

Draft Environmental Assessment

**Garrett Single-Family Residence and Farm
in the Conservation District at Maku‘u**

April 2020

TMK (3rd): 1-5-010:009
Maku‘u, Puna, County of Hawai‘i, State of Hawai‘i

APPLICANT:

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**DETERMINING
AGENCY:**

State of Hawai‘i
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813

CONSULTANT:

Geometrician Associates LLC
P.O. Box 396
Hilo, Hawai‘i 96721

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CLASS OF ACTION:

Use of Land in Conservation District

This document is prepared pursuant to:
The Hawai‘i Environmental Policy Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200.1, Hawai‘i Department of Health Administrative Rules (HAR)

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Garrett Single-Family Residence and Farm at Maku‘u Environmental Assessment

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APPENDIX 3	Cultural Impact Assessment
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SUMMARY OF PROJECT, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Bob Garrett (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence on his 13.436-acre property located *makai* of the Government Beach Road in the Conservation District between the Hawaiian Paradise Park and Hawaiian Shores subdivisions, in the *ahupua‘a* of Maku‘u, in the Lower Puna area of the Island of Hawai‘i. The home will feature underground electrical lines, a water well and an individual wastewater system. The proposed 3-bedroom, 3 ½-bath, two-story residence will include a kitchen, dining and living area, lanai and garage, with a total living space of approximately 2,560 square feet (sf), a covered lanai area of 1,239-sf and basement and garage area of 896-sf. In addition to residential uses, Mr. Garrett plans to continue the ongoing “nonconforming” agricultural uses on the property. Supporting the farming and grazing will be a 680-sf farming and utility shed using the concrete foundation of the prior residence. The farm shed would be an enclosed structure with an area for tractor and tool storage and a small room at the side for a pump, pressure tank and equipment storage.

The roadside half of the property will be the site of the home and continued farming. This area has been used for residence, farming and grazing for centuries, and the vegetation consists almost exclusively of non-native pasture grasses, crops such as taro, melon and squash, herbs, shrubs and individual trees. The *makai* half of the property consists of a dense coconut and hala forest that will not be disturbed. The owner has closely coordinated with descendants of the long-time owner of the property to develop the home with sensitivity and to ensure the family’s access to the property to care for a burial plot, to fish and gather shoreline resources, and have family gatherings. As with most areas in Puna, the shoreline is used occasionally by local residents to fish and gather. Mr. Garrett understands and supports the right to traverse and utilize the shoreline area.

Landclearing and construction activities would occur over much less than an acre, with very minor short-term impacts to noise, air and water quality and scenery. These would be mitigated by Best Management Practices associated with the CDUP and grading permit. The applicant will ensure that all earthwork and grading conforms to applicable laws, regulations and standards. The site has been surveyed for threatened and endangered plants, and none are present with the exception of a patch of the endangered shoreline grass, *Ischaemum byrone*, which is proposed for passive protection that will improve on current conditions. Impacts to the island wide-ranging endangered Hawaiian hoary bat will be avoided through timing of vegetation removal. No cultural sites or practices would be adversely affected. An archaeological inventory survey identified several walls, a former house site, a known, cared-for burial plot, and agricultural features. A preservation plan for the burial plot including family member access is being developed in close coordination with the family. In the unlikely event that additional undocumented archaeological resources, including shell, bones, midden deposits, lava tubes, or similar finds, are encountered during construction, work in the immediate area of the discovery will be halted and the State Historic Preservation Division will be contacted to determine the appropriate actions.

PART 1: PROJECT DESCRIPTION AND E.A. PROCESS

1.1 Project Description and Location

Bob Garrett (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence and related improvements on his 13.436-acre property located *makai* of the Government Beach Road in the Conservation District between the Hawaiian Paradise Park and Hawaiian Shores subdivisions, in the *ahupua‘a* of Maku‘u, in the Lower Puna area of the Island of Hawai‘i (Figures 1-3). The roadside half of the property, where the vegetation consists almost exclusively of non-native pasture grasses, crops such as taro and squash, herbs, shrubs and trees, has been used for residence, farming and grazing for centuries. The property is commonly referred to as the Kamahele Homestead Property or the Kamahele Farm, having been originally owned and homesteaded by Ulrich “Sonny” Kamahele, who kept a wide range of livestock and crops and was well known for the melons that he grew at the farm.

The property’s terrain rises from its *mauka* boundary along Government Beach Road to a broad and distinctive promontory, the crest of which is part of a ridge parallel to the sea. The old Kamahele house, destroyed in a fire several years ago during Tropical Storm Iselle, was located towards the top of the hill, about 270 feet from the *mauka* property boundary, where now only its concrete foundation remains. A family burial plot is located nearby at the top of the hill. The ridge separates the largely open farm portion and the heavily vegetated coastal portion, where the shoreline is 45 feet below the elevation at the top of the hill. The dense vegetation of this *makai* portion consists primarily of *hala* (*Pandanus tectorius*) and coconut (*Cocos nucifera*) trees that are interspersed with common invasive trees and an understory that includes a mix of ferns, sedges, and grasses. Along the shoreline there is a strand of native shoreline vegetation that consists primarily of *naupaka* (*Scaevola taccada*), coconut and *mau‘u ‘aki‘aki* (*Fimbristylis cymosa*). This area also contains a few individuals of the endangered grass *Ischaemum byrone*, which is not uncommonly found on undisturbed pahoe-hoe shorelines in Puna.

The proposed 3-bedroom, 3 ½-bath, two-story residence will include a kitchen, dining and living area, lanai and garage, with a total living space of approximately 2,560 square feet (sf), a covered lanai area of 1,239-sf and basement and garage area of 896-sf. (Figure 3). The maximum height above existing grade will be under 25 feet. Electrical power and telecommunications will be provided to the residence through underground lines extended from existing Hawaiian Electric and Hawaiian Telephone Company lines along the Government Beach Road. The Total Development Area (TDA) for the residence, per the Conservation District Rules (Title 13-5, HAR, Exhibit 4), is 4,824 sf.

The domestic water supply would be provided from an onsite water well to be located near the house, about 240 feet *makai* of the Government Beach Road. The well will have a 1.5-HP pump capable of delivering up to 50 gallons per minute. The water well, pump and water filtration system will be housed in a 6-foot tall, 16-sf well/pump shed. A 10,000-gallon storage tank about 113-sf in area set on a pad of crushed rock will be located next to the well site. The proposed storage will be more than adequate to meet the expected demand based on a family’s projected average daily use of less than 300 gallons per day. It will also have sufficient reserve capacity to meet the fire-flow requirements for the planned residence.

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The residence is designed as a single structure supporting efficient use of energy and materials and facilitating natural ventilation and lighting. Energy-efficient appliances will be used throughout the house. Generous lanais along the east and west faces and an insulated roof structure will reduce potential solar gain to the home. This together with opportunities for natural ventilation will reduce the need for air conditioning. The home will also have roof-mounted photovoltaic and solar water heating panels, reducing energy use and greenhouse gas emissions.

Wastewater would be treated by an individual septic system located adjacent to the residence, which would be designed and installed in conformance with requirements of the State Department of Health at HAR 11-62. The septic system would have a tank capacity of 250 gallons and an absorption field that extends over an area of approximately 390 square feet.

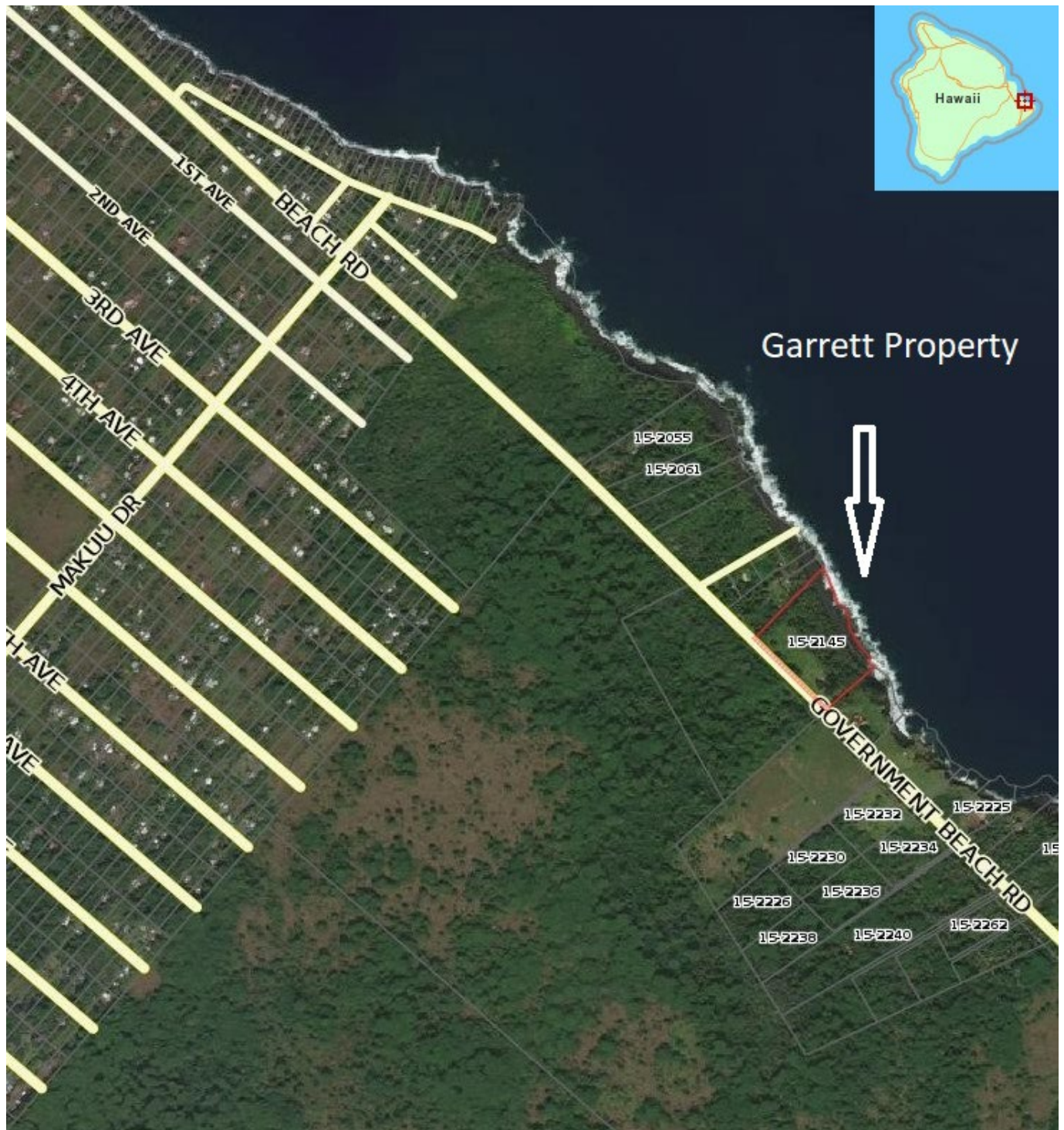
The proposed house site is near the top of the hillside, at the end of the existing driveway, near the site of the former home. It will be set back about 212 feet from the shoreline in order to protect the native shoreline area and also avoid salt spray and coastal hazards. The applicant has extensively coordinated with Mr. Kamahele's *'ohana*, and has made sure to set the house site a minimum of 46 feet from the historical burial site so as to provide appropriate buffer from the site. The planned landscaping for the residence would be limited to re-grassing of disturbed areas around the house site, relocation of two juvenile *hala* trees along the realigned driveway, removal of some of the large Cook pines and as many as six coconut trees around the house and driveway, and new *ti* plants at the boundary of the historic burial site, as requested by the Kamahele family, to serve as a vegetative buffer around the site. The existing gate along the front of the property will be replaced with a decorative wood and metal gate. The wire fence will be replaced with 6-foot solid metal corrugated panels.

The applicant plans to continue the ongoing "nonconforming" agricultural uses on the property. A farm and utility shed is planned nearby using the concrete foundation of the prior residence. The farm shed would be an enclosed structure covering an area of approximately 680 sf, which would include an area for tractor and tool storage and a small room at the side for a pump, pressure tank and equipment storage.

Landclearing and construction activities would occur over less than a quarter of an acre, including the approximately 1,088 square feet of shallow trenching for utility lines and connections, with very minor short-term impacts to noise, air and water quality and scenery. These would be mitigated by Best Management Practices associated with the CDUP and grading permit.

The *makai* half of the property with the coconut and hala forest that will not be disturbed in any way. A patch of the endangered shoreline grass *Ischaemum byrone* is located in an area traversed by fishermen. The patch is proposed for passive protection using one or two courses of dry-stacked rocks that preserve an access way but discourage trampling of the grass. The owner has closely coordinated with descendants of the long-time owner of the property to develop the home with sensitivity and to ensure the family's access to the property to care for a burial plot, to fish and gather shoreline resources, and have family gatherings. As with most areas in Puna, the shoreline is used occasionally by local residents to fish and gather. Mr. Garrett understands and supports the right to traverse and utilize the shoreline area.

Figure 1 Project Location Map



Garrett Single-Family Residence and Farm at Maku'u Environmental Assessment

Figure 2 Site Photos



2a, Above: Aerial Image with Approximate Property Boundary from Google Earth ©

2b, Below: View east across the proposed house site



Figure 2. Site Photos



2c, Above: Pasture on western, *mauka* half of property

2d, Below: Current gate and driveway into property



Figure 2. Site Photos



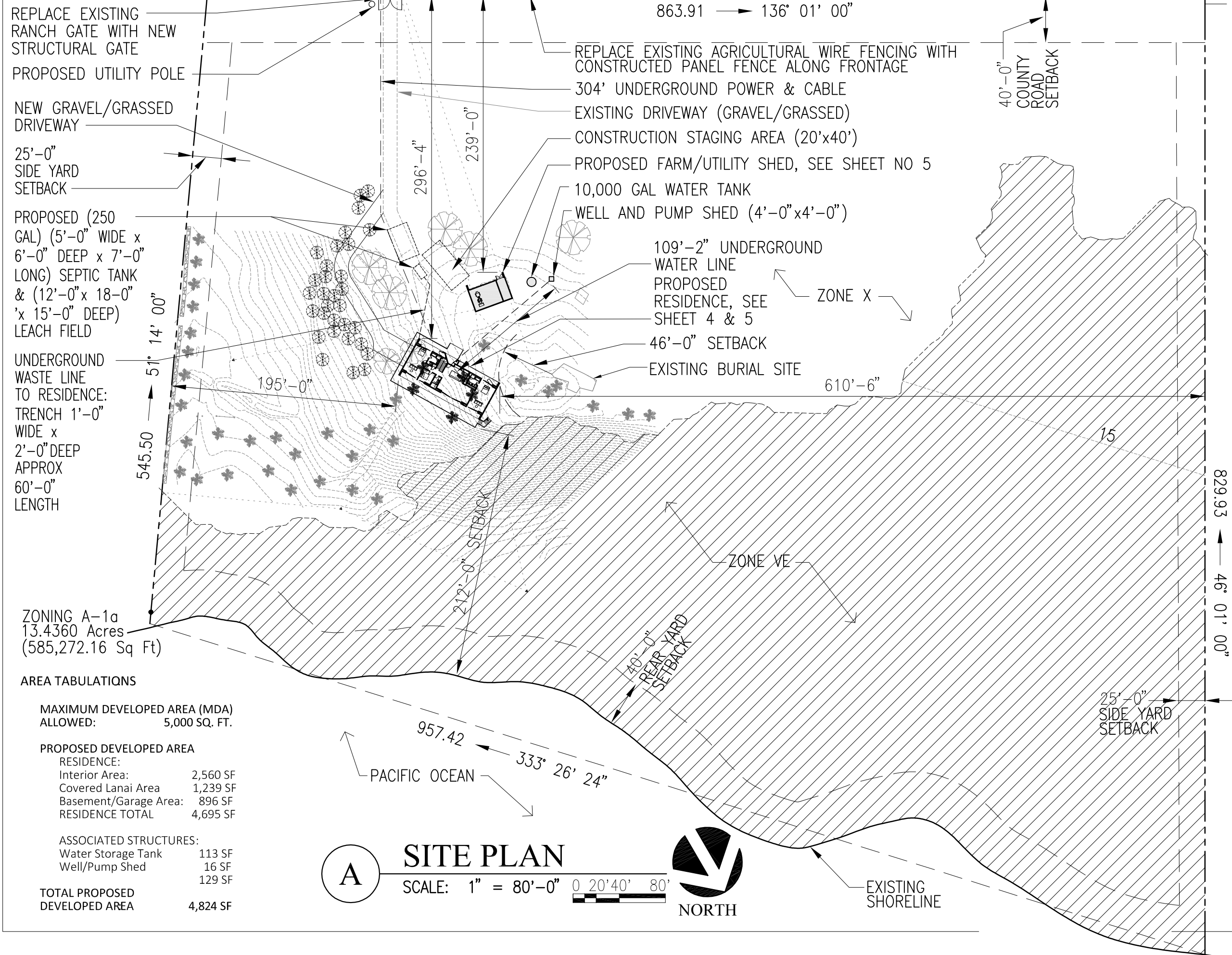
2e, Above: Shoreline, view to northwest from southeast corner.. 2f, Below: Makai coconut/hala forest



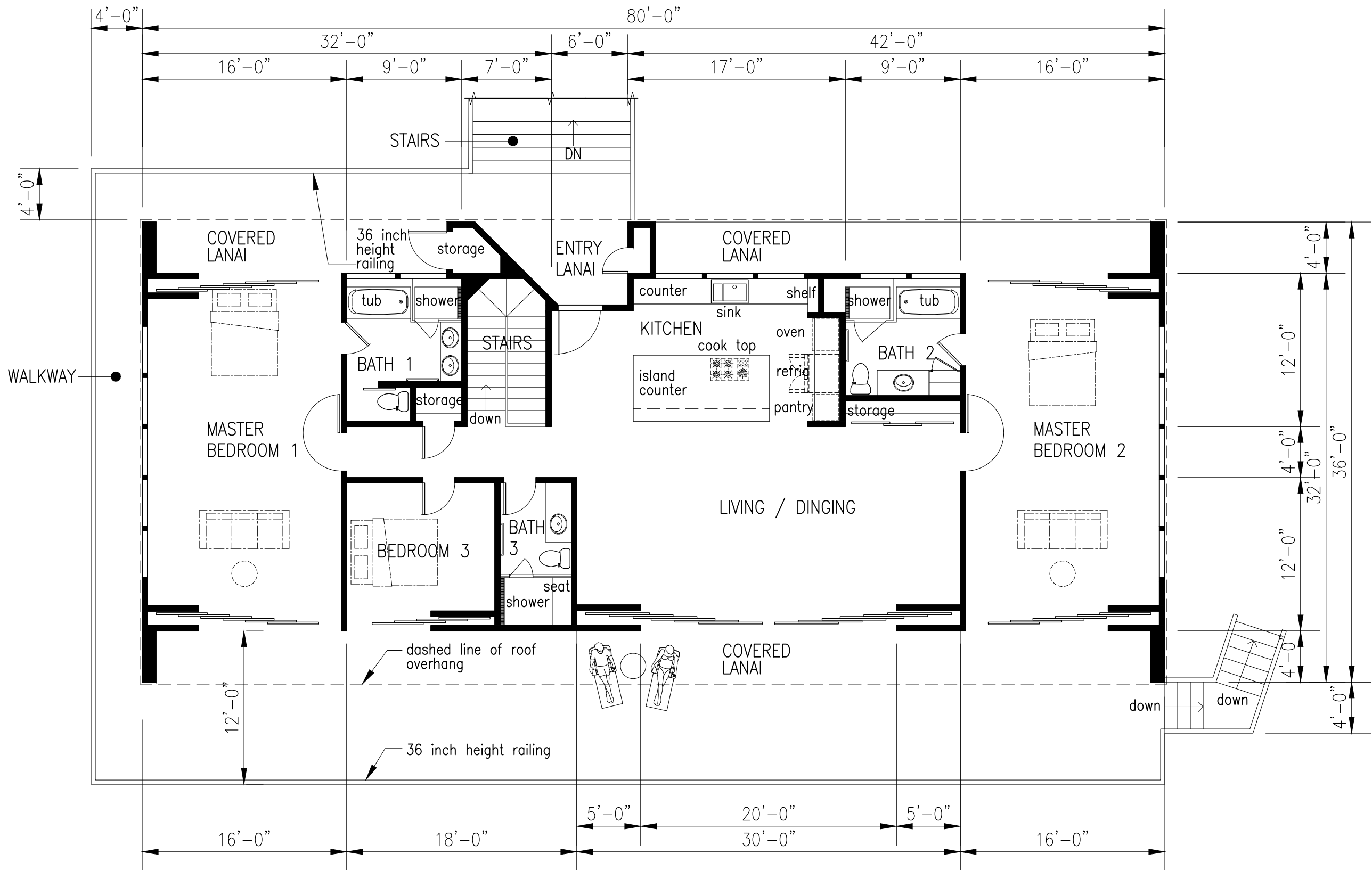


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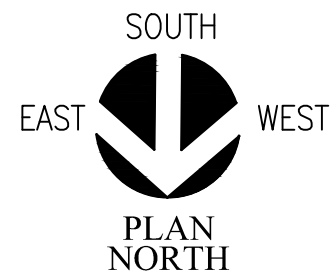
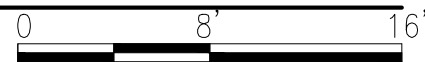


