150 centimeters long, and was positioned perpendicular to the long axis of the mound 68 centimeters from its southern end (Figure 38). Excavation revealed a single constructed layer (Figure 39) of piled medium to small subangular cobbles resting directly on bedrock (Figures 40 and 42). The mound is located at the *makai* edge of a low bedrock outcrop. No cultural material of any kind was observed within TU-1 or in the area surrounding the mound. Based on the results of TU-1, Feature B appears to be a clearing mound, likely associated with livestock ranching. An alternate explanation for the mound could be that it is a remnant of an *ahu* built to demarcate the trail shown on Registered Map No. 2358 (see Figure 42). In the absence of any other physical evidence of that trail, however, interpreting the mound in this way would be speculation at best.

Figure 36. Site 31162 Feature A, view to the east.

Figure 37. Site 31162 Feature B, view to the east.

Figure 38. TU-1 prior to excavation, view to the east.

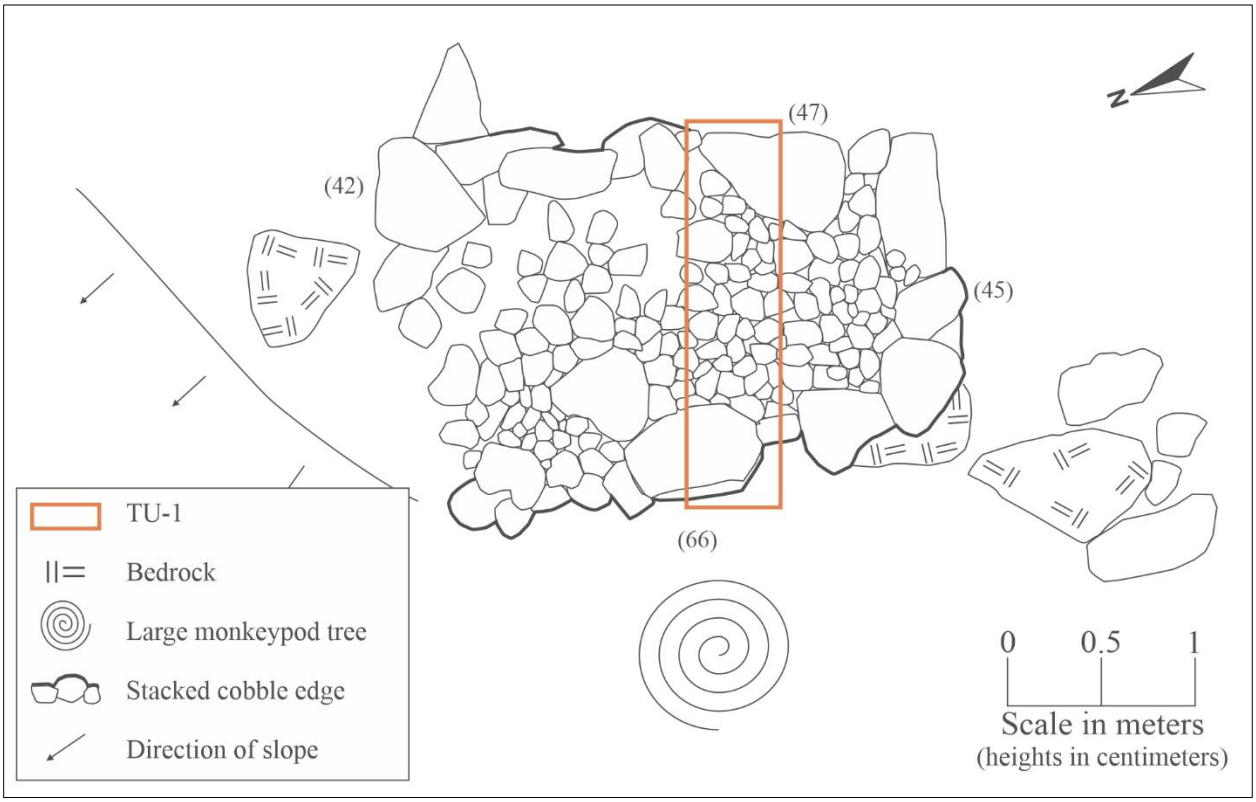

Figure 39. TU-1 plan view.

Figure 40. Site 31162 Feature B base of excavation, view to the east.

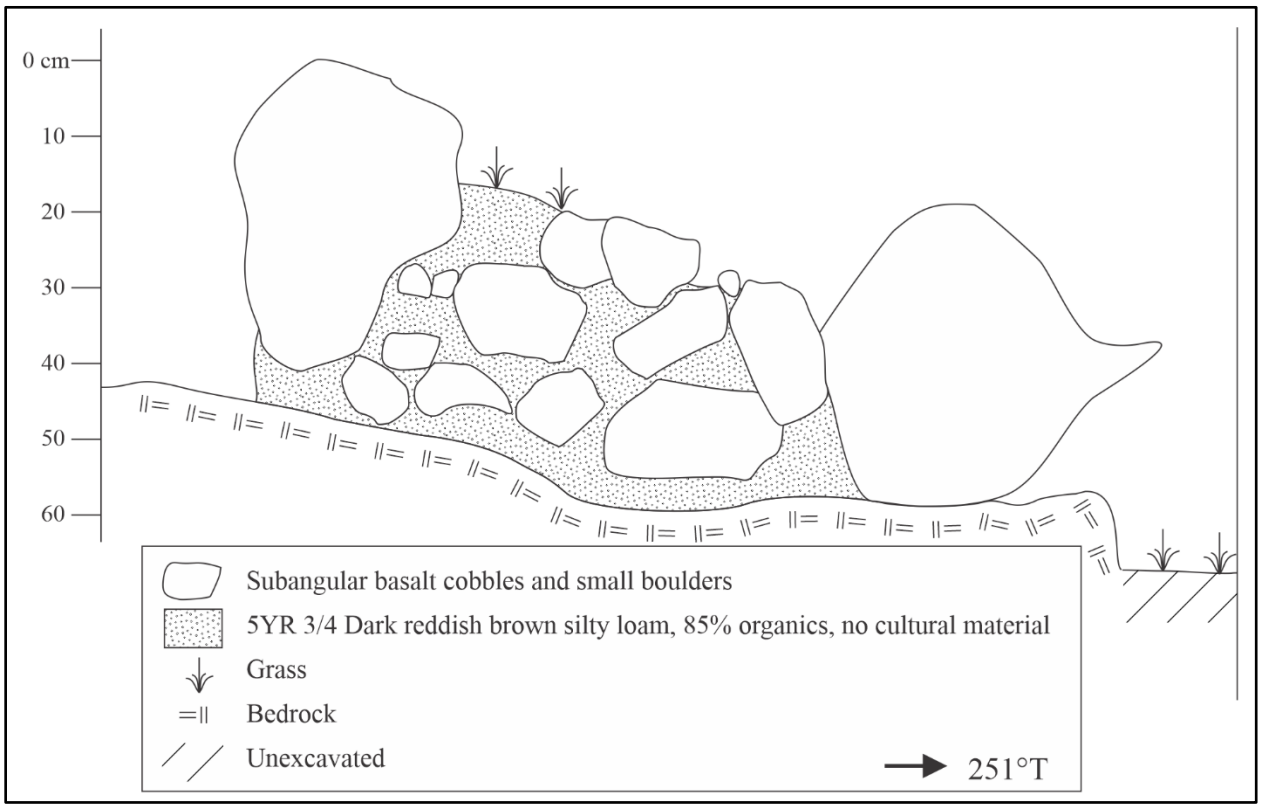

Figure 41. Site 31162 Feature B south wall profile.

SUMMARY

The current project area contains archaeological features that primarily reflect the change in land use from traditional agricultural practices to cattle ranching. Additionally, the northern terminus of the West Hawai‘i Railroad (Site 7124) is also present within the project area, tying it to attempts to include the Kona District in Hawai‘i’s sugar industry.

Eight core-filled walls (Site 31161, Features A-H) located in the project area appear to have been built using rock harvested from *kuaiwi* and other Kona Field System features. Their configuration most likely echoes that of the *kuaiwi* that made up part of these agricultural fields. A cursory examination of satellite imagery (see Figure 3) of the rest of this portion of Honua‘ula suggests that this is so. The walls were likely modified from the *kuaiwi* in the late nineteenth or early twentieth century to create paddocks for cattle. The two other features assigned to Site 31162, and are interpreted to be clearing mounds associated with livestock ranching.

The northern terminus of Site 7214, the West Hawai‘i Railroad, is located within the current project area. Two examples of its construction are present. In the northern end, the site presents as a berm, and is typical of other recorded railroad berms recorded to the south. There is a breach between the berm and the road-cut portion of the railroad. A short trestle likely connected the two segments of railroad. The removal of the trestle during or after the railroad was dismantled. The railroad was constructed in 1906 by the West Hawaii Railroad Company, and in 1927, the rails, ties, and other elements of the railroad were removed. Extant portions of the site that have been recorded elsewhere include the railbed. The current project area contains the northern terminus of the railroad, which extended from here to Onouli, South Kona.

5. SIGNIFICANCE EVALUATIONS AND TREATMENT RECOMMENDATIONS

The recorded archaeological sites are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-275-6. 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.

The portions of all three sites located within the current project area retained sufficient integrity in all categories to be evaluated for their historical significance. The significance and recommended treatment for the three recorded sites is presented in Table 5 and discussed below. Site 7214 is considered significant under Criteria a and c. and Sites 31161 and 31162 are considered significant under Criterion d. No further work is recommended for Sites 31161 and 31162.

Table 5. Site significance and treatment recommendation.

Site #	*Site Type*	*Temporal Affiliation*	*Significance*	*Previous Treatment*	*Recommended Treatment*
7214	West Hawaii Railroad	1906-1927	a, c	Preservation	Preservation
31161	Ranch walls	20th century	d	n/a	NFW
31162	Agricultural features	Historic	d	n/a	NFW

SITE 7124

Site 7124 comprises remnant segments of the West Hawai‘i Railroad. Although only a small portion of the site is located in the current project area, enough of the site have been documented elsewhere (Table 6)—in some cases under a different site number—to allow a consideration of significance and treatment in the context of the entire site. The surviving elements of Site 7124 are limited to segments of railroad bed, as the rails and other hardware were dismantled in 1927. Significance evaluations and treatments for these portions vary by study and location. In the north, the site has been determined significant only for the information it yielded during those studies (Criterion d) and has received treatments of “no further work.” Studies conducted in Hōlualoa and south have generally determined the site to be significant under Criteria a, c, and d. Justifications for significance were not always explicitly provided in previous evaluations. Burtchard (1995) provided the most detailed explanation of the site’s significance under Criterion a:

> Extant roadbed features retain much of the structural integrity of the original line (less ties and rails) and provides an exceptional (indeed the only) example of sugar train operation in the Keauhou area. The West Hawai'i Railroad qualifies as a significant property under Criterion A (among others) primarily by virtue of its association with the development of the sugar industry, its attempted expansion into the environmentally marginal Kona area and the use of corvee labor, an increasingly important aspect of the Hawaiian economy at the time. (Burtchard 1995:128)

Escott and Mello (2020) justify significance under Criterion c by noting that the site embodies distinctive characteristics of the type, period, and method of railroad bed construction. Hammatt et al. (1997:307) similarly states, “Site 10302, the railroad grade has a long berm section of dry stone masonry, which we consider to be an excellent example of early 20th-century construction, as well as a unique site type within the project area.”

Significance under Criterion d is generally under-explained in the prior evaluations of Site 7214, but is assumed to derive from the information yielded during each respective study relative to the location, construction materials, and construction techniques used to build the railroad.

Table 6. HRS 6E Significance Evaluations for Site 50-10-7214, arranged north to south.

Location	*Site Number(s)*	*Features*	*Significance*	*Treatment*	*Reference*
Hienaloli 1 & 2	50-10-28-7214	berm	d	No further work	(Haun and Henry 2000b)
Kahului 1 & 2	50-10-28-7214	road cut	d	No further work	(Haun and Henry 2001c)
Kahului 2	Site outside of project area	-	-	-	(Bulgrin and Rechtman 2005)
Hōlualoa 1 & 2	No site number mentioned	berm	-	-	(Hammatt et al. 1992)
Hōlualoa 1 & 2	50-10-37-29887 Feature 142	berm	d	No further work	(Dircks et al. 2013)
Hōlualoa 1	50-10-37-30592	berm	a, c, d	Preservation	(Escott and Escott 2018, 2020; Escott and Mello 2020)
Kahalu‘u, Keauhou 1 & 2	50-10-37-7214	berm	a, c, d	Preservation	(Burtchard 1995)
Kawanui	50-10-37-7214/10302	berm	c, d	Preservation	(Haun and Henry 2007)
Hōkūkano 1	50-10-37-7214/10302	berm, railroad bed	a, c, d	Data recovery in breaches	(Robins et al. 2001)
Hōkūkano 2	50-10-37-7214/10302	railroad causeway	d	No further work	(Haun and Henry 2004)
Kanaueue, Ke‘eke‘e, Kanakau, Kalukalu	50-10-37-10302	railroad bed	a, c, d	Preservation	(Borthwick and Hammatt 1995; Hammatt et al. 1997; Tomonari-Tuggle and Tuggle 2008)

The condition and SHPD-accepted treatment (see Table 6) of the site also varies along its length (Figure 42). Preserved portions of the site are generally limited to distinctive, intact portions of the site determined to be significant under Criteria a, c, and d. Where recorded portions of the site were in poor condition, they have generally been considered significant under Criterion d with accepted treatments of "no further work." Prior significance evaluations of the previously-recorded portions of the site are presented in Table 6, listed from north to south. After a short stretch of relatively undisturbed road bed immediately south of the project area, the next 7/8 of a mile of the former railroad have been paved, and widened in some places, for automobile use (Figure 42). Approximately 1.6 miles of the site between the current project area and the southern end of Hienaloli Road have been paved for automobile traffic. In some places, the road been widened to two lanes, which required demolishing Historic elements of the railroad bed. Between southern end of Hienaloli Road and Kamehameha III Road in Kahalu'u, a few intermittent intact segments of the railroad remain intact, and only a 265-meter long portion of the site has been formally preserved. The remaining 1.8 miles of the railroad bed in this segment have been destroyed or disturbed by subdivision development. South of Kamehameha III highway in Kahalu'u, Ahupuaʻa, however, the site is far more intact, and relatively large portions have been formally preserved. In general, a 20-foot preservation buffer has been established around the preserved portions of the site.

Based on the results of prior studies and the current study, then, Site 7214 remains significant under Criteria a, c, and d for the reasons described above. Within the current project area, the railroad bed is largely intact, although a rock wall (Site 31161 Feature B) now crosses the former railroad alignment (see Figure 23). Within the project area, the site retains relatively good integrity of design, materials, workmanship, location, and association.

With respect to treatment recommendations, three factors were considered. The first of these is the overall condition of the entire 11-mile-long site. As described above, the northern 3.4 miles (approximately 31 percent of the overall length) of the railroad bed between Kamehameha III Road and the current project area has been heavily altered and/or destroyed. The remainder of the site, including more than 6 miles of its length, is well-preserved south of King Kamehameha III Road. Thus, multiple contiguous representative examples of the site are already preserved.

The second factor considered is the potential extension of Hienaloli Road to the north through the current project area. The current Kona Community Development Plan (Wilson Okamoto Corporation 2008) calls for the extension of Hienaloli Road through or near the current project area (see Figure 42). In the long term, future development of Hienaloli Road extension could be used as an opportunity to rehabilitate the railroad berm as a component of a pedestrian or non-motor vehicle pathway. This could also create an opportunity for public interpretation at what was once the northern terminus of the railroad. Evaluating effects of the development of Hienaloli Road Extension, however, is outside the scope of the current project.

The third factor considered is that avoidance of Site 7124 has been discussed with the project proponent during the planning process for the proposed project. The current project has been carefully designed to avoid adversely affecting Site 7124. No ground disturbance will occur within twenty feet of the railroad berm. The access road will be improved only by laying down gravel on the existing ground surface. The project proponent has also agreed to install protective temporary construction fencing at the edge of planned ground disturbance during construction activities to ensure that no inadvertent damage to the site occurs.

Therefore, because the current project has been designed to avoid affecting Site 7124, and the site has been adequately documented by the current study, no further historic preservation work for the site is recommended *at this time within the current project area*. In the long term, however, it is recommended that future development planning for the extension of Hienaloli Road involve discussions among the County of Hawaiʻi Planning Department, DLNR-SHPD, and the landowner work to consider the potential for rehabilitation of the portion of Site 7124 within the current project area as a pedestrian and/or non-motor vehicular component of the new road's design.

Figure 42. Preservation status of Site 7124.

Figure 43. Hienaloli Road in Hienaloli 4th (at intersection with Keaolani Drive, view to the south.

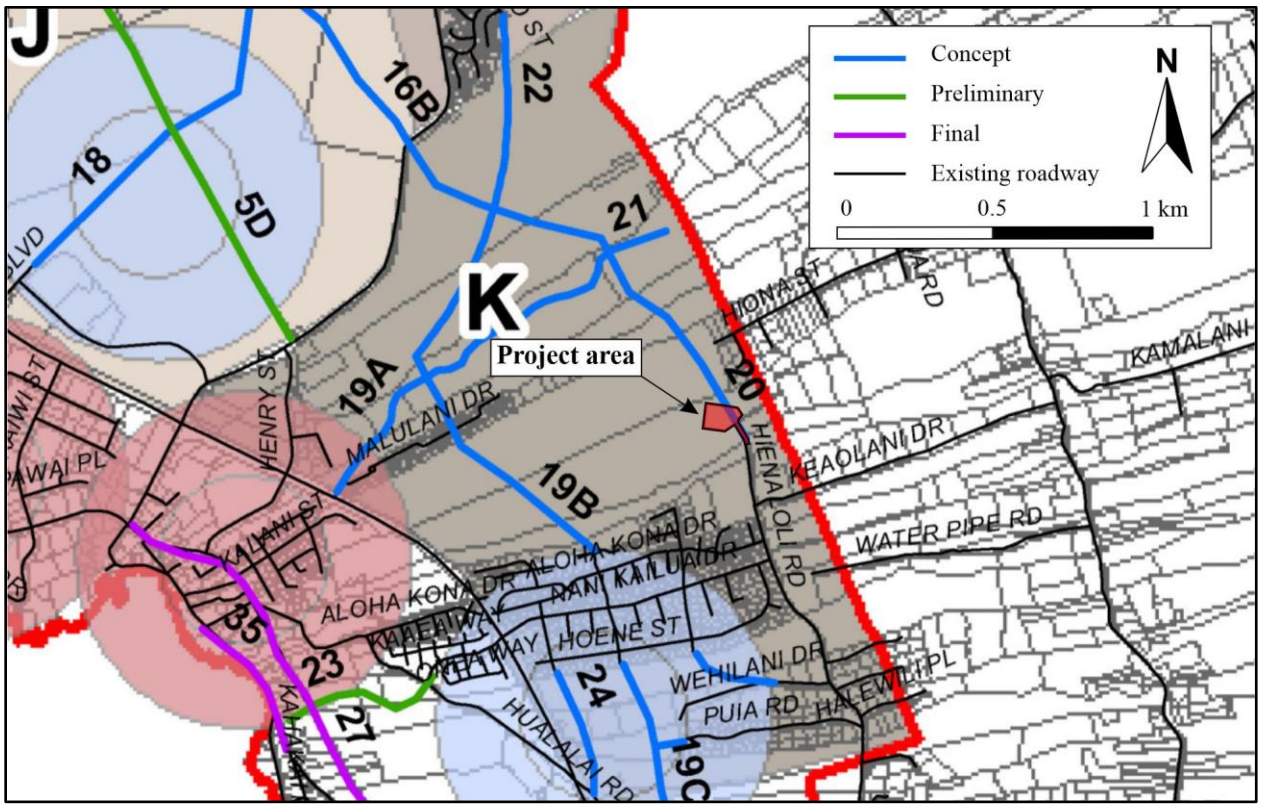

Figure 44. Portion of Kona Community Development Plan road concurrency map (Wilson Okamoto Corporation 2008).

SITE 31161

Site 31161 consists of core-filled walls associated with 20th century livestock ranching. Features B, C, D, E, F, G, and H extend outside of the current project area. The portions of the site located within the current project area retain good integrity of location, design, setting, materials, workmanship, feeling, and association. Some of the walls (Features A, E, and G) have breaches through which ranch roads pass. With the exception of Feature G, only small portions of the walls have partially collapsed. Their locations and orientations within the surrounding parcel, along with their materials and construction techniques, provide information that contributes to the understanding of extent of livestock ranching on the Island of Hawai‘i, as well as construction methods used by ranchers. Site 31161 is considered to be significant under Criterion d for the information it has yielded relative to these topics. The site has been adequately documented within the current project area. No further work is recommended within the current project area.

SITE 31162

Site 31162 is complex consisting of two remnant agricultural features (Features A and B) most likely associated with twentieth century livestock ranching. Both are relatively non-descript mounds most likely associated with land clearing for livestock ranching. Their locations, size, and constituent materials provide information that contributes to the understanding of the extent of livestock ranching on the Island of Hawai‘i, as well as methods used by ranchers. Site 31162 is considered to be significant under Criterion d for the information it has yielded relative to these topics. The site has been adequately documented within the current project area. No further work is recommended within the current project area.

6. RECOMMENDED DETERMINATION OF EFFECT

Two significant archaeological sites (Sites 50-10-28-7124 and 31161) were identified within the project area. Ground disturbance for the project has been designed to avoid Site 7124, and grading for the well pad will avoid Site 7124 by a minimum of twenty feet (Figure 45). The access road to the well pad will be improved only by laying down gravel on the existing ground surface and will utilize the existing breach at the southern end of the raised railbed. The wooden bridge will be covered with steel plates, which will protect the historic rock abutments Although the current project would alter the site's integrity of setting, the effects to Site 7124 are not anticipated to be harmful. It is recommended, however, that protective temporary fencing be installed at the limits of ground disturbance during construction activities to ensure that Site 7124 will not be inadvertently impacted. Construction of the well pad would require dismantling portions of Features B, C, and E of Site 31161 (Historic rock walls). This site is significant under Criterion d only for the information yielded during the current study. The walls have been adequately documented, which has exhausted their information potential. Thus, the results of the current study support a determination of effect of "Effect, with proposed mitigation." The proposed mitigation consists of the documentation of the site during the current study.

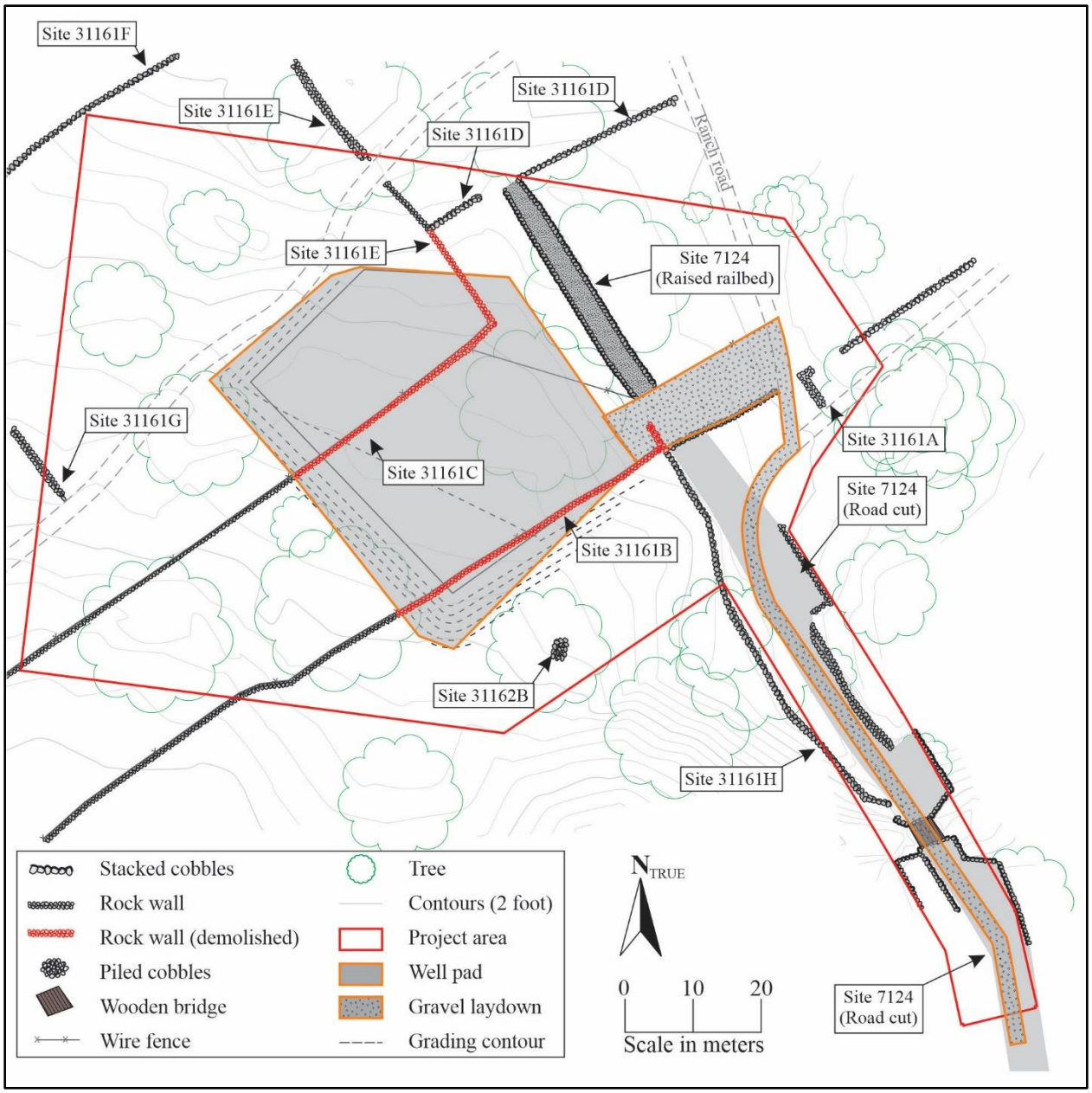

Figure 45. Project impacts to historic properties.

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Appendix D. Cultural Impact Assessment

A Cultural Impact Assessment for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well

TMK (3) 7-5-003:001 (por.)

Honua‘ula Ahupua‘a
North Kona District
Island of Hawai‘i

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A Cultural Impact Assessment for the Exploratory Phase of the Department of Water Supply Honua‘ula Mid-level Well

TMK (3) 7-5-003:001 (por.)

Honua‘ula Ahupua‘a
North Kona District
Island of Hawai‘i

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1. INTRODUCTION

At the request of Tom Nance Water Resource Engineering, on behalf of their client, the County of Hawai‘i Department of Water Supply (agency), ASM Affiliates (ASM) prepared this Cultural Impact Assessment (CIA) for the construction of the exploratory phase of the Department of Water Supply Honua‘ula Mid-level Well (referred to hereafter as the ‘proposed project’). The proposed project will be constructed on roughly 2.9-acres of land comprising a portion of TMK: (3) 7-5-003:001 located in Honua‘ula Ahupua‘a, North Kona District, Island of Hawai‘i (Figures 1, 2, and 3). The majority of the proposed project area is within Honua‘ula, however, a small portion of the access road leading to the project area extends into the *ahupua‘a* of Hienaloli 1st. A detailed project area description and site plan of the proposed project is provided in the ensuing section.

The expenditure of County funds 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; and is conducted 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 that 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 and schematic of the proposed project as well as a general description of the project area. To provide a physical and cultural context of the project area, Section 2 of this report includes a detailed culture-historical background specific to Honua‘ula Ahupua‘a and at times the greater North Kona District. Section 2 also includes a presentation of prior cultural and archaeological studies conducted in the vicinity of the proposed project area. The results of the consultation process are then presented in Section 3, and Section 4 concludes with a discussion of potential cultural impacts as well as recommended actions and strategies that may help to mitigate any such impacts.

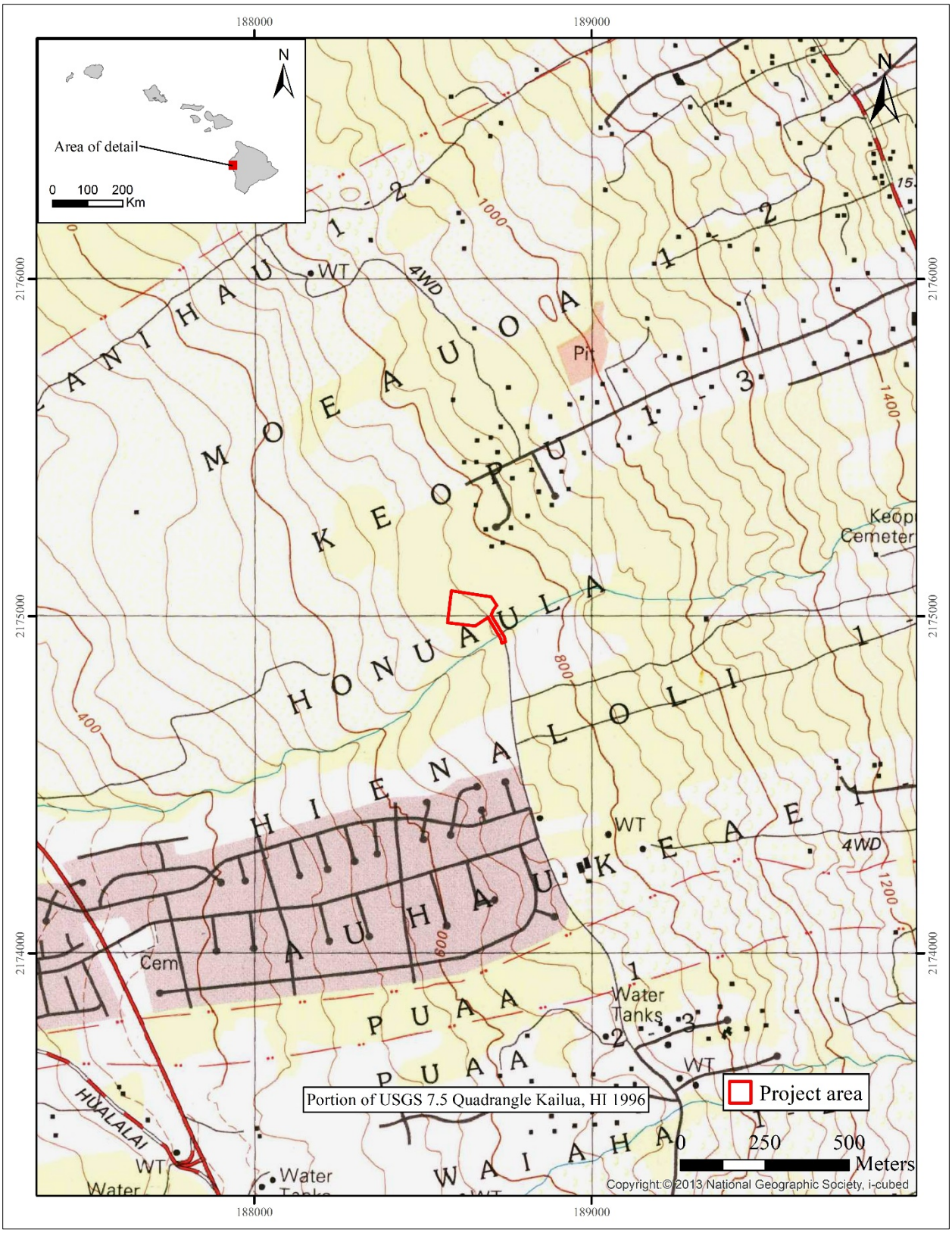


Figure 1. Project area location (outlined red) on a U.S.G.S. 7.5-minute series, Kailua, HI quadrangle, 1996.