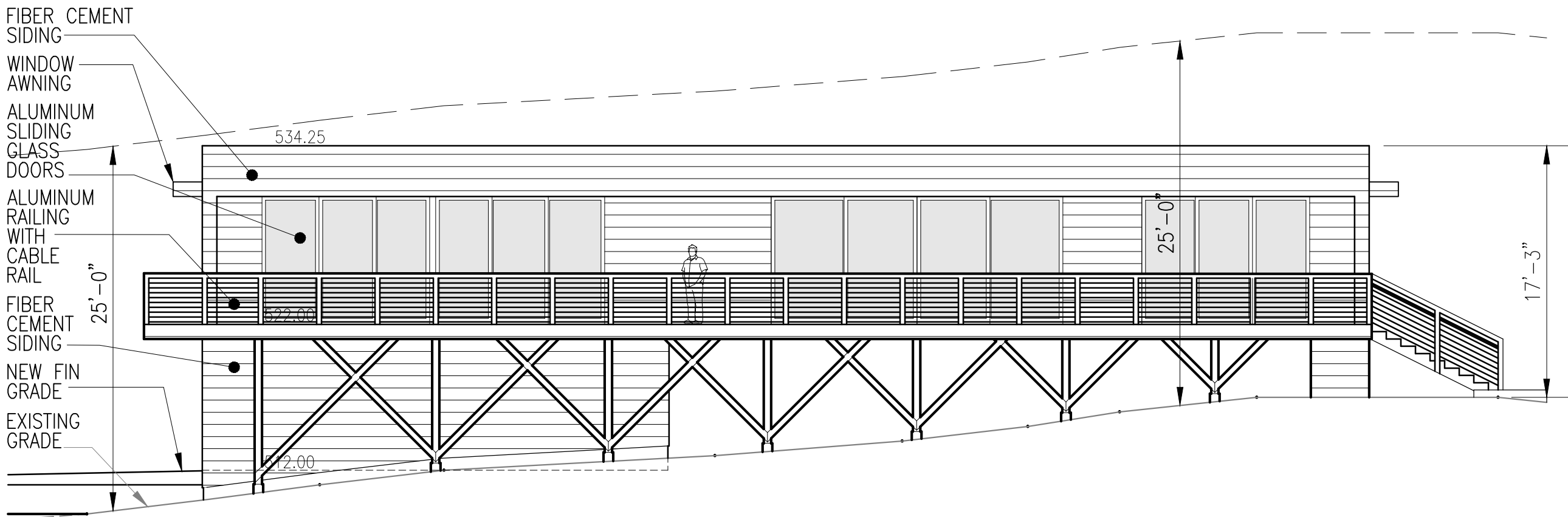
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ENCLOSED AREA 2,560 SQ FT
LANAI AREA 1,239 SQ FT

A FLOOR PLAN - MAIN LEVEL
SCALE: 1/8" = 1'-0"

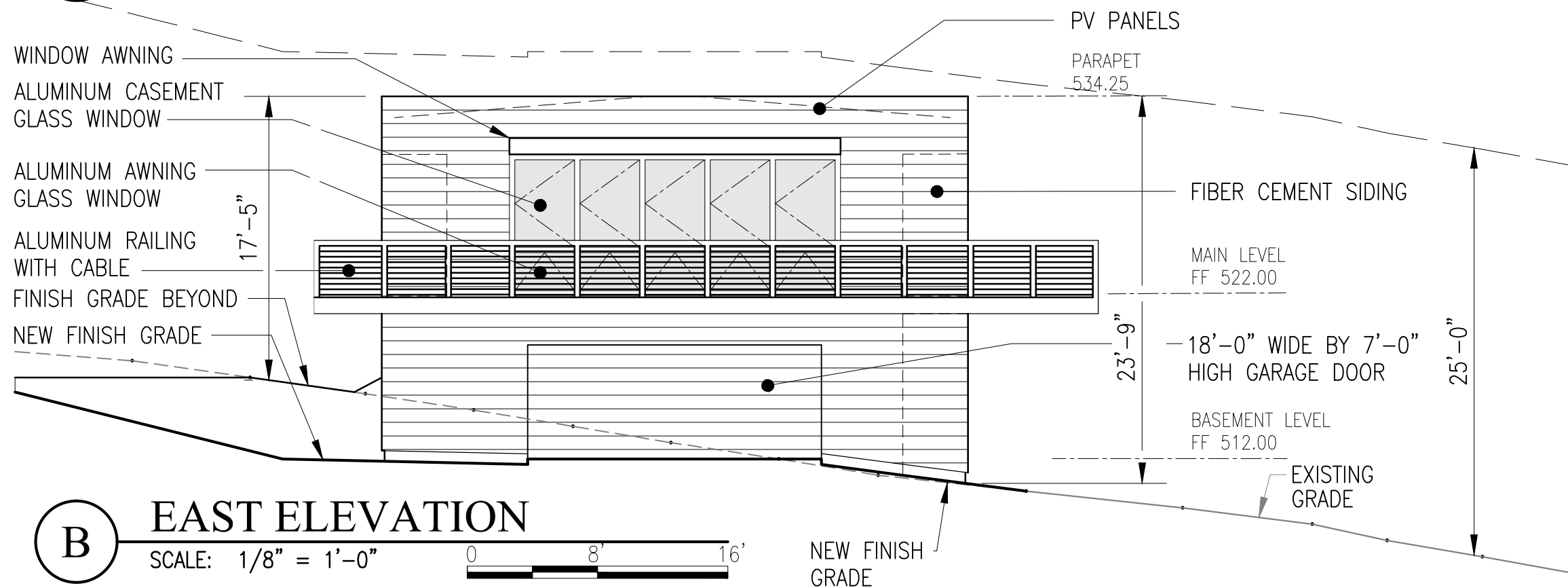
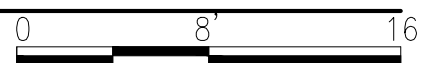




A

NORTH ELEVATION

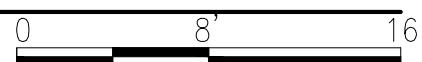
SCALE: 1/8" = 1'-0"

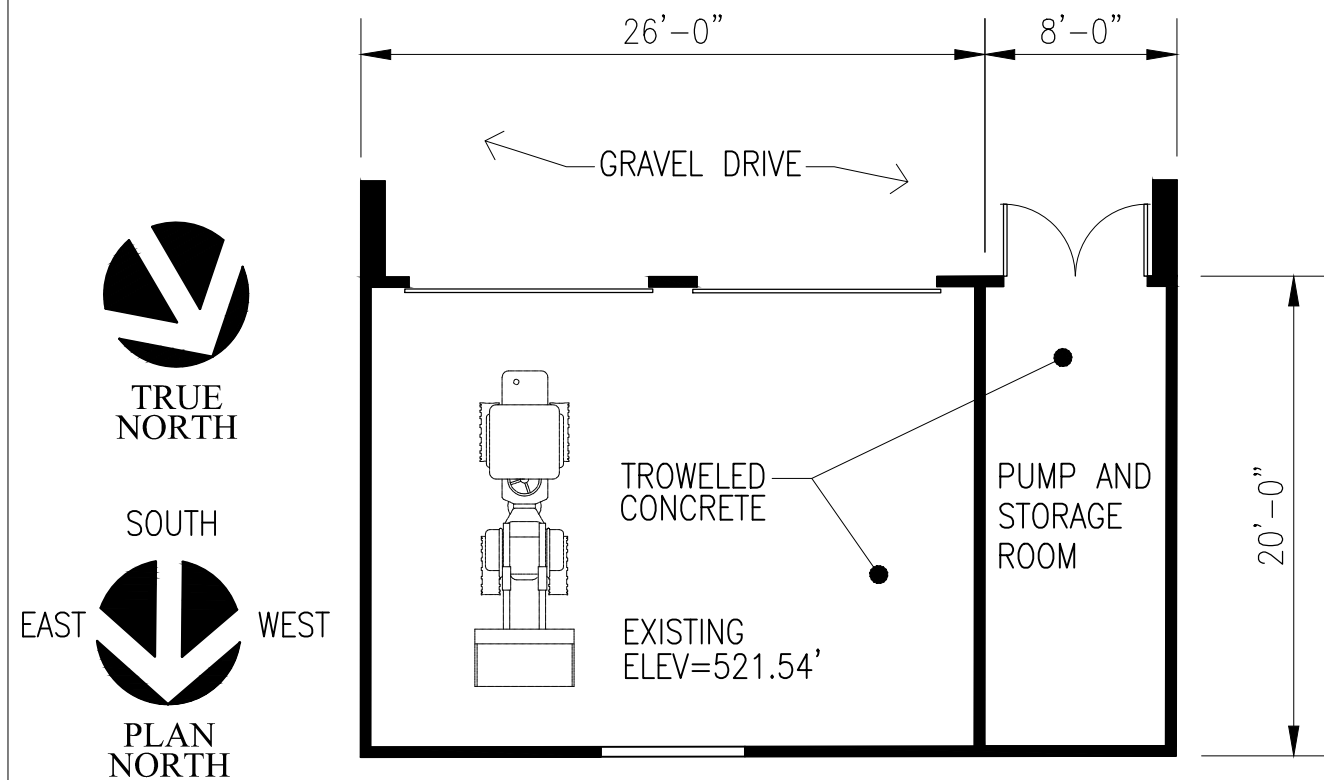


B

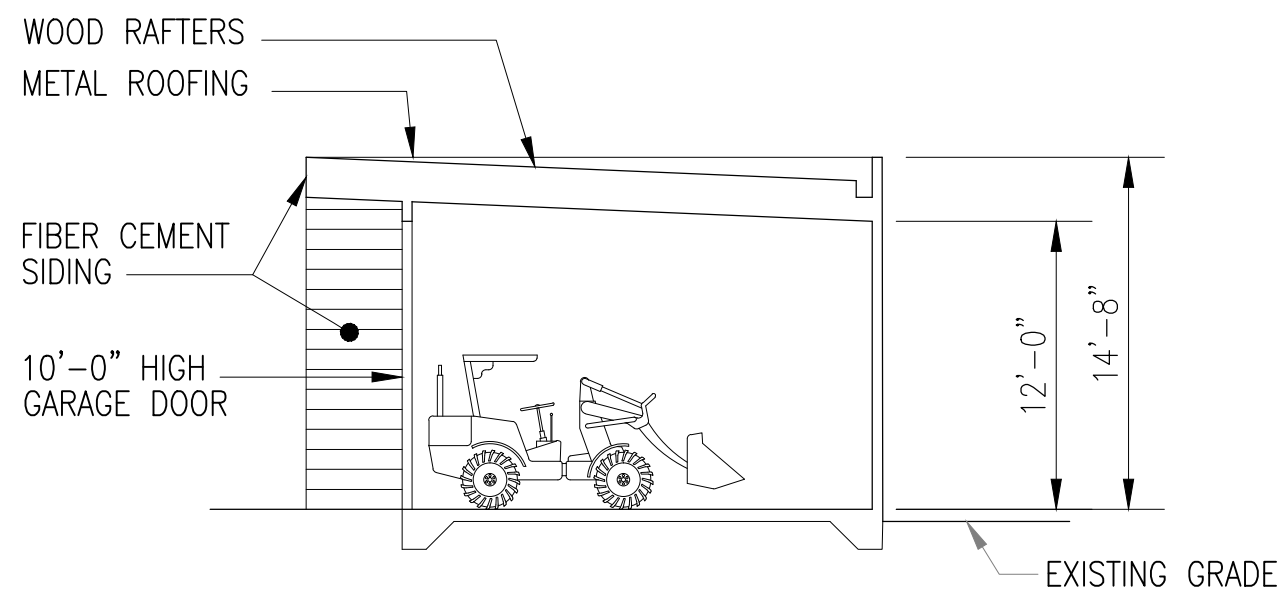
EAST ELEVATION

SCALE: 1/8" = 1'-0"

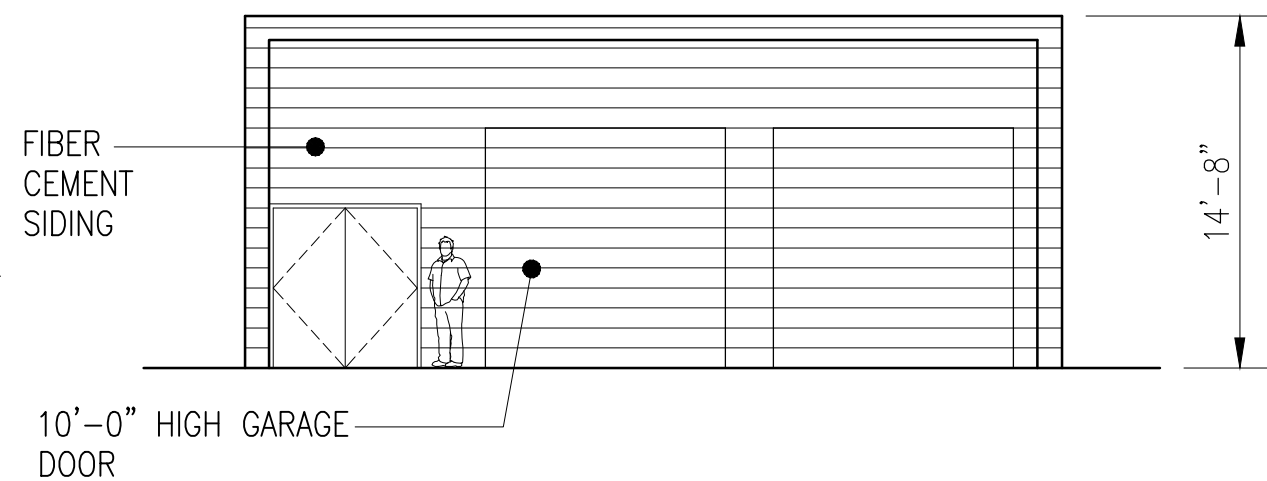




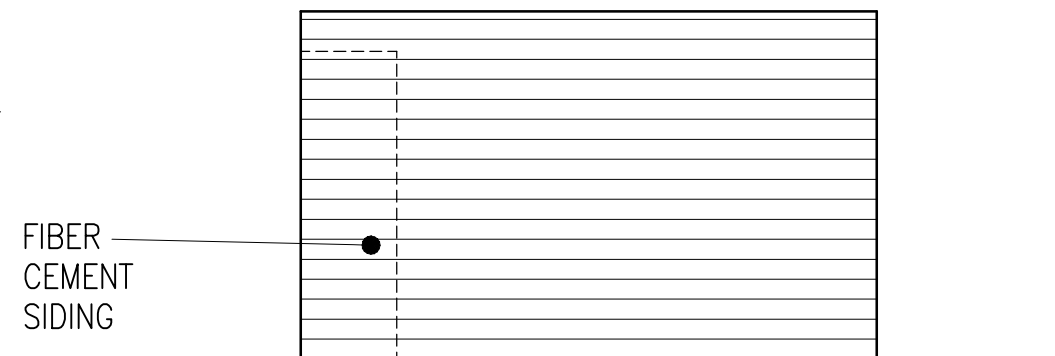
A FLOOR PLAN - FARM UTILITY SHED
SCALE: 1/8" = 1'-0" 0 8' 16'



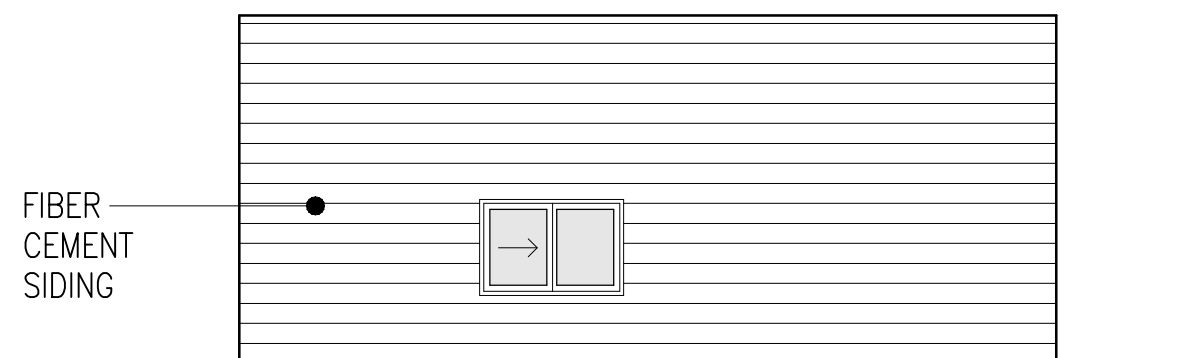
E SECTION THRU BUILDING
SCALE: 1/8" = 1'-0" 0 8' 16'



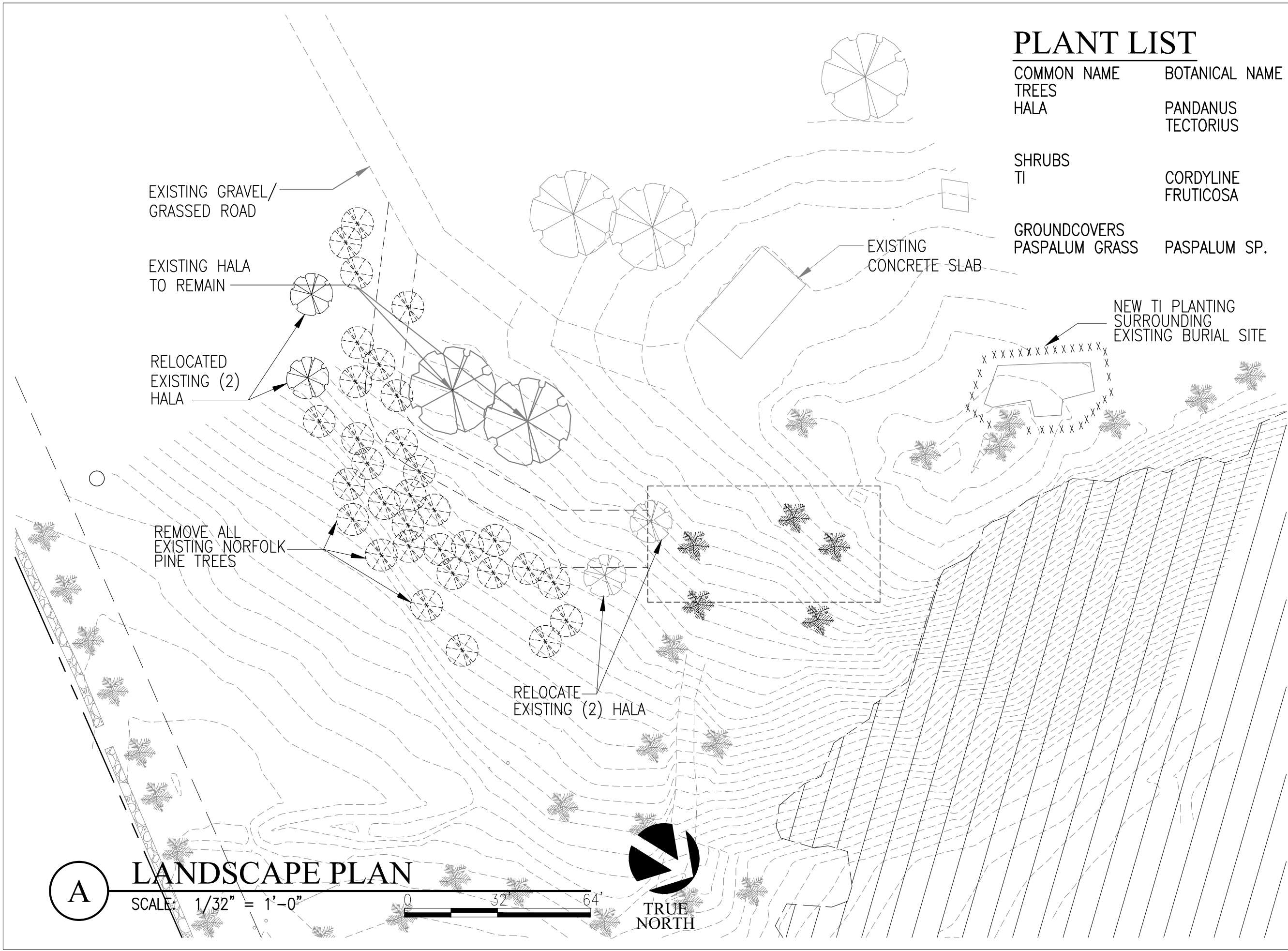
B SOUTH ELEVATION
SCALE: 1/8" = 1'-0" 0 8' 16'



C EAST ELEVATION
SCALE: 1/8" = 1'-0" 0 8' 16'



D NORTH ELEVATION
SCALE: 1/8" = 1'-0" 0 8' 16'



PLANT LIST

COMMON NAME	BOTANICAL NAME
TREES	
HALA	PANDANUS TECTORIUS
SHRUBS	
TI	CORDYLINE FRUTICOSA
GROUNDCOVERS	
PASPALUM GRASS	PASPALUM SP.