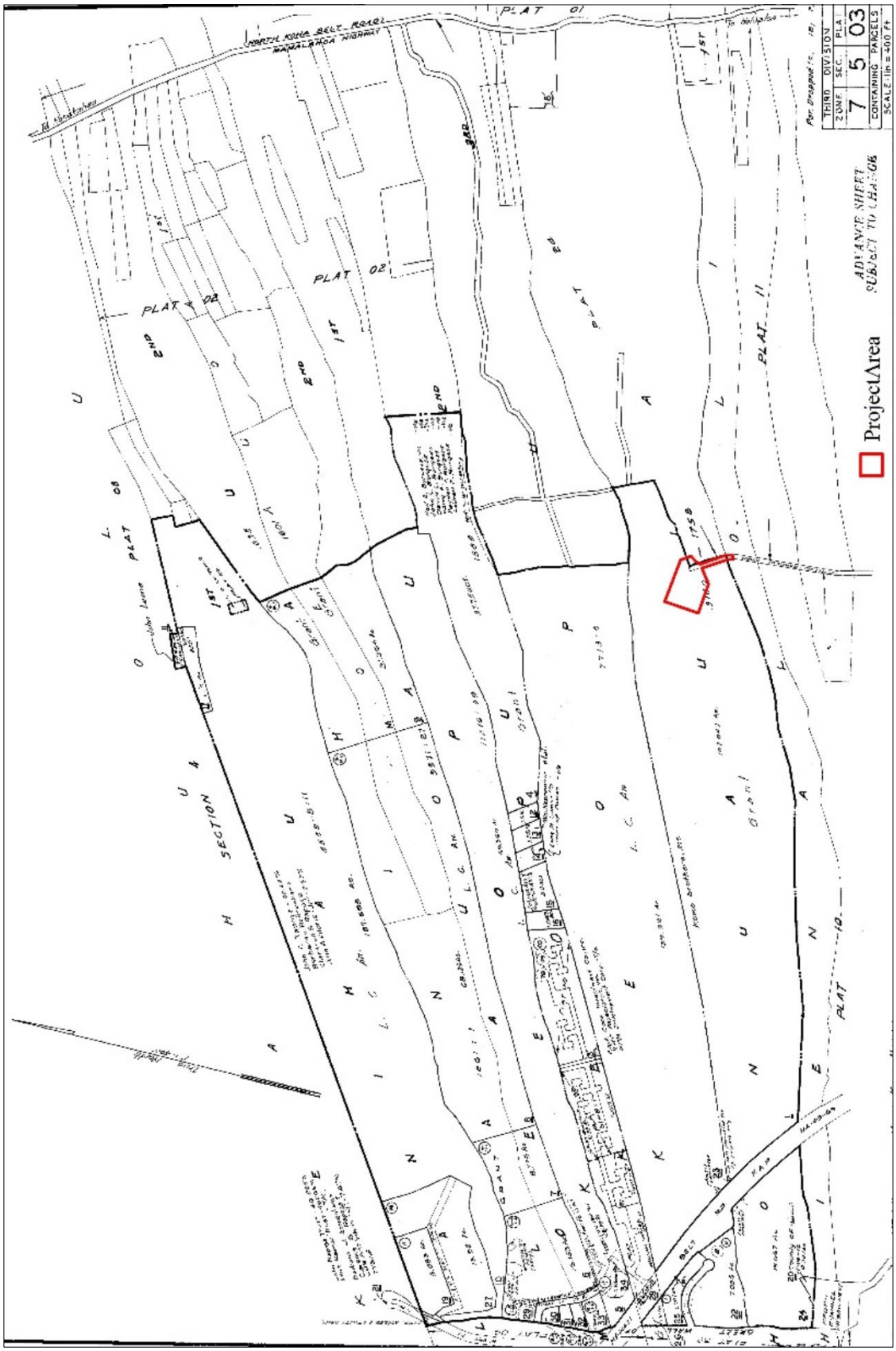


Figure 2. Tax Map Key (3) 7-5-003 showing the current project area :001.

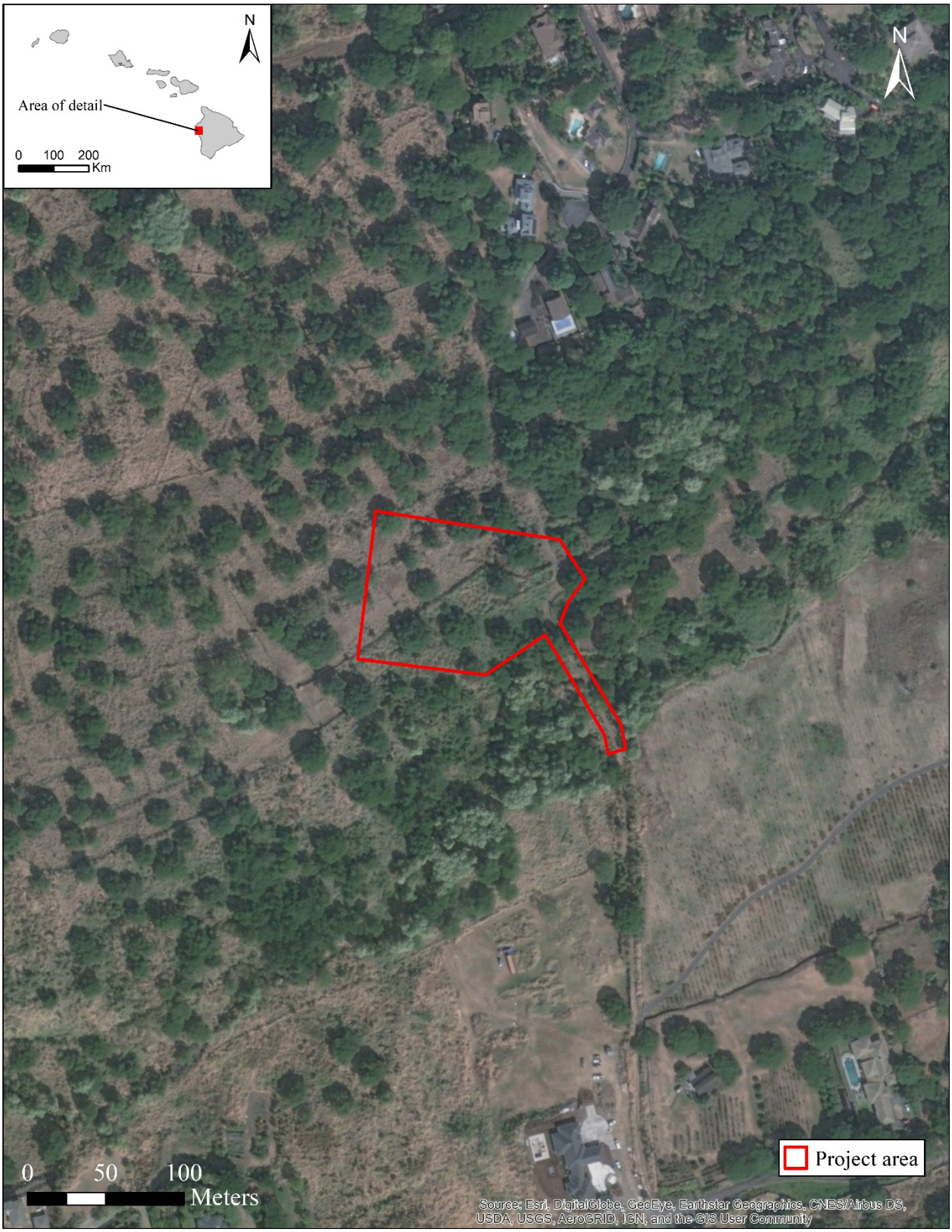


Figure 3. Google Earth™ satellite image showing project area location (outlined in red).

PROPOSED DEVELOPMENT ACTIVITY

The site plans (Figure 4) for the project area include a drill pad site and an unpaved access road that will be improved by laying down gravel over an existing road surface. Within this area, the proposed project will involve grubbing and grading, and drilling of a test well. Aside from the laying of steel plates across an existing wood bridge (Figure 5) at gulch, no ground disturbance will occur in the access road corridor along Hienaloli Road. The portion of the access road corridor that deviates from the existing unpaved portion of Hienaloli Road will be grubbed and graded.

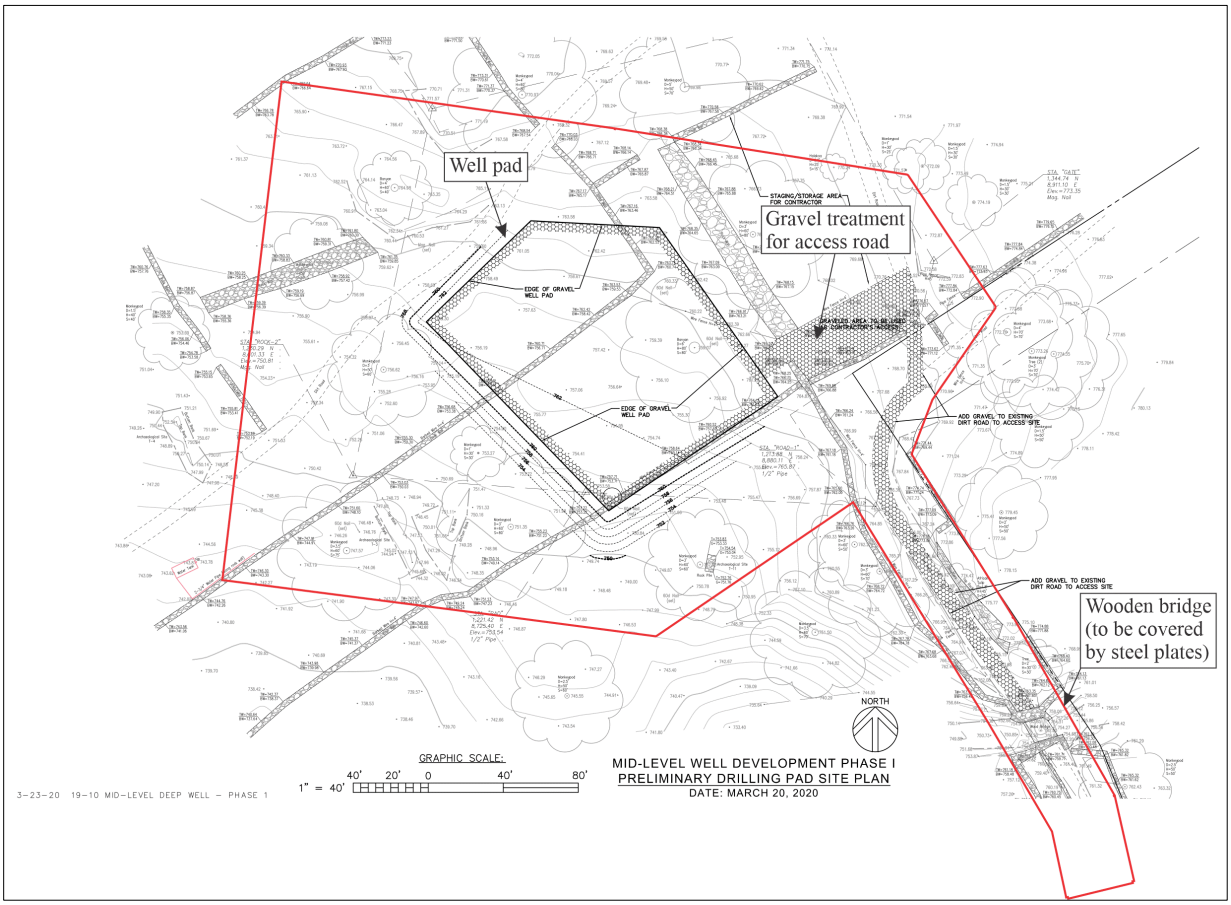


Figure 4. Grading plan with project area outlined in red and key elements of the project indicated.

Figure 5. Wooden bridge and unpaved access road, view to the southeast.

PROJECT AREA DESCRIPTION

The current project area comprises 2.9 acres of cattle pasture (Figure 6) located at about 760 feet (231 meters) elevation on the western flank of Hualālai Volcano, 1.6 miles (2.6 kilometers) inland from Kailua Bay (see Figure 1). Dry-stacked rock walls and wire fences (Figure 39) divide the project area into paddocks (see Figures 3 and 4). Topography in the project area slopes moderately to the west (*makai*) and the gently rolling terrain is punctuated by occasional *pāhoehoe* bedrocks outcrops and *mauka-makai* trending inflationary lobes. Surface geology in the project area consists of *pāhoehoe* lava flows that emanated from Hualālai Volcano between 11,000 and 30,000 years ago and mapped in Figure 8 as "Qh" (Sherrod et al. 2007). Two soil types (Figure 9) are mapped in the project area. The majority of the project area is mapped as Kainaliu-Waiaha Complex, 10 to 20 percent slopes (labeled in Figure 9 as "227"). The Kainaliu component is described as a moderately deep, well-drained silty clay loam formed in basic volcanic ash. The Waiaha component consists of shallow, well-drained cobbly medial silt loam formed in basic volcanic ash over lava flows. The southern end of the project area containing the existing road is mapped as Kainaliu silty clay loam (labeled in Figure 9 as "221"), 10 to 20 percent slopes; however, this portion of the project area contains a graded road flanked on its *mauka* side by bedrock outcrops. Soil depths observed in cattle wallows within the project area indicate that soil depths tend to be relatively shallow. A general smoothness of the ground surface suggests that the project area had been cleared in the past, probably to facilitate its use as pasture. The extreme southern end of the project area includes a wooden bridge (see Figure 5), which crosses over a gulch.

The mean annual rainfall in the project area is 49 inches (1,264 mm), with the majority of rainfall occurring between March and September (Giambelluca et al. 2013). Temperatures are relatively moderate, averaging 69°F (20.5C). Vegetation in the current project area is characterized as introduced pasture grassland, dominated by Guinea grass (*Megathyrsus maximus*) in the majority of the project area, which is used as cattle pasture (Figures 10 and 39). An exception to this is the southernmost portion of the project area (Figures 12 and 39), which is overgrown with weedy vines (e.g., *pilau maile, Paederia foetida*) and stunted Guinea grass. Trees in the project area include monkey pod (*Pithecellobium saman*) and *Ficus* sp.

Figure 6. Pasture lands and ranching infrastructure in the project area, view to the east.

Figure 7. Example of dry-stacked rock wall and fencing in the project area, view to the southwest.

Figure 8. Geology within the project area.

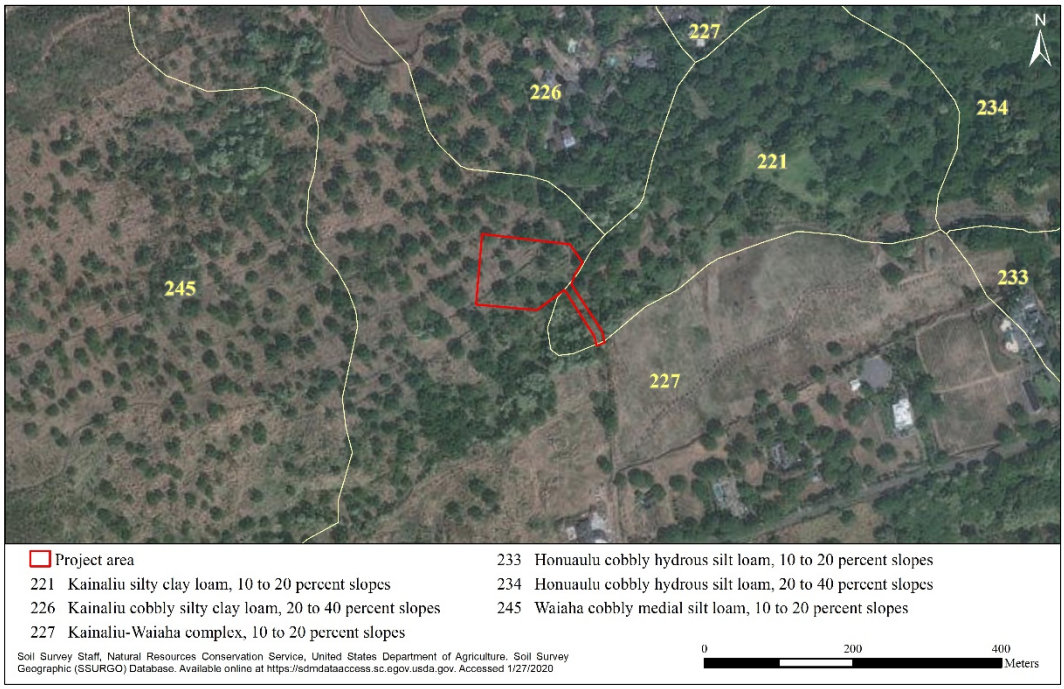


Figure 9. Soils within the project area.

Figure 10. Cattle pasture within the project area, view to the west.

Figure 11. Example of vegetation within the project area, view to the east.

Figure 12. The vegetation within southern portion of the project area, view to the east.

Figure 13. Example of weedy vine within the southern portion of the project area, view to the east.

2. BACKGROUND

This section of the report includes a discussion of the culture-historical background for the proposed project area and greater geographical region and includes a synthesis of relevant prior archaeological and ethnohistorical research. This information is presented to provide a comprehensive understanding of the cultural significance of the proposed project area and general vicinity and to establish an analytical basis for the assessment of any potential cultural impacts that may result from the proposed project. As stated in the OEQC (OEQC 1997) *Guidelines for Assessing Cultural Impacts*, the ability to assess the cultural significance of the current project area is contingent upon developing (at a minimum), a comprehensive understanding of the *ahupuaʻa* in which the project area is located. Furthermore, the OEQC (1997) guidelines go on to state that "[t]his is to ensure that the cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. As will be demonstrated in the ensuing section, developing such an understanding requires consideration of the broader region and island landscape. This broader geographical region constitutes the study area for this CIA.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and a generalized model of traditional Hawaiian land management strategies. The discussion continues with a presentation of legendary and historical references to Honuaʻula Ahupuaʻa and at times the greater Kona District. This summary includes oral traditions and first-hand Historic accounts recorded by visitors and missionaries who visited the area. The results of the changes in land tenure during the mid-19th century are then discussed, with an emphasis on *Māhele* records, land grants, and testimony collected by the Boundary Commission. Land use practices in the study area vicinity are then presented, including a discussion on commercial sugar cultivation, ranching, and other smaller agricultural endeavors. The discussion concludes with a review of the findings from prior investigations conducted in the subject area vicinity.

A Generalized Model of Early Hawaiian Settlement

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, radiometric). With advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter (c.f., Kirch 2011). However, these theories are not universally accepted. What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establishing a uniquely Hawaiian culture. The initial migration to Hawaiʻi is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long-distance voyages occurring fairly regularly through at least the 13th century. It has been generally reported that the sources of the early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). This was a period of widespread environmental modification when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; and the concepts of *puʻuhonua* (places of refuge), *ʻaumakua* (ancestral deity), and *mana* (divine power).

For generations following initial settlement, communities were clustered along the watered, windward (*Koʻolau*) shores of the Hawaiian Islands. Along the *Koʻolau* shores, streams flowed and rainfall was abundant, and agricultural production became established. The *Koʻolau* region also offered sheltered bays from which deep-sea fisheries could be easily accessed, and nearshore fisheries, enriched by nutrients carried in the freshwater, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found (McEldowney 1979). In these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and the population began expanding to the *Kona* (leeward side) and more remote areas of the island (Cordy 2000).

As the population continued to expand so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawaiʻi occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the seasonal, recurrent occupation in which coastal sites

were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well; as Hommon (1976) argues, kinship links between coastal settlements disintegrated as those links within the *mauka-makai* (upland-coastal) settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupuaʻa* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. 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 highly-complex society was the development of the traditional land division system, which included the *ahupuaʻa*—the principal land division that functioned for both taxation purposes and furnished its residents with nearly all of the fundamental necessities. *Ahupuaʻa* are land divisions that typically incorporated all of the ecozones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupuaʻa* land division typically incorporated all of the *wao* (eco-zones), their size and shape varied greatly (Cannelora 1974). In summarizing the types of *wao* that could be found in a given *ahupuaʻa*, Hawaiian scholar and historian, Samuel Kamakau writes:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*ʻano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ʻeiwa*, and makai of that the *wao maʻukele*. Makai of the *wao maʻukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *ʻamaʻu*, fern belt, and makai of the *ʻamaʻu* the *ʻapaʻa*, grasslands.
>
> A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and mauka of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest.
>
> Makai of the *ʻapaʻa* are the *paheʻe* [*pili* grass] and *ʻilima* growths and makai of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge.
>
> That is the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8-9)

The *makaʻāinana* (commoners; lit. people that attend the land) who lived on the land had rights to gather resources for subsistence and tribute (Jokiel et al. 2011). As part of these rights, the *ahupuaʻa* residents were also required to supply resources and labor that supported the royal communities of regional and/or island kingdoms. The *ahupuaʻa* became the equivalent of a local community, with its own social, economic, and political significance, and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During this annual procession, the highest chief of the land sent select members of his retinue to collect *hoʻokupu* (tribute and offerings) in the form of goods from each *ahupuaʻa*. The *makaʻāinana* who resided in the *ahupuaʻa* brought their share of *hoʻokupu* to an *ahu* (altar) that was symbolically marked with the image of a *puaʻa* (pig). *Ahupuaʻa* boundaries, in most instances, were established along rational lines, following mountain ridges, hill, rivers or ravines, 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." *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land (Malo 1951). *Ahupuaʻa* residents were not bound to the land nor were they considered 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. *Ahupuaʻa* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord, who oversaw and coordinated stewardship

of an area's natural resources (ibid.). In some places, the *po'o lawai'a* (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 the area's resources from physical and spiritual depletion.

Many *ahupua'a* were further divided into smaller land units termed *'ili* and *'ili kūpono* (often shortened to *'ili kū*). *'Ili* were created for the convenience of the *ahupua'a* chief and served as the basic land unit, which *hoa'āina* (native tenants) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As the *'ili* themselves were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with it. The right to use and cultivate *'ili* was maintained within the *'ohana*, regardless of any change in title of the *ahupua'a* chief (Handy et al. 1991). Malo (1951), recorded several types of *'ili*: the *'ili pa'a,* a single intact parcel and the *'ili lele*, a discontinuous parcel dispersed across an area. Whether dispersed or wholly intact, the *'ili* land division required a cross-section of available resources, and for the *hoa'āina*, this generally included access to agriculturally fertile lands and coastal fisheries. While much of the same resource principles applied to the *'ili kūpono*, these land units were politically independent of the *ahupua'a* chief. This designation was applied to specific areas containing resources that were highly valued by the ruling chiefs, such as fishponds (Handy et al. 1991).

The *ali'i* who presided over the *ahupua'a* (*ali'i-'ai-ahupua'a*), in turn, answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire *moku or* district) (Malo 1951). On Hawai'i Island, six *moku* (districts) make up the entirety of the island, namely Kona, Ka'ū, Puna, Hilo, Hāmākua, and Kohala. Although *moku* comprises multiple *ahupua'a*, they were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the *ahupua'a* land division was the most common and fundamental unit within the multitiered traditional Hawaiian land management structure, within South Kohala there existed another unique land unit that was termed *kalana*. By definition, *kalana* was a division of land that was smaller than a *moku* and this term was sometimes used interchangeably with the term *'okana* (Lucas 1995; Pukui and Elbert 1986). Kamakau (1976), however, equates a *kalana* to a *moku* and states that *'okana* is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that *kalana* were comprised of several *ahupua'a* and *'ili 'āina*.

This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. As knowledge of place developed over the centuries and passed down intergenerationally by direct teaching and experience, detailed information of an area's natural cycles and resources were retained and well-understood. Decisions were based on generations worth of highly informed knowledge and sustainably adapted to meet the needs of a growing population. This highly complex land management system mirrors the unique Hawaiian culture that coevolved with these islands.

Evolution of Hawaiian Land Stewardship Practices

Their ancient and ingrained philosophy of life tied Hawaiians to their environment and helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and *'āina* (land), Hawaiian historian and cultural specialist, 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 Hawai'i, 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 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 *'āina* (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 Hawaiian *'ōlelo no'eau* (proverbial saying) "*Hānau ka 'āina, hānau ke ali'i, 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) were literally born (*hānau*), and are thus connected through kinship links that extend beyond the immediate family (Pukui 1983:57). *'Āina* or land, was perhaps most revered, as another *'ōlelo no'eau* notes, "*He ali'i ka 'āina; he kauwā ke kanaka,*" which has been translated by Pukui (1983:62) as "[t]he land is a chief; man is its servant." The lifeways of early Hawaiians, which were derived entirely from the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an adaptable management system that integrated the watershed, freshwater, nearshore fisheries, all of which are connected through the many unique ecosystems that extend from the mountains to the sea (Jokiel et al. 2011).

Kilo or astute observation of the natural world became one of the most fundamental stewardship tools used by the ancient Hawaiians. The vast knowledge acquired through the practice of *kilo* enabled them to observe and record the subtlest of changes, distinctions, and correlations in their natural world. Examples of their keen observations are evident in Hawaiian nomenclature, where numerous types of rains, clouds, winds, stones, environments, flora, and fauna, many of which are geographically unique, have been named and recorded in centuries-old traditions such as *oli* (chants), *mele* (songs), *pule* (prayers), *inoa ʻāina* (place names), *ʻōlelo noʻeau* (proverbial sayings), all of which were transmitted orally through the ages. Other traditional Hawaiian arts and practices including, but not limited to *hula* (traditional dance), *lapaʻau* (traditional healing), *lawaiʻa* (fishing), *mahiʻai* (farming) further reinforced knowledge of the natural environment.

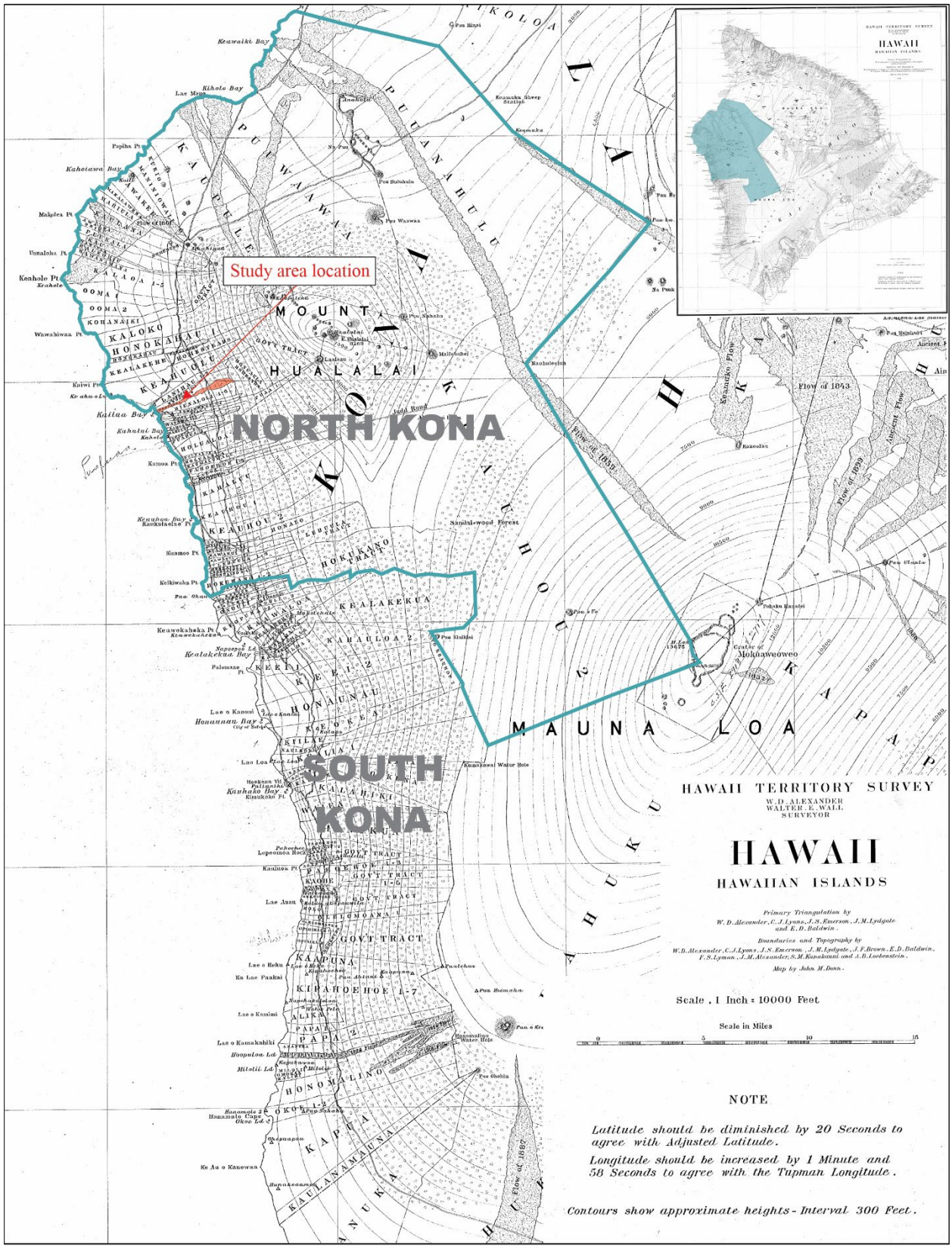
Their exclusive dependency on a thriving natural environment led Hawaiians to develop a sophisticated and comprehensive system of land stewardship that was reinforced through the strict adherence to practices that maintained and enhanced the *kapu* and *mana* of all things in the Hawaiian world. In Hawaiian belief, all things natural, places, and even people, especially those of high rank, possessed a certain degree of *mana* or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). *Mana* is believed to be derived from the plethora of Hawaiian gods (*kini akua*) who were embodied in elemental forces, land, natural resources, and certain 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 ensure the *mana* of the resources, certain places, and people remained protected from over-exploitation and defilement, *kapu* of various kinds were implemented and strictly enforced. Elbert and Pukui (1986:132), defined *kapu* as "taboo, prohibitions; special privilege or exemption..." Kepelino notes that *kapu* associated with the gods applied to all social classes, while the *kapu* associated with the chiefs were applied to the people (Beckwith 1932). As the laws of *kapu* dictated social relationships, it also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). Juxtaposed to the concept of *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 were resources remained unspoiled and 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 still expected to practice sustainable harvesting methods and pay tribute to the ruling chief and the gods and goddesses associated with that resource. *Kapu* were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Violators who managed to escape death sought refuge at a *puʻuhonua*, a designated place of refuge or sometimes were freed by the word of certain chiefs (Kamakau 1992). After completing the proper rituals, the violator was absolved of his or her crime and allowed to reintegrate back into society.

In summary, the layering and interweaving of beliefs, land stewardship practices, and the socio-political system forms the basis of the relationship shared between the Hawaiian people and the land. It is through the analysis of these elements that a cultural understanding of place is developed.

HONUAʻULA AHUPUAʻA AND THE GREATER NORTH KONA DISTRICT

The current project area is situated in the central region of the *moku* (district) of Kona, which is one of six traditional *moku* on Hawaiʻi Island (Figure 39). The *moku* of Kona extends from the shore across the entire volcanic mountain of Hualālai and continues to the summit of Mauna Loa at its southeast end. Due to its sheer size, Kona is often geographically divided into two regions, North Kona or Kona ʻĀkau, and South Kona or Kona Hema (see Figure 39). The project area is situated within the North Kona region, which is traditionally defined as the area between Keahualono at the north to Puʻuohau at the south (Pukui 1983). Furthermore, this section of Kona in which the project area is situated was poetically referred to as Kona Kai ʻŌpua, which has been interpretively translated by Maly (1996b:A-1) as "Kona of the distant horizon clouds on the ocean." The subject *ahupuaʻa* of Honuaʻula, whose literal translation is "red land" (Pukui et al. 1974:51), is bound on the north by Keōpu 3rd and shares its south boundary with Hienaloli 1st Ahupuaʻa. According to Pukui and Elbert (1986:80) the word *honuaʻula* is also in reference to "a variety of sugar cane, a dark brown-red mutant of *manulele*, with purple leaf sheaths and leaves" and that "it was formerly used in medicine, and is one of the best canes for eating raw."


Study area location
NORTH KONA
SOUTH KONA
HAWAII TERRITORY SURVEY
W.D. ALEXANDER
WALTER E. WALL
SURVEYOR
HAWAII
HAWAIIAN ISLANDS
Primary Triangulation by
W. D. Alexander, C. J. Lyons, J. S. Emerson, J. M. Lydgate and E. D. Baldwin.
Boundaries and Topography by
W. D. Alexander, C. J. Lyons, J. S. Emerson, J. M. Lydgate, J. F. Brown, E. D. Baldwin, F. S. Lyman, J. M. Alexander, S. M. Kanakanui and A. D. Lockenstein.
Map by John M. Donn.
Scale, 1 Inch = 10000 Feet
Scale in Miles
NOTE
Latitude should be diminished by 20 Seconds to agree with Adjusted Latitude.
Longitude should be increased by 1 Minute and 58 Seconds to agree with the Tupman Longitude.
Contours show approximate heights - Interval 300 Feet.
MOUNT
HUALALAI
MAUNA LOA
Flow of 1843
Flow of 1859
Flow of 1832
Flow of 1887
Keawaiki Bay
Kikoto Bay
Kaloiawa Bay
Kailua Bay
Kahului Bay
Kealakekua Bay
Honaunau Bay
Kauhako Bay
Kawaihae Bay
Keahole Pt
Kawaihae Pt
Kaiwi Pt
Kamoa Pt
Kiamoo Pt
Keawekaheka Pt
Palemano Pt
Kauhuo Pt
Lae Auau
Lae o Heku
Ka Lae Paakai
Lae o Kaaimi
Lae o Kamakahiki
Kaupulou Ld
Milolii Ld
Honomalino Cape
Okoe Ld
Ke Au o Kanewaa
Kaulanamauna
Kapua
Honomalino
Kaapuna
Kiraheohoe 1-7
Papa 1-2
Alika
Kaaoe
Govt Tract
Kaloko
Honokahau 1
Keauhou 1
Keauhou 2
Kealakekua
Kauaula 2
Keei 1-2
Honaunau
Kaeokea
Kalahiki
Kaawaloa
Kaawaloa 2
Kaleiki
Kaleiki 2
Kaiwi
Kaiwi 2
Kaiwi 3
Kaiwi 4
Kaiwi 5
Kaiwi 6
Kaiwi 7
Kaiwi 8
Kaiwi 9
Kaiwi 10
Kaiwi 11
Kaiwi 12
Kaiwi 13
Kaiwi 14
Kaiwi 15
Kaiwi 16
Kaiwi 17
Kaiwi 18
Kaiwi 19
Kaiwi 20
Kaiwi 21
Kaiwi

Agricultural Production

The natural landscape found in the upper Honuaʻula 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 Kona District. Handy and Handy (1991) in referencing an article from the Hawaiian language newspaper *Ka Hōkū O Hawaiʻi* provided a general description of the vast and highly productive upland areas extending from Kailua to Keauhou during Kamehameha's reign:

> In the uplands above Kahaluʻu, Keauhou, and Kailua, was a vast plantation named Kuahewa (huge), belonging to Kamehameha I. To protect these lands, which were cultivated for his people in the section, Kamehameha established the law that anyone who took one taro or one stalk of sugar cane must plant one cutting of the same in its place. Weary of war in 1812, Kamehameha went to Kuahewa and himself worked as a farmer. "This land that Kamehameha farmed is in the upland of Kailua, in Kaopua…on Honuaʻula, on the hill called Paoloa and by the spring called Waiakauhi." (Hoku o Hawaii, May 3, 1927 in Handy et al. 1991:524)

Presumably, what Handy and Handy (1991:524) described as *"Kuahewa"* may be a portion of what has been referred to by archaeologists as the Kona Field System; an agriculturally fertile region that includes multiple *ahupuaʻa* across North and South Kona districts (Cordy 1995; Newman 1970; Schilt 1984). This dryland agricultural complex has been understood to be a nearly continuous series of agricultural fields covering approximately 34,350 acres from Kaū Ahupuaʻa in the north to Hoʻokena Ahupuaʻa in the south (Figure 39), with an altitudinal range of 0-2,500 meters from the coastline to the forested slopes of Hualālai (Cordy 1995; Horrocks and Rechtman 2009). A large portion of the field system has been designated in the Hawaiʻi Register of Historic Places as Site 50-10-37-6601 and determined eligible for inclusion on the National Register of Historic Places.

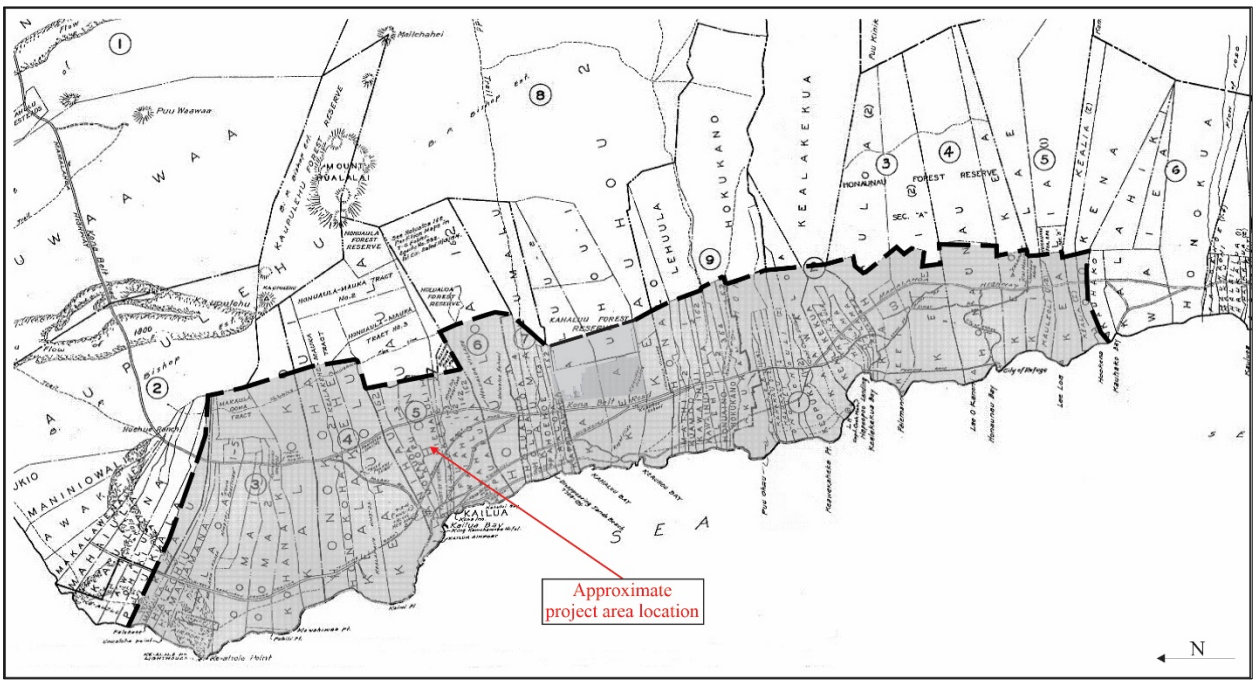


Figure 15. Extant of the Kona Field System (shaded gray) with the approximate location of the project area.

The basic characteristics of this agricultural/residential system as presented in Newman (1970) have been confirmed and elaborated on by ethnohistorical investigations (Kelly 1983) and archaeological research (e.g., (Allen 2001; Burtchard 1995; Cordy et al. 1991; Kawachi 1989; Rechtman et al. 2001; Schilt 1984; Soehren and Newman 1968). Some of the defining features of the Kona Field System is the network of long field walls that extend in a *mauka-makai* direction. These walls are known by several names, all of which share a similar concept of the skeleton of the land, such as *kuaiwi* or backbone (Allen 2004). Handy and Handy provided the following description of this concept, stating:

> Iwi (bone) or iwi kuamoʻo (backbone) was the term applied to the line of rocks and refuse thrown up along the side of moʻo ʻaina, or kihapai in clearing. These iwi or iwi ʻaina demarked the boundaries of plantations and arable holdings, and hence were also called palena, or bounds. They were not mere rubbish heaps, but for example on Hawaii, served for planting sugar cane round about the field of dry taro in upland Kona, Kaʻu, and Kohala… In upland Kona they may be seen today buried in woods or occasionally bounding taro plantations still utilized. (Handy et al. 1991:51)

Situated between the *kuaiwi* there were other traditional Hawaiian planting features such as mounds, terraces, modified outcrops, and platforms. The Kona Field System is generally considered a dryland complex; however, water control features, such as *ʻauwai* and modified waterholes, have been documented in areas where intermittent streams were present (Allen 1984; Kawachi 1989; Rechtman et al. 2003; Schilt 1984).

Historically, the various fields that make up the Kona Field System were thought to be a cohesive unit (Newman 1974), however, recent research and interpretation suggest the field system was more dynamic with distinct agro-ecological zones (Lincoln and Ladefoged 2014). Additionally, the field system is believed to have expanded as the regional population increased and the Hawaiian socio-political system became more centralized (Horrocks and Rechtman 2009; Rechtman et al. 2001). This field system was a major source of food for the Island of Hawaiʻi as evidenced by early European explorers and played a central part in the Hawaiʻi's Precontact economy. Given the lack of major surface streams in this geologically young district, the Kona Field System relied primarily on rainfall, supplemented with innovative regional horticultural techniques(Lincoln and Ladefoged 2014).

Hawaiians traditionally used four terms to describe the major vegetation zones (Table 1). These terms were used to define and segregate space within the *ahupuaʻa* and later, to delineate land claim boundaries during the *Māhele*. The zones are bands of vegetation, roughly parallel to the coast, corresponding to changes in elevation, rainfall, and flora. The current project area is located at roughly the 231 meters elevation thus placing it within the *Kaluʻula* zone, which according to Cordy (1995) extends from the 150-300 meter elevation with an annual average rainfall of 100-140 centimeters. This zone supported an assortment of native cultigens but was perhaps most distinguished by its extensive plantings of *ʻulu* (*Artocarpus altilis*; breadfruit), with an understory of *ʻuala* (*Ipomoea batatas*; sweet potato), and *wauke* (*Broussonetia papyrifera*; paper mulberry). Both *ʻulu* and *ʻuala* were important staple crops and although *wauke* was not a food plant, its fibrous bark was used to produce Hawaiian *kapa* (tapa; bark cloth) (Abbott 1992).

Table 1. Traditional Hawaiian agricultural zones

Zone	*Annual Rainfall (cm)*	*Elevation (ft.) limits*	*Primary Crops*
Kula	75-125	Sea level-500	*ʻUala*, *wauke*, and *ipu*
Kaluʻulu	100-140	500-1,000	*ʻUlu*, *ʻuala*, and *wauke*
ʻĀpaʻa	140-200	1,000-2,500	Dry land *kalo*, *ʻuala*, *kī*, and *kō*
ʻAmaʻu	>200	2,500-4,000	*Maiʻa* (both plantain and banana)

According to Cordy (1995), the *kaluʻulu* zone is not archaeologically distinguishable from the neighboring *ʻāpaʻa* zone (at a higher elevation) and *kuaiwi* are prominent features of the landscape within the *kaluʻulu* zone and the neighboring *ʻāpaʻa* and *ʻamaʻu* zones (Cordy 1995). There is archaeological evidence that habitation did occur within the *kaluʻulu* and *ʻāpaʻa* zone but these occur infrequently (Burtchard 1995; Wolforth 1998).

While evidence of irrigation has been discovered, the Kona Field System depended primarily on rainfall. Mary Kawena Pukui documented several *ʻōlelo noʻeau* (Hawaiian proverbs) for Kona that highlight the traditional cultural practice of observing nature for signs of rain.

> *Aia ka wai i ka maka o ka ʻōpua.*
> Water is in the face of the ʻōpua clouds.
> In Kona, when the ʻōpua clouds appear in the morning, it's a sign that rain is to be expected. (Pukui 1983:9)

> *Ao ʻōpiopio.*
> Young cloud.
> A cloud that rises from sea level or close to the cloud banks and is as white as steam. When seen in Kona, Hawaiʻi, this is a sign of rain. (Pukui 1983: 27)

> *Māmā Kona i ka wai kau mai i ka maka o ka ʻōpua.*
> Kona is lightened in having water in the face of the clouds.
> Kona is relieved, knowing that there will be no drought, when the clouds promise rain. (Pukui 1983:232)

In addition to observing the natural elements for signs of rain, the ancient Hawaiian horticulturalists also invoked certain deities to encourage rainfall and to promote abundance and fertility of the land. Thus, the Kona region is synonymous with the *akua* (god, deity) Lono, who was considered the "rain maker" and closely associated with fertility (Handy et al. 1991:333). Lono was often identified with the southern coast of Hawai'i Island, and according to Kalokuokamaile, a native of Kona, temples dedicated to Lono were established throughout Kona to invoke rain and fertility (Handy et al. 1991). Lono was also embodied in dark rain clouds brought on by the southerly (*kona*) storms. In traditional myths, it is believed that Lono migrated from the south and landed in Kona where he introduced several food plants, such as *kalo* (taro), *'uala* (sweet potato), *uhi* (yams), *kō* (sugar cane), *mai'a* (banana) and *'awa* (kava) (Handy et al. 1991).

While Lono is attributed with bringing water in the rain clouds, *wai* (freshwater) is considered a *kinolau* (physical manifestation) of the *akua* Kāne, who along with his companion Kanaloa (whose dominion was over the ocean), came to Hawai'i from Kahiki (a land outside of Hawai'i). Legend has it that Kāne and Kanaloa both enjoyed consuming *'awa*, a drink prepared by mixing the crushed root of the *'awa* plant (*Piper methysticum*) with fresh water. In their travels, they stopped at various places around the Hawaiian Islands and opened new freshwater springs from which they prepared their favorite drink (Handy et al. 1991). The *'ōlelo no'eau* "*He huewai ola ke kanaka na Kāne*" literally translated as "[m]an is Kāne's living water gourd," highlights the relationship that Hawaiians have to freshwater, and thereby to Kāne (Pukui 1983:68). Handy et al. (1991:64) sheds light on the spiritual relationship that Native Hawaiians have to water:

> Fresh water as a life-giver was not to the Hawaiians merely a physical element; it had a spiritual connotation. In prayers of thanks and invocations used in offering fruits of the land, and in prayers chanted when planting, and in prayers for rain, the "Water of Life of Kane" is referred to over and over again. Kane—the word means "male" and "husband"—was the embodiment of male procreative energy in fresh water, flowing on or under the earth in springs, in streams and rivers, and falling as rain (and also as sunshine), which gives life to plants.

Wai was not only valued for its life-giving properties, but also its purifying properties. The continuous *mauka* to *makai* flow of *wai* provided fresh drinking water, supplied water to irrigated fields, fishponds, recharged ground water supplies, and sustained productive estuaries and fisheries by transporting nutrients from the uplands to the sea (Sproat 2009). Because of the high degree of dependency on *wai* to furnish and satisfy life's needs, *wai* was a public trust resource that was considered inalienable. Handy et al. continue thusly,

> Inalienable title to water rights in relation to land use is a conception that has no place in old Hawaiian thinking…[w]ater, whether for irrigation, for drinking, or other domestic purposes, was something that "belonged" to Kane-i-ka-wai-ola (Procreator-in-the-water-of-life)… The *ali'i nui*, in old Hawaiian thinking and practice, did not exercise personal dominion, but channeled dominion. In other words, he was a trustee. (ibid.:63)

The introduction of western law during the reign of Kamehameha III (1825-1854), and the subsequent land privatization movement known as the *Māhele 'Āina* set in motion new *kānāwai* (laws) that gave rise to the notion of private ownership of the land and its resources. Sproat (2009) notes that although the concept of water as a public trust carried over into the Kingdom of Hawai'i laws, many newcomers were unaware or failed to respect the customary practices resulting in a number of water disputes. This conflict was amplified as sugar and later pineapple plantations began diverting water to furnish their fields, thus resulting in the loss of water for farmers using the traditional method of irrigated taro cultivation (ibid.). *Wai* was and remains a treasured resource.

Ruling Chiefs of Kona (from 'Ehunuikaimalino to Kamehameha) and the Arrival of Europeans

Sometime during the 16th century, the chief 'Ehu-nui-kai-malino (also referred to as 'Ehu) was appointed by his father Kūāiwa to rule over Kona, while a junior son, Hukulani ruled over Kohala. During 'Ehu's reign, four of the six *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). In addition to 'Ehu, Kūāiwa had three sons from a previous wife, Kahoukapu, Hukulani, and Manauea, all of whom became the heads of Hawai'i's aristocratic families (Fornander 1880). Although the 'Ehu line of chiefs grew to be somewhat powerful, 'Ehu is described as being ranked second to Līloa (Kelly 1983). According to Kamakau (1992), 'Ehu placed his son, Laea-nui-kau-manamana (Laea-nui) in Līloa'a royal court and for some time they both resided in Waipi'o where Laea-nui assisted with the construction of the sacred stone slab known as *Ka paepae kapu o Līloa*. Upon the death of Līloa, his kingdom was passed to his eldest son Hākau, who was subsequently killed for his continued mistreatment of the people including his younger brother 'Umi-a-līloa. After the death of Hākau, 'Umi-a-līloa assumed the role of *ali'i*. However, the chiefs of Hilo, Puna,

Ka‘ū, and Kona withheld their allegiance to ‘Umi. According to Kamakau (1992), by the time ‘Umi sought to gain control over Kona, ‘Ehu was of old age, and therefore Kona and Kohala were easily seized by ‘Umi. With regard to the death of ‘Ehunuikaimalino, Malo (1951) notes that he was assassinated by some fishermen out in Keahuolū, Kona, located north of the current study area just beyond Kailua.

While residing in Waipi‘o Valley in Hāmākua, ‘Umi managed to unify Hawai‘i Island and decided to moved his royal court to Kona “where the climate was warm” and where he engaged in farming and fishing (Kamakau 1992:19). He eventually took the daughter of ‘Ehu as his wife, Moku-a-hua-lei-akea and together they had a daughter named ‘Akahi-‘ili-kapu. ‘Umi’s reign is one that is often celebrated as it marked a time of peace and increased productivity and a move towards craft specialization. In characterizing ‘Umi’s reign, Kamakau opined:

> 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, 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. . .
>
> ‘Umi-a-Liloa did two things with his own hands, farming and fishing. He built large wet taro patches in Waipi‘o, and farming was done on all the lands. Much of this was done in Kona. . . (Kamakau 1992:19)

Through ‘Umi’s marriage to Moku-a-hua-lei-akea and the subsequent intermarriage of their descendants, the ‘Ehu genealogical line may be traced well into the time of Kalani‘ōpu‘u and Kamehameha, famed ruling chiefs of the 18th century. By the late 17th century and throughout the 18th century, large areas of Hawai‘i Island had come under the control of 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. 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 1984). Keawe, a Pili line ruler and the son of Kanaloakapulehu, was the chief of Kohala, Kona, and Ka‘ū. When Keawe died, he split the rule of his lands between two of his sons, further dividing the island’s chiefdoms; Kalaninui‘īamamao became the ruling chief of Ka‘ū, and Ke‘eaumoku became the ruling chief of Kona and Kohala (Kamakau 1992). Wars between the *ali‘i* continued unabated through this time. Alapa‘inui, the son of former Kona war chief Kauauanui a Mahi, desired to take control of Hawai‘i Island (Kamakau 1992), and successfully waged war against the chiefs of Kona and Kohala, and he eventually took control of Ka‘ū and Hilo as well. By the early to mid-18th century, Hawai‘i Island fell under the control of Alapa‘inui, who assembled a robust army and assigned his closest potential usurpers (his nephews Keawema‘uhili, Kalani‘ōpu‘u, and Keōua) as generals in his militia. The prodigious ‘Ī clan who was a powerful force and threat to Alapa‘i’s campaign had spread across the districts of Ka‘ū, Puna, and Hilo (Cordy 2000). As Alapa‘i gathered his forces to invade Kekaulike, the *ali‘i nui* of Maui, the high ranking *ali‘i wahine* (chiefess) Keku‘iapoiwa made her way to Kokoiki, Kohala to give birth to Pai‘ea, the birth name of Kamehameha (Cordy 2000).

Kamehameha was reared in the traditions and customs of the ancient chiefs and trained under some of the most skilled warriors of that time including Kekūhaupi‘o (Desha 2000). Upon Alapa‘i’s death in 1754, his eldest son Keawe‘ōpala was named heir to the kingdom (Kamakau 1992). 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). By the mid-18th century, the young and determined Kamehameha directed his efforts toward consolidating Hawai‘i Island under his rule. To accomplish this monumental task, Kamehameha continued his training under his more experienced kin namely Kalani‘ōpu‘u, who at this time, was the *ali‘i nui* of Hawai‘i Island (Ii 1993).

During Kalani‘ōpu‘u’s reign, the first foreign vessels captained by British explorer, James Cook called in Hawaiian waters. Cook first landed at Waimea, Kaua‘i in 1778 and in 1779, he anchored offshore of Kealakekua Bay, Kona. Aboard these foreign ships were innovative technologies and diseases that would eventually decimate the native population (Stannard 1989). Items such as metal, nails, guns, canons, and the large foreign vessels themselves stirred the interest of the *ali‘i* and *maka‘āinana* alike. The acquisition of these technological advancements came through barter. This resulted in the *ali‘i* gaining possession of such items that ultimately set traditional Hawaiian warfare in new trajectory; one that would be forged by none other than Kamehameha. Wars occurred regularly between intra-island and inter-island polities during this period. It was during this time of warfare that Kamehameha, would eventually rise to power and unite all the Hawaiian Islands under his rule (Kamakau 1992).

The Arrival of Captain James Cook and the End of Kalani‘ōpu‘u’s Reign (1778-1782)

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in Waimea, Kaua‘i on January 18, 1778. Nearly a year later on January 17, 1779, on a return trip to Hawaiian waters, Cook anchored near Ka‘awaloa along the north shore of Kealakekua Bay in the South Kona District of Hawai‘i Island to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many chiefs and commoners were gathered around the bay celebrating. It has been suggested that Captain Cook was understood to be the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992). Kalani‘ōpu‘u, the reigning chief of Hawai‘i Island, left a battle with Kahekili on Maui, and after arriving at Kealakekua Bay, visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawai‘i, was present at this meeting (Jarves 1847).

On February 4th, Cook set sail from Kealakekua, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua Bay to make repairs. With Cook’s return, many of the inhabitants of Kealakekua began to doubt that he was the physical manifestation of Lono (Kamakau 1992). Ten days later, a dispute over stolen nails escalated and after one of Cook’s boats was stolen, the captain set ashore at Ka‘awaloa with six marines to ask Kalani‘ōpu‘u for its return. When Kalani‘ōpu‘u denied any knowledge of the theft, Cook tried to take him captive (Kamakau 1992). A fight ensued, and Cook was killed along with four of his men and several natives. Kalani‘ōpu‘u and his retinue retreated inland. After offering the body of Cook as a sacrifice to the *akua*, some of his bones were returned to the British aboard the *Resolution* who shortly thereafter returned to the sea (Kamakau 1992).

After the death of Captain Cook and the departure of *H.M.S. Resolution* and *Discovery*, Kalani‘ōpu‘u moved to Kona, where he surfed and amused himself with the pleasures of *hula* (dance) and *he‘enalu* (surfing) (Kamakau 1992). While he was living in Kona, famine struck the district and Kalani‘ōpu‘u ordered that all the cultivated products of that district be seized. He then he set out on a circuit of the island and while in Kohala, Kalani‘ōpu‘u proclaimed that his son Kīwala‘ō would be his successor and gave the guardianship of the war god Kūka‘ilimoku to his nephew, Kamehameha. As custom dictated, it was the duty of the newly appointed chief to execute a land division process known as a *kālai‘āina* (lit. to carve the land), thereby dividing and redistributing the lands of his kingdom to his closest chiefs, priest, and supporters. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kīwala‘ō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moa‘ula was erected in Waipi‘o Valley at this time (ca. A.D. 1781), and after its dedication, Kalani‘ōpu‘u set out for Hilo to quell a rebellion by a chief named ‘Īmakakoloa.

‘Īmakakoloa was defeated in Puna by Kalani‘ōpu‘u’s superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalani‘ōpu‘u went to Ka‘ū and erected a *heiau* called Pākini (Kamakau 1992). ‘Īmakakoloa was eventually captured and brought to the *heiau*, where Kīwala‘ō was to sacrifice him. “The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief” (Fornander 1996:202). However, before Kīwala‘ō could finish the first offerings, Kamehameha, “grasped the body of ‘Īmakakoloa and offered it up to the god, and the freeing of the tabu for the *heiau* was completed” (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawai‘i. After usurping Kīwala‘ō’s authority with a sacrificial ritual in Ka‘ū, Kamehameha retreated to his home district of Kohala. where he farmed the land, growing taro, and sweet potatoes (Handy et al. 1991). Kalani‘ōpu‘u died in April of 1782 and was succeeded by his son Kīwala‘ō.

The Rule of Kamehameha I (1782-1819)

After Kalani‘ōpu‘u died, several chiefs were unhappy with Kīwala‘ō’s division of the island’s lands, and civil war broke out. Kīwala‘ō was killed at the battle of Moku‘ōhai, South Kona in July of 1782. Supporters of Kīwala‘ō, including his half-brother Keōua and his uncle Keawemauhili, escaped and laid claim to the Hilo, Puna, and Ka‘ū Districts. According to ‘Ī‘ī (1993), nearly ten years of almost continuous warfare followed, as Kamehameha endeavored to unite the island of Hawai‘i under his rule and conquer the islands of Maui and O‘ahu. Keōua became Kamehameha’s main rival on the island of Hawai‘i, and he proved difficult to defeat (Kamakau 1992). Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Pu‘ukoholā at Kawaihae, which was to be dedicated to the war god Kūkā‘ilimoku (Fornander 1996). When Pu‘ukoholā Heiau was completed in the summer of 1791, Kamehameha sent his two counselors, Keaweaheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Pu‘ukoholā by this ruse and when he arrived, he and his party were sacrificed to complete the dedication (Kamakau 1992). The death of Keōua gave Kamehameha undisputed control of Hawai‘i

Island (Greene 1993). Between 1792 and 1796, after the dedication of Puʻukoholā, Kamehameha mostly resided at Kawaihae and worked the lands of the Waikōloa-Waimea region (Maly and Maly 2002). By 1796, Kamehameha had conquered all the island kingdoms except for Kauaʻi. It wasn't until 1810, when Kaumualiʻi, the chief of Kauaʻi gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976). According to Kelly (1983:2), as the ruling chief, Kamehameha had "monopolized all foreign trade, permitting his supporting chiefs to participate only after he had divested his own fields of all marketable crops." When the *ʻiliahi* (sandalwood) trade developed, Kamehameha took control of this market and claimed this resource as his prerogative (Kelly 1983). By 1812, Kamehameha who had been living on Oʻahu for some nine years prior returned to Hawaiʻi Island and lived out the remainder of his life at Kamakahonu in Lanihau Ahupuaʻa, northwest of the current project area.

Traditional Legendary Accounts for Honuaʻula

Unlike other parts of North Kona, where traditional accounts are numerous, traditional narratives making explicit reference to the lands of Honuaʻula are limited. The first account recorded by historian and ethnographer, Kepā Maly picks up on a portion of the lengthy account of Ka-Miki and his brother Maka-ʻiole. Written by J. W. H. I Kihe and other contributors, the legend of Ka-Miki (*Ke Kaʻao Hoʻoniua Puʻuwai no Ka-Miki*) appeared in a series of articles published in the Hawaiian language newspaper *Ka Hōkū O Hawaiʻi* between 1914-1917. Ka-Miki and Makaʻiole were two supernatural brothers who journeyed around Hawaiʻi Island via the ancient *ala loa* and *ala hele* (trails and paths) where they challenged the native residents to a variety of physical and intellectual contests. Maly's summary that describes the lands of Honuaʻula is presented below.

> The story is set in about the 13th century, in the time of *Pili-a-Kaʻaiea* (Pili), sovereign chief of all Kona. The narrative identifies the lands between Lanihau (Kailua) and Puapuaʻa as an integral component of Pili's royal domain. *Pili* was a great advocate of contest and debating, fighting skills and contests of physical strength, and Hinakahua at Puapuaʻa was the site of the chief's longhouses and contest field, which supported these activities. While *Pili* was at Hinakahua he was supported by the agricultural and natural resources of the surrounding *ahupuaʻa*, including Kahului, Waiʻaha, Puaʻa, Auhaukeaʻē, Hinaloli (Hienaloli), Honuaʻula, Keōpū, Moeauoa, and Lanihau. Pili's royal compound was at Niumalu, his canoe fleets were harbored at Oneō, and his weatlth-houses (where tribute was kept until it was needed) were situated at Ahuʻena (Lanihau). (Maly in Henry et al. 1996:A-2)

Also written by J. W. H. I Kihe, the second account for Honuaʻula was published in another series titled *Nā Hoʻonānea o ka Manawa* (Pleasurable Pastimes) and published in the Hawaiian language newspaper *Ka Hōkū O Hawaiʻi* on June 5, 1924. In this article, Kihe sheds light on prominent natural features of North Kona, one of which included *Ka Puʻu o Honuaʻula* (The Hill of Honuaʻula). In describing this hill, Kihe writes:

KA PUU O HONUAULA	THE HILL OF HONUAULA
He puu nui a kiekie keia e nana ia aku nei e ku kilakila mai ana me ka haaheo a hanohano no no hoi a mahope aku o keia puu… [o Puu Hainoa]	This is a large and tall hill seen standing majestically with pride and glory, and behind this hill… [is Hainoa]

In a subsequent portion of the article, Kihe while describing an old house foundation belonging to Kū and Hina on the hill of Hainoa located on Hualalai made the following note about Puʻu Honuaʻula.

Aia mamua mai o keia kahua ma kaaoao akau o ka Puu o Honuaula, kahi i ulu ai ka ohia nona ka inoa o Ku Kaohia La-ka! a o keia ka ohia i olelo ia o ke kino ohia ia o Ku ke kane a Hina.	In front of this foundation on the northern side of the hill of Honuaʻula is the place where the *ʻōhiʻa* by the name of Kū Kaʻōhiʻa Laka grew! This is the *ʻōhiʻa* that is said to have been the *ʻōhiʻa* body form of Kū, the husband of Hina.
He elua wale no pua o keia ohia, ke pua mai he lehua Ula, a he lehua kea, a oiai hookah no kino o keia ohia a he elua nae o na ano pua, he lehua ula, a he lehua kea.	There were only two flowers on this *ʻōhiʻa* when it blooms, a red *lehua* and a white *lehua*, and even though there was only one *ʻōhiʻa* plant, there were two types of flowers, a red *lehua* and a white *lehua*.
Ua maloo keia kumu ohia a na ua pau kona kino i ka lawe ia i mea hoikeike a o ke aa ua pau no i ka eliia a lawe ia a he mau auwaha	This *ʻōhiʻa* tree has dried up and its body has been taken as a display, and the roots have

nunui alualua ke waiho nei ma kahi i ku ai o keia ohia o Ku kaohia-la-ka.	been dug up and taken, and there are uneven grooves remaining where this *ʻōhiʻa* of Kūkaʻōhiʻalaka stood.

In illuminating the cultural significance to Kūkaʻōhiʻalaka, Beckwith (1970:15) explains that Kūkaʻōhiʻalaka was considered a forest god and that "[t]he Ku gods of the forest were worshipped not by the chiefs but by these whose professions took them into the forest or who went there to gather wild good in time of scarcity." Beckwith (1970:16) adds that "Ku-mauna and Ku-ka-ohia-laka were locally worshipped as rain gods." Beckwith continues thusly:

> Ku-ka-ohia-laka is worshipped by canoe builders in the body of the ohia lehua, the principal [*sic*] hardwodd tree of the upland forest. His image in the form of a feather god is also worshipped in the heiau with Ku-nui-akea, Lono, Kane, and Kanaloa. He is the male Laka worshipped in the hula dance. That is why the alter in the dance hall is not complete without a branch of red lehua blossoms. (Beckwith 1970:16)

From the writings of Kihe we learn that during the 13th century, the lands extending from Lanihau (located to the north of the current project area) to Puapuaʻa (located to the south of the current project area), supported what could only be presumed to be a robust population of native inhabitants. Likewise, the ancient contest fields were situated to the south of the current project area in Puapuaʻa Ahupuaʻa. From Kihe's second account, we learn that Puʻu Honuaʻula, a prominent hill in the study area *ahupuaʻa* was the site of Kūkaʻōhiʻalaka, a famed *ʻōhiʻa* (*Metrosideros polymorpha*) characterized by its dual flowers of *lehua ʻula* (red blossom) and *lehua kea* (white blossom).