ENGINEERING PARTNERS

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1.2 Environmental Assessment Process

This Environmental Assessment (EA) is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200.1, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact assessment process in the State of Hawai‘i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the finding that no significant impacts are expected to occur, based on the findings for each criterion made by the consultant in consultation with the Hawai‘i State Department of Land and Natural Resources, the determining agency. If, after considering comments to the Draft EA, DLNR concludes that, as anticipated, no significant impacts would be expected to occur, then the agency will issue a Finding of No Significant Impact (FONSI), and the action will be permitted to proceed to other necessary permits. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement (EIS) will be prepared.

1.3 Public Involvement and Agency Coordination

The following agencies, organizations and individuals have been consulted during the Environmental Assessment Process:

County:

Planning Department	County Council	Civil Defense Agency
Fire Department	Department of Public Works	Police Department
Environmental Management		

State:

Department of Health
Department of Land and Natural Resource (DLNR), Land Division and OCCL
Office of Hawaiian Affairs

Private:

Sierra Club	Malama O Puna
Sheldon Kamahale	Richard Ha
Four Adjacent Property Owners: Lum, Wood, Caldwell, Mancini	

Copies of communications received during early consultation are contained in Appendix 1a.

PART 2: ALTERNATIVES

2.1 Proposed Project, Alternative House Sites and Alternative Uses

The proposed project and its location are described in Section 1.1 above and illustrated in Figures 1-3. The location of the home site, on a hill about 35 feet above sea level at a minimum of about 212 feet from the shoreline shelf, was chosen in order to enjoy coastal breezes and views on the property while avoiding shoreline hazards and interfering with shoreline recreation.

A number of other locations on the property could also serve as the site for a residence, but none have the advantages of the proposed site in terms of all three factors: breezes, views and shoreline hazard avoidance. Furthermore, the proposed location already has a driveway that leads to it and is near the former home site, which honors the previous long-standing resident's siting decisions. There are no known environmental or other reasons for seriously considering other sites on the property.

No other alternative uses for the property that are identified in the Conservation District Rules, such as a commercial farm or tourist nature park, are desired by the applicant, and thus none are addressed in this EA.

2.2 No Action

Under the No Action Alternative, the residence would not be built and the farm would not be continued. The lot would remain unused, except for temporary camping and picnicking by the owner and his guests. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION

The 13.436-acre property is located between the Government Beach Road on the south side and the rocky shoreline of the Pacific Ocean on the north side, flanked on both sides by 5-acre private parcels in the Conservation District that each contain single-family residences (see Fig. 1). U.S. Geological Survey maps of various dates and Google Earth images indicate that elevations on the property vary from about 10 to 40+ feet above sea level, with the chosen residential site lying at about 35 feet.

3.1 Physical Environment

3.1.1 Geology, Soils, Geologic Hazards and Climate

Environmental Setting

The property is located on the flank of Kilauea, an active volcano. Several lava and cinder formations make up the property, as discussed in detail in Appendix 4. The coastal shelf extending *makai* of the shoreline is the oldest exposed lava on the property, part of a lava flow that emerged from Kilauea’s summit between 750 and 1,500 years ago (Moore and Trusdell 1991). Where this flow reached the sea, violent steam explosions from the interaction of molten lava with seawater created widespread cinder deposits and formed the littoral cone that remains as a prominent hill on the property (see Figure 2). The deposits and *pu‘u* make up almost the entire property. Then, between 450 and 750 years ago, another lava flow surrounded but did not inundate the *pu‘u*. This lava flow is present on the southeast and southwest margins of the property.

The nearly 1,000-foot long shoreline frontage of the property generally has five bands: tidepools, a line of large, rounded boulders fronting a low, stepped cliff, behind which is a flattish pahoehoe shelf and then another ridge of boulders, *mauka* of which is the littoral cone and cinder deposits, with the hill highest on the southeast end and gradually disappearing towards the northwest, where conditions are low and swampy (see Figure 2).

Soil in the area is classified as Opihikao highly decomposed plant material. This well-drained, thin organic soil develops over pahoehoe bedrock. It is found from sea level to 1,000 feet in elevation and is rapidly permeable, with slow run-off and a slight erosion hazard. This soil is within subclass VIIs, which means it has limitations that make it unsuitable for cultivation and restrict its use to pasture, range, woodland or wildlife (U.S. Soil Conservation Service 1973).

The entire Island of Hawai‘i is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard as assessed by the U.S. Geological Survey in this area of Puna is zone 3 on a scale of ascending risk 9 to 1 (Heliker 1990:23). The relatively high hazard risk is because Kilauea is an active volcano. Zone 3 includes areas less hazardous than zone 2, which is adjacent to the summit and East Rift Zone (ERZ), because of greater distance from recently active vents and (or) because of topography. One to five percent of zone 3 has been covered since 1800, and 15 to 75 percent has been covered within the

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past 750 years. The property is within the higher-risk margin of zone 3, only about 1.5 miles from the loosely-defined boundary of zone 2.

For many centuries the area between Hawaiian Paradise Park and Hawaiian Beaches has not been threatened by lava, with the nearest lava flow in recent times about 2.5 miles to the southeast in June 1840. For another 150 years no lava flows threatened this area, until 2014, when a lava flow from Kilauea’s ERZ entered Pahoa and almost crossed the Kea‘au-Pahoa Highway. The flow stopped six miles upslope from the property, but the coastal area between Hawaiian Paradise Park and Hawaiian Acres could have been impacted had the eruption continued. On May 4, 2018, a 6.9 magnitude earthquake that occurred initiated one of the largest eruptive events in the last 150 years on the Island of Hawai‘i. By May 27, 2018, 24 fissures had erupted lava in the area between Leilani Estates and Noni Farms Road in the Puna District. In the three months that followed about two thousand residents were evacuated and seven hundred homes were destroyed or made uninhabitable. Businesses ranging from vacation rentals, farms and ranches, and tour operations were destroyed or precluded from operating. Also lost were long segments of three major County roads, the Kua O Ka La Public Charter School, Ahalanui Beach Park, a portion of Isaac Hale Beach Park, and the Wai ‘opae Marine Life Conservation District. Loss of access and subsequent lava damage caused the shutdown of Puna Geothermal Venture, which provided a substantial portion of the County’s electricity. Altogether, 13.7 square miles of land had been covered by the time the eruption had stopped spreading, and 845 acres of land had been added to the island. Although the 2018 lava flow did not approach closer than 5 miles of the Garrett property, it demonstrates the transformative power of a large eruption.

Moore and Trusdell’s map depicts eleven lava flows that have traveled northeast from the ERZ over the past 1,500 years; seven of these have reached the ocean – a total which now is eight. Radiometric dating and detailed mapping is inadequate to define quantitative recurrence intervals for eruptive activity on the ERZ, but that limited data does suggest that “on average”, lava flows travel northeast from that rift zone once every 140 years or so; flows have reached the coastline about every 200 years. Lava flows that have reached the coast are, however, relatively narrow, so that the odds that the Garrett property will be overrun by lava within the next few centuries are relatively low over the expected functional lifetime of the structure.

The Island of Hawai‘i experiences high seismic activity and is at risk from earthquake damage (USGS 2000), especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 2006 and the 6.9-magnitude quake of May 2018 demonstrated. The portion of the property site proposed for improvement is moderately sloped, on the landward side of the summit of the roughly 40-foot high littoral cone. There are appropriate setbacks to surrounding steeper slopes, with a minimum of about 212 to the shoreline shelf. There does not appear to be a substantial risk at the site from subsidence, landslides or other forms of mass wasting.

This area receives an average of about 120 inches of rain annually, with a mean annual temperature of approximately 75 degrees Fahrenheit (Giambelluca et al. 2014; UH Hilo-Geography 1998:57). Guidance to federal agencies for addressing climate change issues in environmental reviews was released in August 2016 by the Council on Environmental Quality (US CEQ 2016). The guidance urged that when

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addressing climate change, agencies should consider: 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and, 2) the effects of climate change on a proposed action and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate. Although this guidance has since been withdrawn for political reasons, the State of Hawai‘i in Hawai‘i Revised Statutes §226-109 and in Hawai‘i Administrative Rules §11-200.1 encourages a similar analysis. It is possible, and even likely, that larger and more frequent tropical storms and even hurricanes will affect the Hawaiian Islands in the future. In addition, as discussed in Section 3.1.2, accelerating sea level rise is expected.

Impacts and Mitigation Measures

In order to deal with the potential for larger and more frequent tropical storms that could be part of a changing climate, the home has been designed to withstand hurricane force winds, and Cook Island pine trees with the potential to be fall on the home are planned for removal. The implications of climate change for the shoreline setting are dealt with in the next section. In general, geologic conditions do not impose undue constraints on the proposed action, as much of the Puna District faces similar volcanic and seismic hazard and yet continues to be the fastest growing region of the State. The applicant understands that there are hazards associated with homes in this geologic setting and has made the decision that a residence is not imprudent to construct or inhabit.

3.1.2 Flood Zones and Shoreline Setting

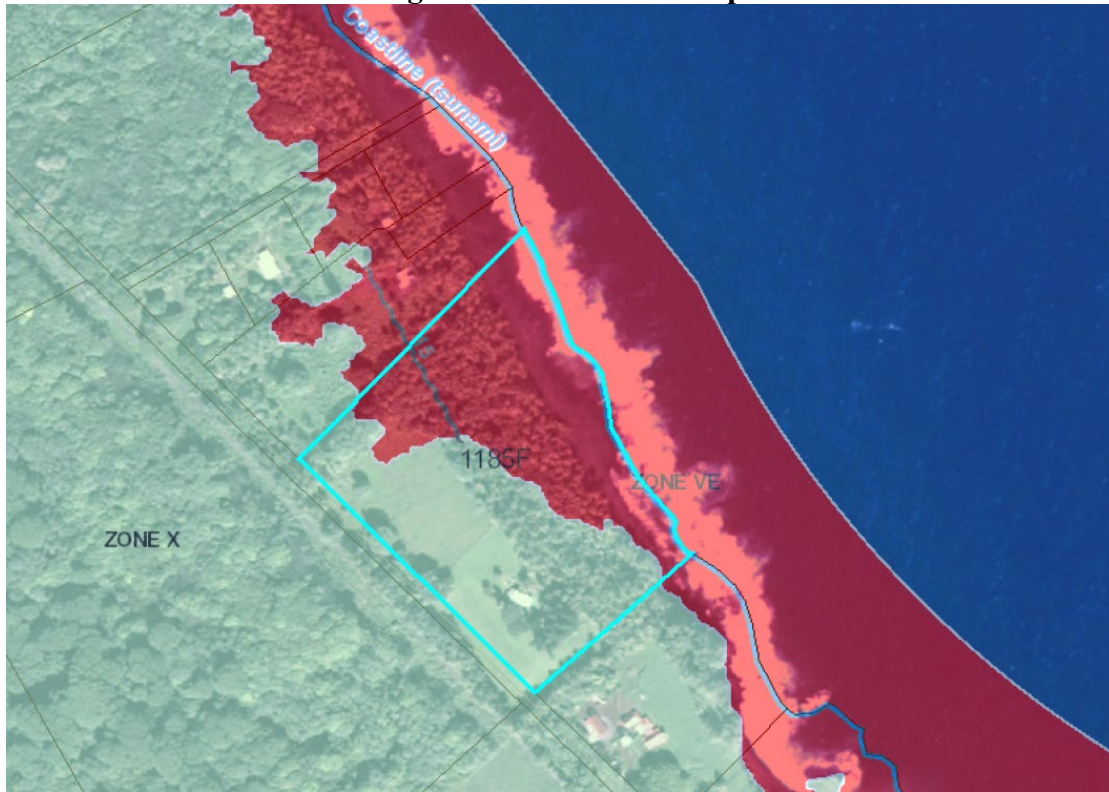
Floodplain Environmental Setting, Impacts and Mitigation Measures


Floodplain status for many areas of the island of Hawai‘i has been determined by the Federal Emergency Management Agency (FEMA), which produces the National Flood Insurance Program’s Flood Insurance Rate Maps (FIRM). The flood zones for this region were recently mapped, and digital maps are available from the Department of Land and Natural Resources at <http://gis.hawaiiinfip.org/fhat/> (Figure 4). Unfortunately, a systematic error of perhaps 50 feet in the registration of the TMK layer and the Google Earth © layer (clearly visible by examining the offset of the Government Road) affects direct interpretation of the map. In any case, the residence building site is classified in Flood Zone X, areas with minimal flood hazards, including tsunami inundation.

The proposed home site is located about 35 feet above sea level, about 212 feet back from the shoreline shelf, behind a tall littoral cone, in an area that is clearly out of the flood zone. The proposed home site is behind a high littoral cone and is completely outside the area affected by high waves and tsunami inundation. Although storm waves generated by Tropical Storm Iselle, which hit the Puna coastline on

Garrett Single-Family Residence and Farm at Maku'u Environmental Assessment

Figure 4. Flood Zone Map





Flood Hazard Assessment Report

www.hawaiiifip.org

Property Information



COUNTY: HAWAII
 TMK NO: (3) 1-5-010-009
 WATERSHED: KAAHAKINI
 PARCEL ADDRESS: 15-2145 GOVERNMENT BEACH ROAD
 KEAAU, HI 96749

Flood Hazard Information

FIRM INDEX DATE: SEPTEMBER 29, 2017
 LETTER OF MAP CHANGE(S): NONE
 FEMA FIRM PANEL: 1551661185F
 PANEL EFFECTIVE DATE: SEPTEMBER 29, 2017

THIS PROPERTY IS WITHIN A TSUNAMI EVACUATION ZONE: YES
 FOR MORE INFO, VISIT: <http://www.scd.hawaii.gov/>

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
 FOR MORE INFO, VISIT: <http://dinreng.hawaii.gov/dam/>

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

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

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND

(Note: legend does not correspond with NFHL)

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

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

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

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

OTHER FLOOD AREAS

	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase applies, but coverage is available in participating communities.
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Garrett Single-Family Residence and Farm at Maku‘u Environmental Assessment

Source: Hawai‘i DLNR: <http://gis.hawaiinfip.org/fhat/>

August 8, 2014, clearly affected the shoreline here, there were no effects to the proposed home site. Other than mega-tsunami of the type that would inundate all of Hilo and Honolulu, the home site is not at risk of tsunami. Mr. Garrett has chosen to locate the home about 212 feet from the shoreline on the *mauka* edge of the hill in order to completely avoid wave damage and minimize spray from waves. Furthermore, the very conservative siting of the home in this position at about 35 feet above sea level ensures that even when sea level rises five or more feet above its current level, the home will continue to remain well out of the effective flood zone (see sea level rise exposure area in Figure 5). Even extremely large rises in sea level of the type that would essentially require the relocation of much of downtown Hilo and Honolulu would not affect the home in its proposed location.

Coastal Erosion Issues: Background

Property near the shoreline is subject to natural coastal processes including erosion and accretion, which can be affected by human actions such as removal of sand or shoreline hardening. Erosion may adversely affect not only a lot owner’s improvements but also State land and waters, along with the recreational and ecosystem values they support.

Single Family Residential permitting in Conservation Districts in the State of Hawai‘i is regulated by State of Hawai‘i Administrative Rules governing Conservation Districts (Title 13, Subtitle 1 Chapter 5, adopted August 12, 2011). Applications to permit shoreline residential construction in the Conservation Districts must consider rates of coastal erosion. The State DLNR requires an estimate of annual erosion rate in the form of a Coastal Erosion Study for any property for which construction is proposed. Such a study integrates on-site quantitative measurements by a credentialed specialist, inspection of available aerial and satellite imagery taken over a period of time, and a review of geological literature.

A Coastal Erosion Study that also considered other coastal hazards was prepared for the property by T.E. Scheffler, Ph.D., and J.P. Lockwood, Ph.D. The full report is attached as Appendix 4 and summarized briefly below. The reader is referred to the report for additional detailed description, maps and photos.

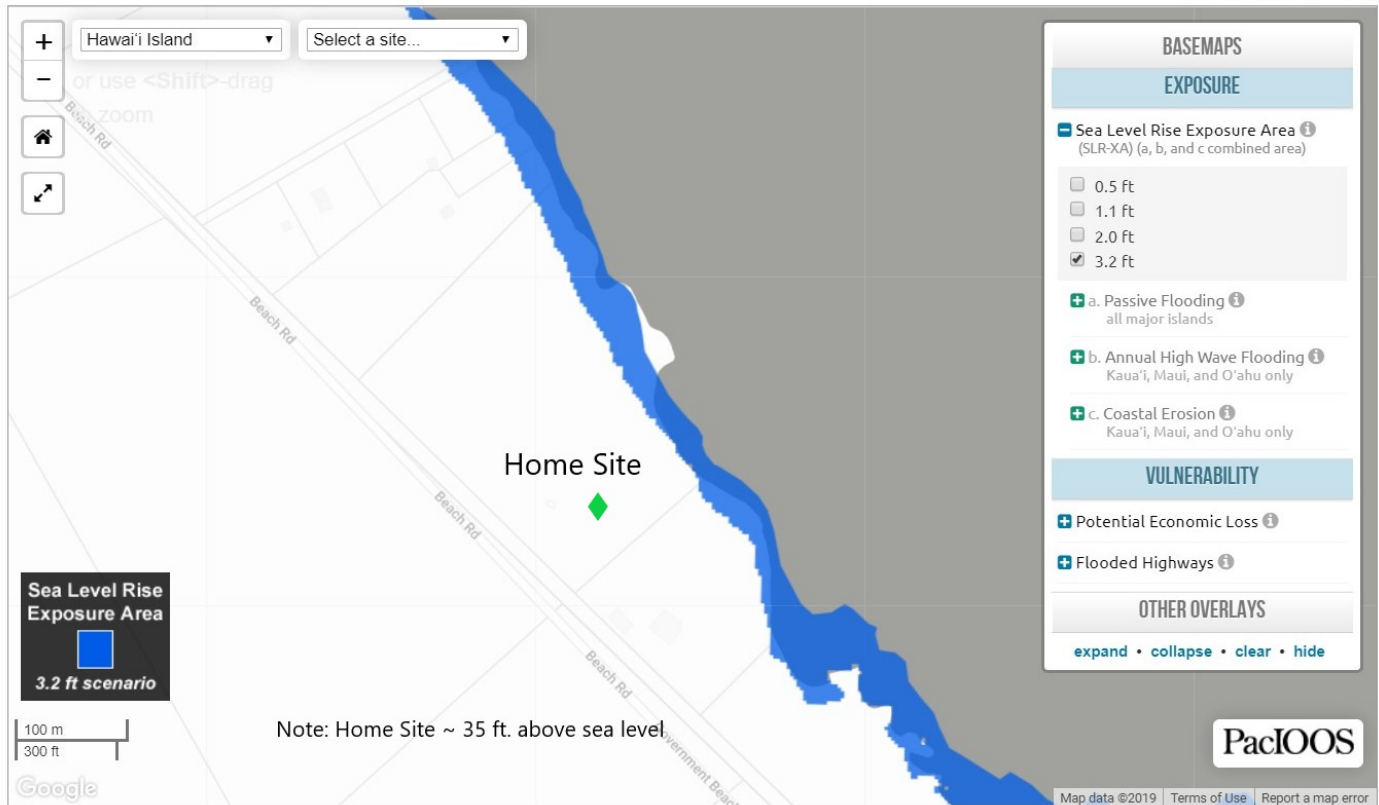
Sea Level Rise

Because the proposed use of a single-family residence on this coastal property has an expected useful lifetime of 40 to 70 years, it is important to first examine the potential for future sea level rise. Sea level rise also factors into future rates of coastal retreat and erosion.

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nations’ Intergovernmental Panel on Climate Change (UH Manoa Sea Grant 2014). Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. This will be accompanied by the warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. Wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. For Hawai‘i, where warming air temperatures are already quite apparent, not only is the equable climate at

risk but also agriculture, ecosystems, the visitor industry and public health.