Nineteenth-Century Descriptions of Honuaʻula

Many of the early written descriptions documented the life and the environs of the Kamakahonu vicinity and there are but few descriptions of the uplands of Honuaʻula. Likewise, most of the recorded observations of Honuaʻula were written by early missionaries including William Ellis and Lucy Thurston. One of earliest and perhaps culturally rich accounts comes from Hawaiian historian, John Papa ʻĪʻī (1993).

Accounts of John Papa ʻĪʻī (1812)

Born in 1800 on Oʻahu and raised under the traditional *kapu* system, ʻĪʻī, was a descendant of the Luluka line and in following the customs of his family, served as *kahu* (caretaker) to the *aliʻi*. ʻĪʻī's accounts offer an intimate look into the lives of the chiefs during the early 19th century prior to the arrival of Christianity. Although ʻĪʻī penned his accounts in 1866, some of his writings describe his childhood years, which included a trip to Honuaʻula to visit his grandfather. After departing Maui, ʻĪʻī describes his trip along the North Kona coast landing first at Kaʻelehuluhulu then anchoring offshore of Honuaʻula. ʻĪʻī provided a rather detailed portrayal of the landscape from Kamakahonu to Honuaʻula, including the houses, trails, walls, *heiau*, springs, surf spots, and the upland agricultural areas. Figure 39 below shows the locations of some of the sites in the Kamakahonu-Honuaʻula vicinity described by ʻĪʻī. ʻĪʻī's account reads thusly:

> The gentle Eka sea breeze of the land was blowing when the ship sailed past the lands of the Mahaiulas, Awalua, Haleohiu, Kalaoas, Hoona, on to Oomas, Kohanaiki, Kaloko, Honokohaus, and Kealakehe, then around the cape of Hiiakanoholae, which was two long points of land. At first it seemed that these two were the only jutting points of land, but then more were seen, extending as far as Kapalilua. After Hiiakanoholae Point, Kaliliki Point was passed, and then the many houses that covered the land from Honuaula to Auhaukeae were visible. Anchor was dropped outside the reef at Honuaula, and the eyes of those aboard ship traveled over the land from Kaliliki to Honuaula, a land of rough aa and smooth pahoehoe, adorned with growth.
>
> Kamakahonu was a fine cove, with sand along the edge of the sea and islets of pahoehoe, making it look like a pond, with a grove of *kou* trees a little inland and a heap of pahoehoe in the center of the stretch of sand. A stone wall ran inland from the right side of Kamakahonu, and on the other side of that wall there was sand as far as a rock promontory. This sandy stretch, called Kaiakekua was a canoe landing, with some houses mauka of it. The rock promontory above Kaiaakekua is the Pa O Umi. Beyond it are the sands of Niumalu, and next, the spot where Hulihee Palace now stands. On this land, Kalakee, was the first site of the king's residence, and his house was called Papa. Outside of the enclosure, by the edge of the sea, was a spring called Kiope. Its fresh water came up from the pahoehoe and mixed with the water of the sea. It was a gathering place for those who went swimming and a place where the surf rolled in and dashed on land when it was rough. It was deep enough there for boats to land when the tide was high, and when it was ebb tide the boats cam up close to its rocky pahoehoe side. From there the sea was shallow as far as the spring of Honuaula,

> where there was a house side on a raised pavement. There the young chief lived. Just makai was a patch of sand facing north, where canoes landed, in front of the heiau of Keikipuipui. A Hale O Lono faced directly toward the upland, and toward the north there was a bed of pahoehoe which reached to the sea, where there was a surfing place for children. To the south was where the waves dashed onto the land. West of the Keikipuipui heiau was a surfing place called Huiha, north of Kapohonau. Later, a heiau was built there by the king.
>
> Perhaps because the ship was anchored so far to the south, the north side of Keikipuipui heiau seemed to be adjacent to Kiope spring. Some women standing there in *pa'u* dyed with turmeric were noticed by Ii, who spoke aloud, "How is it that those women are standing so close to the heiau wall?" He was told that this only seemed to be so because of the position of the ship. The women were Kailipono and Kamakaeheikuli, *kaikuahine* relatives of Papa. Those on shore had recognized Papa's ship and, perhaps, had gone to the spot near the edge of the sea to get a good view of the ship and the boy. When next he noticed the women, they were approaching in a canoe. Then wailing was exchanged between them and Kaupe, Nahoounauna, and the boy. The sun was sinking toward the islet of Lehua by this time, and the women urged that the boy go ashore with them, telling him of Papa's illness.
>
> Ii went with them, and the canoe landed where the water was shallow. Then the women led the way to the main trail. They went past the Kaaipuhi spring, between the houses on both sides of the trail, and on until they arrived at the mauka side of the Honuaula cave. On the upper side of this trail, about 5 or 6 chains from where their canoe had landed, was a small group of houses standing apart. Where the houses began on the south side of the trail that ran through the village another trail branched off, ascending the mountain and leading to the food patches. A stone wall to protect the food plots stretched back of the village from one end to the other and beyond.
>
> The boy and the two women stood at the enclosure entrance of the house in which Papa lay ill. As this was a men's house, *mua*, and only men were permitted there, they waited a little while, until Kuike, a kinsman of the boy, came out and learned who the boy was. The boy was led through the entrance and in through the door of the house where his namesake lay, beyond the *ukuwai*, or center of the house. (Ii 1993:121)

Later in 'Ī'ī's (1959) journal is a description of a royal center, Papaula, located near coastal Honua'ula. This royal center was eventually claimed by the *ali'i*, Leleiohoku, during the 1848 *Māhele 'Āina*. 'Ī'ī's narrative describes the royal compound as it appeared during the era of *'aikapu* (pre-1819), as well as the upland areas, which were accessed via a trail that extended *mauka* from Papaula:

> Soon after the building of the king's [Kamehameha] houses at Kamakahonu, two ti-thatched houses were built for the young chief [Liholiho] at Papaula in Honuaula. One was a *mua* [men's house] for the heir of the kingdom; the other, a *hale 'aina* [woman's eating house] for his young wife. The name of the woman's eating house was Kawaluna; that of the husband was Hookuku.
>
> Two or three storehouses, some work sheds (*halau*), and work houses in which women could print their tapa were also built. There were two kinds of work sheds, all thatched with pili grass, behind the white sands of Kaiakeakua and the brine-covered sands close to the pahoehoe. Behind these houses was the trail that went up to the plains, to the area overgrown with thickets, to the bottom of the mountain slope, to the region where the *'ama'u* ferns grew wild, and on to the mountain.
>
> In the storehouses were piled bundles of surplus *pa'u*, malos, and tapa sheets. These had been given to the chiefs as *makahiki* taxes that were presented to the gods when they made a circuit of the island every twelfth month. Because the profit received from these taxes on the land was so large, combined with the king's personal sharesfrom his other lands, goods were piled in great heaps. If one looked into the storehouses, one saw small, large, extra large, and medium-sized bundles and wooden bowls filled with hard poi. There were separate bundles for women and for men. Consequently, separate storehouses were provided for the food to be eaten by each sex. There was no separation of the fishes, however, because either men or women could take what they wanted. (Ii 1993)

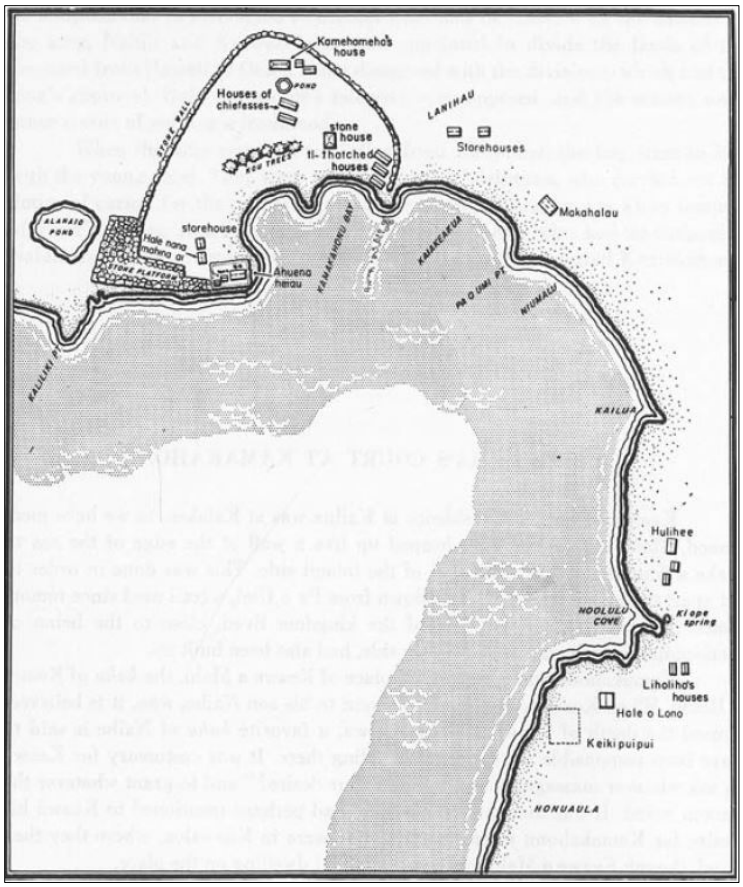


Figure 16. Keikipuipui *heiau* and other sites located in coastal Honuaʻula, map by Paul Rockwood; project area not shown (Ii 1993:118).

Between the time of ʻĪʻī's account and the arrival of the first missionaries in 1820, Hawaiian society had undergone major socio-political transformations. On May 8th, 1819, Kamehameha died at his royal residence at Kamakahonu in Kailua-Kona and named his son ʻIolani Liholiho (Kamehameha II) heir to his kingdom (Kamakau 1992). By May 21st Liholiho at the age of twenty-one began his rule. As traditional custom dictated, following the death of a prominent chief, it was customary to relax all *kapu* that maintained social order. Thus, following Kamehameha's death, a period of *ʻai noa* (free eating) was observed along with the relaxation of other *kapu*. It was the responsibility of the new ruler and *kahuna* (priest) to conduct the proper rituals and ceremonies to reinstate all *kapu.* Immediately upon the death of Kamehameha I, Liholiho was sent away to Kawaihae to keep him safe from the impurities brought about from the death of his father. However, Liholiho's attempts to reinstate the long-standing *kapu* system were futile and the future of the *kapu* system stood in a state of uncertainty. *Kuhina Nui* (Premier), Kaʻahumanu (the wife of Kamehameha and the *hānai* (adopted) mother of Liholiho) and his biological mother Keōpūolani lured the young chief back to Kona and the *kapu* system was symbolically abolished when Liholiho ate in the presence of his mothers and wandered about the women's house (Kamakau 1992). While he may have done so during a time when he had not yet reinstituted the eating *kapu,* other chiefs present appear to have thought otherwise, and word spread that the *kapu* had been abandoned.

Kekuaokalani, caretaker of the war god Kūkaʻilimoku, was dismayed by his cousin's (Liholiho) actions and revolted against him. Determined to reinstate the ancient *kapu* of the land, Kekuaokalani, went head-to-head against Liholiho's forces, which were headed by Kalanimoku in the battle of Kuamoʻo (Fornander 1918-1919). Western weaponry had already permeated traditional Hawaiian warfare and Kekuaokalani, who stood behind the ancient laws of the land was killed by gunfire on the battlefield alongside his wife Manono, thereby extinguishing the last public display of resistance. By December of 1819, Kaʻahumanu 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 (Auna 1822; Kamakau 1992). He did, however, allow the personal family religion,

the *ʻaumakua* worship, to continue (Kamakau 1992; Oliver 1961). The abolishment of the *kapu* system in 1819, began to undermine the very foundations upon which traditional Hawaiian culture was formed. Such changes would be furthered with the arrival if the first missionaries.

In October of 1819, just five months after the death of Kamehameha, the first American Protestant missionaries aboard the Brig. *Thaddeus* left Boston, Massachusetts and by March 30th, 1820, they sailed to Kawaihae on the northwest coast of Hawaiʻi Island (Hawaiian Mission Children's Society 1901). After receiving permission from Liholiho and his council of chiefs, the missionaries were permitted to remain in the kingdom on am interim basis for a year (Kelly and Barrère 1980). These missionaries had arrived to a society whose chiefs had just overturned the socio-religious system. These early missionaries quickly set out to develop relationships with Hawaiian nobility with the intent of establishing mission stations around the islands that would help advance their efforts to spread the Christian gospel, beliefs, and lifeways.

William Ellis (1823) Tour through Kona

By 1823, to accommodate Hawaiʻi's growing Calvinist mission, British missionary William Ellis (1917) along with members of the American Board of Commissioners for Foreign Missions (ABCFM) circuited Hawaiʻi Island in search of suitable locations for future mission stations and churches. After departing Kailua, Ellis and his party, along with their native guide Makoa, made their way south along the coast, passing through the area of Honuaʻula. While Ellis' accounts describe coastal scene similar to ʻĪʻī, he also makes a brief reference to the upland areas. In relating his observation of the area, Ellis noted:

> Leaving Kairua [Kailua], we passed through the villages thickly scattered along the shore to the southward. The country around looked unusually green and cheerful, owing to the frequent rains, which for some months have fallen on this side of the island. Even the barren lava, over which we traveled, seemed to veil its sterility beneath frequent tufts of tan waving grass, or spreading shrubs and flowers.
>
> The sides of the hills, laid out for a considerable extent in gardens and fields, and generally cultivated with potatoes, and other vegetables, were beautiful.
>
> The number of heiaus, and depositories of the dead, which we passed, convinced us that this part of the island must formerly have been populous. The latter were built with fragments of lava, laid up evenly on the outside, generally about eight feet long, from four to six broad, and about four feet high. Some appeared very ancient, others had evidently been standing but a few years. (Ellis 1917:87-88)

As these early missionaries toured the island looking for a suitable location for their future mission station, one of their requirements was the ability to easily procure fresh water. While Kailua was a highly recommended locale as it was one of the most populous centers in Kona, the scarcity of fresh water, which was only "found in pools, or small streams, in the mountains, four or five miles from the shore" made it somewhat undesirable to the missionaries (Ellis 1917:45). Ellis and his crew set out from Kailua in a southeast direction to identify "the most eligible place for digging a well" (Ellis 1917:46). While on their return trip to Kailua, Ellis (1917:46) and his party "explored a celebrated cavern in the vicinity, called Raniakea [Laniākea]," situated near the boundary of Honuaʻula and Hienaloli 1st. Ellis recounted the exploration:

> After entering it by a small aperture, they passed on in a direction nearly parallel with the surface; sometimes along a spacious arched way, not less than twenty-five feet high and twenty wide; at other times, by a passage so narrow, that they could with difficulty press through, till they had proceeded about 1200 feet; here their progress was arrested by a pool of water, wide, deep, and as salt as that found in the hollows of the lava within a few yards of the sea. This later circumstance, in a great degree, damped their hopes of finding fresh water by digging through the lava.
>
> The mouth of the cave is about half a mile from the sea, and the perpendicular depth to the water probably not less than fifty or sixty feet. The pool is occasionally visited by the natives, for the purpose of bathing, as its water is cool and refreshing. From its ebbing and flowing with the tide, it has probably a direct communication with the sea. (Ellis 1917:46)

Ellis (1917) also described and sketched an old fortification (Figure 17) belonging to the *makaʻāinana* near the mouth of Laniākea Cave and information received from Hawaiians at that time as to the use of the cave. Regarding the ancient fort, Kelly (1983:12) adds that "[t]his is the only mention found of the remains of what must have been an ancient *puʻukaua* and *puʻuhonua* (fortification and refuge) in the Kailua area." Ellis' account is as follows:

> All that at present remains is part of the wall, about eighteen or twenty feet high, and fourteen feet thick at the bottom, built of lava, and apparently entire. In the upper part of the wall are apertures resembling embrasures; but they could not have been designed for cannon, that being an engine of war with which the natives have but recently become acquainted. (Ellis 1917:76)
>
> The part of the wall now standing, is near the mouth of Raniakea [Laniākea], the spacious cavern already mentioned, which formed a valuable appendage to the fort. In this cavern, children and aged persons were placed for security during an assault or sally from the fort, and sometimes the wives of the warriors also, when they did not accompany their husbands to the battle.
>
> The fortification was probably extensive, as traces of the ancient walls are discoverable in several places; but what were its original dimensions, the native who were with us could not tell. They asserted, however, that the cavern, if not the fort also, was formerly surrounded by a strong palisade. (Ellis 1917:78)

Citing population census data provided by the visiting missionaries in 1823, Kelly and Barrère (1980:18) reported "…a population of note less than 20,000 inhabitants along a 30-mile stretch of the Kona coast, including 3,000 at Kailua itself." Kelly and Barrère (1980) added that although most of the population was concentrated along the coast, another belt of residence was situated about two miles inland in the area *mauka* of the project area.

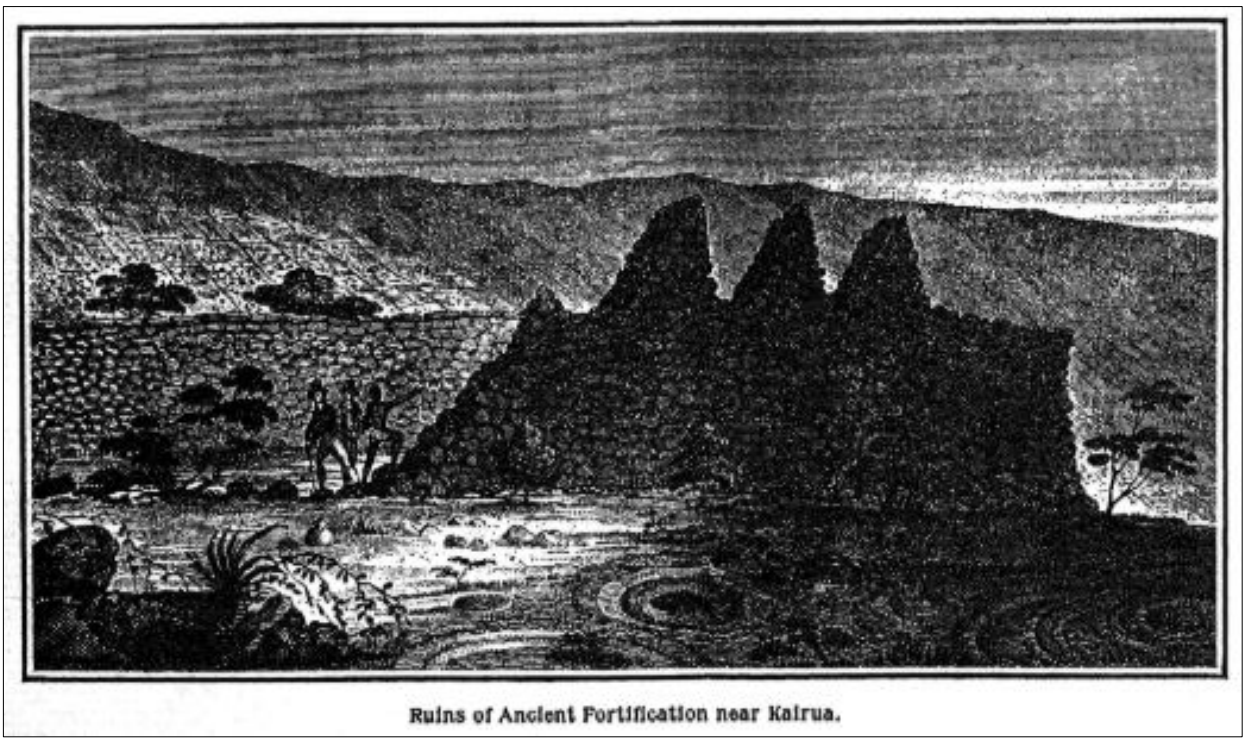


Figure 17. Ellis' depiction of "Ruins of Ancient Fortification near Kairua [Kailua]" (Ellis 1917:77).

The Life and Times of Mrs. Lucy J Thurston (1825)

Reverend Asa and Lucy Goodale Thurston were in the first company of American Christian Missionaries to the Hawaiian Islands, arriving in Kailua-Kona on the *Thaddeus* in 1820. In November of 1823, the couple had moved from Honolulu to Kailua where they established a strong presence and under the direction of Governor Kuakini, initiated the construction of Mokuʻaikaua Church in Keōpū Ahupuaʻa, northwest of the project area. By 1825, the Thurston's were provided with some land near the Honuaʻula-Hienaloli boundary to establish a parsonage. Asa and Lucy Thurston built their home near Laniākea Cave within Honuaʻula Ahupuaʻa. In a journal entry written by Mrs. Lucy Thurston regarding the cave, she explains:

> The name of the cave is Laniakea, signifying the broad heavens. As it enclosed in our premises, the natives were quick to give the name to our establishment, so that it has become universally known as Laniakea. (Thurston 1882:85)

An 1883 Hawai‘i Registered Map No. 1325 (Figure 18) prepared by G. E. G. Jackson depicts the location of Thurston’s home *mauka* of Kailua Bay as well as Moku‘aikaaua Church shown on the map at “Prot Church”. The 1883 map also shows the “Ruin of old Prison,” which is more than likely the remains of the old fortification described and sketch by Ellis in 1823 (see Figure 17) at the coast of the adjacent Hienaloli Ahupua‘a. In addition to the Thurston home, the 1883 map also depicts four structures at the coast of Honua‘ula, one of which appears to have been partially enclosed by a wall. In relating information about their home, Lucy Thurston (1882:83) described the house site as such:

> Back of the village on that arid slope, a third of a mile from the shore, was an unoccupied, eligible site for a house and grounds. There we set about making such a home as circumstances would allow, and as the double responsibilities required, of molding heathen society, and of forming the characters of our children.
>
> Five acres were enclosed with a stone wall three feet wide and six feet high, with simply the front gate for entrance. A large thatched house was erected. A large thatched house was erected. Space was allowed for a yard twenty-five feet in breadth. (Thurston 1882:83)

By 1837, following a succession of thatched dwellings, a two-story wooden house was constructed (Thurston 1882); and as can be seen in a ca.1840 sketch (Figure 19) of the property by Persis Thurston (daughter of Asa and Lucy), several thatched structures also remained. This image also depicts the various bands of vegetation at the time, which correlate to elevational changes within the Kona Field System within the *ahupua‘a* of Hienaloli and Honu‘ula. Using georeferencing technology, the approximate location of the study area was identified on the Thurston sketch, however, it falls just outside and along the border of the image (see Figure 19). The Thurston sketch proved to be in good alignment with the natural features of the landscape, and accurately depicts the boundaries of the various vegetative zones, and, as suggested by the sketch (see Figure 19) the approximate project area is located within the *kalu‘ulu* zone. Lucy Thurston also commented on the back county of Kailua noting that:

> Along the coast for two miles back, it is sterile; but there is a belt that is very rich, about a mile wide at the foot of the mountain, which is dotted here and there with kukui, breadfruit and orange, all splendid trees; of smaller growth, pine apple [*sic*], sugar cane, arrowroot, taro and potatoes. Above this fertile belt is quite a width of forest, after which the bare sides of the mountain rise to a peak. It stands towards the rising sun. These distant scenes of the mountain, and perpetual verdure of forest and vegetation, are ever to be enjoyed. (Thurston 1882:82-83)

Another sketch (Figure 20) done by Persis Thurston shows what appears to be the view of the coastal Honua‘ula-Kailua area as it appears from their home in 1836. The sketch shows a concentration of traditional thatched huts along the coast as well as the Protestant church and what appears to be stone enclosures in the area adjacent to the roadway leading to the Thurston home. By 1890, the Thurston residence appears to have been subsequently replaced with stone structures (Figure 21), and then abandoned by the early twentieth century. The structural remains of the Thurston House have been designated as SHIP Site 50-10-28-7248.

Although limited, these early historical accounts illuminate the changing lifeways following the arrival of Westerners. The growing missionary presence in addition to the introduction of Western concepts of trade and commerce sparked major religious and economic shifts. These shifts reshaped traditional spiritual practices, beliefs, and influenced traditional concepts of land. By 1848, under the administration of the reigning monarch, Kauikeaouli (Kamehameha III), Hawai‘i’s traditional land tenure system would undergo a drastic reformation—a process that forever altered traditional concepts and beliefs around the land.

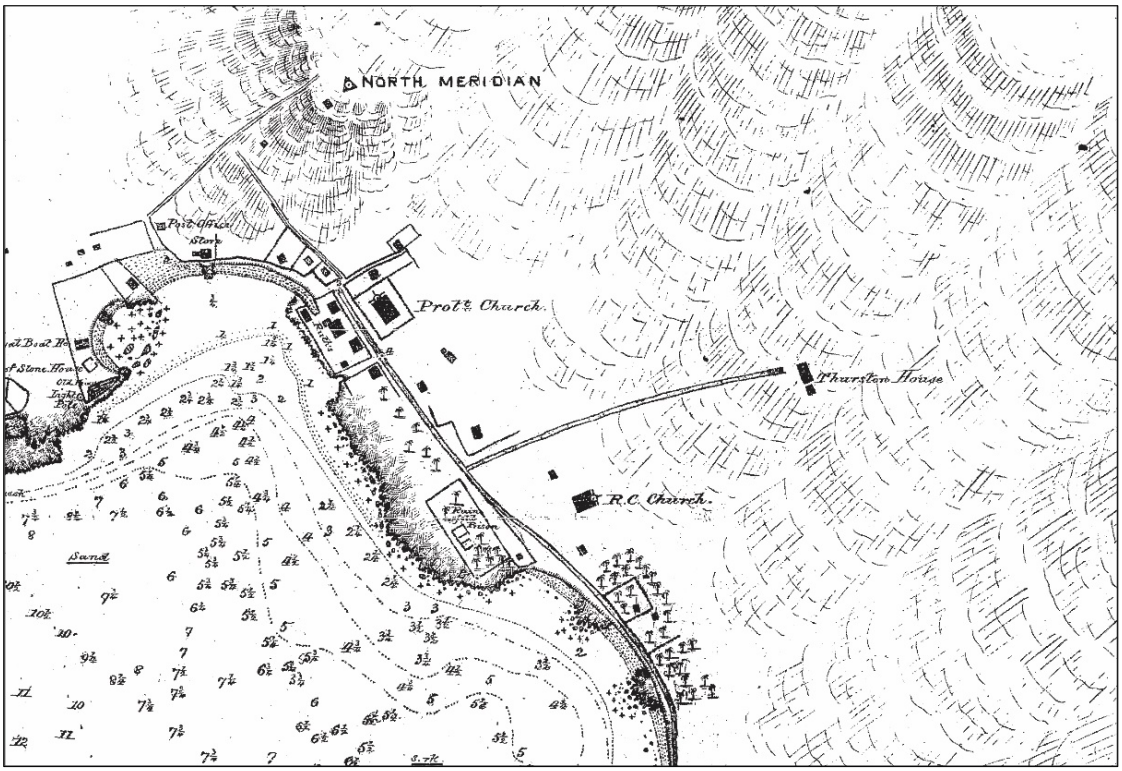


Figure 18. A portion of an 1883 Hawai‘i Registered Map No. 1325 showing the location of the Thurston house within the coastal portion of Honua‘ula; project area not shown.

Figure 19. Sketch of the Thurston Residence and the landscape drawn by Persis Thurston in 1827 (Thurston 1882:126).

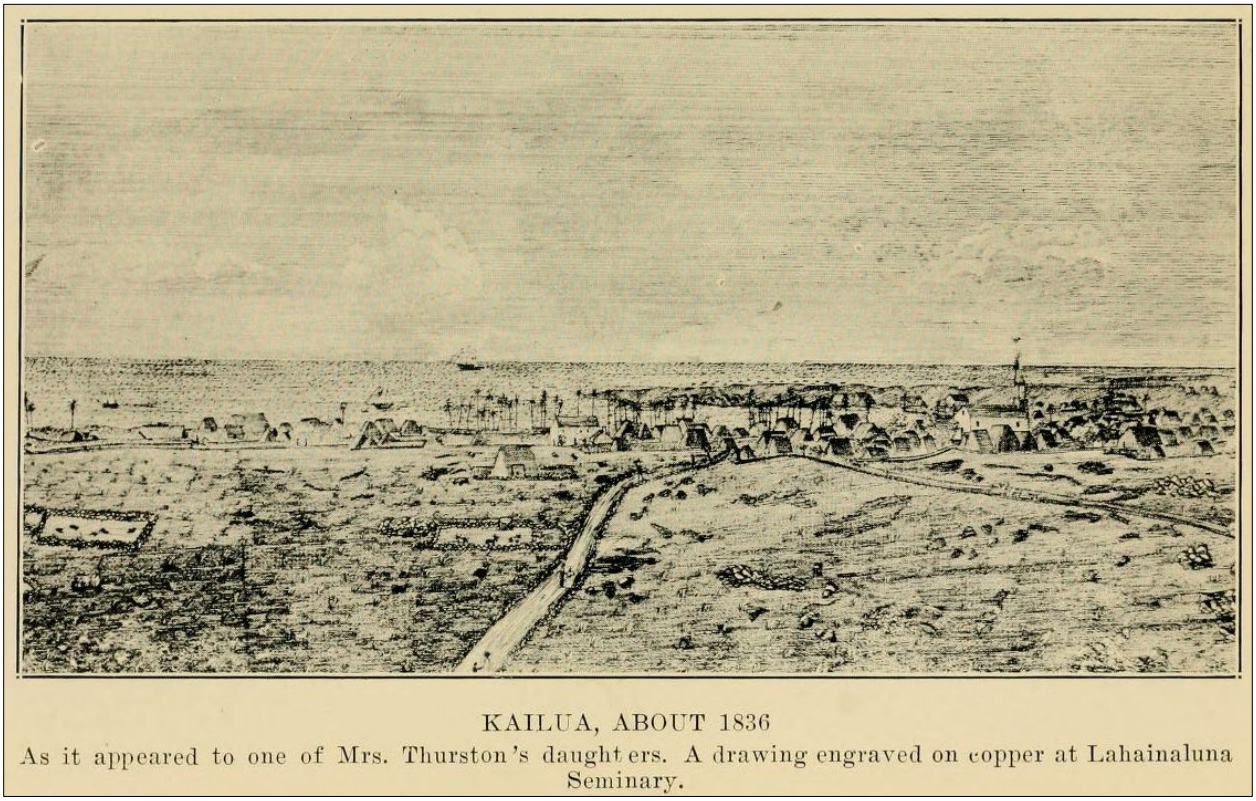


Figure 20. View of the coastal Honuaʻula-Kailua area in 1836 (Thurston 1882:174).

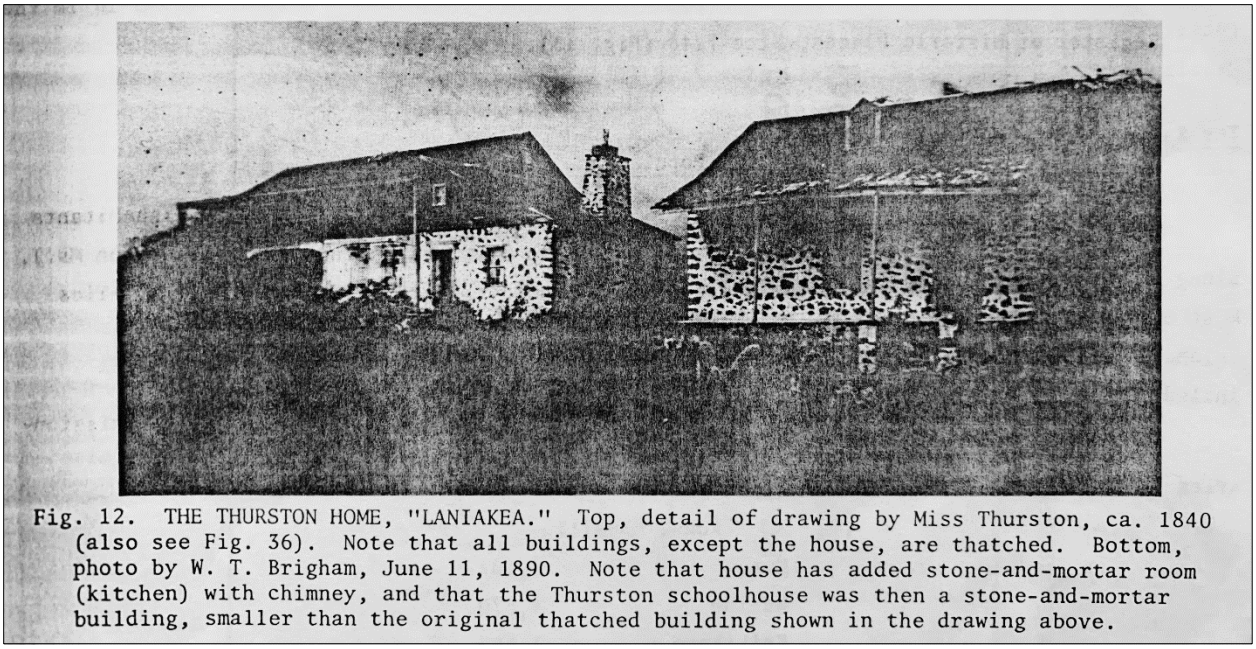


Figure 21. "The Thurston Home, Laniakea," photograph by W.T. Brigham June 11, 1890 (Kelly 1983:13).

Wilkes' Exploring Expedition (1840)

Commodore Wilkes of the U.S. Exploring Expedition provided the following comments about the environs of Kailua and makes explicit reference to the cultivation practice of the natives in the uplands areas. Wilkes' writings also relate information about cattle and goats roaming in the interior parts of Kailua. His comments read thusly:

> The town of Kailau [Kailua] is the residence of Kuakini, better known among foreigners by the name Governor Adams, who is governor of Hawaii.
>
> This district lies to the north of Kealakekua, and begins about five miles from Napolo [Nāpoʻopoʻo]. It is similar to it in character, but the lava is of more recent formation, the eruptions from Hualalai having flowed down and covered nearly the whole norther portion. This eruption happened about thirty years since, in 1809 and 1810…
>
> Rain seldom falls on the coast except in showers, and a rainy day once in the year is looked upon as something remarkable. This, together with the absence of all dew, prevents the existence of much cultivation; it affords, nevertheless, a coarse vegetation, sufficient to pasture a few hundred goats; but, a mile back from the shore, the surface is covered with herbage, which maintains cattle, &c.; and two miles in the interior there is sufficient moisture to keep up a constant verdure.
>
> Here, in a belt half a mile wide, the bread-fruit is met with in abundance, and above this the taro is cultivated with success. At an elevation of between two and three thousand feet, and at the distance of five miles, the forest is first met with. The trees of this are suitable for building timber, and boards and shingles are made of them. The products of this portion of Kona are the same as before described. (Wilkes 1845:94-95)

Samuel Kamakau (1844)

Hawaiian historian, Samuel Kamakau (1992) mentions Honuaʻula in connection with the death of Kuakini, the royal governor (1820-1844) of Hawaiʻi Island. Although Kuakini assisted the early missionaries in setting up their stations and churches, it appears that his Christain zeal dwindled towards the latter part of his life. He was eventually suspended from the church and when he died in 1844, he was given Hawaiian interment rites, not Christain (Kelly and Barrère 1980). While the account above by ʻĪʻī describes the Honuaʻula vicinity as it appeared to him prior to the changes brought about by Christianity, the account given by Kamakau reflects the changing lifestyle of Hawaiian royalty, which by this time appears to have included the adoption of Western-style wooden houses. Kamakau writes:

> Ka-lua-i-konahale Kua-kini lived as a ruling district chief until he was a feeble tottering man. He died at his home in the handsome wooden house of Hulihe'e at Honuaʻula in Kailua, Hawaiʻi, at nine o'clock in the morning, December 9, 1844. He was born in 1791 at Kahaluʻu on Hawaii and was called Ka-lua-i-konahale (the-burial-cave-at-Konahale) after the grave of Kalola at Kalamaʻula on Molokai. When [his half brother] Kua-kini died of the cholera at the beach of Waiʻalae, the name Kuakini was given to Ka-lua-i-Konahale. This name was for a multitude [of chiefs] at the back (*kuakini o ke kua*) of Kamehameha-nui, son of Ke-kau-like. [Ka-lua-i-Konahale Kua-kini was known as John Adams by the foreigners]. (Kamakau 1992:388)

Summary of Historical Accounts

Although limited, the historical accounts specific to Honuaʻula describes an important transitional phase of Hawaiian culture during the early part of the 19th century. From ʻĪʻī's account which provides a snapshot into the life of Hawaiian nobility who resided within Honuaʻula prior to the arrival of the first missionaries to those of Ellis, Thurston, Wilkes, and Kamakau which reflects the lifestyle changes brought about after the arrival of Europeans and missionaries. It is clear from ʻĪʻī's writings that coastal Honuaʻula was an important royal center and given its proximity to Kamakahonu, it may have stood on the fringes of what was likely an expansive royal center. Collectively, these accounts show an increased detraction from traditional lifeways and beliefs and the adoption of certain Western customs, religion, and ideologies of land.

The *Māhele ʻĀina* of 1848

By the mid-19th century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible

with a constitutional government, the *Mōʻī* Kauikeaouli and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). The change in land tenure was further endorsed by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī* (King), the *aliʻi* (chiefs) and *konohiki* (land agents), and the *makaʻāinana* (common people or native tenants).

In 1845 the legislature created the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission), first to adopt guiding principles and procedures for dividing the lands and granting land titles, and then to act as a court of record to investigate and ultimately award or reject all claims brought before them. All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants 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, 1848) to be considered. This deadline was extended several times for the *aliʻi* and *konohiki*, but not for commoners (Alexander 1920; Soehren 2004).

The *Mōʻī* and some 245 *aliʻi* (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). 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), and the names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*) of the Hawaiian Islands and the chiefs who claimed them, were recorded in the *Buke Mahele* (also known as the *Māhele* Book) (Soehren 2004). As this process unfolded the *Mōʻī*, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division when the last chief was recorded in the *Buke Māhele*, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike the King, the *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Award (LCAw.). The chiefs who participated in the *Māhele* were also required to provide commutations of a portion of their lands to the government to receive a Royal Patent that gave them title to their remaining lands. The lands surrendered to the government by the *Mōʻī* and *aliʻi* became known as "Government Land," while the lands that were personally retained by the *Mōʻī* became known as "Crown Land," and the lands received by the *aliʻi* became known as "*Konohiki* Land" (Chinen 1958:vii; 1961:13). Most importantly, all lands (Crown, Government, and *Konohiki* lands) identified and claimed during the *Māhele* were "subject to the rights of the native tenants" therein (Garavoy 2005:524). Finally, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be formally surveyed. This process expedited the work of the Land Commission.

During the *Māhele* of 1848, Honuaʻula was claimed by the chiefess Keahikuni Kekauʻōnohi (also known as Mikahele or Miriam Kekauʻōhoni). She subsequently relinquished her interest and the land was retained as Government land (Soehren 2004).

Kuleana Claims in Honuaʻula

As the King and his *aliʻi* and *konohiki* made claims to entire ahupuaʻa and the prized *ʻili kūpono* lands via the *Māhele*, questions arose regarding the protection of rights for the native tenants. To resolve this matter, on August 6, 1850, the *Kuleana* Act (also known as the Enabling Act) was passed, clarifying the process by which native tenants could claim fee simple title to any portion of lands that they physically occupied, actively cultivated, or had improved (Garavoy 2005). The *Kuleana* Act also clarified access to *kuleana* parcels, which were typically landlocked, and addressed gathering rights within an *ahupuaʻa*. Lands awarded through the *Kuleana* Act were, and still are, referred to as *kuleana* awards or *kuleana* lands. The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (LCAws.) (Chinen 1958). Native tenants wishing to make a claim to their lands were required to register in writing with the Land Commission, who assigned a number to each claim, and that number (the Native Register) was used to track the claimant through the entire land claims process. The native tenants registering their *kuleana* were then required to have at least two individuals (typically neighbors) provide testimony to confirm their claim to the land. Those testimonies given in Hawaiian became known as the Native Testimony, and those given in English became known as Foreign Testimony. Upon provision of the required information, the Land Commission rendered a decision, and if successful, the tenant was issued the LCAw which conferred a less than allodial title (Barrère 1994). Finally, to relinquished any government interest in the property, the holder of a LCAw. obtained a Royal Patent Grant from the Minister of the Interior upon payment of the commutation fee (Barrère 1994). The information recorded in the Native Register and Native and Foreign Testimony provides insight into land use and settlement patterns around the time of the *Māhele*. An 1892 Hawaiʻi Registerd Map No. 1676 (Figure 22) shows all the awarded LCAw. within Honuaʻula. The details of these *kuleana* awards and further discussed below.

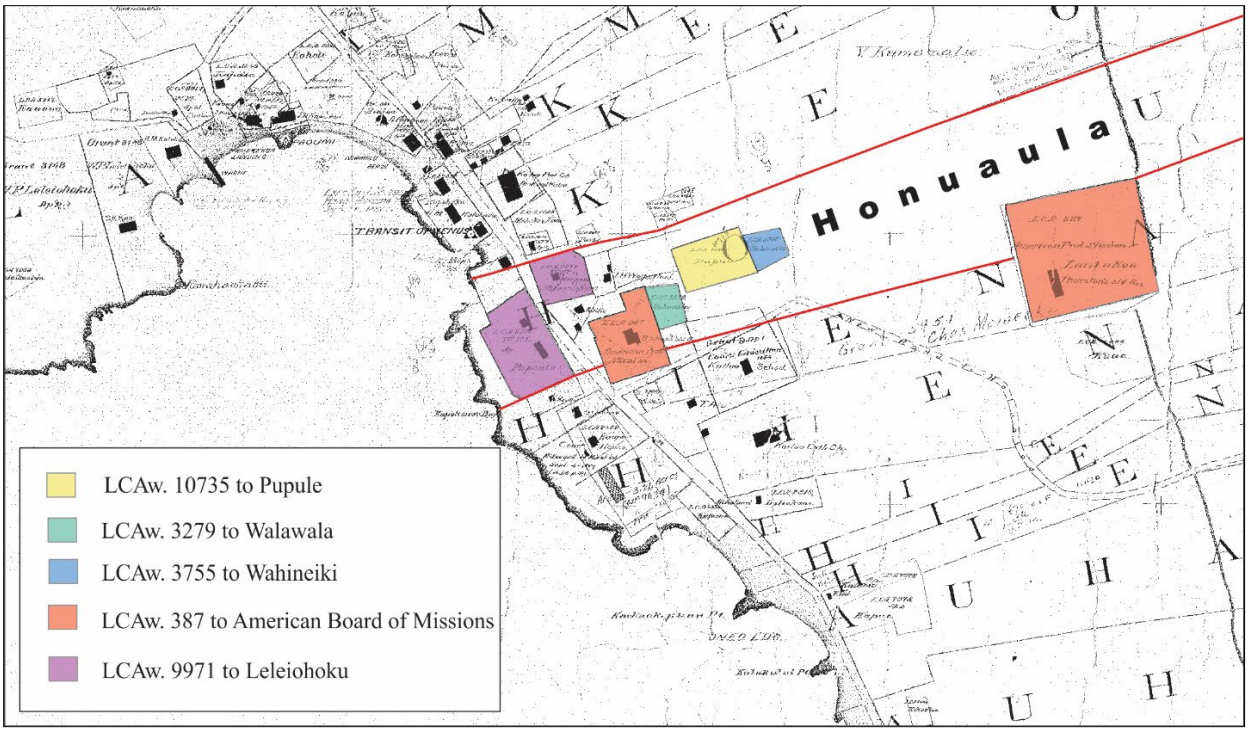


Figure 22. A portion of Hawai‘i Registered Map No. 1676 showing the LCAw. in Honua‘ula Ahupua‘a, project area not shown.

Kuleana Awards Granted in Honua‘ula

In summary, four individuals and one institution were awarded a total of seven distinct LCAw. parcels within Honua‘ula (see Figure 22 above and Table 3 below). With the exception of LCAw. 387, awarded to the American Protestant Mission which was located *mauka* near the boundary of the Kuakini Wall and included the Thurston residence (Laniakea), all remaining LCAws. were located within 0.25 miles of the coast, *makai* of modern-day Kuakini Highway. Concerning the history of Kuakini Wall, which extended from Palani Road above Kailua Bay to about Kahalu‘u Bay and was built to keep out feral animals introduced to the island by early foreign visitors, Kelly (1983) notes that prior to 1855, it was known as the Great Stone Wall. Perhaps the 1915 account by Reverand Albert Baker (1915:83), who remarked that "…a huge stone was built in Kuakini's time to keep pigs from the cultivated lands above" that the wall has become known as the Kuakini Wall.

The American Protestant Mission received multiple awards within the general North Kona region, including two parcels (LCAw. 387) within Honua‘ula, totaling 6.74 acres. Supporting testimony in the Foreign Register, provided in 1846 by Asa Thurston, indicates that the Kailua Mission lands were received by verbal gift from Ka‘ahumanu I in 1821. The American Protestant Mission claims within Honua‘ula include a 5.26-acre *mauka* parcel for the Thurston residence, and a 1.6-acre parcel, which was the residence of Dr. Seth Andrews (see Figure 22). Dr. Andrews' Foreign Register testimony provided in 1846 indicated the presence of a lime kiln on the property. Figure 22 above labels the location of the Thurston House, as well as Dr. Andrews' residence, which is labeled "Bishop's Old Res.".

Along the eastern boundary of Dr. Andrews' parcel is LCAw. 3279, awarded to Walawala (see Figure 22). Native testimony provided in 1848 by Palila for Walawala's claim indicated that the land belonged to his grandparents during the time of Kamehameha I, and consisted of an enclosed, 0.43-acre lot containing three buildings-2 sleeping quarters for Walawala and one meeting house. A footpath was also noted along the *mauka* boundary of the parcel. Interestingly, Walawala was officially awarded his land in 1919, nearly seventy years after his claim was made.

LCAw. 3755 (see Figure 22), awarded to Wahineiki, consisted of 0.41 acres, and, according to native testimony provided by Kuae in 1849, was an enclosed lot containing one house in which he resided. Interestingly, Wahineiki's Royal Patent Grant (8539) was not officiated until 1961.

LCAw 10735 (see Figure 22) awarded to Pupule, consisted of 1.4 acres. Native testimony provided by Mose in 1848 indicates that Pupule's land consists of 22 *kihapai* in the *‘ili* (land section) of Pualoalo. Testimony for Pupule's lot also indicates that the land was partially cultivated, however specific cultivars are not mentioned.

The *ali‘i* William Pitt Leleiohoku received a total of three parcels, only two of which (LCAw 9971:45 and 46; see) are shown in Figure 22 totaling approximately 3 acres within Honua‘ula. All three parcels were for *pāhale* (house lots). Parcel 45, the *makai* most parcel, is identified in the LCAw. documents as Pa o Papaula and on the 1892 map (see Figure 22) as Papaula and parcel 46 located to the northeast is identified as Pa o Papa. Although Figure 22 only shows the location of two of Leleiohoku's LCAw. parcels the LCAw. documents reveal that the Leleiohoku had been awarded a third parcel in Honua‘ula identified as LCAw. 9971:47 which was for another *pāhale* for a husband and wife likely of *ali‘i* status, Naheana (f) and Kaiwi (m). The 1892 map (see Figure 22) however, associates the names of these two individuals with parcel 46. Although Leleiohoku had received a total of three LCAw. parcels in Honua‘ula, only the location of two are shown in the 1892 map (see Figure 22). The Native Testimony documents specify that Leleiohoku had received parcels 45 and 46 from Governor John Adams Kuakini in 1834 and parcel 47 was received in 1840 from Naheana's parents who held the land since the time of Kamehameha.

Three other LCAw. (LCAw 7379 to Kaohenana, LCAw. 7981 to Puniawa, and LCAw. 9197 to Kalaniwahine) claims were made, but not awarded within Honua‘ula. Kaohenana (LCAw 7379) claimed five parcels within Honua‘ula. Testimony provided by Hulu in 1848 states that he has seen Kaohenana's land sections within the *‘ili* of Laeoumi, of which he has tilled with his own hands. Two potato *kīhapai* were noted within parcel 5 of Kaohenana's claim. Puniawa's claim (LCAw 9197) indicates the presence of 10 cultivated *kihapai* within the *‘ili* of Pualoalo, and that the land was passed down from Palila during the time of Kamehameha I. Kalaniwahine claimed two sections of land within the *‘ili* of Lahomaumau (LCAw 9197), a *pāhale* and a *kīhāpai*. Testimony provided by Palila in 1848 for Kalaniwahine's claims states that he resided in a house on his land, which was passed down from his grandparents.

Table 2. Land Commission Awards within Honua‘ula Ahupua‘a

LCAw. No.	*Awardee Name*	*No. of parcels awarded*	*‘Ili name*	*Royal Patent No.*	*Award Year*	*Acres*
387	American Board of Missions	2	n/a	1600 & 1930	1855	6.74
3279	Walawala	1	n/a	8324	1919	0.43
3755	Wahineiki	1	n/a	8539	1961	0.41
10735	Pupule	1	Ililoa	n/a	n/a	1.4
9971	Leleiohoku	3	Pa o Papaula and Pa o Papa	6693	1875	2.84

Summary of Land Commission Awards

A review of the historical documents associated with each of these *kuleana* claims indicated that the majority of the parcels awarded were for *pāhale* near to the coast, and within the *kula* zone. Interestingly, no *kuleana* claims were awarded in the *mauka* portion of Honua‘ula despite claims made by several native tenants, who were not awarded land as part of the Kuleana Act. Native Testimony also indicates that the majority of the claimants were residing on their parcels, and some were partially cultivated and contained *kīhāpai,* however specific crops were not disclosed.

Hawai‘i Registered Map No. 1676 of Kailua Town and the vicinity (see Figure 22), also depicts the location of structures within four of the awarded *kuleana* parcels. Additionally, four other structures, which do not appear to have been affiliated with a LCAw. parcel are also indicated within the coastal portion of Honua‘ula. Two of these structures are labeled with the names Kuike and J. H. Waipoilani. A review of *Māhele* records yielded negative findings for any *kuleana* claims associated with these names within Honua‘ula. Testimony provided by Asa Thurston and Dr. Seth Andrews indicates that lands were originally gifted by Ka‘ahumanu in 1821, while other claims indicate that lands had been passed down through family ties, spanning generations. A review of boundaries surveyed also shows the presence of trails, roads and streets bounding or at times passing through some of the *kuleana* parcels. It does not appear that any *kuleana* claims were made for the *mauka* portions of Honua‘ula, which (as shown through historic accounts) was cultivated and provided sustenance to the residents of Honua‘ula and the lands immediately surrounding it. The drastic reduction in the amount of cultivatable land for the native tenants would have likely had an adverse impact on their ability to sufficiently sustain themselves. Additionally, given that the *Māhele ‘Āina* codified preexisting land-use patterns that were in place for several generations or more, this suggests that at least some if not most of the native people were still living according to the principles of the traditional *ahupua‘a* system during this time.

Government Land Grants in Honua‘ula

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 ‘Āina*. 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 this 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.

Excluding the parcels previously awarded by the Land Commission, the *ahupua‘a* of Honua‘ula was divided into two large land grants. A portion of Hawai‘i Registered Map No. 1280 (Figure 23) by J. S. E. Emerson ca. 1880s shows the location of the grants and situates the current project area within Grant 1758 sold to George Luther Kapeau. In May of 1855, G. L. Kapeau purchased 585 acres of land in Honua‘ula, extending *mauka* (east) of the Kuakini Wall to *mauka* most boundary of the *ahupua‘a* (see Figure 23). Kapeau descended from a Maui chief and was considered a *kaukauali‘i* (lesser chiefs or nobles in service to the *Ali‘i Nui*) (Osorio 2002) He was also one of the first Native Hawaiians to receive a western education at the missionary school Lahainaluna where he graduated in 1837. He then served in the House of Nobles under Kauikeaouli (Kamehameha III) from 1848 to 1855, and was appointed deputy Governor of Hawai‘i Island under Governor William Pitt Leleiohoku, who also held several LCAw. in coastal Honua‘ula (Osorio 2002). The second, Grant 3148:4 was purchased by William Pitt Leleiohoku in April of 1875, which encompassed approximately 98.48 acres of land *makai* of the Kuakini Wall (see Figure 23). The extent of Leleiohoku’s grant is also shown Hawai‘i Registered Map No. 2357 from 1924 (Figure 24).

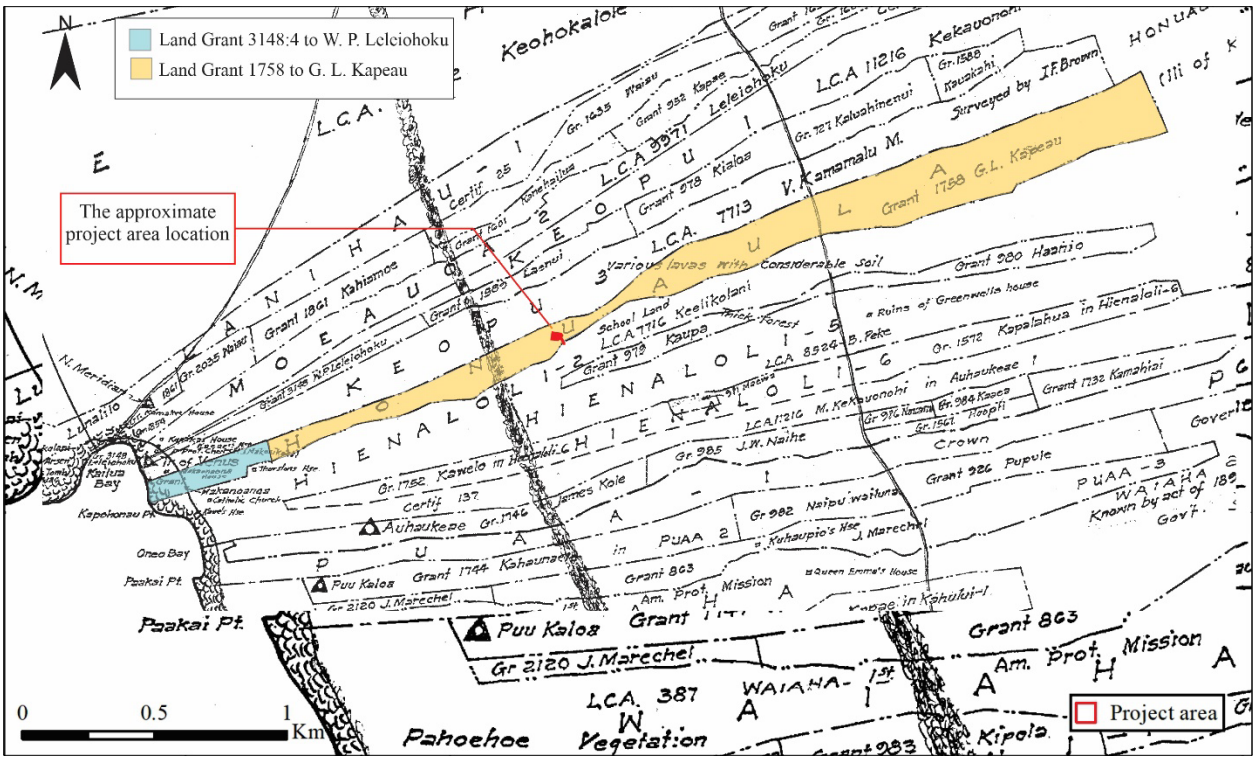


Figure 23. A portion of Hawai‘i Registered Map No. 1280 ca. 1880s by J. S. E. Emerson the project area within Government Land Grant 1758 to G. L. Kapeau.

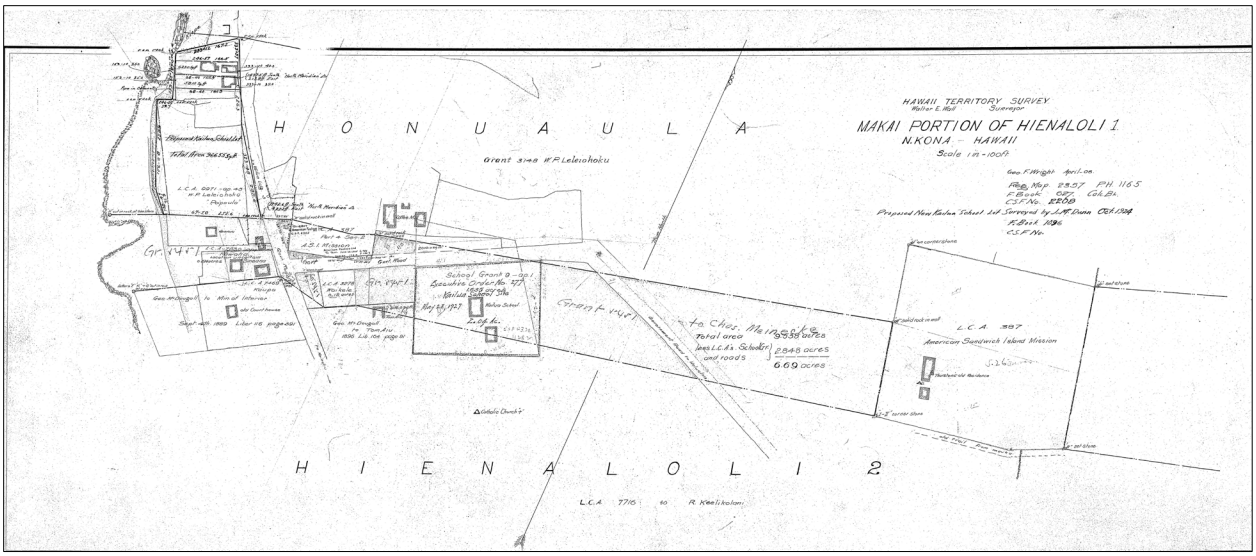


Figure 24. Hawai‘i Registered Map No. 2357 showing Land Grant 3148 to W. P. Leleiohoku and other structures as it appeared in 1924; project area not shown.

The *Palapala Sila Nui* (Royal Patent Grant) documents for both Leleiohoku and Kapeau grant parcels provide detailed information about the metes and bounds, but no schematic was generated that reflected that location of the various boundary markers (i.e. marked rocks and a wall) noted in the survey notes. However, a 1906 Hawai‘i Territory Survey Map of the Hienaloli 1st and 2nd Ahupua‘a boundaries (Figure 25) shows the location of *ahu*, marked stones, trails, and vegetation along Honua‘ula’s southern boundary that were described in the Royal Patent Grant documents.

Upon closer review of the 1906 map, it appears that Kapeau may have resided in the *mauka* portion of Honua‘ula, as a close up of the 1906 Hawai‘i Territory Survey Map map (Figure 26; identified as Inset 1 in Figure 25) depicts the location of “Kapeau old house site” *mauka* of the current project area near the old Government Road. The close up also shows coffee groves near the old Government Road. Another close up of the 1906 Hawai‘i Territory Survey map (Figure 27; identified as Inset 2 in Figure 25) shows several historic features within the current project area, including a portion of a railroad bed alignment as well as a portion of an “old trail” shown meandering near the Honua‘ula-Hienaloli 1st boundary. Annotations made to the map also depict the Hienaloli Road right-of-way that is discussed below. While physical landmarks are depicted correctly, the boundary between Hienaloli 1st and Honua‘ula is drawn to the north of its actual location (the actual boundary is drawn as a rock wall interpreted by surveyor George Wright as approximating the Hienaloli 1st and 2nd boundary). In the vicinity of the current project area (see Figure 25), the map shows a portion of an “old trail” paralleling the north side of the (mis-surveyed) boundary between Honua‘ula and Hienaloli 1st. As the trail approaches from the southwest, it passes a small cluster of monkeypod (*Pithecellobium saman*) trees, and then crosses through the current project area. A survey marker consisting of a “+” carved into solid rock is indicated on the south side of the trail, near or just outside the current project area’s eastern boundary. On the map, the trail continues toward the northeast for approximately 120 meters, then turns toward the north.

Vegetation is also shown within the vicinity of the project area including “guava” (*Psidium guajava*) and “Monkey Pod” (*Pithecellobium saman*) trees. The final close up of the 1906 Hawai‘i Territory Survey map (Figure 28; identified as Inset 3 in Figure 25) shows a walled “taro patch” located along the Honua‘ula-Hienaloli boundary.

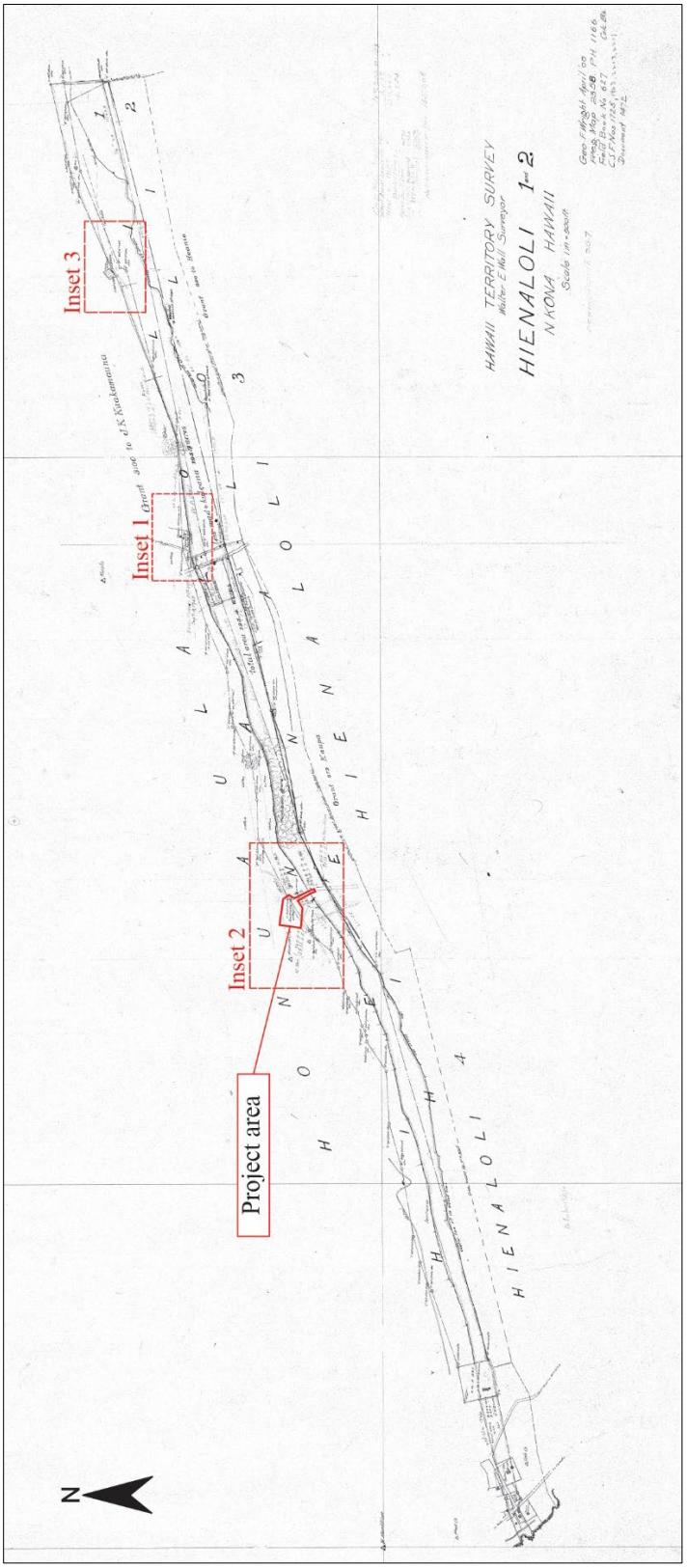


Figure 25. A 1906 Hawai‘i Territory Survey Map (Hawai‘i Registered Map No. 2358) showing the boundaries of Honua‘ula and Hienaloli 1-2.