Figure 5. Sea Level Rise Exposure Area



Source: <https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/>

An overall global (or eustatic, meaning not attributable to local factors) rise in sea level of 3.3 feet by the end of the 21st century was proposed by Fletcher (2010) and others. More recent scientific assessments (e.g., Rahmstorf et al. 2012) posit 4 feet as a reasonable upper bound. Some recent research that concentrates on the potential for Antarctic melting to contribute more to sea level than generally modeled envisions as much as an additional meter (3.3 feet) of sea level rise (DeConto and Pollard 2016). Not only the magnitude of sea level rise but also the timing is the subject of debate. According to the Hawai'i Climate Change Mitigation and Adaptation Commission (HCCMAC) (2017:v):

While the IPCC's "business as usual" scenario, where GHG emissions continue at the current rate of increase, predicts up to 3.2 feet of global sea level rise by year 2100 (IPCC 2014), recent observations and projections suggest that this magnitude of sea level rise could occur as early as year 2060 under more recently published highest-end scenarios...

The HCCMAC report goes on to state that the Island of Hawai'i is in many senses the least vulnerable of the main Hawaiian Islands to the impacts of sea level rise, but that certain areas – particularly Kona, Puakō, Kapoho and Hilo Bay ".....face serious threats. It is estimated that at least 130 existing structures

would experience chronic flooding if there were 3.2 feet of sea level rise.”

Relative sea-level rise is a result of the combined eustatic water rise and land subsidence. In some locations, the effects of eustatic sea level rise can be magnified substantially. The 1975 Kalapana earthquake on Kilauea’s rift caused land in Kapoho to drop 0.8 feet (based on Hawaiian Volcano Observatory (USGS) data in Hwang et al. (2007:6). This episodic, seismic-induced subsidence is difficult to estimate over human-scale time periods. On the basis of InSAR (Synthetic Aperture Radar Interferometry) remote sensing data, Hwang et al. (ibid.) state that the coastline at Kapoho may be subsiding at a continuous rate of between 0.31-0.67 in/yr. Rates of subsidence at the Garrett property are certainly much lower as a result of its distance from Kilauea’s tectonically active rift zone, as well as its position on the west side of the rift zone, where land is supported by the bulk of Mauna Loa. A rate in the middle of this estimate, or a little less than 0.5 in/yr., is probably conservative. A highly conservative estimate of overall sea level change by the year 2100, accounting for a eustatic rise of 5 feet and local tectonic sinking of about 3 feet, is 8 feet. The greatest rate of SLR will take place during the second half of this century according to recent modelling (e.g., Cazenave and Le Cozannet 2014).

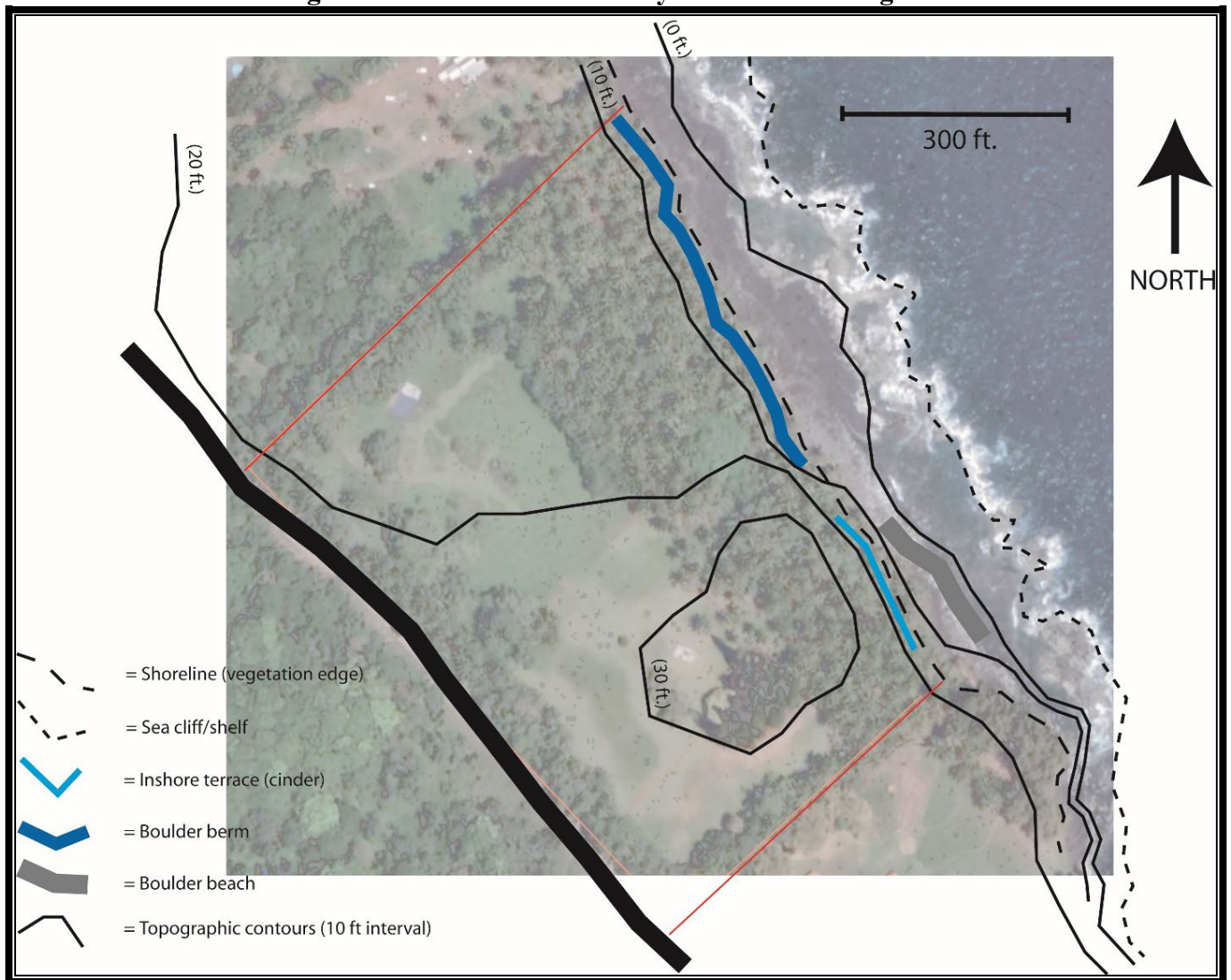
Coastal Erosion: Physical Setting

As discussed in Section 3.1.1, the coastline at the project site is typical of much of Puna. There are no perched sand beaches above the high tide line. The pahoe-hoe lava extends out 200 feet or more from the vegetation-defined shoreline and ends abruptly in deep water. This bench lies less than 3 feet above the waterline at high tide and contains numerous tide pools. The nearly 1,000-foot long shoreline in front of the property generally has five bands: tidepools, a line of large, rounded boulders fronting a low, stepped cliff, behind which is a flattish pahoe-hoe shelf and then another ridge of boulders, *mauka* of which is the littoral cone and cinder deposits, with the hill highest on the southeast end and gradually disappearing towards the northwest, where conditions are low and swampy. The northeastern part of the shoreline contrasts with the remainder. A boulder beach has formed on top of this bench at this end. In Figure 5a, the bench can be seen extending out from the “boulder beach” to a similar width, though it is now partially submerged.

The coast of this part of the Puna District faces the open ocean with no barrier of offshore reefs or bars. The submarine slope is approximately 1,300 feet/mile for a distance of roughly 6 miles, descending into the deepwater Puna Canyon. Large waves reaching the coast are predominantly related to trade wind conditions, though the shoreline is also somewhat exposed to North Pacific swells.

The shoreline is legally defined in Hawai‘i as “the upper reaches of the wash of the waves, other than storm and seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves, ...” (HAR §13-5-2). Because of the proposed home site’s long distance from the shoreline, and the presence of a 40-foot plus hill between the home site and shoreline, there should be no need to establish the exact position of the shoreline, but it can strongly be presumed to coincide with the clearly discernible edge of the naupaka/coconut/hala vegetation (see photos in Figure 5).

Figure 5. Coastal Erosion Study and Shoreline Figures



5a, Above: Shoreline features of property.

Figure 5. Coastal Erosion Study and Shoreline Figures



5b, Above: Boulder Beach, view west-northwest. 5c, Below: Sea Cliffs at southeast property corner, view south.



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Coastal Erosion Rate

Most shoreline studies in Hawai'i and elsewhere focus on erosion of "soft" coasts, for the obvious reasons that erosion rates are faster (sometimes over 3 feet per year) and thus more observable and consequential for human occupation. Andriati and Walsh (2007) studied the erosion of carbonate (limestone and low-grade marble) hard coast near Bari, Italy, and documented that the finer the crystallinity of the rock, the slower the rate of retreat. They established shoreline shift rates of 0.03-0.3 feet/year – as much as 4 inches/year. The conditions of the Garrett property are considerably different in terms of the relative crystallinity of the rock, its degree of fracturing, marine dynamics, climate, and other factors, but the work in Italy reinforces the observation that hard coasts are significantly more resistant to erosion.

As discussed above, the property shoreline is massively rocky and "hard" as opposed to unconsolidated and "soft", and by nature it resists erosion far more effectively than Hawai'i's beaches. Several key processes are at work contributing to erosion of this and all typical hard coasts. Wave energy impacting the cliff loosens masses of rock by compressing air within fractures, while the drag of moving water abrasively grinds smaller fragments at the shore. There is no way to definitively quantify the relative contributions of these processes, though it is reasonable to say that the energy released by wave action is probably the main cause of shoreline retreat at this locality.

Inspection of airphotos and digital aerial imagery of the property from 1954, 1965, and 2014 show no measurable change in position of the overall coastal sea cliff, tidepools, vegetation line or other features since the earliest 1954 photo. In fact, an argument for stasis can be made based on the general shape and configuration of the coast and shore. The same boulder beach is distinguishable, as is the wide coastal shelf. The large scale (limited resolution) of the airphotos makes quantitative analyses of fine-scale morphological changes of the sea cliff or vegetation positions impossible, and it is doubtful that horizontal changes of less than 10 feet could be detected. Simply calculating maximum erosion based on what the lack of resolution could be "hiding" yields potential maximum erosion rates of 2.2 to 3.8/inches per year, depending on the airphotos considered. Although methodologically defensible as a worse-case scenario, by definition they likely overestimate of the erosion on this hard coastline.

As an approximation of the erosion rate at this property is not statistically feasible using the methods often used for Hawai'i sand beaches as outlined by Hwang (2005), any shoreline determinations must rely upon alternative indicators. Using the framework and assumptions of the geological data presented in detail in Appendix 5, an independent evidence-based inference was made, with assumption that the littoral bench dates 750-1,500 before the present. If so, the width between what was the leading edge of lava flow when it formed and the current shoreline represents the sum total of erosion since the formation of the current coast. This width was measured digitally from current aerial imagery at ten locations along the property's ocean frontage, approximately every 100 feet, yielding widths of 195-242 feet. This geo-historical method results in an average annual erosion rate of about 2.58 inches per year.

It is important to stress that rate was anything but steady over the 1,500 years and constantly changed with conditions. The migration of the "shoreline" (berm) only began when the original sea cliff could be overtopped by waves. Sea level was 25-30 feet lower 1,750 years ago compared to today, and the coastal

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cliff would not have been overtopped and very little erosion would have occurred. Late Holocene sea level rise accelerated erosion by allowing ever more frequent overtopping of storm waves. The berm at the shoreline is a result of this cumulative process. If sea levels were to rise above the low coastal bench (another 3 feet, perhaps) it would have dramatic consequences for future erosion rates. It is thus important for predicting future erosion rates to factor in the sea level rise discussed above. For this particular geological setting, the coastal geologists determined that the durability and 12-foot height of the coastal sea cliff on the southeast corner of the property (where all improvements are proposed) ensures that combined sea level change and land subsidence will not cause significant shoreline transgression in this area, although it will slowly increase the erosive action of storm waves over the next several decades and centuries. The low-lying northwest corner behind the low coastal bench and protected only by the boulder berm will be subject to increasing inundation events – although that will not affect any aspect of the proposed action, which does not include any activities in that area.

Fletcher et al. 2002 Coastal Hazard Assessment of Property

Hwang (2005) recommended that all hazards facing coastal areas – not just erosion – should be considered when planning for zoning in Hawai‘i. In a USGS-sponsored study, Fletcher et al. (2002) portrayed generalized hazards assessments for long sections of Hawai‘i’s coastlines; the ratings of the specific hazards for the section of Puna coastline including the property are shown in Table 1. They considered overall hazards along this stretch of coastline as “high”, but these geologists critically re-evaluated the ratings as they apply to the individual property. Several of the hazard ratings are clearly much lower on the Garrett property because of its topography and elevation. First, no streams are present within about five miles, and the stream flooding hazard, rather than medium-high, is non-existent. Furthermore, there is, no indication or historic recording of the 1960 tsunami or any previous one overrunning the property. The higher ground of the littoral cone would mitigate some of these effects locally if such a tsunami were to occur. Similar observations were made concerning high waves. Coastal erosion for most of the property is also not a severe hazard, at least on a 50-year time scale. However, the high volcanic/seismic hazard would appear accurate.

Table 1. Natural Hazards Impacting Property Coastline

Hazard Type	Relative Threat	Fletcher et al. Rating (1-4)
Tsunami	Medium-high	4
Stream Flooding	Medium-high	4
High Waves	Medium-high	4
Storms	Medium-high	3-4
Erosion	Low	3
Sea Level Change	Medium-high	3-4
Volcanic/Seismic	High	4
Overall Hazard Assessment	High	6-7 (on scale of 1-7)

After Fletcher et al. 2002, p.150).

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Overall Assessment of Coastal Hazard: Impacts and Mitigation Measures

Although actual erosion of the property has been modest in the past, with an absolute maximum value of 2-3 inches per year, and an actual value that is likely less, several factors dictated a more conservative approach to location of the proposed residence with relationship to the sea cliff. First, global sea levels are rising, and the island is slowly subsiding, and if this proceeds relatively rapidly, within 80 years the current 12-foot plus tall sea cliffs may be only 4 feet or so in height. Furthermore, the frequency and severity of tropical storms is likely to increase due to warming oceans and climate change. These factors may increase the erosion “work” of the ocean and accelerate cliff retreat. More importantly, they will cause waves to overtop the cliff more frequently, with wash extending further back, causing the “shoreline” – the most *mauka* line of the annual wash of the waves – to retreat as well.

For these reasons, Mr. Garrett has chosen to locate the home about 35 feet above sea level, about 212 feet back from the shoreline shelf, behind a tall littoral cone, outside the flood zone. This will situate the residence and farm activities in a zone that should be safe for many decades, if not a century or more, under most future scenarios.

Although a scenario of modest sea level rise and tropical storm activity would likely not substantially affect the integrity or use of the proposed residence and continuing farming, worst-case increases, particularly in a case of sudden onset, could have some impact. If so, the Garrett property would be among tens of thousands of impacted properties in what would be the largest disaster to affect the Hawaiian Islands since human settlement. As sea level rise is gradual, there would probably be an opportunity for the owner to consider relocating or scrapping all structures for re-use of their valuable materials should sea level rise sufficiently to endanger the structure.

In order to ensure that the public interest in avoiding shoreline modification is safeguarded, the owner would agree to a CDUP and/or deed condition that would prevent any future request for shoreline hardening to protect the residence, regardless of hardship, and a condition requiring moving or dismantling the home if sea level rise eventually threatens the integrity of the structure.

3.1.3 Water Quality

The house would be set back a minimum of about 212 feet from the shoreline area and on the *mauka* side of the littoral cone, and no grading activities would occur *makai* of this area. No streams, springs, or anchialine ponds are found on or near the property, but a swampy/marshy wetland is present at the far northwest of the property, away from any current or proposed uses.

With home construction, the primary activity with potential to affect water quality is grading. Overall, the proposed improvements will require relatively little grading due to the careful design of the structures to fit the site, the use of the prior house foundation for the farm and utility shed and a realignment of the driveway approach to the house site, which has been planned to minimize the amount of grading required for the both carport foundation and driveway approach. Landclearing for construction activities would occur on an area of much less than a quarter of an acre. Other related site improvements would include the

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placement of the underground utilities lines connecting to the potable water and septic systems, the extension power and telecommunication lines to the house, and the replacement of the existing gate and fencing along the front of the property. Grading has been planned and will be conducted to balance cut and fill material for the graded area in order to avoid the need to import or export of soils from the site. Related to the trenching required for the septic system, extracted materials (spoils) will be used to refill the trenched areas and to blend the areas with the surrounding topography.

A County grading permit will be required. After actual grading plans are developed, the applicant will determine whether the area of disturbance is sufficiently large to require a National Pollutant Discharge Elimination System permit, although currently none is anticipated. Grading for the driveway and home site will include practices to minimize the potential for sedimentation, erosion and pollution of coastal waters. The applicant will ensure all earthwork and grading is conducted in conformance with:

- (a) "Storm Drainage Standards," County of Hawai'i, October, 1970, and as revised.
- (b) Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawai'i County Code.
- (c) Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
- (d) Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawai'i County Code.
- (e) Conditions of an NPDES permit, if required, and any additional best management practices required by the Board of Land and Natural Resources.

The applicant will require that the construction contractor implement the following practices:

- Minimizing the total amount of land disturbance required, which will be delineated to the construction contractor prior to the commencement of any onsite work. The *makai* limits of grading will be marked and fenced at the construction areas to avoid any possible disturbance to the ground or vegetation within *makai* area during construction activities.
- The contractor will take special precautions, including use of a dual-layer sedimentation control system in erosion prone areas, so as to not allow any sediment to leave the work areas, particularly towards the sea.
- Construction activities with the potential to produce potential stormwater run-off will not be allowed during periods of unusually heavy rains or storm conditions.
- Prior to the start of construction, contractors will implement erosion and dust control measures to prevent any sediment from leaving the construction areas, especially towards the ocean.
- Graded areas will be replanted or otherwise stabilized as soon as possible following grading activity.

No grading is required to continue farming. As evidenced by ethnographic work contained in Appendices 2 and 3, for at least the last sixty years, and more likely for the last seven centuries, farming has been conducted on the property, which has rich cinder soils from an old littoral cone. Taro, coconut, 'ape,

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breadfruit, avocado, mango and noni have all been harvested on the property and are still being cared for. Horses and sheep periodically graze on the pastures. The farm was well-known in the 1960s for growing watermelons, for which customers would drive all the way from Hilo. Continuing practices would include growing dryland taro at or near the existing taro patch, trimming existing fruit trees, planting new fruit trees, and continuing to feed and provide care for horses, sheep, chickens and perhaps several milk cows. Trees and other crops will be planted in individual holes to minimize the need for ground disturbance, and any soil removed to plant trees will be piled up around the tree saplings. All farming and grazing will be conducted on the *mauka* half of the property, which generally slopes away rather than towards the ocean from a prominent ridge that runs through the center of the property. This reduces runoff and erosion concerns, as the farming occurs in what is essentially a shallow basin. If at some time in the future farming involves grubbing or grading, Mr. Garrett would work with the U.S. Natural Resources Conservation Service to become a cooperator in order to ensure the best soil conservation practices. If, at that time, implementation of the soil conservation practices required a Conservation District Use Permit or other approvals, he would apply for the permit and await approvals before conducting the activities.

Mr. Garrett will utilize Best Management Practices (BMPs) formulated through consultation of the University of Hawai'i-Manoa, College of Tropical Agriculture and Human Resource's *Best Management Practices to Manage Non-Point Pollution in Agriculture* (Abbas and Fares 2009). These include short-term practices meant to control erosion and sedimentation related to ground-disturbing activities. He will also incorporate long-term practices related to soil management through cultivation practices that minimize tillage, add organic material to the soils and establish ground covers. When trees are planted, holes will be dug rather than grading or tilling the area for cultivation. Existing ground cover will be maintained to the greatest degree feasible. Because of the high precipitation, no irrigation will be required, although some hand watering of new plantings may be occasionally needed. Nutrients will be managed by regulating and monitoring their application of nutrients to the soil according to the specific crop nutrient requirements. Nutrient management will also include selecting and using the appropriate organic manure amendments, which can help stabilize soils while reducing the need for chemical nutrients. Pests will be managed through integrated pest management stressing pest-resistant crops, biological control, removal and eradication of pests, and, only where necessary, safe and effective storage, handling and application of pesticides.

In summary, the general shoreline area from Hawaiian Paradise Park to the Papaya Farms area already supports hundreds of homes several homes and is utilized by residents and property owners to park vehicles and fish, and there are no reported water quality problems from these uses. Upon its completion, the home, along with continuing farming operations, would appear similar to the homes, pastures, gardens and orchards on shoreline lots in the area, and they would be not expected to contribute to sedimentation, erosion, and pollution of coastal waters.

3.1.4 Flora and Fauna

Environmental Setting: Flora

Prior to the advent of commercial agriculture, ranching, and lot subdivision, the natural vegetation of this part of the Puna shoreline, with its substrate of geologically recent lava and littoral cones, was mostly coastal forest and strand vegetation. It was dominated by naupaka (*Scaevola taccada*), hala (*Pandanus tectorius*), ‘ōhi‘a (*Metrosideros polymorpha*), nanea (*Vigna marina*) and various ferns, sedges and grasses (Gagne and Cuddihy 1990).

The entire Garrett property was systematically inspected for plants by Dr. Ron Terry in March and April 2019. As visible on the aerial and ground photos in Figure 2, many decades of use for farming and grazing has left the *mauka* half of the property as an intermittently woody pasture, with numerous fruit trees and weedy trees, shrubs, herbs and grasses, and crops such as taro and squash. ‘Ōhi‘a is no longer present, and aside from hala, no native trees are to be seen. The *makai* half of the property consists of a coconut and hala forest with an understory of ferns, sedges and grasses. There is a narrow band of truly shoreline vegetation constricted by the dense coconut and hala forest and consisting of naupaka and mau‘u ‘aki‘aki (*Fimbristylis cymosa*). In one roughly 50-foot long, 10-foot wide area on the northeastern shoreline are a number of clumps of *Ischaemum byrhone*, a State and federally listed endangered grass known to grow on pahoe-hoe close the edge of sea cliffs, where salt spray may limit other plants. The grass is found only in the Hilo and Puna Districts of the Big Island. Interestingly, the grass is found in an area that is frequently trodden by fishermen traveling up and down the coast; despite the trampling it receives, the tough, clumpy grass has survived and even thrived. Nevertheless, it is important to take steps to ensure the conservation of this population, as discussed under mitigation below. A full list of species detected on the property itself is found in Table 2. Aside from *Ischaemum byrhone*, all native plants found on the property are very common in the region, on the island, and throughout the Hawaiian Islands.

Environmental Setting: Fauna

During several visits in 2019, we observed Japanese white-eyes (*Zosterops japonicus*), cattle egrets (*Bubulcus ibis*), domestic chickens (*Gallus gallus domesticus*), common mynas (*Acridotheres tristis*), northern cardinals (*Cardinalis cardinalis*), spotted doves (*Streptopelia chinensis*), striped doves (*Geopelia striata*) and house finches (*Carpodacus mexicanus*).

The only native bird seen was the kolea or Pacific golden-plover (*Pluvialis fulva*), a migratory bird common on both shorelines and pastures from late August to late April. Other migratory shorebirds such as ruddy turnstone (*Arenaria interpres*) and wandering tattler (*Heteroscelus incanus*) often seen feeding on the Puna coastline are likely to be present *makai* of the Garrett property. The seabird black noddy (*Anous minutus melanogenys*) flies near cliffs over nearshore waters. It nests in crevices and caves in lava (especially pahoe-hoe) sea cliffs; no black noddy nests were observed on the low cliffs in front of the property. The Hawaiian Goose or nēnē (*Branta sandvicensis*) is an endemic, federally-listed endangered species that has been observed in many locations in Puna. Nēnē breeding season generally runs October through March, with most goslings hatching in December and January. Eggs have been reported in all

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Table 2. Plant Species Observed on Property

Scientific Name	Family	Common Name	Life Form	Status*
<i>Ageratum conyzoides</i>	Asteraceae	Ageratum	Herb	A
<i>Ageratum houstonianum</i>	Asteraceae	Ageratum	Herb	A
<i>Alocasia macrorrhizos</i>	Araceae	'Ape	Shrub	PI
<i>Aloe vera</i>	Agavaceae	Aloe	Shrub	A
<i>Araucaria columnaris</i>	Araucariaceae	Cook Pine	Tree	A
<i>Artocarpus altilis</i>	Moraceae	Breadfruit	Tree	A
<i>Axonopus compressus</i>	Poaceae	Wide-leafed Carpet Grass	Grass	A
<i>Bacopa monnieri</i>	Plantaginaceae	'Ae'ae	Herb	I
<i>Begonia sp.</i>	Begoniaceae	Begonia	Herb	A
<i>Catharanthus roseus</i>	Apocynaceae	Madagascar Periwinkle	Shrub	A
<i>Cecropia obtusifolia</i>	Cecropiaceae	Cecropia	Tree	A
<i>Centella asiatica</i>	Apiaceae	Asiatic Pennywort	Herb	A
<i>Chamaecrista nictitans</i>	Fabaceae	Partridge Pea	Herb	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden Spurge	Herb	A
<i>Christella dentata</i>	Thelypteridaceae	Cyclosorus	Fern	A
<i>Citrus sp.</i>	Rutaceae	Citrus	Tree	A
<i>Clidemia hirta</i>	Melastomataceae	Koster's Curse	Herb	A
<i>Clusia rosea</i>	Clusiaceae	Autograph Tree	Tree	A
<i>Colocasia esculenta</i>	Araceae	Taro	Shrub	A
<i>Cocos nucifera</i>	Arecaceae	Niu	Tree	PI
<i>Commelina diffusa</i>	Commelinaceae	Honohono	Herb	A
<i>Cordyline fruticosa</i>	Agavaceae	Ti	Shrub	A
<i>Crotalaria sp.</i>	Fabaceae	Rattlepod	Herb	A
<i>Cynodon dactylon</i>	Poaceae	Bermuda Grass	Grass	A
<i>Cyperus javanicus</i>	Cyperaceae	'Ahuawa	Sedge	I
<i>Cyperus halpan</i>	Cyperaceae	Cyperus	Sedge	A
<i>Cyperus polystachyos</i>	Cyperaceae	Pycrus	Herb	I
<i>Desmodium tortuosum</i>	Fabaceae	Florida Beggarweed	Herb	A
<i>Desmodium triflorum</i>	Fabaceae	Tick Clover	Herb	A
<i>Dieffenbachia seguine</i>	Araceae	Dumb Cane	Herb	A
<i>Digitaria ciliaris</i>	Poaceae	Digitaria	Herb	A
<i>Eleusine indica</i>	Poaceae	Goose Grass	Grass	A
<i>Emilia sonchifolia</i>	Asteraceae	Pualele	Herb	A
<i>Epipremnum pinnatum</i>	Araceae	Pothos	Vine	A
<i>Erechtites valerianifolia</i>	Asteraceae	Fireweed	Herb	A
<i>Ficus microcarpa</i>	Moraceae	Banyan	Tree	A
<i>Fimbristylis cymosa</i>	Cyperaceae	Mau'u 'Aki'aki	Herb	I
<i>Fimbristylis dichotoma</i>	Cyperaceae	Fimbristylis	Herb	I
<i>Hippobroma longiflora</i>	Campanulaceae	Star of Bethlehem	Herb	A
<i>Ischaemum byrone</i>	Poaceae	Hilo Ischaemum	Herb	END
<i>Ipomoea triloba</i>	Convolvulaceae	Little Bell	Vine	A
<i>Kyllinga brevifolia</i>	Cyperaceae	Kyllinga	Herb	A
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Lepisorus thunbergianus</i>	Polypodiaceae	Pakahakaha	Fern	I

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Table 2, continued				
Scientific Name	Family	Common Name	Life Form	Status*
<i>Macaranga mappia</i>	Euphorbiaceae	Macaranga	Shrub	A
<i>Macaranga tanarius</i>	Euphorbiaceae	Macaranga	Tree	A
<i>Mangifera indica</i>	Anacardiaceae	Mango	Tree	A
<i>Megathyrsus maximus</i>	Poaceae	Guinea Grass	Grass	A
<i>Melochia umbellata</i>	Sterculiaceae	Melochia	Tree	A
<i>Monstera deliciosa</i>	Araceae	Monstera	Vine	A
<i>Morinda citrifolia</i>	Rubiaceae	Noni	Tree	
<i>Nephrolepis cordifolia</i>	Nephrolepidaceae	Sword Fern	Fern	I
<i>Nephrolepis multiflora</i>	Nephrolepidaceae	Sword Fern	Fern	A
<i>Oplismenus hirtellus</i>	Poaceae	Basketgrass	Herb	A
<i>Oxalis corniculata</i>	Oxalidaceae	Yellow Wood Sorrel	Herb	I
<i>Paederia scandens</i>	Rubiaceae	Maile Pilau	Vine	A
<i>Pandanus tectorius</i>	Pandanaceae	Hala	Tree	I
<i>Paspalum conjugatum</i>	Poaceae	Hilo Grass	Herb	A
<i>Paspalum urvillei</i>	Poaceae	Paspalum	Herb	A
<i>Persea americana</i>	Lauraceae	Avocado	Tree	A
<i>Pluchea carolinensis</i>	Asteraceae	Sourbush	Shrub	A
<i>Phymatosorus grossus</i>	Polypodiaceae	Laua‘e	Fern	A
<i>Pseuderanthemum carruthersii</i>	Acanthaceae	Purple Pseuderanthemum	Shrub	A
<i>Psidium cattleianum</i>	Myrtaceae	Strawberry Guava	Tree	A
<i>Psidium guajava</i>	Myrtaceae	Guava	Tree	A
<i>Sacciolepis indica</i>	Poaceae	Glenwood Grass	Herb	A
<i>Scaevola taccada</i>	Goodeniaceae	Beach Naupaka	Shrub	I
<i>Scleria testacea</i>	Cyperaceae	Scleria	Herb	I
<i>Senna occidentalis</i>	Fabaceae	Coffee senna	Herb	A
<i>Sesuvium portulacastrum</i>	Aizoaceae	‘Akulikuli	Herb	I
<i>Sida rhombifolia</i>	Malvaceae	Broom Weed	Herb	A
<i>Spathoglottis plicata</i>	Orchidaceae	Philippine Ground Orchid	Herb	A
<i>Sphagneticola trilobata</i>	Asteraceae	Wedelia	Shrub	A
<i>Sporobolus africanus</i>	Poaceae	Smutgrass	Herb	A
<i>Syzygium malaccense</i>	Myrtaceae	Mountain Apple	Tree	A
<i>Terminalia catappa</i>	Combretaceae	False Kamani	Tree	A
<i>Tournefortia argentea</i>	Boraginaceae	Tree Heliotrope	Tree	A
<i>Trema orientalis</i>	Ulmaceae	Gunpowder Tree	Tree	A
<i>Vigna marina</i>	Fabaceae	Nanea, Beach Pea	Vine	I

A=Alien E=Endemic I=Indigenous PI= Polynesian Introduction END=Federal and State Listed Endangered

When nēnē are not breeding, they rejoin flocking groups. Goslings may be present in the nest for several months after hatching (U.S. Fish and Wildlife Service 2004; 2012). No nēnē were observed on the property but the grass there may attract birds to rest or even nest.

Native forest birds would be not expected at the project site due to its low elevation, alien vegetation and lack of adequate forest resources. However, it is not inconceivable that a few Hawai‘i ‘amakihi

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(*Hemignathus virens*) are sometimes present, as some populations of this native honeycreeper appear to have adapted to the mosquito-borne diseases of the Hawaiian lowlands. However, the ‘ōhi‘a trees with which these birds are commonly significantly associated are not present on or near the property.

As with all of East Hawai‘i, several endangered native terrestrial vertebrates may be present in the general area and may overfly, roost, or utilize resources of the property. These include the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the endangered Hawaiian petrel (*Pterodroma sandwichensis*), the endangered band-rumped storm petrel (*Oceanodroma castro*), and the threatened Newell’s shearwater (*Puffinus auricularis newelli*). In addition, the formerly endangered Hawaiian hawk (*Buteo solitarius*) hunts in all portions of Puna, including the coastal areas, although no suitable nesting trees are present.

Aside from the bat, other mammals in the project area are all introduced species, including the horses (*Equus ferus caballus*) and sheep (*Ovis aries*) that graze the property, and feral cats (*Felis catus*), feral pigs (*Sus scrofa*), small Indian mongooses (*Herpestes a. auropunctatus*) and various species of rats (*Rattus* spp.) that wander in and out. Several species of non-native reptiles and amphibians may also be present. A green anole (*Anolis carolinensis*) was seen during the survey, and the highly invasive coqui frog (*Eleutherodactylus coqui*) is nearly universal in lowland Puna. None of the feral animals are of conservation concern and all are deleterious to native flora and fauna.

The coastal and marine fauna and flora are typical of the high-energy coasts of Puna, which are young ecosystems with limited coral growth but a variety of algae, fish and invertebrates. Marine mammals and reptiles, some of them endangered, also visit the Puna coastal waters.

Impacts and Mitigation Measures

Other than *Ischaemum byrhone*, no rare, threatened or endangered plant species are present. The project site is dominated by alien vegetation. Because of the location and nature of the project relative to sensitive vegetation and species, construction and use of the single-family residence as well as continuing farming are not likely to cause adverse biological impacts.

The shoreline vegetation on the *makai* half of the property, where several common native strand plants are present mixed with the Polynesian-introduced coconut, will not be affected in any way, although non-disturbing cultural uses associated with Mr. Garrett’s friends may occur in the coconut/hala forest. However, it is important to further protect the endangered native grass *Ischaemum byrhone* from trampling by passing fishermen as well as any visitors to the Garrett home who might not be aware of the sensitivity of the grass. Mr. Garrett proposes to encircle the grass patches with rock curbs (one or two courses or dry-stack rock high). This simple and unobtrusive measures has been found successful in encouraging those walking along the shoreline to utilize a path around rather than on top of the grass.

The precautions for preventing effects to water quality during construction listed in Sections 3.1.1 and 3.1.6 will reduce adverse impact on aquatic biological resources in coastal waters to negligible levels.

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In order to avoid impacts to the endangered but regionally widespread terrestrial vertebrates listed above, the applicant will commit to several mitigation measures. Specifically, construction will refrain from activities that disturb or remove shrubs or trees taller than 15 feet between June 1 and September 15, when Hawaiian hoary bats may be sensitive to disturbance. Although it is highly unlikely that Hawaiian hawks nest on the property, if any tree cutting occurs between the months of March and September, inclusive, a pre-construction hawk nest search by a qualified ornithologist using standard methods will be conducted. If Hawaiian hawk nests are present, no landclearing will be allowed until October, when hawk nestlings will have fledged. Although no exterior lighting is planned other than a low light emitting security light, the applicant agrees to shield any exterior lighting from shining upward, in conformance with Hawai‘i County Code § 14 – 50 et seq., to minimize the potential for disorientation of seabirds. months except for May, June, and July. The applicant will ensure that no nēnē will be harassed during construction or occupation of the residence. If nēnē nests are found, DLNR-DOFAW will be contacted.

3.1.5 Air Quality, Noise, and Scenic Resources

Environmental Setting

Air quality in the area is generally excellent, due to its rural nature and minimal degree of human activity, although vog from Kilauea volcano is occasionally blown into this part of Puna when this volcano is erupting, which it currently is not. Noise on the site is low and is derived from natural sources (such as surf, birds and wind) due to the very rural nature of the area.

The area shares the quality of scenic beauty along with most of the Puna coastline. The County of Hawai‘i General Plan contains Goals, Policies and Standards intended to preserve areas of natural beauty and scenic vistas from encroachment. The General Plan discusses the black sand beaches and tidal ponds as noted features of natural beauty in Puna, as well as views of Mauna Kea and Mauna Loa. Among specific examples of natural beauty the Plan does not identify any features or views in the *ahupua‘a* of Maku‘u, in Plat 1-5-010, or any other location near the project site. Shoreline views from the Government Beach Road are completely blocked by topography and vegetation, but the hill on which the former home stood and the new home will be built are visible from the road.

Impacts and Mitigation Measures

The project would not affect air quality or noise levels in any substantial ways. Brief and minor adverse effects would occur during construction. However, there are virtually no sensitive noise receptors in the vicinity – with no houses or other structures within 300 feet of the proposed home site. Given the small scale and short duration of any noise impacts, coupled with the lack of sensitive receptors, noise mitigation would not be necessary.

Because all grading and construction would occur, at the closest, about 212 feet from the shoreline, atop the back end of a littoral cone, the residence would be barely visible from the shoreline or the sea. The home would be visible above the 6-foot solid metal corrugated panel fence through existing hedgerow trees from 250 feet away on the Government Beach Road but would not be visually intrusive. In any case,

it would occupy the same location as a home that was present for five decades. No adverse visual impacts would occur. The ongoing farming would continue to offer pleasant pastoral scenery that for many decades has been a hallmark of the drive past the property. Exterior lighting will consist of one or two low light emitting fixtures using blue-deficient filtered LED lights with a Correlated Color Temperature (CCT) of 2700 Kelvin or less, shielded to protect dark skies and transiting seabirds. The overall effect would be a landscape in harmony with the rural landscape of Puna.

3.1.6 Hazardous Substances, Toxic Waste and Hazardous Conditions

Based on onsite inspection and the lack of any known former and current uses on the property, it appears that the site contains no hazardous or toxic substances and exhibits no other hazardous conditions. In addition to the measures related to water quality detailed in Section 3.1.3, in order to ensure to minimize the possibility for spills of hazardous materials, the applicant proposes the following:

- Unused materials and excess fill (if any) will be disposed of at an authorized waste disposal site.
- During construction, emergency spill treatment, storage, and disposal of all hazardous materials, will be explicitly required to meet all State and County requirements, and the contractor will adhere to “Good Housekeeping” for all appropriate substances, with the following instructions:
 - Onsite storage of the minimum practical quantity of hazardous materials necessary to complete the job;
 - Fuel storage and use will be conducted to prevent leaks, spills or fires;
 - Products will be kept in their original containers unless unresealable, and original labels and safety data will be retained;
 - Disposal of surplus will follow manufacturer’s recommendation and all regulations;
 - Manufacturers’ instructions for proper use and disposal will be strictly followed;
 - Regular inspection by contractor to ensure proper use and disposal;
 - Onsite vehicles and machinery will be monitored for leaks and receive regular maintenance;
 - Construction materials, petroleum products, wastes, debris, and landscaping substances (herbicides, pesticides, and fertilizers) will be prevented from blowing, falling, flowing, washing or leaching into the ocean; and
 - All spills will be cleaned up and properly disposed of immediately after discovery.

3.2 Socioeconomic and Cultural

3.2.1 Land Use, Socioeconomic Characteristics and Recreation

Existing Environment

Because of the gradual occupation of lots developed during widespread land subdivision about sixty years ago, the Puna District has been the Big Island’s fastest-growing district over the last thirty years. Population as measured in the 2010 U.S. Census was 45,326, a 66 percent increase over the 2000 count of 27,232. Despite the lava hazards and a lack of basic infrastructure such as paved roads and water in most subdivisions, the relatively inexpensive lots, which typically range in size from one to three acres, have

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attracted residents from the U.S. mainland and other parts of the State of Hawai‘i who seek affordable property. The basis of the economy of Puna has evolved from cattle ranching and sugar to diversified agriculture, various services for the growing populations, commuting to Hilo, and tourism, which has been stimulated by being home to Kilauea, one of the world’s most active volcanoes. Some Puna subdivisions between Pahoa and Hilo (including Hawaiian Beaches and Hawaiian Shores, both near the project site), are now partially bedroom communities for Hilo’s workforce, as evidenced by the heavy flow of Hilo-bound traffic during the AM rush hour.

The Garrett property is bordered by the shoreline to the north, by the Government Beach Road to the south, and by occupied 5-acre home lots to the east and west. Across and along the Government Beach Road are various farms, cattle pastures and single-family homes.

Puna experiences a high demand for coastal recreation, especially in calmer shorelines areas near population centers. Despite the long coastline, there are few beaches in Puna, and none in the vicinity of the project site. In most location in Puna, ocean recreation consists primarily of fishing from the cliffs, and there is some use of the shoreline in this general area. Maps of public accesses produced by the County of Hawai‘i do not indicate any nearby official *mauka-makai* shoreline public accesses from the Government Beach Road (<https://www.hawaiicounty.gov/departments/planning/shoreline-access/puna>). However, from an informal access located about a half-mile to west, many Puna residents visit a set of tidepools known as Auwae, and from there they may walk west back into Hawaiian Paradise Park or east to the shoreline that fronts the Garrett property. All along this coast they may fish, pick *opihi*, gather *limu*, or if they are highly skilled, dive on calm days. The project site does not have an official shoreline trail but it is readily accessible (see photos in Figure 5) and the current and former owners have always welcomed access in front of the property.

Impacts and Mitigation Measures

No adverse socioeconomic impacts would result from the project. The project will have a very small positive economic impact for the County of Hawai‘i. The residence and associated improvements will not adversely affect recreation, as access along the shoreline will not be hindered. The proposed residential and farming uses will not interfere with this continuing use. Mr. Garrett is fully familiar and welcomes the rights of the public to utilize these areas and the cultural and subsistence importance of these practices and expects that conditions ensuring continued public access along the front of the property will be codified within the Conservation District Use Permit to make the access situation explicit.