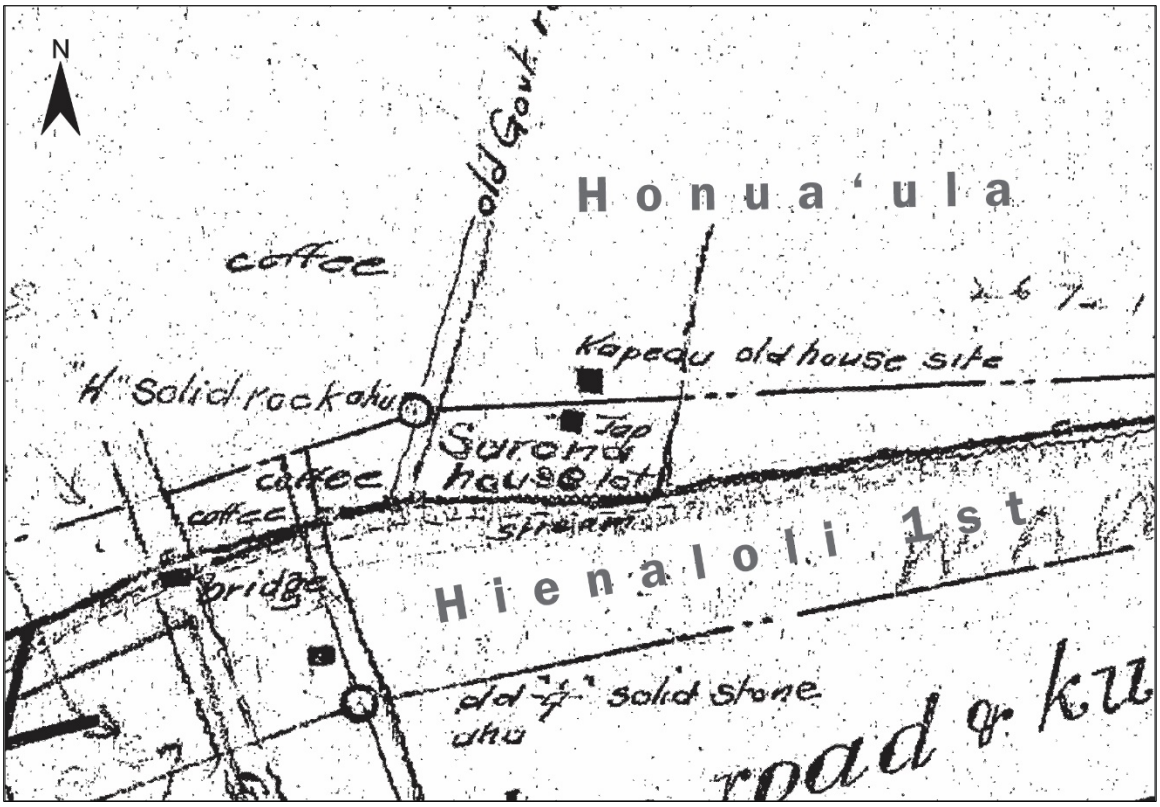


Figure 26. Inset 1: Portion of Hawai‘i Registered Map No. 2358 depicting the location of Kapeau’s old house site within Honua‘ula near the old Government Road; project area not shown.

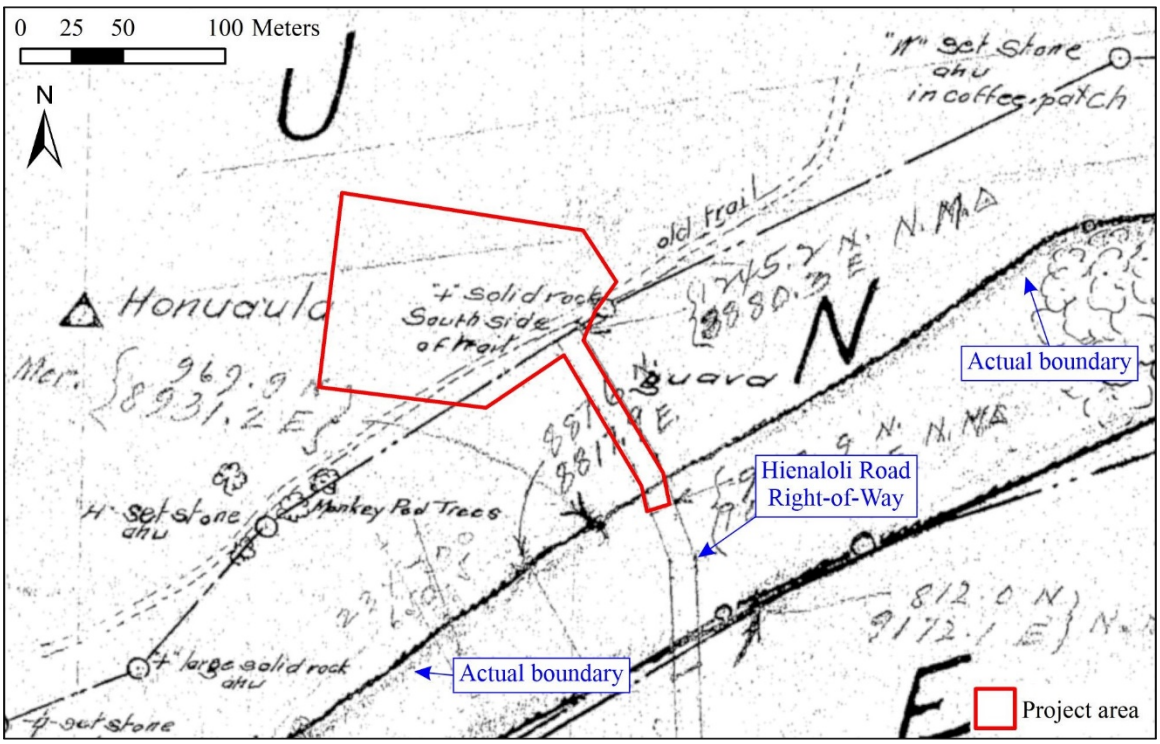


Figure 27. Inset 2: Portion of Hawai‘i Registered Map No. 2358 showing the location of an “old trail” within Honua‘ula (southern boundary of Honua‘ula with Hienaloli 1 outlined in red).

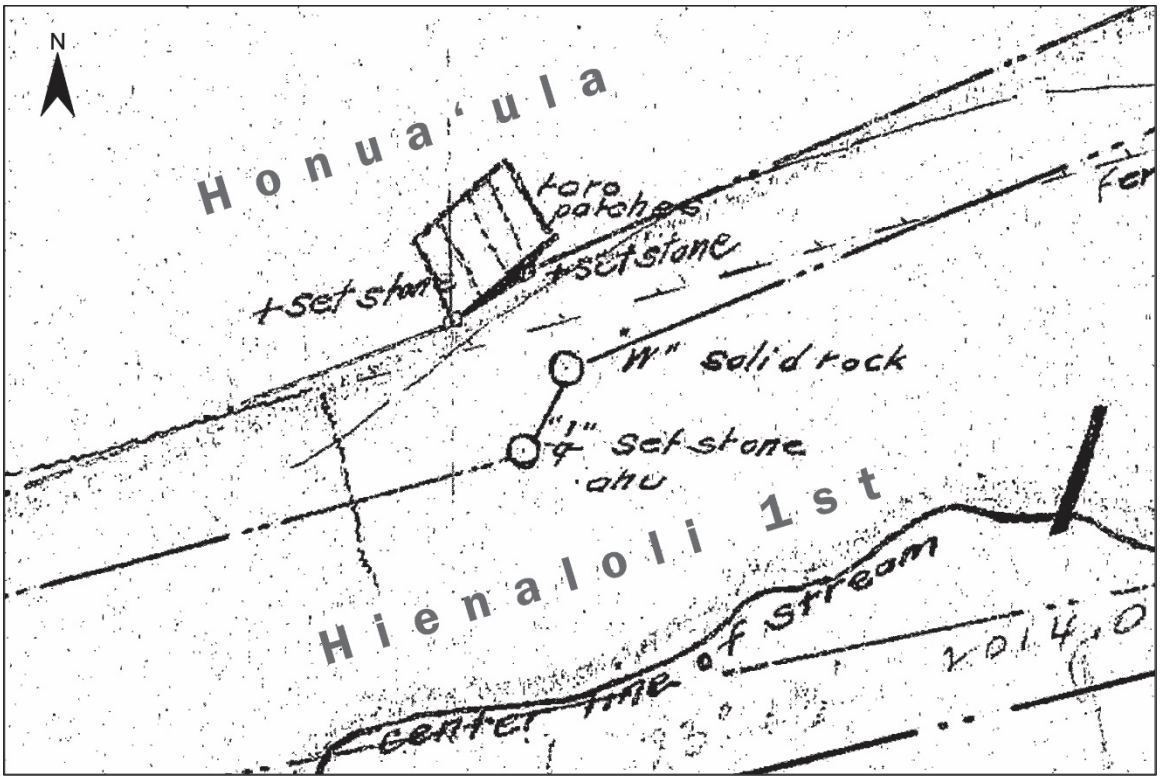


Figure 28. Inset 3: Portion of Hawai'i Registered Map No. 2358 showing the location of "taro patches" along the Honua'ula-Hienaloli 1st boundary.

Boundary Commission Testimony

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai'i to legally set the boundaries of all the *ahupua'a* that had been awarded solely by name as a part of the *Māhele 'Āina*. Subsequently, in 1874, the Boundary Commission was authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents who typically learned of the boundaries from an elder relative or neighbor. The boundary information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and simultaneously transcribed by the courts into English. Although hearings for most *ahupua'a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua'a* boundaries were established by conducting surveys on adjacent *ahupua'a*. Or in cases where the entire *ahupua'a* was divided and awarded as Land Claim Awards and or Government-issued Land Grants (both which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua'a*. This was the case for Honua'ula Ahupua'a given that it was divided into several LCAw. and two Government Land Grants. Although no oral testimony was taken for Honua'ula, testimony was provided by two native tenants, Haleokane and Kaukalio, in 1874 for the adjacent Hienaloli 1st and 2nd Ahupua'a. Given the current project area is situated on the boundary of Honua'ula and Hienaloli 1st, the following presentation of testimony will help shed light on traditional land use. While most of the testimony focuses on the lands of Hienaloli (written in the testimony as Hianaloli), some information specific to the Honua'ula-Hienaloli 1st boundary is provided and only those portions have been transcribed below:

> Haleokane k. sworn.
>
> I was born at Hianaloli, North Kona, Hawaii but do not know when (is rather an old man). Kapohonau is the boundary at the sea shore between Hianaloli 1st and Honuaula said place is an old heiau. Thence mauka to Thurstons yard at the Kohala end of the house. A few Kaheka (Kailua) at the shore, but no sea…
>
> The north corner of Hienaloli 1st on the boundary of Honuaula is at Kokomo, the kahawai [stream] bathing place.

> Kaukalio [k] sworn.
>
> I was born on Oahu but have lived on Keopu North Kona Hawaii for over twenty years. I have had charge of Hianaloli 1st and Hianaloli 2nd for about three years and know a part of the boundaries. Aipu and old kamaaina of the land, now gone to Maui pointed them out to me. Kapohonau is the boundary at shore between Honuaula and Hianaloli. Thence the boundary runs along the wall on iwi aina, on the Kohala side of Aepu's house, thence mauka through Montgomery's premises. The boundary line running on the Kohala side of the house… (Boundary Commission 1874:379-380)

Although limited, the testimonies provided during the 1874 Boundary Commission hearings provide insight into significant cultural features and residency in Honua‘ula. From these recollections, we learn that the southwestern *ahupua‘a* boundary was the site of an old *heiau* called Kapohonau, which may have been the "ancient fortification" described by Ellis (1917:77) in 1823 (see Figure 17). Likewise, these accounts also depict the demographic changes in the area as a result of the increased missionary presence.

Shortly after the Boundary Commision held its hearings for the adjacent lands, it appears that the upper portion of Honua‘ula near the Government Road was parceled out into 50-acre lots. An undated Hawai‘i Registered Map 25 (Figure 39) map produced by S. C. Wiltse who conducted much of his survey work between the 1860s and 1870s shows seven lots, three of which are *makai* of the Government Road and the remaining four located *mauka* of the road.

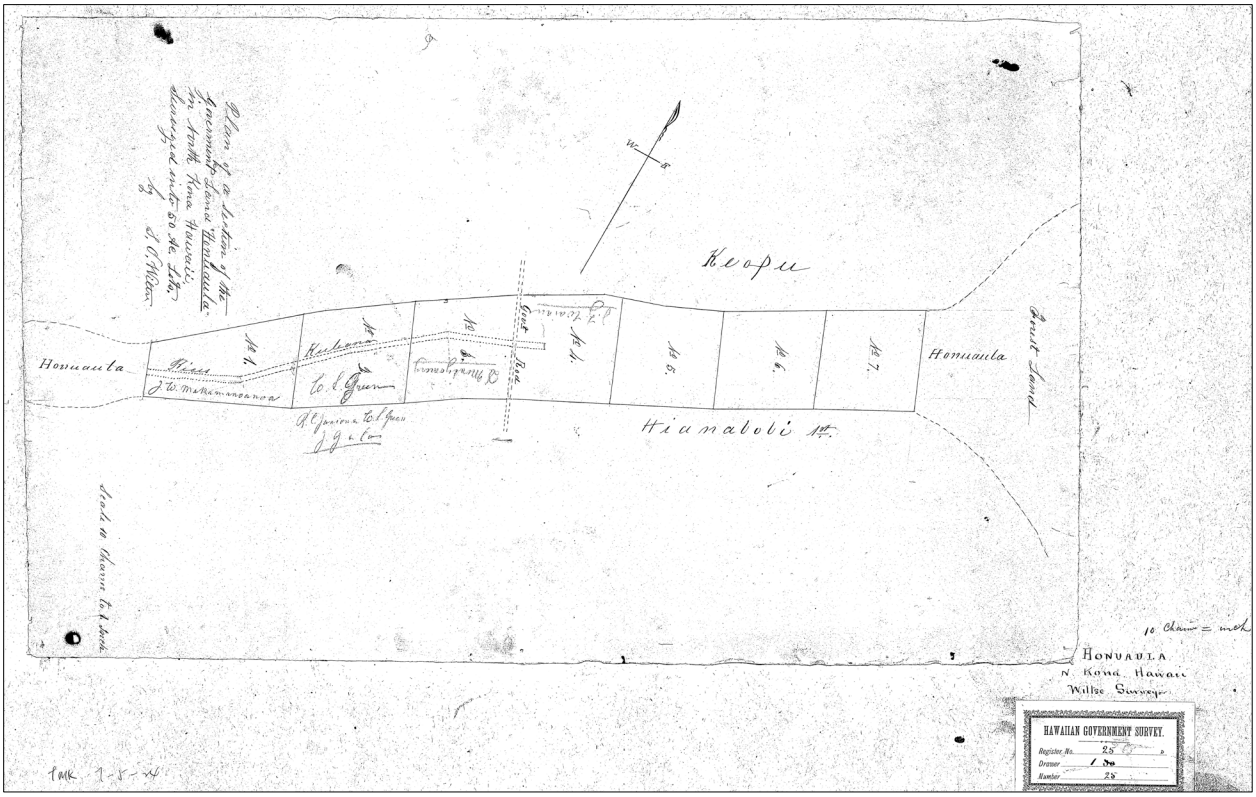


Figure 29. Hawai‘i Registered Map 25 by S. C. Wiltse in ca. 1860s-1870s showing 50-acre government lots *mauka* of the project area near the Government Road.

The Kona Sugar Company and the West Hawaii Railroad

The success of the sugarcane fields in the wetter and more agriculturally fertile lands of the archipelago led to attempts to spread the industry into the drier, less suitable hillsides of North and South Kona. The Kona Sugar Company was incorporated in 1898, having purchased the lease to 1,300 acres of land formerly held by the Waiaha Sugar Company (which had been created two years before) and an additional 2,000 acres located 6 to7 miles to the south in Onouli, South Kona (Kona Historical Society 1998; The Hawaiian Star 1898). The company's mill was situated south of Kailua Village near Wai‘aha Stream, and a 7-mile long narrow-gauge railroad was built beginning in 1901 to haul cane to a flume feeding the mill (Figure 39). Despite building a reservoir and flume near the mill water proved inadequate for cane production, and financial troubles forced the company into receivership in 1902 (The Honolulu Advertiser 1902).

The assets of the company were purchased in 1906 by two companies formed by James Castle and Associates, the Kona Development Company and the West Hawaii Railroad Company (Condé and Best 1973; Dorrance and Morgan 2000; Hilo Tribune 1906). The Kona Development Company operated as a cooperative, purchasing cane from independent homestead farmers and hauling it to the company's mill (Dorrance and Morgan 2000). The railroad was operated by the West Hawaii Railroad Company, which worked to extend the line to the south along the old plantation road (Hawaii Herald 1909). By 1914, eleven miles of the railroad was in operation and leased by the Kona Development Company for hauling the company's sugar (Honolulu Star-Bulletin 1914). The railroad was described as a public carrier but primarily functioned to haul the plantation's cane to the mill.

After ten years of operation, the Kona Development Company and the West Hawaii Railroad Company were sold to a corporation headed by Tomekichi Konno, formerly of the Laupahoehoe Sugar Company (Hilo Daily Tribune 1915; Siddall 1921:241). This was the first sugar plantation to be owned outright by a company headed by a Japanese immigrant. The two companies continued to cultivate sugarcane and operate the railroad. In 1921, the company reported its maximum production of 4,219 tons of sugar, but five years later the plantation closed (Dorrance and Morgan 2000). On April 18, 1927, torrential rains caused a massive flood that destroyed the sugar mill (The Honolulu Adverstiser 1927a). The plantation's assets were ultimately purchased by a sugar mogul based in Manila. The company's trustee, R. Burton Hind had the mill and railroad dismantled and shipped to the Philippines (The Honolulu Adverstiser 1927b).

The railroad right of way was repurposed by the government as the Hienaloli-Kahului Road. A survey of the road right-of-way was conducted in 1932 (Figures 31 and 39). Maps created for this survey record the presence of a road, symbolized by a pair of dashed lines, already in use along the former railroad. Within the current project area, this new road turns *mauka* at the northern end of the government's road Parcel 1 (see Figure 31).

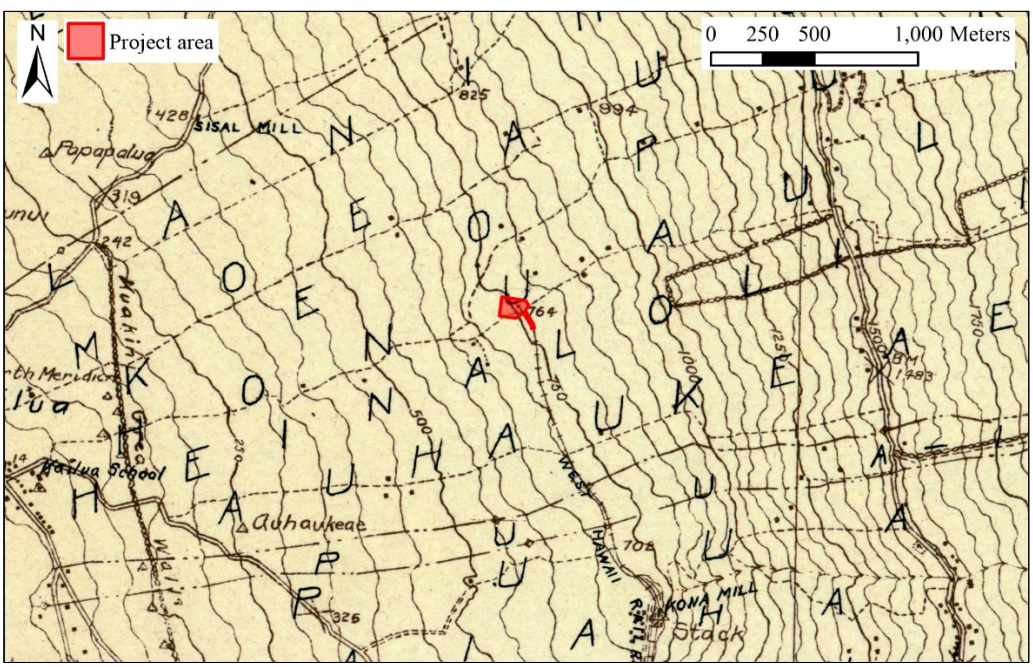


Figure 30. Caption. Portion of 1923 USGS Kailua Quadrangle showing the location of the West Hawaii Sugar Co. railroad and mill south of the project area.

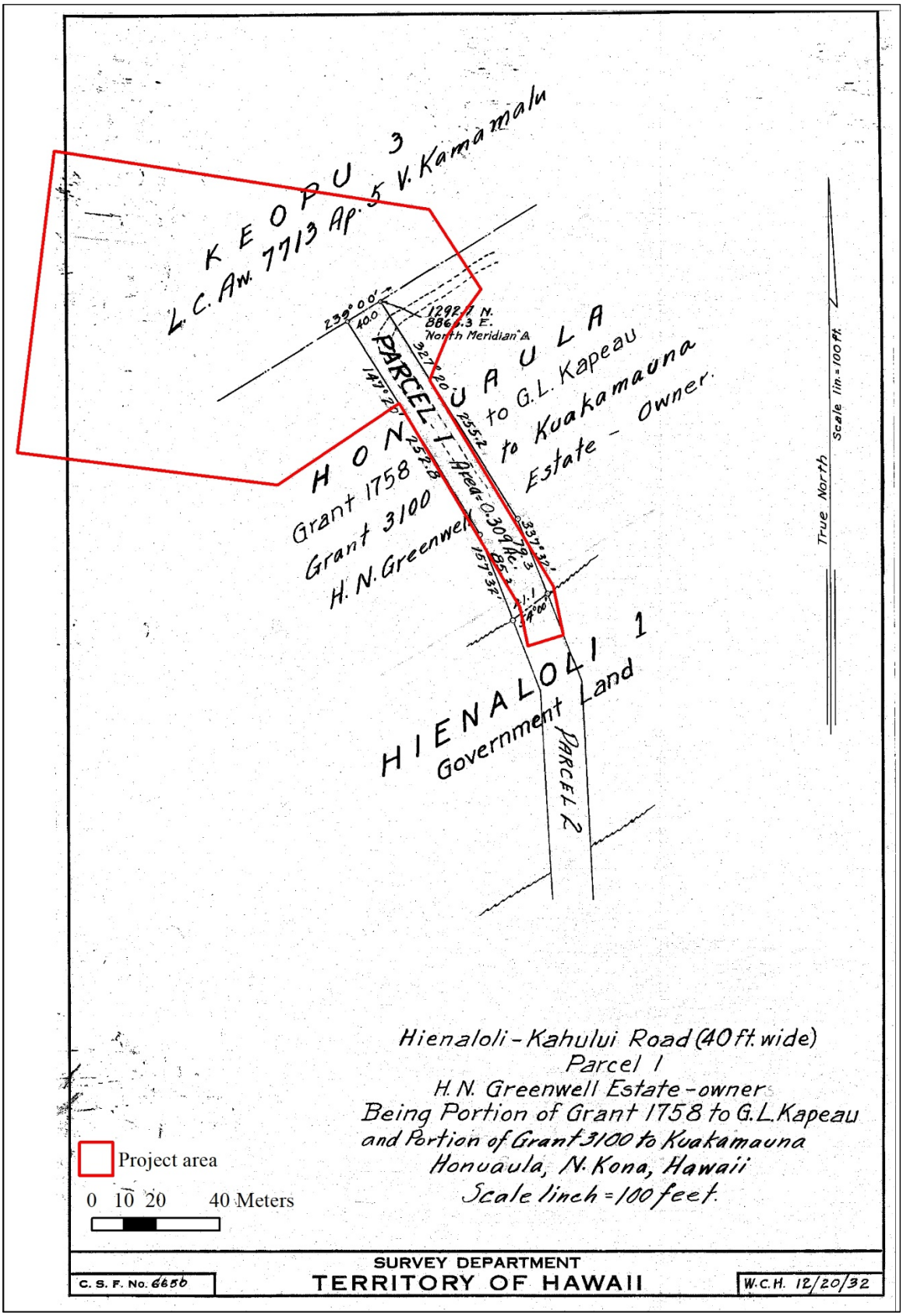


Figure 31. Map of Hienaloli-Kahului Road right-of-way, Parcel 1.

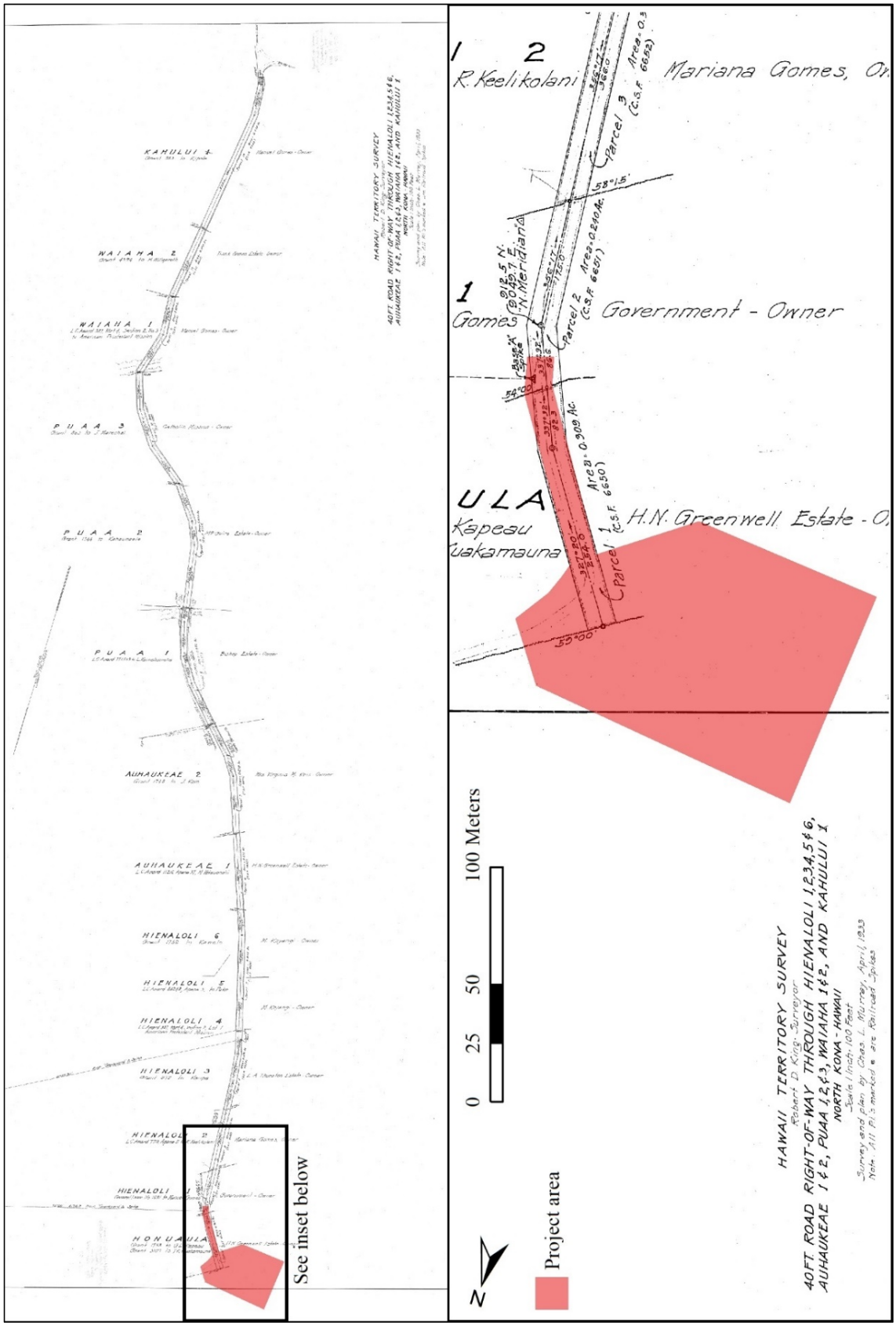


Figure 32. Project area relative to the Hienaloli-Kahului Road right-of-way.

Ranching

Hawai‘i’s ranching industry can be traced back to the introduction of the first cattle in 1793 when Captain George Vancouver gifted Kamehameha I with several horned cattle and other ungulates. To ensure growth for the newly introduced cattle, Vancouver encouraged Kamehameha I to instate a ten-year *kapu* that prevented people from hunting the animals. The *kapu* placed on the cattle later proved to be an environmental disaster and greatly affected the crops, homes, and the livelihood of the native residents. By 1812, unrestricted herds of cattle had made their way down towards the coast and roamed freely between Kailua and Keauhou (Maly 1996a). To combat the effects of cattle on the local food crops and houses, native residents began constructing stone walls as a deterrent (Handy et al. 1991; Ii 1993). Bowser (1880) reported that at the order of the Kamehameha, the native tenants were summoned to aid with the construction of a large walled area, roughly 485 acres above Kainaliu to provide a secure location for the cattle to graze and reproduce. In a 1981 interview with Mr. Joe Gomes, a long-time Kona resident and rancher, Kelly (1983:112) documented the various types of walls commonly used in the local cattle industry.

> Most of the walls have been here since the land was made into kuleana. Most walls were built by Hawaiians. Some were built for the ranches. Walls about 3 ft. high can keep donkeys penned. The usual wall is about 4 ½ feet high and keeps cattle in. For goats, you need a wall 6 to 8 ft. high. For wild pigs you need a 6 to 8 ft.-high wall. They climb over lower walls easily. . .
>
> It takes a skilled person to build stone walls. In the early days (1920s-1930s) walls were built and paid for in fathom-long sections (6ft.) for 35¢ or 40¢ a section. They had to be 3 ft. wide at the bottom and 2 ½ ft. wide at the top. You had to lock the rocks and fill the middle with rubble that helped lock the two sides together. Hawaiian built good walls, and later some of the Japanese did, too.

The blossoming of the hide and tallow trade in the pacific in the 1820s coupled with a growing demand for meat to provision whaling ships, provided an incentive to develop a sustained commercial cattle industry. Initial attempts by foreign-born “bullock-hunters” to kill, skin, and render tallow from feral cattle in the mountains reduced herds substantially, yet ultimately proved to be inefficient. The earliest ranching entrepreneurs on Hawai‘i Island (such as John Palmer Parker in Waimea) were foreign-born, often former bullock-hunters, and like many foreigners before the 1830s married into chiefly Hawaiian families. Considerable folklore has developed around the introduction of cattle ranching to the islands (Barna 2013), but it is clear that around 1830, Kauikeaouli (King Kamehameha III) hired from California to bring the remaining herds under control and to train a Hawaiian workforce of cowboys to manage them.

The early ranches were stocked from offspring of the cattle that were introduced by Vancouver and in subsequent years cattle were imported from Scotland, Australia, England, and the United States (Kelly 1983). The *kula* lands behind Kailua were utilized during Hawai‘i’s early ranching era and Kailua Bay served as one of several shipping ports on the west coast of the island (Figure 33).