3.2.2 Cultural and Historic Resources

An archaeological inventory survey and a cultural impact assessment were prepared for the property and are attached as Appendices 2 and 3, respectively. Research for this report included primary fieldwork, consultation of archaeological and ethnographical studies and primary documents including maps and Mahele testimony, and consultation of informants. In the interest of readability, the summary below does not include all scholarly references; readers interested in extended discussion and sources may consult these appendices. Separately, the Office of Hawaiian Affairs, the Lower Puna Councilperson, the Sierra

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Club, Malama O Puna and four neighbors were also consulted as part of the EA to determine whether they had any information on natural or cultural resources that might be present or affected, and additional research on cultural resources and impacts was conducted.

Historical and Cultural Background

The first inhabitants of Hawai‘i were believed to be settlers who had undertaken difficult voyages across the open ocean. For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai‘i were underway by A. D. 300, although recent work suggests that Polynesians may not have arrived in Hawai‘i until at least A. D. 1000 (Kirch 2012).

The initial inhabitants of Hawai‘i are believed to have come from the southern Marquesas Islands and settled initially on the windward side, eventually expanding to leeward areas. Early Hawaiian farmers developed new strategies and tools for their new environment (Kirch 2012; Pogue 1978). Societal order was maintained by their traditional philosophies and by the conical clan principle of genealogical seniority (Kirch 2012). Universal Polynesian customs brought from their homeland included the observance of major gods *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge, various beliefs, and the concepts of *mana* and the *‘aumakua* (Fornander 1969).

The Development Period, believed under Kirch’s new concept to have occurred from A. D. 1100 to 1350, brought an evolution of traditional tools, including a variation of the adze (*ko‘i*), and some new Hawaiian inventions such as the two-piece fishhook and the octopus-lure breadloaf sinker. That was followed by the Expansion Period (A. D. 1350 to 1650) which saw greater social stratification, intensive land modification, and population growth. This period was also the setting for the second major migration to Hawai‘i, this time from Tahiti. Also established during this period was the *ahupua‘a*, a land-use concept that incorporated all of the eco-zones from the mountains to the shore and beyond. The usually wedge-shaped *ahupua‘a* provided a diverse subsistence resource base (Hommon 1986) and added another component to what was already becoming a well-stratified society (Kirch 2012).

As population grew during the following centuries so did the reach of inland cultivation in the upland environmental zones and consequent political and social stresses. During the Proto-Historic Period (A. D. 1650-1795), wars reflective of a complex and competitive social environment are evidenced by *heiau* building. During this period, sometime during the reign of Kalaniopu‘u (A. D. 1736-1758), Kamehameha I was born in North Kohala.

Ahupua‘a were ruled by *ali‘i ‘ai ahupua‘a* or lesser chiefs and managed by a *konohiki*. *Ali‘i* and *maka‘ainana*, or commoners, were not confined to the boundaries of *ahupua‘a* as resources were shared when a need was identified. *Ahupua‘a* were further divided into smaller sections such as *‘ili*, *mo‘o‘aina*, *pauku‘aina*, *kihapai*, *koele*, *hakuone* and *kuakua*. The chiefs of these land units have their allegiance to a territorial chief or *mo‘i* (literally translated as king) (Hommon 1986). The Garrett property is located within the *ahupua‘a* of Maku‘u, which translates literally as “canoe end pieces” (Pūku‘i et al. 1974), in the traditional *moku-o-loko* or district of Puna, which comprises some fifty *ahupua‘a* on the eastern/

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windward shores of Hawai‘i Island. As Maku‘u encompasses *mauka* agricultural and forest resources and *makai* fisheries, residents were once able to procure nearly all that they needed to sustain their families and contribute to the larger community from within the land division.

The Pre-Western contact population of the Puna District lived in small settlements along the coast where they subsisted on marine resources and agricultural products. As McGregor stated in reference to the lava flows that periodically alter the district, “Puna is where new land is created and new growth and new life sprout. The new land is sacred, fresh, clean, and untouched. After vegetation begins to grow upon it, it is ready for human use.” (2007:145). The villages of Puna, McEldowney notes, were similar to those of the Hilo District, and they:

...comprised the same complex of huts, gardens, windbreaking shrubs, and utilized groves, although the form and overall size of each appear to differ. The major differences between this portion of the coast and Hilo occurred in the type of agriculture practiced and structural forms reflecting the uneven nature of the young terrain. Platforms and walls were built to include and abut outcrops, crevices were filled and paved for burials, and the large numbers of loose surface stones were arranged into terraces. To supplement the limited and often spotty deposits of soil, mounds were built of gathered soil, mulch, sorted sizes of stones, and in many circumstances, from burnt brush and surrounding the gardens. Although all major cultigens appear to have been present in these gardens, sweet potatoes, ti (*Cordyline terminalis*), noni (*Morinda citrifolia*), and gourds (*Lagenaria siceraria*) seem to have been more conspicuous. Breadfruit, pandanus, and mountain apple (*Eugenia malaccensis*) were the more significant components of the groves that grew in more disjunct patterns than those in Hilo Bay. (McEldowney 1979:17)

Located along the coast, the property is within the Coastal Settlement Zone (Zone I) as modeled by McEldowney (1979:15-18), where families often lived clustered around sheltered bays (McEldowney 1979). In their refinement of the model as it applies to Puna, Burtchard and Moblo (1994) elaborate on McEldowney’s concept of the Coastal Settlement Zone:

As with her model, [the Coastal Settlement Zone] includes coastal terrain to about one half mile inland. This is the zone expected to have the greatest density and variety of prehistoric surface features in the general study area. Primary settlements are expected in places where agriculturally productive sediments (principally well-weathered ‘a‘ā flows) co-occur with sheltered embayments and productive fisheries. Settlements within this zone are expected to be logistically linked to inland agricultural and forest exploitation zones accessed through a network of upslope-downslope (*Mauka-makai*) trails. Larger settlements and resource acquisition areas may have been connected by cross-terrain trail networks (1994:26).

In addition to the agricultural resources listed above, the barrenness of surrounding lava flows was not a limiting factor for the cultivation of sweet-potato or ‘uala, which requires practically no soil to flourish. Its propagation is discussed in detail by many nineteenth and early twentieth century visitors to the district, who described seeing the ‘uala growing from mounds of lava stones. In the following passage, published under the title “Hawaii-Nei” in *Harper’s Magazine*, Charles Nordhoff (1873a:382-402)

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described the vegetation of Puna and mention early commercial coffee production in the district. Nordhoff also provided observations of the narrow coastal trail “across unceasing beds of lava” that “was actually hammered down to make it smooth enough for travel” in some places (1873a:401). According to Nordhoff, “most of the lava is probably very ancient, though some is quite recent, and ferns and guava bushes and other scanty herbage grow through it” (ibid.). Nordhoff’s narrative continued:

...after a descent to the sea-shore, you are rewarded with the pleasant sight of groves of cocoa-nuts and umbrageous arbors of pandanus, and occasionally with a patch of green. Almost the whole of the Puna coast is waterless...

It will surprise you to find people living among the lava, making potato patches in it, planting coffee and some fruit trees in it, fencing in their small holdings, even, with lava blocks. Very little soil is needed to give vegetation a chance in a rainy season, and the decomposed lava makes a rich earth. But, except the cocoa-nut, which grows on the beach, and seems to draw its sustenance from the waves, and the sweet-potato, which does very well among the lava, nothing seems really to thrive. (ibid.).

In another installment titled “Hawaii-Nei-II”, Nordhoff (1873b:544-559) wrote of the lack of fresh water in Puna and how Dr. Coan had told him about how Native Hawaiians collected freshwater for his use during his missionary tour “from the drippings of dew in caves” (1873b:550). For, “wells are here out of the question, for there is no soil except a little decomposed lava, and the lava lets through all the water which comes from rains” compounded by the lack of mountain streams (ibid.). Nordhoff also presented the following observations of the communities in Puna as well as traditional sweet potato planting methods:

There are no fields, according to our meaning of the word. Yet formerly the people in this district were numbered by thousands: even yet there is a considerable population, not unprosperous by any means. Churches and schools are as frequent as in the best part of New England. Yet when I asked a native to show me his sweet-potato patch he took me to the most curious and barren-looking collection of lava you can imagine, surrounded too, by a very formidable wall made of lava, and explained to me that by digging holes in the lava where it was a little decayed, carrying a handful of earth to each of these holes, and planting there in a wet season, he got a very satisfactory crop. Not only that, but being desirous of something more than a bare living, this man had planted a little coffee in the same way, and had just sold 1600 pounds, his last crop. (ibid.)

Although *‘uala* was cultivated widely, Handy et al. said that it did not appear to have been a staple food of Puna, a district “most famous for its breadfruit” (1991:190). Handy opined:

. . . Despite the fact that sweet potatoes were planted almost universally and many patches are still maintained, the Puna natives seem to regard this vegetable with little interest, probably because Puna people prided themselves upon and relished their breadfruit, and also because potato was nowhere and at no time the staple for this rainswept district. (1940:165)

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Breadfruit (*'ulu*) was a *kinolau* (physical manifestation) of the goddess Haumea, the “patron of childbirth,” and the principal staple food of Puna, where it was most famous (Beckwith 1970:283; Handy et al. 1991). Careful and gentle propagation was required, which entailed the removal and replanting of the root sucker cutting while ensuring it remained within its original, undisturbed soil casing. With respect to *'ulu* as a sustainable food source, Handy et al. explained that, “except in Puna, Hawaii, breadfruit was wholly secondary to taro and sweet potato as a staple. I am told that in Puna in a good year, breadfruit may be eaten for 8 months of the year, beginning with May” (1991:152).

Although *'ulu* appears to have been the preferred source of sustenance for residents of Puna, taro (*kalo*) rivaled it as a staple food source. Puna's lack of flowing streams made growing wetland *kalo* impossible. Despite this freshwater stream deficit, Puna received plentiful rainfall throughout the year, which made the cultivation of dryland *kalo* possible, even along the coast as far north as Hilo (Handy 1940). Handy et al. related that, “the wet and sometimes marshy pandanus forests from Kapoho through Poho-iki to 'Opihikao used to be planted with taro in places” (1991:541). The method of planting dryland taro in the lowland forests of Puna is described by Handy et al. as the “*pa-hala* (pandanus clearing) method” (1991:104) and was advantageous for it did not require the constant weeding necessitated in better soils. The Pa-hala planting process is as follows:

Make holes in the *'a 'a* (broken lava) by taking out some of the stones. Be sure that the place chosen is in a *pu hala* grove, to save the labor of hauling *hala* branches into the patch later on. Fill the hole with whatever weeds can be found and leave them there for six weeks or more. The weeds will rot and make soil. When the weeds have rotted away, the taro *huli* are wrapped in *lau hala* (*hala* leaves) to keep them moist and are planted. When there or four leaves have appeared on each *huli*, then that is the time to cut down the *pu hala* to let in the sun. The branches of the *hala* are cut off and the patch covered with them until this is not a trace of the taro to be seen. This is left until sufficiently dry to set on fire. The fire does not hurt the taro much as the *huli* are already well rooted. The *hala* reduced to ashes, give the taro the needed nourishment and they grow so tall that a man can be hidden under their leaves (Handy et al. 1991:104–105).

Hala was valued for its fragrance and harvested for more utilitarian purposes. The inhabitants of Puna were recognized for their skilled *lauhala* (*hala* leaf) weaving. The dried leaves were used to plait *lauhala* mats for thatching onto house rafters and walls in a method typically employed in Puna and the neighboring district of Hilo in the absence of *pili* grass. Plaited *lauhala* was also used for pillows, fans, floor coverings, canoe sails, baskets, and occasionally as clothing (Handy et al. 1991). According to Fornander (1918-1919), two styles of *lauhala* mats were associated with Puna; the *makali 'i*, a braided, small-stranded mat, and the *puahala* or *hīnano*, made from the male *hala* blossom. The latter was highly valued, and “...is only made in Puna where the *hala* tree is very abundant. It is a regular article of trade among the natives who greatly prize it as a choice mat to sleep on” (Summers 1999:17). *Hala* had many other significant uses and came to be identified with the people of Puna.

In addition to *hala*, *kalo*, *'ulu*, and *ti* mentioned above, other crops such as coconut (*niu*) and *'awa* were cultivated in Puna. *Niu* thrived in coastal Puna and is frequently mentioned in historical accounts. With respect to varieties, Handy et al. (1991) list only two: the *niu hiwa* (particularly used for ceremony,

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medicine, and cooking), and the *niu lelo* (used primarily for nonreligious purposes). Water from the *niu* was palatable and flavorful. It could also be utilized on a spiritual level by priests practicing divination. The raw meat was edible and could be scraped out of the shell with a large ‘*opihi* to be eaten as is or incorporated into the preparation of various sweets including *haupia* (*haukō*), *kūlolo*, and *pi‘epi‘e ‘ulu*. Besides being utilized for human consumption, coconut meat could also be used to feed animals.

Puna was a region famed in legendary history for its associations with the goddess Pele and god Kāne. Because of the relatively young geological history and persistent volcanic activity, the region has a strong association with Pele. However, the connection to Kāne is perhaps more ancient. Kāne, ancestor to both chiefs and commoners, is the god of sunlight, fresh water, verdant growth, and forests. It is said that before Pele migrated to Hawai‘i from Kahiki, Puna was esteemed the most beautiful place in the islands by many. Contributing to that beauty were the groves of fragrant hala and forests of ‘*ōhi‘a lehua* for which Puna was famous. The inhabitants of Puna were likewise famous for their expertise and skill in *lauhala* weaving.

Many ‘*ōlelo no ‘eau* (traditional sayings) speak of Puna, and most mention the land – which could at any time be covered in inky lava left in Pele’s furious wake – and the air, which was sweetly scented with the heavenly fragrances of *hala*, *maile*, and *lehua* blossoms. The following ‘*ōlelo no ‘eau* are from Mary Kawena Pūku‘i (1983):

Ka makani hali ‘ala o Puna.

The fragrance-bearing wind of Puna

Puna, Hawai‘i, was famed for the fragrance of *maile*, *lehua*, and *hala*. It was said that when the wind blew from the land, fishermen at sea could smell the fragrance of these leaves and flowers. (p. 158)

Ke one lau‘ena a Kāne.

The rich, fertile land of Kāne.

Puna, Hawai‘i, was said to have been a beautiful, fertile land loved by the god Kāne. Pele came from Kahiki and changed it into a land of lava beds, cinder, and rock. (p.191)

The fragrant breezes of Puna were also celebrated in Hawaiian *mele* (songs). One such mele, *Ke Ha‘a Lā Puna i ka Makani*, accompanied the very first recorded *hula* of the Pele and Hi‘iaka saga (Kanahele and Wise 1989). A tale of jealousy and spite is recounted in the legend *Hopoe the Dancing Stone*, published by Westervelt (1916). Pele called upon each of her sisters to fetch her dream lover Lohi‘au from Kaua‘i. Knowing Pele’s tempestuous temper, each feared possible repercussions and refused to go. After being denied by all but one sister, Pele rumbled her home, the volcano, sending out burning smoke and vapors, impatiently beckoning her very last option. Hi‘iaka did so, leaving behind her dear friend Hōpoe, a skilled and graceful hula dancer who had spent much time teaching Hi‘iaka old Hawaiian hula. Before Hi‘iaka could return, Pele’s impatient fury caused her to shake the earth with great ferocity and heaved her lava in a torrent of devastation, annihilating Hi‘iaka’s ‘*ōhi‘a lehua* forest, obliterating all of Puna, and finally cornering Hōpoe as she lingered by the sea:

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Hopoe was the last object of Pele’s anger at her younger sister, but there was no escape. The slow torrent of lava surrounded the beach where Hopoe waited death. She placed the garlands Hiiaka had loved over her head and shoulders. She wore the finest skirt she had woven from lauhala leaves. She looked out over the death-dealing seas into which she could not flee, and then began the dance of death. (Westervelt 1916:94)

In her death, Hōpoe was transformed. She was reborn as a stone, carefully balanced alongside the sea where she could continue her graceful dance throughout the centuries when touched by the soft breeze or the rumbling of the earth. And Hi‘iaka, her heart bitter with her sister’s betrayal, brought Lohi‘au back to Pele, faithfully as she swore she would.

Many other stories, chants and songs deal with legendary events in Puna that still bring meaning to the landscape today. Some of them dealt with *‘aumakua*, which are certain animals, trees, flowers, insects, and natural phenomena who were half god and half human and communicated through mediums, possessed by their spirits. Of special significance are *‘aumakua manō* (shark deities) who are frequently worshipped in Hawai‘i.

A traditional *mo‘olelo* (story), “The Heart Stirring Story of Ka-Miki” (*Kaao Hooniua Puuwai no Ka-Miki*), originally appeared in *Ka Hoku o Hawai‘i* (a Hawaiian language newspaper) between 1914 and 1917. The story tells of two supernatural brothers, Ka-Miki and Maka-‘iole, who were skilled *‘ōlohe* (competitors/fighters) and their travels around Hawai‘i Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *‘ōlohe*. Among several tales involving Puna, during an expedition through the uplands, Ka-Miki and Maka-‘iole encountered a man named Pōhakulua who was intensely working on a large *koa* log. They were headed to Kea‘au but had lost their way. They stopped and asked Pōhakulua for directions, but he was startled by the unexpected appearance of the brothers and replied impolitely. Taunts were exchanged between the two parties, which led to a physical altercation. It was at this point, that Pōhakulua realized that these two men were extraordinarily skilled as well as spiritually protected, and he admitted his defeat. Pōhakulua wished to prepare a meal and drink of *‘awa* with his newfound friends, and solicited the help of his brother in law, an *‘ōlohe* chief named Kapu‘euhi. However, Kapu‘euhi had plans of his own. He intended to compete with and conquer the brothers but was defeated by them instead. Kapu‘euhi was infuriated by his defeat, and by Pōhakulua’s refusal to aid in retaliation against Ka-Miki and Maka-‘iole.

Kapu‘euhi invited the brothers back to his house to partake in a meal and a particularly potent type of *‘awa*, scheming to get them drunk. Unbeknownst to Ka-Miki and Maka-‘iole, this was common practice for Kapu‘euhi, who often housed weary travelers, intoxicated them with *‘awa*, then killed them and stole their belongings. Kapu‘euhi waged a bet with the brothers; if they couldn’t drink five cups of the *‘awa*, then he would throw them out and they would be at the mercy of the Puna forest. Ka-Miki and Maka-‘iole agreed and counteracted his bet with one of their own; if they were able to drink five cups, they would throw Kapu‘euhi out of his own house. The brothers prayed and chanted to their ancestral goddess and were able to consume the entire quantity of *‘awa* without getting drunk. As agreed upon, Kapu‘euhi was thrown out. Stunned, and angered that he was thwarted once again, Kapu‘euhi requested assistance from Kaniahiku (a much feared Puna *‘ōlohe* and forest guardian) and her grandson Keahialaka. “At that time,

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Keahialaka was under the guardianship of Pānau and Kaimū, and he enjoyed the ocean waters from Nānāwale to Kaunaloa, Puna” (*Ka Hoku o Hawai‘i* October 28, 1915; translated by Maly 1998:20), which Maly suggests is symbolic of controlling those regions.

Together, Kapu‘euhi and Kaniahiku conspired to lead the brothers deep into the Puna forest, where Kaniahiku would be able to murder them, all the while maintaining the façade that they were taking them to the ‘awa grove of Mauānuikananuha. Once Ka-Miki and Ka-‘iole were well within the domain of Kaniahiku, she created a dark and murky environment, spreading gloomy mists and an overgrowth of twisted vegetation intended to ensnare the brothers. Ka-Miki and Maka‘iole were overcome, and left for dead by Kapu‘euhi, who made his way back to safety, led by Kaniahiku’s sister. They prayed to their ancestor, Ka-uluhe-nui-hihi-kolo-i-uka for help. All at once, her presence became apparent, and the brothers were able to continue on to the ‘awa grove. Another attempt by Kaniahiku to kill the brothers was made, but Ka-uluhe’s protection over them was too strong, and she failed (Maly 1998).

The subject *ahupua‘a* of Maku‘u is specifically mentioned in the *Legend of Halemano*, the tale of a romance between Halemano of O‘ahu and the beautiful and forbidden princess Kamalālāwalu (Kama) of Puna (Fornander 1918-1919:234). Kama lived under a strict *kapu* that kept her from leaving her home or having visitors and companionless except for her brother Kumukahi. Her parents had promised her as the wife of either the Hilo or the Puna King upon reaching maturity. Instead, Kama became untied with a young man from O‘ahu named Halemano through his learning of her in his dreams and sailing a canoe across to Puna with gifts for her and her brother, Kumukahi, who could act as an intermediary.