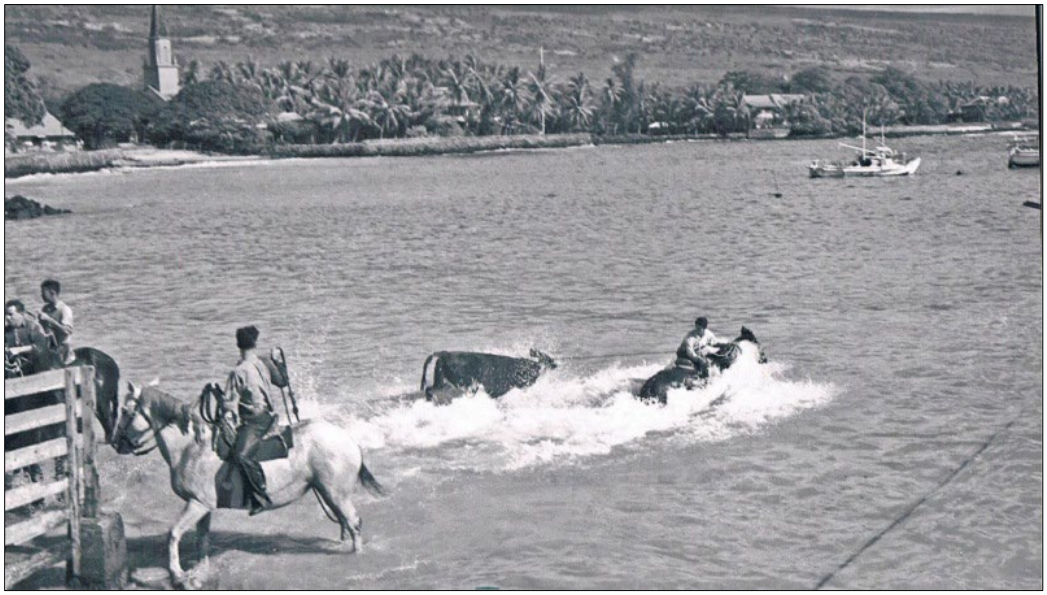


Figure 33. Cattle being shipped from Kailua Bay (Kaiakeakua) with Moku‘aikaua Church in the background (from the Christiansen collection at the North Hawai‘i Education Research Center).

After the *Māhele ʻĀina*, a major shift in land use began in the 1880s when commercial cattle ranching was introduced to both North and South Kona. Commercial ranching and privately-held herds of cattle spread into South Kona during the late 1800s across privately held and leased lands. At first, impacts on the Kona Field System were nominal as most of the ranching took place at the higher elevations on the slopes of Hualālai, which minimized the physical effects of ranching on the earlier created agricultural landscape. Also, because ranching employed relatively few people, the traditional life patterns of the residents in the *kula* were generally not affected by the industry (Kelly 1983).

The land surrounding the current project area became part of the vast grazing lands found throughout the *kaluʻulu* and *ʻāpaʻa* zones of North and South Kona. Henry N. Greenwell began grazing cattle around 1875, establishing what would grow into the 36,000-acre Greenwell Ranch (Henke 1929). Greenwell got his start in Hawaiʻi in 1850 by operating a store in Kailua, and later establishing another in Kealakekua in 1870. Greenwell was a successful farmer of oranges and promoter of Kona coffee. The ranch began as a dairying operation. Upon H. N. Greenwell's death in 1891, the ranch was run by his son William H. Greenwell. After the annexation of Hawaiʻi by the United States in 1898, increased beef prices spurred a switch in emphasis away from dairying (Henke 1929). When William H. Greenwell died in 1927, the three sections of the ranch were distributed among three of his sons, with their mother Elizabeth controlling all three sections as a single unit until her death in 1934 (Springer and Greenwell 1992). The northern section of the ranch, known at the time as Honokōhau Ranch and Hualalai Ranch, included about 20,000 acres, 4,000 of which were owned by the ranch. These lands included the current project area, which had been purchased by the H. N. Greenwell as Government Grant 3100 (the land originally sold as Grant 1758 to Kapeau appears to have become Government Land prior to this). Stone walls and wire fences were used to divide the ranch land into paddocks.

By the 1940s, the parcel was owned by Kakuro Komo, who had emigrated from Hiroshima Prefecture, Japan to Hawaiʻi and worked for the Kona Development Company as a locomotive engineer for the sugar plantation in the early 1900s (Nishimoto 1991). Around the 1920s, Komo leased land in the Keopū area for his home, a general store, and coffee land, and eventually acquired additional properties, including the current project area. County of Hawaiʻi tax records indicates that throughout the second half of the twentieth century, about 108 acres of the property were used as pasture, which was leased to local ranchers. Aerial photography from 1965 and 1977 (Figures 34 and 35) documents relatively little change to the project area vicinity. The land remained in use as cattle pasture, and as the aerial photographs show, was mainly kept grazed down with the exception of large trees. By 1977, a ranch road had been cleared *makai* of the project area, and development had begun in Keōpū 3rd Ahupuaʻa to the north, but the current project area appears to have changed little.

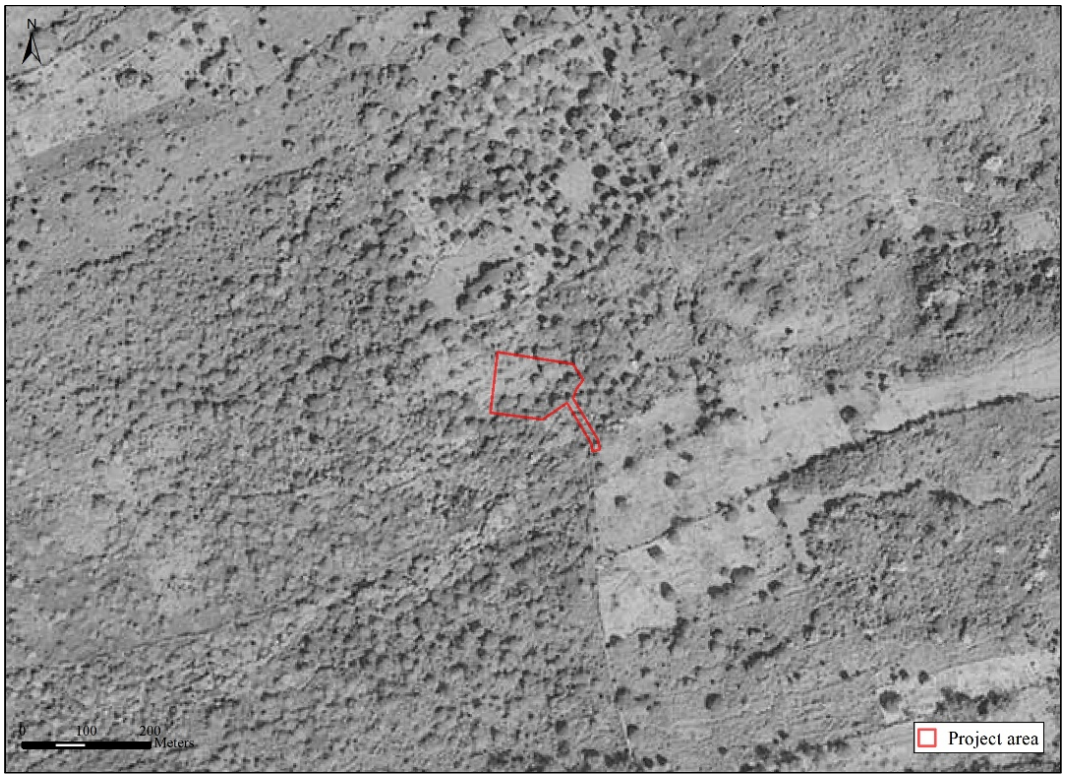


Figure 34. Aerial imagery of the project area vicinity in 1965 (Hawaii Statewide GIS Program 2017).

Figure 35. Aerial imagery of the project area vicinity in 1977 (Hawaii Statewide GIS Program 2017).

Other Agriculture Industries in Kona

Developing alongside Kona's ranching industry during the early part of the 20th century was the commercial cultivation of cotton. Prior to his passing in 1844, Governor Kuakini, who appears to have saw this as a viable enterprise, constructed a stone-build cotton factory in Kailua and employed a small workforce of roughly thirty Hawaiian women to work the factory (Kelly 1983). Kelly (1983) reported that after 1926, rougly 400 acres of cotton were planted at an elevation of 800-900 feet in the vicinity of Hualālai Road and south of its junction along the railroad track.

The commercial cultivation of tobacco in Kona which occurred between 1853 to the mid 20th century was another important agricultural industry. Kelly (1983:89) reported that around 1913 "[a]pproximately 100 acres were under cultivation, at elevations between 500 and 3,000 ft." Within the Kailua area, the industry was forged by the Kona Tobacco Company, which was established in 1908 but by 1912, after the packing house and two crops of tobacco burned, the company was unable to recover its losses and closed its doors. Despite efforts to establish cotton and tobacco as major industries, it never saw the same success as Kona's coffee industry which flourished after 1828, when American missionary Reverand Samuel Ruggles planted the first coffee cuttings in Nāpoʻopoʻo, South Kona (Kinro 2003). By the 1850s, coffee had become a major export crop that flourished between the 800-1,700 foot elevation in the rocky volcanic soil found along the leeward slopes of Hualālai and Mauna Loa—in the same narrow region where the native Hawaiian planters had cultivated a variety of staple crops in the decades prior (Kelly 1983). Between 1836 and 1855, most of the coffee plantations in Kona were headed by Americans and Europeans. Between 1860 to 1885, when drought, blight, depressed coffee prices, and the passing of the Reciprocity Treaty in 1876, which helped to stabilize the sugar industry, many of the American and European growers abandoned their fields leaving their prized cash crops to wither away (Goto 1982). As former coffee fields became choked with weeds, many Hawaiian took over the surviving patches of coffee that were growing in the old *kukui* (*Aleurites moluccana*) groves. In a 1937 interview with Mr. John Gaspar who had arrived in Kona in 1872 noted that:

> When I arrived here 65 years ago, there were many patches of coffee borth in North and South Kona. They were growing under the kukui trees and were not planted regularly. The systematic method of planting was made after the Japanese came to Kona.
>
> In those days, *Kanakas* were the only coffee planters. They lived down on the beach and went up to the coffee patches only to pick coffee. Coffee trees grew wild without being hoed or pruned. Once in several months, tall weeds were pulled out, but usually weeds could not grow as these trees were never pruned, and as they grew under the kukui shade, there was not enough sunlight for any weeds to grow.
>
> There were only horse trails in those days. The *Kanakas* used to pack the coffee on their back from the patches to the beach to dry. Many had horses so that was another way of picking… (Goto 1982:115)

Overtime, Kona's coffee industry attracted growers of various ethnic backgrounds, many of whom had arrived in Hawaiʻi previously as part of the mass immigration of contract sugar plantation laborers (Goto 1982). In Kona, many Japanese families took up coffee farming as a family endeavor as it provided them with greater economic independence that was nor afforded to them during their sugar contract work (Kelly 1983). However, unlike sugar cultivation, coffee was as a minor crop and its persistence is attributed "to the fact that it passed from a plantation type of industry to a small-scale enterprise" often maintained by families (Kelly 1983:87). The success of coffee industry peaked slightly during the 1890s, as Hackfield and Company established a branch in 1898 in Kailua, which ultimately helped the small family-run farms establish a market for their crop. A portion of the 1906 Hawaiʻi Registered Map No. 2357 (see Figure 26) shows coffee plantings in Honuaʻula *mauka* of the current project area and near the Government Road in the area narrow region often referred to as the "coffee belt".

Creation of the Honuaʻula Homestead and Forest Reserve

By 1899 roughly 2003.5 acres of government land was set aside for the creation of the Honuaʻula Homestead subdivision, a proposed subdivision that extended along the upper limits of Honuaʻula Ahupuaʻa and covered the area from Lanihau (north of the project area) to ʻAuhaukeaʻē (south of the project area) (Wall 1905). Hawaiʻi Registered Map No. 1972 prepared by Water E. Wall in 1899 (Figure 36) shows the extent of the Honuaʻula Homestead Subdivision. By the turn of the 20th century, roughly 3,044 acres in the *mauka* portion of Honuaʻula above the Honuaʻula Homestead lots were leased to Mr. John A. Maguire, who in 1886 founded Huʻehuʻe Ranch (Judd 1921). Maguire appears to have lost a portion of his Honuaʻula lease in 1905 in a public action when he was out-bid by J. G. Henriques and Frank Gomes. In this same year, Mr. Ralph Hosmer, Superintendent of Forestry made a proposition to

the Commissioner of Public Lands, Mr. J. W. Pratt to set aside portions of Henriques and Gomes holdings as a forest reserve. After failed attempts at negotiation, Pratt announced his intention to lease the lower part of Honuaʻula, including the old homestead tract to Henriques and Gomes, which they accepted (Blackman 1907). The following year, efforts to establish the Honuaʻula Forest Reserve was underway.

By 1905, discussions about the impacts of grazing cattle in the *mauka* portions of the *ahupuaʻa* and the need to protect certain valuable forest resources led to the establishment of the Honuaʻula Forest Reserve. In the *Report of the Division of Forestry* for the year 1905, the following description is provided for the then proposed Honuaʻula Forest Reserve.

> A small but important reserve is about to be made on a portion of the land of Honuaula, North Kona, Hawaii. This land contains one of the best stands of Koa (*Acacia koa.*) on any government land in the Territory, which in view of the growing market for Koa lumber is of no small potential value. The land was leased by the last administration for grazing purposes, but by an arrangement with the lessees, effected through the courtesy of the Commissioner of Public Lands, the forested portion has been relinquished to the Board. A relocation of the boundary is to be made by one of the Government Surveyors during January, 1906, following which the land will be set apart, as the Honuaula Forest Reserve. The area is between 600 and 700 acres. (Territory of Hawaii 1906:30)

The Honuaʻula Forest Reserve was formally established on April 4, 1906, by proclamation of the Governor in June of 1921. C. S. Judd, the Superintendent of Forestry visited the Honuaʻula track and wrote about his expedition into the forest reserve with Mr. John Lind, then manager of the John Maguire Estate Ranch:

> On July 19, I visited the Honuaula Forest Reserve on the southwest slope of Hualalai, between the elevations of 5,400 and 6,360 feet, in company with Mr. John Lind, manager of the John Maguire Estate Ranch. This I found to be completely fenced in a stock-proof manner, the fences on the upper sides being also sheep-proof, and with no animals in the reserve. The forest consists of splendid large koa trees, with a stand of the smaller naio and mamani, and a heavy undergrowth of akala bushes and luxuriant ferns. This is probably the best stand of large koa trees left in Kona and the only stand which has not been deteriorated by cattle grazing.
>
> This reserve embraces 665 acres, all of which is government land. In my opinion, this forest area is valuable and has some beneficial effect in helping to condense the atmospheric moisture which drifts in every afternoon in the form of cloud banks. On account of the splendid stand of koa trees of huge proportions, this forest, after all other koa forests in Kona have been destroyed by grazing, will also be of value for its botanical and historical interest, just as the remaining redwood forests in California are now esteemed and protected.
>
> Surrounding this reserve on three sides there are 5,197 acres of the government land of Honuaula, which have been parceled out in three grazing leases issued by the Land Office. On these and on the fourth side, which includes the private lands of Puaa 1st and Holualoa, the forest has been severely injured by grazing and before long will entirely disappear. (Judd 1921:203)

During its establishment, the forest reserve spanned 665 acres and over the years the reserve has expanded to roughly 8,489 acres (PBR Hawaiʻi 2019). The extent of the Honuaʻula Forest Reserve in 1965 is shown in Hawaiʻi Registered Map 4135 (Figure 37) which depicts three large tracts totaling roughly 5,930 acres. Throughout the remainder of the 20th century, more acreage was added to the reserve which included another 1,232 acres of the *mauka* portion of Kealakehe as well as another 1,271 acres in Makaʻula-ʻOʻoma, and an access easement near the Hienaloli-Honuaʻula boundary and extending *mauka* from the Government Road into the forest reserve.

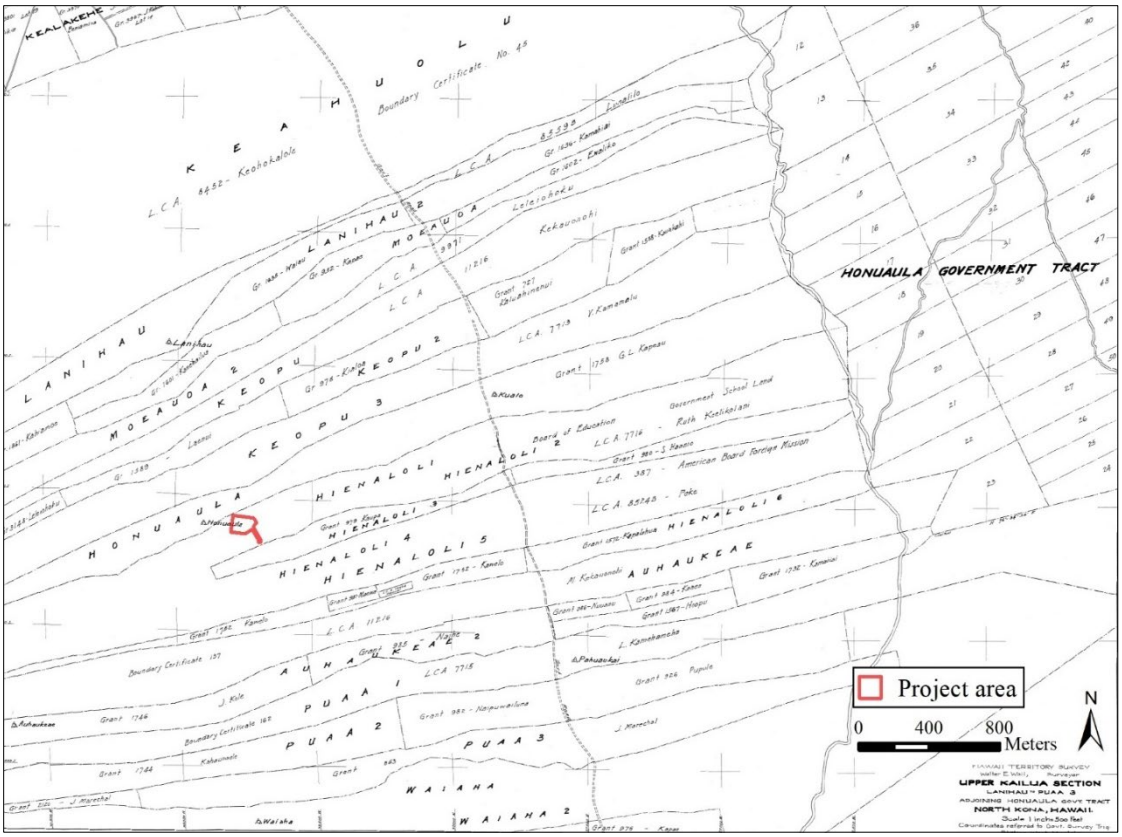


Figure 36. A portion of Hawai‘i Registered Map 1972 showing the Honua‘ula Homestead (labeled as Honuaula Government Tract) in the *mauka* portion of the *ahupua‘a*.

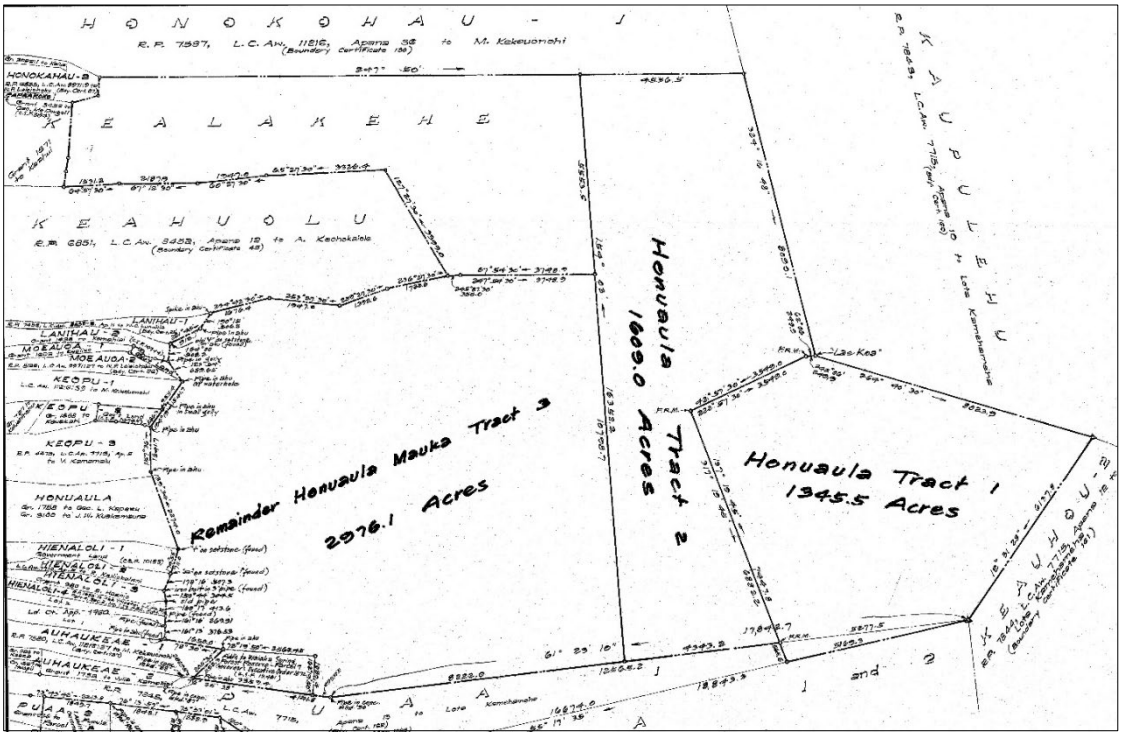


Figure 37. Hawai‘i Registered Map No. 4135 from 1965 showing the *mauka* portion of Honua‘ula and the boundaries of the Honua‘ula Forest Reserve; project area not shown.

PREVIOUS ARCHAEOLOGICAL AND CULTURAL STUDIES

Most of the archaeological studies conducted in Honuaʻula Ahupuaʻa have been concentrated in the *kula* and coastal zones (from sea level-500 foot elevation) of the Kona Field System (Bonk 1985; Elmore and Kennedy 2000; Hammatt 1997; Haun 2000b; Schilt 1984; Soehren 1979). These studies collectively reveal a pattern of precontact land use consisting of temporary and permanent habitation, limited agriculture, marine exploitation, landscaping, and burials within the coastal areas (Bonk 1985; Elmore and Kennedy 2000; Hammatt 1997; Haun 2000a; Rechtman et al. 2005; Schilt 1984; Soehren 1979). Furthermore, these studies indicate that habitation and burial activities continued to occur in this area into the Historic period and the 20th century. Few previous studies have occurred within the *ʻāpaʻa* zone (from 1,000-2,500 foot elevation) in Honuaʻula (Barna and Rechtman 2014; Haun and Henry 2001b, 2002b; Haun et al. 2005; Rosendahl 1991), and none have occurred within the *kaluʻulu* zone, in which the current project area is located. However, studies within the *kaluʻulu* zone of the Kona Field System have been conducted in the *ahupuaʻa* of Keōpū and Hienaloli which neighbor Honuaʻula to the north and south. The following discussion focuses on relevant studies that have been carried out within the *kaluʻulu* and *ʻāpaʻa* Kona Field System zones in Honuaʻula Ahupuaʻa and the neighboring *ahupuaʻa* of Keōpū and Hienaloli. Each of these studies has been listed chronologically in Table 3 and its locations relevant to the current project area is depicted in Figure 38.

Table 3. Previous studies conducted in Honuaʻula and neighboring *ahupuaʻa*

Year	*Author*	*Ahupuaʻa*	*Elevation (ft.)*	*Type of Study*
1991	Rosendahl	Honuaʻula	1,540-1,750	Inventory
1996	Devereux et al.	Hienaloli 1st	1,200-1,250	Inventory
1996	Henry et al.	Hienaloli 3rd and 4th	750-1,450	Inventory
2000c	Haun	Hienaloli 2nd	1,300-1,480	Inventory
2000a	Haun and Henry	Hienaloli 1st and 2nd	750-1,480	Data recovery
2001a	Haun and Henry	Hienaloli 2nd-5th	750-1,480	Inventory
2001b	Haun and Henry	Honuaʻula and Keōpū 3rd	1,605-2,305	Inventory
2002a	Haun and Henry	Honuaʻula and Keōpū 3rd	1,605-2,305	Burial treatment plan
2004	Haun et al.	Honuaʻula and Keōpū 3rd	1,605-2,305	Data recovery
2005	Haun et al.	Honuaʻula and Keōpū 3rd	1,605-2,305	Data recovery
2006	Johnson and Wolforth	Keōpū 3rd	220-840	Inventory
2008	Wong-Smith	Hienaloli 1st	n/a	Cultural impact
2008	Clark et al.	Hienaloli 1st	1,440-1,780	Inventory
2014	Rechtman	Hienaloli 1st	1,440	Inventory
2014	Barna and Rechtman	Hienaloli 1st	1,440	Data recovery
2015	Rechtman and Barna	Keōpū 2nd	1,125-1,225	Inventory
2020	Glennon and Barna	Honuaʻula	project area	Inventory

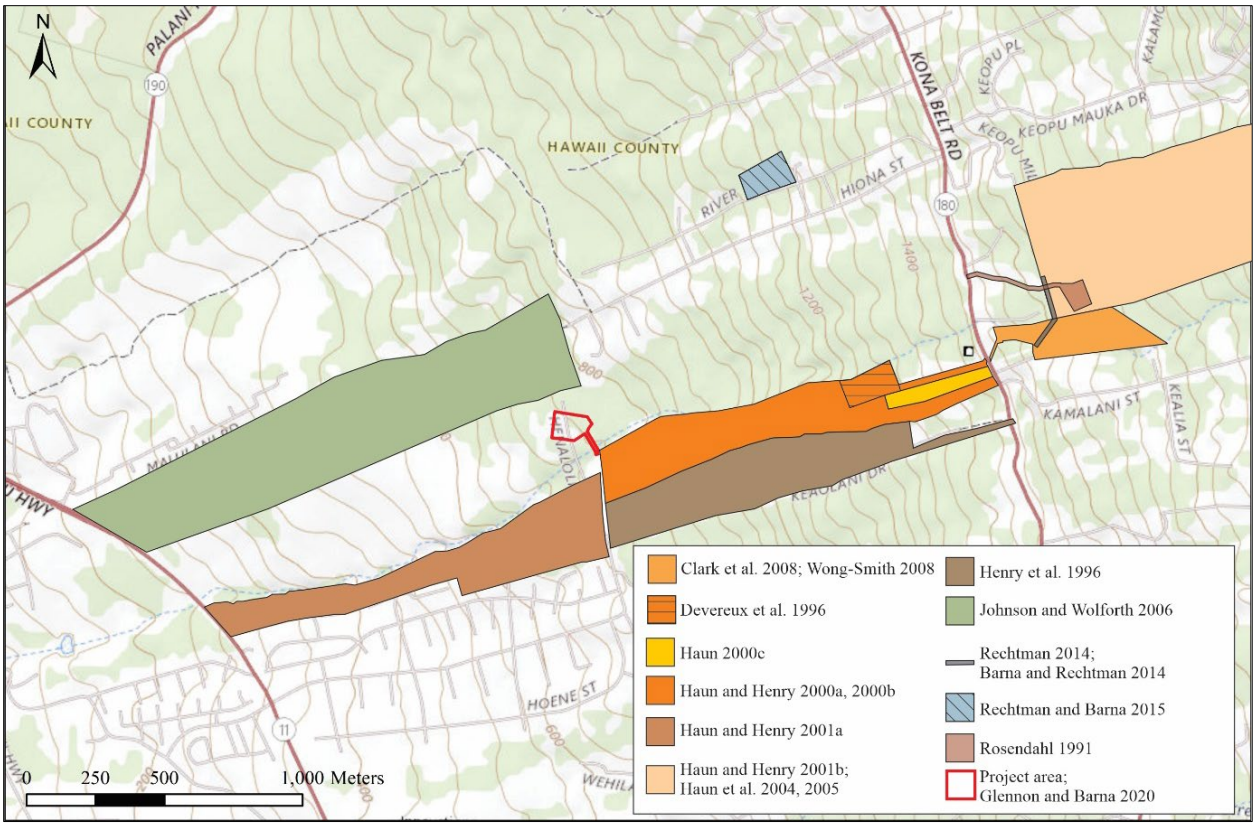


Figure 38. Previous archaeological and cultural studies in the vicinity of the current study area.

Prior Relevant Studies Conducted within Honua'ula

Within the *'āpa'a* zone of Honua'ula, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey (AIS) (Rosendahl 1991) of a proposed well site and access corridor located to the east (*mauka*) of the project area (see Figure 38). Rosendahl (1991) observed that the area had been extensively disturbed by historic ranching and agriculture. Agricultural terraces, bulldozer cuts, old road grades, cattle walls, and paddocks were observed, and Rosendahl (1991:2) concluded that "some of the agricultural terraces may be part of the Kona Field System" including "remnants of *kuaiwi.*"

In 2002, the area inventoried by Rosendahl (1991) was included in an AIS conducted by Haun and Associates (Haun and Henry 2001b) of a larger 200-acre parcel (TMK:(3) 7-5-001: 044; see Figure 38). Twenty-nine sites and 86 features dating from the Precontact to Early Historic period were identified during their survey. Precontact features included modified outcrops, mounds, walls, terraces, and two burials; these were associated with temporary and permanent habitation, agriculture, storage, and burial practices were identified. Historic sites included ranch walls for livestock control, a historic trail segment, and a water tank. A large agricultural complex (Site 50-10-28-22978) was interpreted to have been used from the Precontact period until the 19th century. Many culturally sterile lava tubes were observed within their project area. In 2002, a burial treatment plan Haun and Henry (2002a) for the two burials (Sites 50-10-28-22957 and 22977) was prepared. Data recovery was conducted to mitigate impacts to seven sites (Haun et al. 2004) (see Figure 38), followed by supplemental archaeological data recovery at four features of Site 22978 (the large agricultural complex) (Haun et al. 2005) (see Figure 38). Data recovery concluded that agricultural pursuits, habitation and livestock control/ranching were occurring within these sites.

In 2020, ASM Affiliates, (Glennon and Barna 2020) conducted an inventory of the current project area (see Figure 38). A total of three archaeological sites were recorded (Sites 50-10-27-7214, 31161, and 31162) (Figure 39). Site 7214 described as the West Hawaii Railroad, a segment of which was previously documented by Haun and Henry (2000b) in Hienaloli 1st. Site 31161described as a complex consisting of eight Historic core-filled ranch wall segments located within and extending beyond the project area boundaries were recorded. Site 31162 described as two remnant agricultural features associated with 20th-century livestock ranching were also recorded. Sites 31161 and 31162 were considered significant under criterion d and no further work was the recommended treatment for both sites. Site 7214

was considered significant under criteria a, c, and d. Regarding the preservation measures for Site 7214, Glennen and Barna (2020:i) stated that:

> Because the current project has been designed to avoid affecting Site 7124, and the site has been adequately documented by the current study, no further historic preservation work for the site is recommended *at this time within the current project area*. In the long term, however, it is recommended that future development planning for the extension of Hienaloli Road involve discussions among the County of Hawai‘i Planning Department, DLNR-SHPD, and the landowner work to consider the potential for rehabilitation of the portion of Site 7124 within the current project area as a pedestrian and/or non-motor vehicular component of the new road’s design.