After these different things were ready they set out for Puna, Hawaii. Upon their arrival off of Makuu and Popoki, two small pieces of lands next to Puna, the kite was put up. When the people on the shore saw this flying object they all shouted with joy (ibid.)

Their shouting drew Kumukahi out onto the beach where he became enthralled by the gifts he saw there, according to plan. Since Kama could not refuse her dear brother’s wishes, she agreed to come down to the beach and eventually onto Halemano’s canoe, and the pair were paddled off to O‘ahu.

Traditional life in Hawai‘i took a sharp turn on January 18, 1778 with the arrival of British Capt. James Cook in the islands. On a return trip to Hawai‘i ten months later, Kamehameha visited Cook aboard his ship the *Resolution* off the east coast of Maui and helped Cook navigate his way to Hawai‘i Island. Cook exchanged gifts with Kalaniopu‘u at Kealahakua Bay the following January and then attempted to leave Hawai‘i in February. However, his ship then sustained damage to a mast in a severe storm off Kohala and returned to Kealahakua, setting the stage for his death on the shores of the bay.

During the Proto-Historic Period there was a continuation of the trend toward intensification of agriculture, *ali‘i*-controlled aquaculture, settling of upland areas and development of traditional oral history. The *Ku* cult, *luakini heiau* and the *kapu* system were at their peaks, but the influence of western civilization was being felt in the introduction of trade for profit and a market-system economy. By 1810, the sandalwood trade established by Europeans and Americans twenty years earlier was flourishing. That

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contributed to the breakdown of the traditional subsistence system, as farmers and fishermen were required to toil at logging, which resulted in food shortages and a decline in population.

The rampant sandalwood trade resulted in the first Hawaiian national debt, as promissory notes and levies granted by American traders were enforced by American warships. The assimilation of western ways continued with the short-lived whaling industry to the production of sugarcane, which was more lucrative but carried a heavy environmental price.

Following the death of Kamehameha I in 1819, the customary relaxing of *kapu* took place. But with the introduction of Christianity shortly thereafter, his successor, Kamehameha II, renounced the traditional religion and ordered that *heiau* structures either be destroyed or left to deteriorate. The family worship of ‘aumakua images was allowed to continue.

In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawai‘i scouting communities in which to establish church centers for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal (Ellis 1963). His writings contain descriptions of residences and practices elsewhere in Puna that are applicable to the general project area:

The population in this part of Puna, though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is usually shallow.

We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their *po‘e* [*poi*] and sweet potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea coasts of the north and south parts of the island.

Besides what is reserved for their own subsistence, they cure large quantities as an article of commerce, which they exchange for the vegetable productions of Hilo and Mamakua [Hāmākua], or the mamake and other tapas of Ora [‘Ōla‘a] and the more fertile districts of Hawaii.

Ellis and the ABCFM missionaries travelled along the coast of Kauwai, Wa‘awa‘a, and Nānāwale Ahupua‘a and then turned *mauka* toward a village in Honolulu Ahupua‘a (Ellis 2004:294). On August 8, 1823, the Ellis and the missionaries left Honolulu and visited the village of Waiakahiula to the southeast of the project site. Ellis’ journal provides a brief first-hand description of the village’s location relative to the coast:

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We arose early on the 8th, and Mr. Thurston held morning worship with the friendly people of the place [Honolulu]. Although I had been much indisposed through the night, we left Honoruru soon after six a.m. and, travelling slowly towards the sea-shore, reached Waiakeheula about eight, where I was obliged to stop, and lie down under the shade of a canoe-house near the shore. Messrs. Thurston and Bishop walked up to the settlement about half a mile inland, where the former preached to the people... (Ellis 2004:295).

After preaching, Bishop continued on alone toward Waiakea, while Thurston returned to fetch Ellis from the canoe shed. Upon reaching the village, Ellis found its residences to be interspersed among the agricultural fields rather than in a single, nucleated settlement:

The country was populous, but the houses stood singly, or in small clusters, generally on the plantations, which were scattered over the whole country. Grass and herbage were abundant, vegetation in many places luxuriant, and the soil, though shallow, was light and fertile. (Ellis 2004:296)

A year after Ellis' visit, in 1824, the ABCFM established a base church in Hilo. From that church (Haili), the missionaries traveled to the more remote areas of the Hilo and Puna Districts. David Lyman, who came to Hawai'i in 1832, and Titus Coan, who arrived in 1835, were two of the most influential Congregational missionaries in Puna and Hilo. As part of their duties they conducted a census of the areas within their missions. In 1835, 4,800 individuals were recorded as residing in the district of Puna; the smallest total district population on the island of Hawai'i. In 1841, Titus Coan stated that most of the 4,371 recorded residents of Puna lived near the shore, though hundreds also lived inland.

In 1835, the United States Exploring Expedition under the direction of Commander Charles Wilkes toured Hawai'i Island and travelled through the Puna District. Wilkes produced a map of Puna, which illustrates the coastal trail but shows only a large "Pandanus Forest" covering the lands *mauka* of the Garrett property (see Figure 8 of Appendix 2). Wilkes described the trail between Hilo and Nānāwale (Nanavalie) as follows:

In some places they have taken great pains to secure a good road or walking path; thus, there is a part of the road from Nanavalie to Hilo which is built of pieces of lava, about four feet high and three feet wide on the top; but not withstanding this, the road is exceedingly fatiguing to the stranger, as the lumps are so arranged that he is obliged to take a long and short step alternately; but this the natives do not seem to mind, and they pass over the road with great facility, even when heavy laden...(Wilkes 1856, Vol. IV:188-193).

The *Mahele 'Aina* took place in 1848, placing all land in Hawai'i into three categories: Crown Lands, Government Lands and Konohiki Lands. Ownership rights were "subject to the rights of the native tenants," or those individuals who lived on the land and worked it for their subsistence and for their chiefs. As a result of the *Māhele*, Maku‘u, along with the immediately adjacent *ahupua‘a* of Pōpōkī and Hālonā, were retained as Government Lands in their entirety (Charvet-Pond and Rosendahl 1993:C-2). In addition, the Commissioners of Boundaries (Boundary Commission) never certified the boundaries of

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Maku‘u Ahupua‘a, which is why it is so often grouped with the neighboring *ahupua‘a* of Pōpōkī and Hālonā. These three *ahupua‘a* were generally not depicted individually on maps; in literature, all three are commonly referenced together as a single unit called Maku‘u. Very few *kuleana* claims were made during the Māhele for Puna, mostly owing to rapid depopulation from disease and migration, and none were made for *kuleana* within Maku‘u Ahupua‘a (Waihona ‘Āina database).

In conjunction with the Māhele ‘Āina of 1848, the King authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the “Enabling Act,” which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the Māhele should be set aside and sold as grants. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the Māhele, to purchase lands of their own. Despite this goal, many of the Government Lands were eventually sold or leased to foreigners. Between 1852 and 1855, coastal portions of Pōpōkī, Maku‘u and Hālonā *ahupua‘a* were divided and sold as fee simple Land Grants (see Figure 6 of Appendix 2). Grant 1013 was sold to D. Maiau in 1852; Grant 1014 to Kea in 1852; and Grant 1537 to Kapohano(a) in 1855. The Garrett property is situated within the eastern coastal portion of Grant 1537, which was crossed by the *alanui aupuni* or government road (Maly 1999:67). Around the time that Grant 1014 was sold, Puna’s population had suffered a sharp drop. Within a quarter of a century, Puna’s population declined by more than half, from 4,800 in 1835 to 2,158 in 1860 (Anderson 1865). In 1868 volcanic activity emanating from Mauna Loa volcano devastated Hawai‘i Island with lava flows, earthquakes and a tsunami. This transformed the landscape of the southern part of island forever, and further contributed to the depopulation in Puna. Even with this disaster, however, transportation infrastructure in the project area continued to improve in order to serve the growing commercial sugar, timber and coffee operations in Puna. The Puna District population fell further to a mere 1,043 in 1878 and reached an unsurpassed low of 944 persons by 1884 (Thrum 1885 and 1886).

Post-Māhele historical accounts of Puna were generally authored by visitors to the Hawaiian Islands and mostly take the form of travelogues. Such accounts include those of the famous travelers Mark Twain and Isabella Bird, as well as lesser known authors such as Henry Whitney, George Chaney and John Roy Musick. These writings demonstrate a considerable transformation from the almost exclusive traditional native subsistence strategies discussed in earlier chronicles to a new way of life. Many mention the Government Beach Road, which evolved from earlier trail routes and was under construction as a true road by the 1840s. The road remained the preferred route of travel between Hilo and the outlying areas of Puna until 1895, when the Kea‘au-Pāhoa Road (now Highway 130) was established to access the growing inland population centers and agricultural areas (Maly 1999:6). A small settlement at Maku‘u reached after traveling through miles of hala groves is frequently mentioned.

By 1900 Puna was on the verge of major economic growth, spurred by the sugar and lumber industries. The rise and fall of these industries can be traced along the rusted railroad tracks that litter the landscape *mauka* of the property. In 1899, the ‘Ōla‘a Sugar Company began operating around Kea‘au. The directors of the company realized early that the lack of cargo transportation facilities would hinder their success. As a result, they organized the Hilo Railroad Company and, on April 8, 1899, were granted a 50-year charter (Best 1978). The railroad’s infrastructure developed quickly. Rail service to ‘Ōla‘a (Kea‘au) from Hilo

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began on June 18, 1900. Puna Sugar Company, located near the village of Kapoho, had been organized within the Puna District earlier that same year. Puna Sugar had cane fields scattered all over lower Puna from Kapoho to Pāhoa Town itself. Coastal Maku‘u’s thin, sticky, acidic soils, however, did not allow sugar cane cultivation. The scattered geography of suitable agricultural lands in Puna also hindered the growth of the sugar industry. As with ‘Ōla‘a Sugar’s early Kea‘au operations, the lack of a reliable transportation system made it expensive to collect and transport the cane from the scattered fields to the mill. So, when Hilo Railroad proposed to lay four miles of track from Kapoho to Pāhoa, the Puna Sugar Company paid for half the cost. By March 1, 1902, the Hilo Railroad was making regular stops at the ‘Ōla‘a Sugar Mill, the town of Pāhoa, and in lower Puna. By 1905 the harvests of the Puna Sugar Co. were being ground at the ‘Ōla‘a Mill, and the Puna Sugar Co. was operating as a division of the ‘Ōla‘a Sugar Co. (Dorrance and Morgan 2000). The railroad in this area lasted until 1948. The route of the railroad across Maku‘u is still found on County tax maps, about two miles *mauka* of the Garrett property.

A constant through all these eras of history is that the well-developed Hawaiian traditions of fishing and collecting food from the ocean continue to be practiced. This orientation to the shoreline and the traditional practices developed in Hawai‘i are still passed down from generation to generation. Many fishermen catch *pūhi* to fish for ‘*ulua* along the cliffs of Puna. Whether they use a hand-line or rod and reel, they use knowledge and techniques of past fishermen to select fishing locations, proper bait, and technique. Fishermen throw net, fish by rod and reel, or spear fish at different locations along the shoreline including the Maku‘u area to catch specific fish such as *āholehole*, ‘*āweoweo*, *kala*, *kole*, *kūmū*, *manini*, *mamo*, *moana* and many other types of fish. In addition, the traditional collection of ‘*ōpihi*, ‘*a‘ama*, and *limu* along the rocky shoreline is still practiced. Others fish by boat out of Hilo for *akule*, *kawele‘ā*, *mahimahi*, *ono*, ‘*ōpakapaka*, and other species. Traditional Hawaiian fishing practices, shoreline gathering practices, and ocean access are protected by State law. A former resident of the Garrett property, Mrs. Mary Ann Kamahale, recalled in an interview that a few hundred yards to the east of the property was Opunaha, a canoe landing spot, as well as Kula, a *ko‘a* (fishing ground) where *āholehole* were caught (Ewart and Luscomb 1974).

During the mid-1960s, the lands to the southeast and northwest of the project site were subdivided into the Hawaiian Beaches, Hawaiian Parks, and Hawaiian Shores subdivisions. In recent years several residences have been constructed along the coast in the Maku‘u area within the subdivided parcels of the former grant properties.

The historic and cultural investigations of the property benefitted greatly from the fact that descendants of the Kamahale family, who acquired the property over a century ago, have provided much information and assisted Mr. Garrett in his goals of building a home and honoring the legacy of the property. The oldest of these family members still vividly recall when the area was still isolated and traditional agriculture and fishing (as well as more modern techniques) were vital to making a living here.

Land Grant 1014 purchased by the Kea family was subdivided and what is now the Garrett property was purchased by the Kamahale-Kamoe family in the early 20th century. Frank Kamahale and Ann Kamahale (née Kamoe) had eight children including Ulrich “Sonny” Kamahale. The family was living on the property when Ann passed away and she and other Kamoe family members are buried in a family plot

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(State Inventory of Historic Places [SIHP] Site 50-10-45-18987)¹ on the property. Sonny (April 15, 1923-November 6, 2002) lived on the property and grew produce there until he passed away. Sonny’s house (the foundation of which is Site 7476) and the property were later sold after Sonny passed away. The home burned down in 2014 during Tropical Storm Iselle and is no longer present on the property.

In order to gain insight into cultural resources and practices as well as archaeological sites, consultation with seven members of the Kamahele family (including Richard Ha) was conducted at the property on Saturday April 27, 2019. In addition, SCS Senior Archaeologist Glenn Escott spoke to Sheldon Kamahele at an earlier date on the property. Richard Ha has also written several posts on his family blog describing Uncle Sonny Kamahele and his watermelon farm at Maku‘u. Detailed information of the consultations and posts is contained in Appendices 2 and 3 and summarized here. All of the family members remembered the property well, especially Uncle Sonny’s house and farm, as many had frequently visited him on his farm from the time they were very young, when road access was circuitous and the trip took many hours. Mr. Ha, whose maternal grandmother was Sonny’s sister, wrote the following in a January 2017 blog post:

When we were small kids, Pop took us in his ’51 Chevy to visit. He turned left just past the heart of Pāhoa town, where the barbershop is today. We drove down that road until he hit the railroad tracks, and then turned left on the old railroad grade back toward Hilo. A few miles down the railroad grading was the old Maku‘u station. It was an old wooden shack with bench seats, as I recall. That is where the train stopped in the old days. A road wound around the pāhoehoe lava flow all the way down the beach to Maku‘u. That was before there were the Paradise Park or Hawaiian Beaches subdivisions.

We did not know there was a district called Maku‘u; we thought the family compound was named Maku‘u. Of the 20-acre property, maybe 10 acres consisted of a kipuka where the soil was ten feet deep. The 10 acres on the Hilo side were typical pāhoehoe lava. The property had a long oceanfront with a coconut grove running the length of the oceanfront. It was maybe 30 trees deep and 50 feet tall.

The old-style, two-story house sat on the edge of a slope just behind the coconut grove. If I recall correctly, it had a red roof and green walls. Instead of concrete blocks as supports for the posts, they used big rocks from down the beach.

There was no telephone, no electricity and no running water. So when we arrived it was a special occasion. We kids never, ever got as welcome a reception as we got whenever we went to Maku‘u.

The person who was always happiest to see us small kids was tutu lady Meleana, my grandma Leihulu’s mom. She was a tiny, gentle woman, maybe 100 pounds, but very much the matriarch of the family. She spoke very little English but it was never an issue. We communicated just fine.

¹ All SIHP historic sites referenced in this EA are contained within the Makuu Quadrangle of the Island of Hawai‘i in the State of Hawai‘i, which is designated by the code 50-10-45; henceforth in this EA, site numbers omit this code)

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We could not wait to go down the beach. Once she took us kids to catch ‘ohua—baby manini. She used a net with coconut leaves as handles that she used to herd the fish into the net. I don’t recall how she dried it, but I remember how we used to stick our hands in a jar to eat one at a time. They were good.

She would get a few ‘opihi and a few haukeuke and we spent a lot of time poking around looking at this sea creature and that.

Between the ocean in the front and the taro patch, ulu trees, bananas and pig pen in the back, there was no problem about food. I know how Hawaiians could be self-sufficient because I saw it in action.

The house was full of rolls of stripped lauhala leaves. There were several lauhala trees and one was a variegated type. I don’t recall if they used it for lauhala mats but it dominated the road to the house. There were lauhala mats all over the place, four and five thick. There was a redwood water tank, and a Bull Durham bag hung on the kitchen water pipe as a filter.

Sonny kept pigs and cows and would net nenu and other fish to supplement the vegetables he grew on his property. Sonny would also go to town most Fridays for anything else he needed. Sonny was a well-known farmer and he made an annual income growing watermelons up until 2000. People would come from all over to buy his watermelons. Sonny had about twelve hills of watermelons with four plants growing in each hill. In addition, he grew tomatoes, corn, ulu, kalo, coconuts, and bananas.

Puanani Mukai, Uncle Sonny’s primary caretaker when he was older, remembered that Sonny’s maternal grandmother was buried at the family grave plot northeast of the house. She thought that one of the grandmother’s sons who had died during the war might also be buried there. She didn’t know the names of the other individuals buried there but was certain they were from the Kamoe and Kamahele family. She thought it was possible that some of the deceased family members’ ashes might have been scattered off the coastline of the property.

Family members fondly remembered fishing and swimming along the shoreline. They recalled a spring along the northwest edge of the property that Sonny dug out and made into a shallow well with a pump he installed. They also remembered that Uncle Sonny kept the west half of the property around the house and watermelon fields well maintained by cutting the grass often and weeding. None of the family members were aware of any cultural practices, other than fishing, that occurred on the property.

In addition to consultation with the Kamoe and Kamahele families, the author of the cultural impact assessment undertook consultation with the Lui family at the Garrett property on October 30, 2019. Mr. Ramon Lui, his wife Agnes and daughter Nicole were present. The Lui family is descended from Kea, who first owned L.G 1014. Nicole shared genealogy documents for the Kea family. L.G. 1014 was a 56.4-acre property purchased in 1852. The Garrett property is the southeast corner of the land grant. Kea passed away in July 1871 and the property was inherited by his wife, Kaohumalu and his five children, Jokepa, Kahokumaka, Kaluahine, Kekuewa, and Kaholowaa. Jokepa was appointed the estate

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administrator. The family later sold off the property in smaller portions. The Lui family believes that members of their family are present at the burial plot (Site 18987) on the property. Nicole Lui, a traditional cultural practitioner and historian also knows that Maku‘u Ahupua‘a and its residents were known for the practices of the “dark arts.” The Lui family members were not aware of any cultural practices conducted specifically on the Garrett property.

Archaeological Investigations and Resources

Previous archaeological studies conducted in the general project area provide a working model for the types and density of features that the archaeologists could expect on the project site. These studies are reviewed in Appendix 2. Based on previous archaeological studies, historical research and family interviews it was expected that pre-Western Contact to early Historic era agricultural and habitation features would be located on the property. The features would include the Kamahale house Site 7476 and also likely include rock walls, rock clearing mounds and possible enclosures. It was also hypothesized that Site 20598, a remnant segment of trail located along the coastal cliff on the property to the southeast, might continue onto the Garrett property.

A pedestrian survey was conducted in March and April 2019 by SCS Senior Archaeologists Glenn Escott M.A. and Suzan Escott, B.A. A series of northwest/southeast transects spaced three meters apart were walked across the entire project site, and ground visibility was very good throughout the transects. Sites were plotted with Global Position System (GPS) units, and descriptions, scale plan view drawings, and photographs were generated for all of the archaeological features identified.

Five archaeological sites were identified in the project area. Three of the sites (Sites 50-10-45-7476, 18980 and 18987) were previously recorded in Ewart and Luscomb (1974) and two were previously undocumented sites. The three previously identified sites include a cement foundation at the Kamahale House (Site 7476), an agricultural complex (Site 18980) and the family burial plot (Site 18987). Five 0.5-m diameter shovel probes were excavated at Site 18980 and the matrix removed was screened for cultural material through 1/8th-inch mesh. Four stratigraphic trenches 11.0 to 12.0 meters long by 0.75 meters (45.0 linear meters total) were excavated by backhoe to determine soil stratigraphy and identify subsurface features and diagnostic artifacts at the project site. All of the trenches terminated in culturally sterile sediment or on bedrock. Matrix removed from stratigraphic trenches was visually inspected for the presence of artifacts. Two newly recorded sites include the rock wall along the southeast, southwest and northwest boundaries of Parcel 009 (Site TS1) and a short rock wall segment (Site TS2) in the southeast corner of the project area. No portion of Site 20598, a remnant segment of trail located at the top of a high coastal cliff on the property to the southeast, was found on the Garrett property. It appears probably that the trail involved the shoreline pahoe hoe bench here, as there is no high cliff.