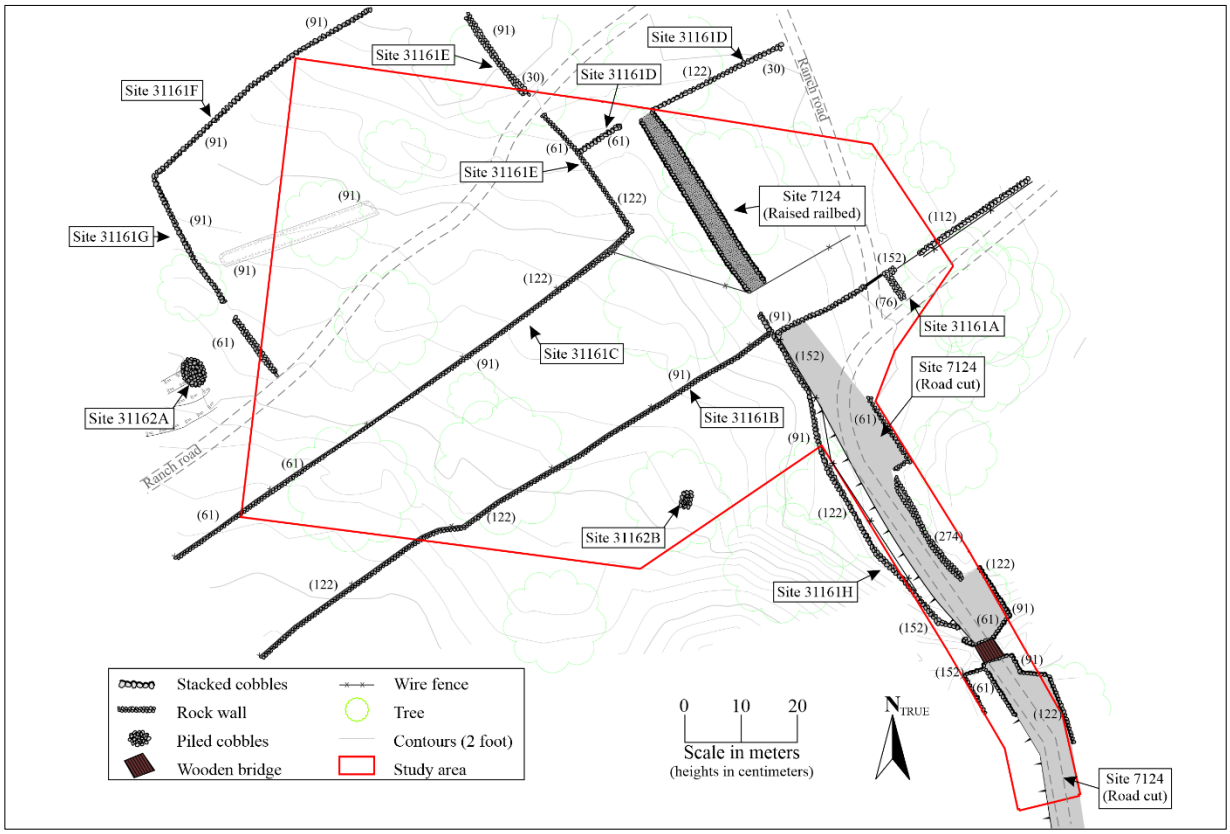


Figure 39. Archaeological sites recorded by Glennon and Barna (2020) in the current project area.

Previous Studies Conducted within the Neighboring Lands of Hienaloli

In 1996, PHRI conducted an AIS (Henry et al. 1996) of a roughly 50-acre parcel (TMK: (3) 7-5-11:002) located southwest of the current project area within Hienaloli 3rd and 4th, within the *kalu‘ulu* zone of the Kona Field System (see Figure 38). As a result of the survey nine archaeological sites were recorded on the parcel. The sites included two agricultural complexes (Sites 50-10-28-18658 and 18661), two Historic boundary walls (Sites 18659 and 18660), three Precontact habitation enclosures (Sites 18662, 20689, and 20691), a Precontact platform interpreted as a men’s house (Site 20690), and a platform used for Precontact habitation (Site 18663). One of the agricultural complexes (Site 18658) was interpreted as being used during Historic times. It contained 20 features including 15 mounds, 3 walls, an alignment, and a terrace. The other agricultural complex (Site 18661) was interpreted as being used during Precontact and Historic times. It contained 131 features including 21 mounds, 60 terraces, 4 modified outcrops, 11 enclosures, 34 walls, and one feature that was bulldozed beyond recognition. Both agricultural sites were interpreted as being part of the Kona Field System. In addition to the recording of surface features, forty shovel test pits were excavated in the vicinity of surface features within identified sites, revealing a partially disturbed, Precontact cultural deposit that extended to a depth of 0.15 meters below ground surface. Cultural debris recovered from the test pits included volcanic glass flakes, charcoal, a stoneware ceramic fragment, and a metal nail.

In 1996, Cultural Surveys Hawai‘i (CSH) conducted an AIS (Devereux et al. 1996) of a five-acre parcel in (TMK): (3)-7-5-011:004 in Hienaloli 1, located to the southwest of the current project area and within the *āpa‘a* zone (see

Figure 38). Three sites were identified within their project area. These consisted of two Historic cattle walls (Sites 50-10-28-5084 and 20846) and a complex of agricultural features (Site 20847). Agricultural features recorded within Site 20847 include seven *kuaiwi* walls and eight terraces. The complex was organized into 11 agricultural plots/fields that were bounded by the *kuaiwi* and terraces. Mechanical clearing had occurred on the property.

In 2000, Haun & Associates conducted an AIS (Haun and Henry 2000b) of a roughly 56-acre property (TMKs: (3) 7-5-11:003, 004 and 024) located southeast of the current project area within Hienaloli 1 and 2 (see Figure 38). Eight archaeological sites containing a total of thirty-nine features were identified. The sites included five Historic ranch walls (Sites 50-10-28-5085, 18659, 20846, 21878, and 21879), a railroad bed (Site 7214), a *heiau* (Site 21880), and an agricultural complex (Site 21881). The agricultural complex contained thirty-two features including mounds, modified outcrops, *kuaiwi*, platforms, and terraces concentrated in areas least affected by mechanical clearing. Haun and Henry (2000b) suggested that Site 21880 was probably a small agricultural *heiau* based on its setting, and that it was likely built and used sometime between A.D. 1400 and 1600. As a result of the inventory survey Site 21881 was recommended for data recovery, Site 21880 was recommended for preservation, and the remaining sites were recommended for no further work. Haun and Henry (2000a) later conducted data recovery excavations at Sites 21848 and 21881. The data recovery consisted of seven mechanical trenches that bisected five terraces and one *kuaiwi*. The results of the data recovery suggested that "initial agricultural use of the area began in the early 1400s with the formation of *kuaiwi* [sic] followed by the construction of terraces within a few decades", and that "the agricultural features probably continued in use until at least the early to mid-1800s" (Haun and Henry 2000a:ii).

In 2000, Haun & Associates conducted an AIS (Haun 2000c) of TMK: (3) 7-5-11:023 (por.) in Hienaloli 1st and 2nd, located to the southeast of the current project area within the *āpa'a* zone (see Figure 38). The survey identified one site (Site 50-10-28-21848) with 17 features within the boundaries of LCAw. 10406. The features consisted of a modern house, a probable animal pen, an enclosure, and an enclosing wall with a series of subdividing walls and a terrace forming at least ten formal agricultural fields. Land Commission testimony for the parcel indicated that the property was used for the cultivation of taro, sweet potatoes, and coffee during the early to middle 1800s. As a result of the survey Site 21848 was recommended for data recovery, which was completed on selected features (Haun and Henry 2000a).

In 2001, Haun & Associates conducted an AIS (Haun and Henry 2001a) of a 51-acre project area (TMKs: (3)7-5-010: 052, 065, and 066) in Hienaloli 2nd-5th Ahupua'a, located to the southwest of the current project area (see Figure 38). The survey identified 22 sites and 134 features consisting of modified outcrops, mounds, walls, terraces, and *kuaiwi*. No *kuaiwi* were observed within the *kalu'ulu* zone of their project area, however this was explained to likely have resulted from recent mechanical clearing. In addition to Precontact and early Historic agricultural features, Historic ranch infrastructure dating from the mid-1800s to 1900s was recorded, including numerous walls, a water tank and an enclosure. A 220-meter-long section of The West Hawai'i Railway Company railroad bed, Site 50-10-28-7124, was identified along eastern boundary of their project area, where it was in use as Hienaloli Road.

A cultural impact assessment was completed in 2008 by Paul H. Rosendahl Inc. (Wong-Smith 2008) for a well site (TMK: (3) 7-5-013:022 por.) located to the southeast of the current project area (see Figure 38). Culture-historical background information for the Hienaloli and adjacent areas was gathered and interviews were conducted with three informants. Wong-Smith (2009:25) reported that "…informant information on Hienaloli was scarce" and that only one interviewee, Mr. Clarence Medeiros Jr. provided information about the area, however, the information was not concerning any cultural practice in the vicinity. The other two interviewees, Mr. Mahealani Pai and Mrs. Ulalia Berman did not relate information specific to Hienaloli, rather the lands of Keahuolū. In summary, Wong-Smith (2008:27) concluded that the proposed well would "…have little effect on Hawaiian cultural resources, beliefs, and practices" and that if "…such resources are encountered during land-altering activities associated with construction, work in the immediate area of the discovery should be halted and DLNR-SHPD contacted…"

In 2008, Rechtman Consulting, LLC completed an AIS (Clark et al. 2008) of a roughly 17-acre portion of TMK: (3) 7-5-013:022 which was the subject of Wong-Smith's (2008) cultural impact assessment (see Figure 38). Five sites were recorded within the roughly 17-acre project area. The sites included four core-filled ranching/boundary walls (Sites 50-10-28-20754, 20755, 20757, and 20758) and a terrace and wall (Site 20759). A 1 x 1-meter test unit was excavated at Site 20759 revealing a soil deposit, but only modern cultural material. As a result of the Clark et al. (2008) study, Sites 20754, 20755, 20757, 20758, and 20759 were to be significant under Criterion d for information yielded relative to past use of the project area. In 2014, ASM Affiliates prepared an update (Rechtman 2014) to the Clark et al. (2008) AIS. As a result, two previously undocumented *kuaiwi* (Site 22975 Features B and C) and a Historic Period roadway (Site 22974 Feature B) were recorded. All three sites were assessed as significant under Criterion d for the information that they yielded. This was followed by data recovery of the two *kuaiwi* features (conducted at the request of DLNR-SHPD), which produced radiocarbon samples that placed the building of the features in the late

A.D. 1600s or early A.D. 1700s, toward the end of the construction of the larger agricultural complex (Barna and Rechtman 2014).

Previous Studies Conducted within the Neighboring Lands of Keōpu

In 2006, Scientific Consultant Services Inc. conducted an AIS (Johnson and Wolforth 2006) of 125 acres located on TMK: (3) 7-5-003:023 north of the current project area (see Figure 38) within the upper *kula* and *kalu'ulu* zones of the Kona Field System. Twenty-eight sites were recorded, including Precontact agricultural and habitation sites as well as Historic Period ranching, animal husbandry and trails. The majority of these features were categorized as agricultural and included soil and rock filled terraces, mounds, modified outcrops, and *kuaiwi*. Other site types included platforms, walkways, pavements, ranch walls, and enclosures. No further work was recommended for the agricultural sites, activity areas, and animal pens, temporary habitation and platform mounds of unknown function. Of particular relevance is Site 50-10-28-24870, a complex of 84 agricultural and ranching features located within the *kalu'ulu* zone at roughly at the same elevation as the current project area (Figure 40). Johnson and Wolforth (2006) note a relative absence of non-agricultural features within Site 24870, suggesting that permanent or temporary residency did not occur at this particular elevation. Permanent habitation features were observed at lower elevations in the *kula* lands. Site 24870 also included 24 Historic walls associated with livestock ranching. Johnson and Wolforth (2006) indicate that the locations of the majority of the ranch walls within Site 24870 appear to correspond with earlier *kuaiwi*, suggesting that the walls were built by modifying *kuaiwi*.

In 2015, ASM Affiliates conducted an AIS (Rechtman and Barna 2015) of a previously-disturbed, roughly 5-acre parcel located on TMK: (3) 7-5-002:033 north of the current project area (see Figure 38). As a result of the surface survey, only three previously unrecorded sites, each a Historic Period boundary wall, were recorded.

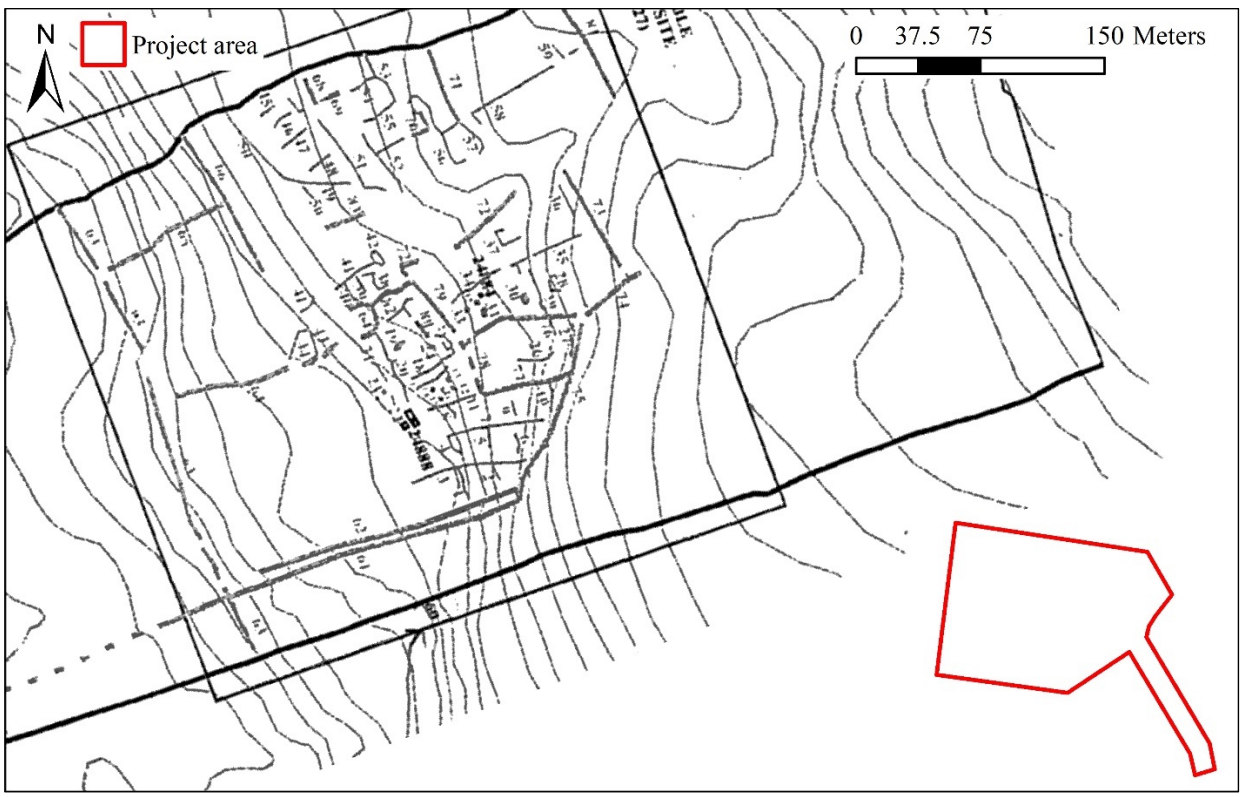


Figure 40. Features recorded by Johnson and Wolforth (2006) relative to the current project area.

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 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.

In an effort to identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current project area, a public notice was submitted to the Office of Hawaiian Affairs (OHA) for publication in their monthly newspaper, *Ka Wai Ola*. The public notice was submitted on May 22, 2020 and was published in the July 2020 edition of *Ka Wai Ola*. A copy of the public notice has been included in Appendix A. As of the date of the current report, no responses have been received from the public notice.

Although no responses were received as a result of the *Ka Wai Ola* publication, four individuals were contacted via phone and U.S postal service: Mr. Clarence Rapoza, Mr. Kenneth Komo, Mr. Solomon Haleamau, and Ms. Nicole Lui. Because the project area parcel has been privately owned with controlled access by the Komo family since the turn of the 20th century, the authors reached out to the individuals listed above, all of whom were identified as possessing knowledge related to the study area vicinity or Kona's ranching history. Of the four individuals contacted, three individuals accepted the interview request.

Given the current state and social distancing recommendations associated with the global COVID-19 pandemic, ASM staff worked with each of the interviewees to determine the most appropriate way to conduct the interviews. The interviews with Mr. Clarence Rapoza and Mr. Kenneth Komo were conducted via phone and the interview with Mr. Solomon Haleamau was conducted in-person. An invitation letter which contained a project description and associated maps were mailed to Mr. Rapoza and Mr. Komo. During the in-person interview with Mr. Haleamau, face masks were worn, sanitary measures were followed, and social distancing was practiced during the entirety of the interview. With the approval of the interviewees, the finalized versions of the summaries are presented below.

CLARENCE RAPOZA

A phone interview was conducted by ASM Staff, Lokelani Brandt on June 16, 2020, with Mr. Clarence Rapoza, a Kona-born cattle rancher. Mr. Rapoza has conducted his ranching operation on the subject property for the past thirty years. He explained that prior to him ranching these lands, his father John Rapoza, also ranched this same area. He shared that he leases the property from Mr. Kenneth Komo and recommended that ASM staff also contact the Komo family. When asked if he was familiar with any historic/archaeological resources on the property, Mr. Rapoza explained that as far as he was aware, most of the features in the project area were ranching related, including walls and his cattle pen located *makai* of the proposed project area. He went on to explain that there are older archaeological sites *makai* of the project area where the land has remained relatively undisturbed. Mr. Rapoza also shared that the old railroad bed extends into the project area and also serves as the road that he uses to access the property. When asked if he was aware of any ongoing traditional cultural practices occurring on the subject parcel, Mr. Rapoza stated that aside from ranching, he has not observed any persons performing cultural activities on the property. Mr. Rapoza was also asked if the thought the proposed well project would impede upon his ranching operations, to which he replied that he didn't think so. He related that his cattle pen located outside of the project area is one of the main areas that he uses and since the project didn't extend into this area, he believed that the project wouldn't have a direct impact to his operations.

KENNETH KOMO

At the recommendation of Mr. Clarence Rapoza, ASM staff, Lokelani Brandt mailed a request for consultation letter and supporting maps of the proposed project to Mr. Kenneth Komo. On June 22, 2020, Mr. Komo contacted Ms. Brandt via phone. In the phone interview, Mr. Komo, who was born in 1928 in Keopū Ahupuaʻa shared that he is the current owner of the property. He explained that the property was purchased by his father Mr. Kakuru Komo who migrated from Japan to work for the Kona Development Company during the end of the 19th century. He shared that

the property has been in their family since its was purchase by his father. He related that the property has been leased out for ranching for many years to the Rapoza family. When asked if he was aware of any ongoing or past traditional cultural practices, Mr. Komo shared that he was not aware of any such practices occurring on the property. He noted that other than ranching, he was not aware of any other traditional cultural uses or sites on the property.

SOLOMON HALEAMAU

On July 14, 2020, ASM staff, Lokelani Brandt conducted an in-person interview with Mr. Solomon Haleamau, a native of the ʻOʻoma-Kalaoa area of North Kona. Born in North Kona in 1945, Mr. Haleamau explained that he attended Konawaena High School with Mr. Clarence Rapoza, who currently leases the subject property for ranching. He shared that during his youth and up until about the age of thirty, he was a *paniolo* and often helped Johnny "Old Man" Rapoza (the father of Mr. Clarence Rapoza) with various ranching duties. Mr. Haleamau recalled riding on horseback with Mr. J. Rapoza and others in the Lanihau-Honuaʻula area to check fencing and waterlines for Mr. Rapoza's properties. He related stories of staying at a stone corral near Lanihau (in the vicinity of present-day Wal-Mart) where they castrated *pipi* (cattle) and sorted the cattle for distribution. He shared a story about being at the corral one evening after work and hearing old Hawaiian music. He explained that the music he and the other men heard was the spirits of *kūpuna* who had passed. He shared that when he would hear and experience these kinds of spiritual events, they were comforting and that he was never scared. He recalled memories of the old cattle drives, where the *paniolo* would drive their cattle down the mountainside to the coast of Kailua. He described the scene of cattle swimming out or being hoisted onto the steamships for shipping. He shared stories about being on horseback and observing their horses acting strangely, sometimes wiggling their ears back and forth or walking sideways. He explained that when the horses displayed this type of behavior, it was a warning and sometimes the horses were warning them about the presence of *iwi* (bones). He shared about how if they found human *iwi*, they would gather up any exposed *iwi* any rebury them in-place. Mr. Haleamau stated that in the old day, sometimes people were buried where they died. When asked if he was aware of *iwi* in the project area, he stated that he was not sure.

He shared how although ranching and life as a *paniolo* was hard work there were lots of good memories and experiences on the land. Mr. Haleamau related that about the age of thirty he changed careers and worked as a truck driver for Kona Trans, which he did for fifty-six years. He explained that while he enjoyed working as a *paniolo*, the pay was low and that having a family to provide for prompted him to change careers. After this, he explained that ranching became more of a hobby and that he would still *kōkua* (assist/help) ranchers, including Mr. J. Rapoza when he needed help.

With respect to the presence of any cultural resources in the area, Mr. Haleamau shared that the old railroad extends into the project area. He pointed to the access road and explained that the access road leading into the project area is the old railroad. Mr. Haleamau shared that the project area as far as he knew was used for ranching but thought that sugarcane may have been grown in the area prior to cattle ranching. He shared that coffee was also another big industry in this part of Kona and related that the project area is located *makai* of the area most preferred for coffee cultivation. In sharing about how coffee arrived in Kona, he explained that coffee *pulapula* (seedlings,cuttings) were brought from California by the *poʻe haole* (foreigners) and allowed to grow wild in Kona's rich volcanic soil. He related that over time, Hawaiians began tending and harvesting the wild coffee. He explained that the old families of Kona relied on the resources that extended from the uplands to the sea, thus they moved seasonally between the uplands and the coast. Mr. Haleamau opined that the old people went *mauka* to do certain activities such as tending to coffee crops, hunting wild cattle and sheep, then they moved *makai* to harvest marine resources.

When asked if he was aware of any other important cultural resources in the area, Mr. Haleamau reiterated that aside from the railroad, this property was used for ranching and he was unaware of any other uses for this area.

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. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. In the Hawai‘i Revised Statutes–Chapter 6E a definition of traditional cultural property is provided.

> "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.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "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 Pa‘akai O Ka ‘Āina* 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.

A review of the culture-historical background material reveals that during the Precontact times, Honuaʻula Ahupuaʻa was part of the cultural landscape centered around the Kamakahonu-Kailua area, where royal centers were established and a massive agricultural field system was developed along the slopes of Hualālai. A review of historic accounts written by both native historians and early missionaries between the years 1812-1844 revealed the presence of royal compounds, habitation sites, and a ceremonial *heiau* (possibly named Kapohonau) situated along coastal Honuaʻula. A review of traditional accounts traces occupation of this area from at least the 13th century with the rule of Pili-a-Kaʻaiea into the mid 19th century when the *aliʻi* Leleiohōkū laid claim to Pā O Papaula and Pā o Papa at the coast of Honuaʻula. The early historic accounts also reflect the lifestyle changes brought about after the arrival of Europeans in 1778-79 and missionaries in 1820. Honuaʻula figures prominently in Kona's missionary settler history as it served as the main parsonage for the Thurston family who helped to establish Mokuʻaikaua Church located to the northwest of the project area in Keōpū Ahupuaʻa. The two-story Thurston family home was located *makai* of the current project area on the Honuaʻula-Hienaloli 1st Ahupuaʻa boundary.

By the mid-19th-century, the ever-growing population of Westerners convinced that the traditional Hawaiian land tenure practiced was not compatible with the newly established constitutional monarchy encouraged the *Mōʻī* and his high ranking chiefs to overhaul the traditional land tenure system. This culminated in the event known historically as the *Māhele ʻĀina* which effectively established fee-simple ownership to Hawaiian lands. During the land division between the King and chiefs, Honuaʻula Ahupuaʻa was claimed by the chiefess Keahikuhi Kekauʻōnohi (also known as Mikahele or Miriam Kekauʻōnohi), who subsequently relinquished her interest and the land was retained as Government land. Additionally, four individuals (Pupule, Walawala, Wahineiki, and the *aliʻi* Leleiohoku) and one institution (American Board of Missions) were awarded a total of seven *kuleana* parcels in coastal Honuaʻula. While most of the awarded parcels appear to have been for house lots, testimony collected during the land claim process indicates that some of the awardees had cultivated parcels. While the location of these cultivated parcels was not disclosed, general land use patters for the Kona District at this time suggest that such cultivated plots were likely located *mauka* of the current project area in the vicinity of the current Māmalahoa Highway. The land claims made by the *aliʻi* Leleiohoku provides insight into a royal compound at the coast identified in the land claim documents as Pā o Papa and Pā o Papaula. Given that the *Māhele ʻĀina* codified preexisting land-use patterns that were in place for several generations or more, this suggests that at least some if not most of the native people were still living according to the principles of the traditional *ahupuaʻa* system during this time.

In addition to the awarding of Land Commission Awards during the *Māhele ʻĀina*, the Hawaiian Kingdom government authorized the issuance of Land Grants to applicants for tracts of Government land that were allocated during the *Māhele ʻĀina* at a cost of fifty cents per acre. Although the stated goal of the program was to enable native tenants to purchase land, it also allowed many foreigners to acquire large tracts of Government land. Excluding the *kuleana* parcels, the remaining lands of Honuaʻula were divided into two large land grants (Grant 1758 sold to George L. Kapeau and Grant 3148:4 sold to William P. Leleiohoku, who also was awarded two *kuleana* parcels discussed above). The current project area is within a portion of George L. Kapeau's 585-acre grant. As a descendant of a Maui chief, Kapeau was considered a *kaukaualiʻi* (lesser chief) and held various government positions.

In 1862, the Boundary Commission was authorized to settle and certify the boundaries for lands that were awarded by name only during the 1848 *Māhele ʻĀina*. Elder residents were brought into the hearings to give testimony about the known boundaries. While the Boundary Commission did not hold testimony to settle the boundaries of Honuaʻula, testimony was gathered for the adjacent *ahupuaʻa* of Hienaloli 1st and 2nd.

A review of historic maps produced during the late 19th and early 20th century reveals changes in land use in the immediate project area vicinity. A Hawaiʻi Territory Survey map (see Figure 27) produced in 1906 shows survey markers and a trail alignment extending in a *mauka-makai* direction along the southern boundary of the current project area. The map also depicts the presence of various introduced species in the vicinity of the project area including *guava*, and monkeypod trees. While most of the testimony focuses on the lands of Hienaloli (written in the testimony as Hianaloli), some information specific to the Honuaʻula-Hienaloli 1st boundary is provided and only those portions have been analyzed in this study. From these recollections of the elder residents, we learn that the southwestern *ahupuaʻa* boundary was the site of an old *heiau* called Kapohonau, which may have been the "ancient fortification" described by Ellis (1917:77) in 1823 (see Figure 17). Likewise, these accounts also depict the demographic changes in the area as a result of the increased missionary presence.

Shortly after the Boundary Commission held its hearings for the adjacent lands, it appears that the upper portion of Honuaʻula near the Government Road was parceled out into 50-acre lots. An undated Hawaiʻi Registered Map 25 (see Figure 29) map produced by S. C. Wiltse who conducted much of his survey work between the 1860s and 1870s shows seven lots, three of which are *makai* of the Government Road and the remaining four located *mauka* of the road.

During the early 20th century, as large swaths of land around the Hawaiian Island were transformed into vast plantations of sugarcane, the Kona Sugar Company set out to establish a marketable sugar industry in Kona. The rise of sugar plantations not only transformed the land but also the cultural tapestry of the islands as migrant laborers from various ethnic backgrounds developed into a massive plantation workforce. To facilitate the movement of cane to the mills, the West Hawaii Railroad Company built 11-miles of track in Kona, with the northernmost limit of the railroad extending into the project area (see Figure 30). After ten years of operation, the Kona Development Company and West Hawaii Railroad were sold to Tomekichi Konna, formerly of the Laupahoehoe Sugar Company, becoming the first sugar plantation to be owned by a Japanese immigrant. After the closure of the two companies in 1927, the railroad right of way was repurposed by the Government and became the Hienaloli-Kahului Road.

Around 1875, Henry N. Greenwell began grazing cattle in the project area vicinity and eventually established the 36,000-acre Greenwell Ranch. The northern section of the ranch, known at the time as Honokōhau Ranch and Hualalai Ranch, included about 20,000 acres, 4,000 of which were owned by the ranch. These lands included the current project area, which had been purchased by H. N. Greenwell as Grant 3100 (but originally sold as Grant 1758 to Kapeau). Stone walls and wire fences were used to divide the ranch land into paddocks.

By the 1940s, the parcel was owned by Kakuro Komo, who had emigrated from Hiroshima Prefecture, Japan to Hawai‘i and worked for the Kona Development Company as a locomotive engineer. Around the 1920s, Komo leased land in the Keopū area for his home, a general store, and coffee land, and eventually acquired additional properties, including the current project area. County of Hawai‘i tax records indicates that throughout the second half of the twentieth century, about 108 acres of the property were used as pasture, which was leased to local ranchers. Aerial photography from 1965 and 1977 (see Figures 34 and 35) documents relatively little change to the project area vicinity. The land remained in use as cattle pasture, and as the aerial photographs show, was mainly kept grazed down with the exception of large trees. By 1977, a ranch road had been cleared *makai* of the project area, and development had begun in Keōpū 3rd Ahupua‘a to the north, but the current project area appears to have changed little.

The very first archaeological study to be completed in the project area was in 2020 when ASM Affiliates (Glennon and Barna 2020) recorded three archaeological sites (Site 50-10-27-7214, 31161, and 31162.). Site 7214 described as the West Hawaii Railroad, a segment of which was previously documented by Haun and Henry (2000b) in Hienaloli 1st. Site 31161described as a complex consisting of eight Historic core-filled ranch wall segments located within and extending beyond the project area boundaries were recorded. Site 31162 described as two remnant agricultural features associated with 20th-century livestock ranching were also recorded. Site 7214 was considered significant under criteria a and c, and recommended for preservation. Sites 31161 and 31162 were considered significant under criterion d and no further work was the recommended treatment.

Consultation was conducted with three individuals, Mr. Clarence Rapoza (the current lessee), Mr. Kenneth Komo (landowner), and Mr. Solomon Haleamau (former *paniolo*). All of the interviewees were identified as being born and raised in North Kona and as having in-depth knowledge of the project area. Through the consultation process, the interviewees shared their knowledge about several known archaeological sites including the former railroad bed and ranching infrastructures such as walls and a nearby corral. Aside from ranching activities, none of the consulted parties were aware of any past or ongoing traditional cultural practices.

As identified in the consultation portion of this study, two of the three interviewees expressed some degree of knowledge and attachment to the former railroad. The railroad was documented in the AIS conducted by Glennon and Barna (2020) as Site 7214 and considered significant under criteria a, c, and d. While the current project has been designed to avoid affecting Site 7214, Glennon and Barna (2020:i) concluded that no further work was the appropriate treatment with the clause that “future development planning for the extension of Hienaloli Road involves discussions among the County of Hawai‘i Planning Department, DLNR-SHPD, and the landowner work to consider the potential for rehabilitation of the portion of Site 7124 within the current project area as a pedestrian and/or non-motor vehicle component of the new road’s design.” To safeguard against impacting Site 7214, it is recommended that a temporary protective buffer be placed around the site prior to the commencement of any construction activities and a briefing be held with all construction crew members informing them about the location of Site 7214.

In the consultation with Mr. Haleamau, he expressed concern over the possibility of encountering subsurface burials. While none of the consulted parties were aware of any known burial sites in the project area, nor were any burials identified during the AIS of the project area (Glennon and Barna 2020), as a precautionary measure, it is recommended that an archaeological monitor be present during any ground-disturbing activities. If subsurface human remains are uncovered during any earth-moving activities, all construction in the general area should cease and the State Historic Preservation Division should be notified.

In summary, the recommendations provided above are intended to ensure that the proposed project considers the concerns and thoughts shared by the consulted parties. While none of the consulted parties explicitly opposed the proposed project, the concerns, and recommendations offered above are intended to support the Department of Water Supply in being mindful of the cultural and environmental uniqueness in which their project area is situated. Conducting background research, consulting with community members, and taking steps towards mitigating any potential impact will aid in maintaining the cultural heritage of North Kona. Attention to and implementation of the above-described issues and measures relative to the above-identified study area will help to ensure no such resources, practices, or beliefs will be adversely affected by the proposed project.

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APPENDIX A.
KA WAI OLA PUBLIC NOTICE

CULTURAL IMPACT ASSESSMENT - HONUA'ULA AHUPUA'A, ISLAND OF HAWAI'I

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) for a proposed County of Hawai'i Department of Water Supply exploratory mid-level well on a portion of TMK: (3) 7-5-003:001, Honua'ula Ahupua'a, North Kona District, Island of Hawai'i. The CIA report will serve as a companion document to the Environmental Assessment being prepared in compliance with Hawai'i Revised Statutes Chapter 343. We are seeking consultation with community members that might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the subject property, that may be impacted by the proposed project. If you have and can share any such information please contact Lokelani Brandt (lbrandt@asmaffiliates.com); phone (808) 969-6066, mailing address ASM Affiliates 507-A E. Lanikaula Street, Hilo, HI 96720.