The research determined that the sites are primarily Historic era in age, though Site 18980, an agricultural complex, could possibly have a pre-Western Contact era component. The Site 18980 features are constructed in the manner of, and have characteristics common to, Historic era features. Sites identified on the project area were constructed by the Kamahale and Kamoe families as part of a working farm and home. The sites were used up through the modern era.

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Evaluation of Significance and Assessment of Impacts to Archaeological Resources

The five archaeological sites identified during the AIS study were assessed for significance as outlined in Hawai‘i Administrative Rules §13-284-6, which is discussed in detail in Appendix 2. Table 3 summarizes the determinations of the archaeologists. Preservation at Site 18980 and Site 18987 will consist of avoidance and protection (conservation) per HAR §13-277-3(1). Site 18980 will be preserved in accordance with an Archaeological Preservation Plan to be written. Site 18987 will be preserved in accordance with a Burial Site Component of a Preservation Plan to be written. The overall proposed project determination is effect with agreed upon mitigation.

Table 3. Archaeological Site Significance and Recommended Treatments

SIHP #50-10-45:	TYPE	FUNCTION	SITE AGE	SIGNIFICANCE CRITERIA*	RECOMMENDED TREATMENT
7476	Kamahele House	Habitation	Historic Era	d	No Further Work
18980	Complex (Agriculture)	Rock walls and rock mounds	Pre-Contact to early post-Contact Era	d	Preservation
18987	Burials	Historic graves	Historic Era	d, e	Preservation
TS-1	Rock Wall	Property Boundary	Historic Era	d	No Further Work
TS-2	Rock Wall	Road edge	Historic Era	d	No Further Work

*(a) Associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property).

(b) Associated with the lives of persons significant in the past property.

(c) Embodies distinctive characteristics of a type, period, or method of construction, or represents a significant and distinguishable entity whose components may lack individual distinction.

(d) Has yielded or may be likely to yield, information important in prehistory or history property

(e) Has an important value to 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, oral accounts-- these associations being important to the group's history and cultural identity property.

The survey was provided to SHPD for their review and comment on site identification, significance and treatment recommendations on March 13, 2020 as part of submittal of the Draft EA and was assigned the SHPD Log No. 2020.00702. The Final EA will report on the progress of review. As an additional mitigation measure, in the unlikely event that any unanticipated archaeological resources are unearthed within the project site during the proposed development activities, work in the immediate vicinity of those resources should be halted and SHPD should be contacted in compliance with Hawai‘i Administrative Rules 13§13-280.

Cultural Resources and Practices

When assessing potential cultural impacts to resources, practices, and beliefs, input gathered from

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community members with genealogical ties and/or long-standing residency relationships to the project area is vital. It is precisely these individuals who ascribe meaning and value to traditional resources and practices. Community members may also retain traditional knowledge and beliefs unavailable elsewhere in the historical or cultural record of a place. As discussed above, a key consultation effort involved the Kamahale family – who have the longest and deepest association with the property – and also the Lui family. Other outreach efforts to help identify and determine the significance of potential cultural resources, practices, and beliefs associated with the project site, along with potential cultural impacts and appropriate mitigation as necessary, were also undertaken. A notice describing the action and location and inviting consultation was published in the Honolulu Star-Advertiser, the Hawai‘i Tribune Herald, and the Office of Hawaiian Affairs (OHA) newspaper *Ka Wai Ola* (June 2019). No responses were received.

In summary, the investigations of the property and its history did not reveal any cultural resources or practices aside from the family burial plot and the utilization of shoreline resources *makai* of the property. While some users are newcomers simply engaging in recreation and/or collecting food, others have deeper ties and are undertaking traditional gathering and fishing cultural practices as well.

Impacts and Mitigation Measures for Cultural Resources

Mr. Garrett understands and supports the right to traverse and utilize the shoreline area, and the shoreline access and the cultural activities this affords will not be affected. The burial plot will be preserved by measures developed in coordination with the family will be granted access for visitation. The burial will be much better protected and visitation will be improved over the status quo, because heretofore there were no formal arrangements, and unauthorized camping very nearby by trespassers endangered the integrity of the site. It is important to note that based on a well-attended, onsite meeting as well as phone conversations, the preservation and access provisions appear to be supported by the several members of the family of the former owners, and there is no known opposition. It is reasonable to conclude, based upon the limited range of resources and the proposed mitigation to all affected resources, that the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs. The Draft EA was distributed to agencies and groups who might have knowledge in order to confirm this finding.

3.3 Public Roads, Services and Utilities

3.3.1 Roads and Access

Existing Environment, Impacts and Mitigation Measures

The sole road access to the project site is via an existing driveway from the Government Beach Road (see Figures 1 and 2). The existing driveway that currently extends to proposed house site would be slightly realigned, widened to 15 feet and improved with gravel but left unpaved. The driveway would also be expanded to include an improved but unpaved parking and turn-around area near the residence.

3.3.2 Public Utilities and Services

Environmental Setting, Impacts and Mitigation Measures

Electrical power and telecommunications to the home would be provided by underground lines adjacent to the driveway from the power poles on Government Beach Road.

Domestic water would be supplied from an onsite water well (see Figure 3 for location). It would have a 1.5-HP pump capable of delivering up to 50 gallons per minute at maximum use. A 10,000-gallon storage tank will be located adjacent to the well. The proposed storage is expected to be more than adequate to meet the expected demand, based on the applicant's expected use of less than 300 gallons per day.

Wastewater would be treated with a septic system in conformance with requirements of the State Department of Health (see Figure 3 for location).

No parks, schools or other public facilities are present nearby. Police, fire and emergency medical service are available about seven road miles away at new facilities on Highway 130 in Pahoā. For fire protection, the applicant proposes use of the water tank.

There will be no adverse impact to any public or private utilities. The addition of one single-family home will have no measurable adverse impact to or additional demand on public facilities such as schools, police or fire services, or recreational areas. Mr. Garrett acknowledges and understands that this lot, along with almost all other residences in the Puna District, is not located within a mile of emergency services.

3.4 Secondary and Cumulative Impacts

Due to its small scale, the proposed project would not produce any major secondary impacts, such as population changes or effects on public facilities.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. The County of Hawai'i occasionally performs road maintenance on the Government Beach Road. No substantial government or private projects such as roadways, schools, businesses, or subdivisions, are known to be occurring or in planning for this portion of Puna. Reopening of various roadways covered by the 2018 lava flows, including potentially Highway 137, will likely be occurring approximately 10 miles away but would not produce impacts in the Maku'u area. There are several dozen private lots on the three-mile stretch of the narrow and unpaved Government Beach Road between the Hawaiian Paradise Park and Hawaiian Shores subdivisions. At any given time, a home may be under construction, and occasionally there are two or more homes under construction simultaneously. The adverse effects of building a single-family residence and farming in this context are very minor and involve temporary disturbances to air quality, noise, traffic and visual quality during construction. It should again be noted that the proposed home and existing farm are in a somewhat isolated, sparsely populated area, and no accumulation of adverse construction effects would be expected. Other than the precautions for preventing adverse impacts during construction listed

above in Sections 3.1.3 and 3.1.6, no special mitigation measures should be required to counteract the small adverse cumulative effect.

3.5 Required Permits and Approvals

County of Hawai‘i:

Special Management Area Permit or Exemption
Plan Approval and Grubbing, Grading, and Building Permits

State of Hawai‘i:

Conservation District Use Permit
Wastewater System Approval
Water Well Permit

3.6 Consistency with Government Plans and Policies

3.6.1 Hawai‘i County General Plan

The *General Plan* for the County of Hawai‘i is the document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005. The General Plan’s Land Use Allocation Guide Map designates the property as Open. The *General Plan* is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Below are pertinent sections followed by a discussion of conformance.

ECONOMIC GOALS

- (a) Provide residents with opportunities to improve their quality of life through economic development that enhances the County’s natural and social environments.
- (b) Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.
- (d) Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County’s cultural, natural, and social environment.

Discussion: The proposed construction and occupation of a single-family home and continuation of farming and grazing would be in balance with the natural, cultural and social environment of the County, would create temporary construction jobs for local residents, and would indirectly boost the economy through construction industry purchases from local suppliers. A multiplier effect takes place when these employees spend their income for food, housing, and other living expenses in the retail sector of the economy. Such activities are in keeping with the overall economic development of the island.

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ENVIRONMENTAL QUALITY GOALS

- (a) Define the most desirable use of land within the County that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.
- (b) Maintain and, if feasible, improve the existing environmental quality of the island.
- (c) Control pollution.

ENVIRONMENTAL QUALITY POLICIES

- (a) Take positive action to further maintain the quality of the environment.

ENVIRONMENTAL QUALITY STANDARDS

- (a) Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.
- (b) Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.
- (c) Federal and State environmental regulations shall be adhered to.

Discussion: The proposed construction and occupation of a single-family home and continuation of farming and grazing would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The home and associated improvements would be compatible with the existing rural single-family homes and farming, grazing and recreational uses in the general project area. Pertinent environmental regulations would be followed, including those for mitigation of water quality impacts.

HISTORIC SITES GOALS

- (a) Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.
- (b) Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

HISTORIC SITES POLICIES

- (a) Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.
- (b) Amend appropriate ordinances to incorporate the stewardship and protection of historic sites, buildings and objects.
- (c) Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are

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indications that the land under consideration has historical significance.

(d) Public access to significant historic sites and objects shall be acquired, where appropriate.

Discussion: An archaeological inventory survey properly documented five archaeological sites, for some of which preservation plans will be prepared. Aside from shoreline area fishing and gathering uses, which will be encouraged and not adversely affected by the action, the only cultural resources or practices involve family care for a documented burial. This practice will continue and in fact be aided by owner's increased access provisions for the descendant families, who have expressed support for the proposed action in an onsite meeting and in phone calls.

FLOOD CONTROL AND DRAINAGE GOALS

- (a) Protect human life.
- (b) Prevent damage to man-made improvements.
- (c) Control pollution.
- (d) Prevent damage from inundation.
- (e) Reduce surface water and sediment runoff.
- (f) Maximize soil and water conservation.

FLOOD CONTROL AND DRAINAGE POLICIES

(a) Enact restrictive land use and building structure regulations in areas vulnerable to severe damage due to the impact of wave action. Only uses that cannot be located elsewhere due to public necessity and character, such as maritime activities and the necessary public facilities and utilities, shall be allowed in these areas.

(g) Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works and in compliance with all State and Federal laws.

FLOOD CONTROL AND DRAINAGE STANDARDS

- (a) "Storm Drainage Standards," County of Hawaii, October, 1970, and as revised.
- (b) Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.
- (c) Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
- (d) Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawaii County Code.
- (e) Applicable standards and regulations of the Natural Resources Conservation Service and the Soil and Water Conservation Districts.

Discussion: The proposed home site is within Zone X, or areas outside of the 500-year floodplain as determined by detailed methods in the Flood Insurance Rate Maps (FIRM). The project will conform to applicable drainage regulations and policies of the County of Hawai'i.

NATURAL BEAUTY GOALS

- (a) Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
- (b) Protect scenic vistas and view planes from becoming obstructed.
- (c) Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

NATURAL BEAUTY POLICIES

- (a) Increase public pedestrian access opportunities to scenic places and vistas.
- (b) Develop and establish view plane regulations to preserve and enhance views of scenic or prominent landscapes from specific locations, and coastal aesthetic values.

Discussion: The improvements are minor and consistent with longstanding uses of the land and will not cause scenic impacts or impede access.

NATURAL RESOURCES AND SHORELINES GOALS

- (a) Protect and conserve the natural resources from undue exploitation, encroachment and damage.
- (b) Provide opportunities for recreational, economic, and educational needs without despoiling or endangering natural resources.
- (c) Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.
- (d) Protect rare or endangered species and habitats native to Hawaii.
- (e) Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural areas.
- (f) Ensure that alterations to existing land forms, vegetation, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of an earthquake.

NATURAL RESOURCES AND SHORELINES POLICIES

- (a) Require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.
- (c) Maintain the shoreline for recreational, cultural, educational, and/or scientific uses in a manner that is protective of resources and is of the maximum benefit to the general public.
- (d) Protect the shoreline from the encroachment of man-made improvements and structures.
- (h) Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
- (p) Encourage the use of native plants for screening and landscaping.
- (r) Ensure public access is provided to the shoreline, public trails and hunting areas, including free public parking where appropriate.

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(u) Ensure that activities authorized or funded by the County do not damage important natural resources.

Discussion: The home would be located about 35 feet above sea level, about 212 feet back from the shoreline shelf, behind a low littoral cone, in an area that is clearly out of the flood zone, and it would not affect shoreline resources or be damaged by waves or tides.

PUNA COMMUNITY DEVELOPMENT PLAN

The Puna Community Development Plan (CDP) encompasses the judicial district of Puna and was developed under the framework of the February 2005 County of Hawai'i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area.

The Puna CDP does not specify land use in the project area but contains the following Goals for Managing Growth that are relevant to the action.

3.1.1 Goals (for Managing Growth)

- a. Puna retains a rural character while it protects its native natural and cultural resources.
- b. The quality of life improves and economic opportunity expands for Puna's residents.
- d. Exposure to high risk from natural hazards situations is reduced.
- f. Native vegetation, coastal and historic resources are provided new forms of protection.

Discussion: The proposed single-family home and the continuation of farming and grazing will help the area retain a rural character. Through provision of housing and production of fruit and vegetables, it improves the quality of life, natural resources and the economy. The lot shares the same volcanic and seismic hazard as all of Puna. By virtue of the home's proposed location on the lot, coastal hazards are avoided. No native vegetation, rare species, coastal resources or historic sites will be adversely affected, and a rare, endangered plant species will attain additional care and protection. The construction of a of a single-family home and the continuation of farming and grazing are not inconsistent with the Puna CDP.

3.6.2 Hawai'i County Zoning and Special Management Area

The State Land Use District for property is Conservation. The entire property is zoned by the County of Hawai'i as within the Agricultural District, minimum lot size of one acre (A-1a), although County zoning per se does not apply in the Conservation District. No aspect of the project appears to be inconsistent with County zoning.

The entire property is within the Special Management Area. The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawai'i Revised Statutes (HRS), entitled *Coastal Zone Management*. The County of Hawai'i Planning Department requires preparation of an SMA Assessment Application, in which SMA issues are expressly dealt with. A summary of consistency is

provided below.

Single-family residences and the continuation of farming and grazing uses may be determined to be an exempt action under the County's Special Management Area (SMA) guidelines. The proposed use would be consistent with Chapter 205A because it would not affect public access to recreational areas, historic resources, scenic and open space resources, coastal ecosystems, economic uses, or coastal hazards.

The proposed improvements are not likely to result in any substantial adverse impact on the surrounding environment. The house site is set far back from the shoreline and will not restrict any shoreline uses such as hiking, fishing or water sports. Lateral pedestrian use of the shoreline area will not be impacted and there will be no effect on the public's access to or enjoyment of this shoreline area. Furthermore, viewplanes towards the project site will not be adversely impacted, as the home will be in area barely visible from the sea or shoreline and will have the same visibility from 250 feet away on the Government Beach Road through an existing hedgerow of trees that the former home had for over five decades, although the view will be blocked below the top of the 6-foot tall solid metal corrugated panel fence. The property contains mostly non-native and several common native plants, and it is expected that the project will not result in any impact on biological resources, particularly with the proposed enhanced care for an cluster of the endangered grass *Ischaemum byrone*. There will be no adverse effect on the economy. The project site is not situated over any natural drainage system or water feature that would flow into the nearby coastal ecosystem. No floodplains are present in the affected area. In terms of beach protection, construction is set back from the shoreline and would not affect any beaches nor adversely affect public use and recreation of the shoreline in this area. With implementation of Best Management Practices associated with grading permits, there should be no impacts on marine resources. No historic sites will be adversely affected. Aside from shoreline area fishing and gathering uses, which will be encouraged and not adversely affected by the action, the only cultural resources or practices involve family care for a documented burial. This practice will continue and in fact be aided by owner's increased access provisions for the descendant families, who have expressed support for the proposed action.

The Planning Director will be asked to make the determination that the proposed development of a single-family home and continuation of farming and grazing are not considered "development" under Special Management Area Rules and Regulations of the County of Hawai'i, Section 9-4 (10) (B) and that the project is otherwise not subject to an SMA Major Permit.

3.6.3 Conservation District

The State Land Use District for the Garrett property is Conservation. Its subzone is Resource, for which, according to Hawai'i Administrative Rules (HAR) §13-5-15, a single-family residence is an identified use; continuation of the farming and grazing is a legal nonconforming use. Any proposed use must undergo an examination for its consistency with the goals and rules of this district and subzone. The applicant has concurrently prepared a Conservation District Use Application (CDUA), to which this EA is an appendix. The CDUA includes a detailed evaluation of the consistency of the project with the criteria of the Conservation District permit process. Briefly, the following individual consistency criteria should be noted:

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1. The proposed land use is consistent with the purpose of the Conservation District;

The development of the single-family residence is in conformance with the purpose of the Conservation District. It is an identified use within the Conservation District, requiring a Board Permit for such use. A commitment by the applicant to continue good stewardship of the traditional farming practices that have been in place for decades will conserve, protect and preserve the natural features on the subject property. The proposed use will not impact lateral coastal access or the public's ability to utilize the coastal resources that front this property. Additionally, due to the careful and limited nature of the proposed development, there would be no significant impacts to the natural or cultural resources of the area.

2. The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

The objective of the Resource subzone "...is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas." Single-family residences are an identified use in the Resource subzone under HAR 13-5-24, R-8, and continuing farming or grazing is considered a legal, nonconforming use under HAR 13-5. The proposed farm shed is an identified use under HAR 13-5-22, P-9 (Structures Accessory - Construction or placement of structures accessory to existing facilities or uses). These identified uses, which conforms to the design standards in 13-5-41 as applicable, will ensure the sustained use of the natural resources in the project area by mitigating potential impacts as outlined in this document.

3. The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawaii Revised Statutes (HRS), entitled "Coastal Zone Management," where applicable;

The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawai'i Revised Statutes (HRS), entitled *Coastal Zone Management*, as discussed in detail above in Section 3.6.2.

4. The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

Because of the relatively minor nature of the project and the lack of native terrestrial ecosystems and threatened or endangered plant species except for a small patch of an endangered grass that will benefit from the additional care a resident owner can provide, the proposed single-family residence and continuation of farming and grazing are not likely to cause adverse biological impacts. Impacts to the island wide-ranging endangered Hawaiian hoary bat and formerly endangered Hawaiian hawk will be avoided through timing of vegetation removal and/or hawk nest survey. No effect on any coastal ecosystem will occur, because of the wide shoreline vegetated zone that will be left completely untouched, along with planned precautions for preventing soil runoff during construction. The proposed action will also have no impact on the public's current access to or use of the shoreline area.

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5. The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

The proposed use is consistent with other single-family residential and farming uses in the area. The proposed 3-bedroom, 3 ½-bath, two-story residence will include a kitchen, dining and living area, lanai and garage, with a total living space of approximately 2,560 square feet (sf), (Figure 3) and a covered lanai area of 1,239-sf and a basement and garage area of 896-sf. With accessory features including a farm and utility shed, water tank, etc., the Total Development Area (TDA) for the residence, per the Conservation District Rules (Title 13-5, HAR, Exhibit 4), is 4,824 sf. The maximum height above existing grade will be under 25 feet. The home will be located about 35 feet above sea level, 212 feet back from the shoreline shelf, behind a tall littoral cone, outside the flood zone. It will be in area barely visible from the sea or shoreline and will have the same visibility from 250 feet away on the Government Beach Road through existing hedgerows of trees that the former home had for over five decades, although the view will be blocked below the top of the 6-foot tall solid metal corrugated panel fence. This identified use, which conforms to the design standards in HAR 13-5-41, will ensure the sustained use of the natural resources in the project area by mitigating impacts. The use will not adversely affect the surrounding properties or how these properties are utilized, which are for single-family residences. This land use will be attractive and compatible with the area, as across Government Beach Road and directly east as well there is existing grazing. Only minor exterior lighting is planned, and it will be shielded to protect dark skies and transiting seabirds.

6. The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

The proposed use of the subject property for a single-family residence and the continuation of farming and grazing will help conserve, protect and preserve the natural features of the area.

7. Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District;

The proposed action does not involve or depend upon subdivision and will not lead to any increase in intensity of use beyond the requested single-family residence.

8. The proposed land use will not be materially detrimental to the public health, safety and welfare.

The proposed single-family residence and the continuation of farming and grazing will not be detrimental to the public health, safety, and welfare.

PART 4: DETERMINATION, FINDINGS AND REASONS

4.1 Determination

The applicant expects that the State of Hawai‘i, Department of Land and Natural Resources, will determine that the proposed action will not significantly alter the environment, as impacts will be minimal, and that this agency will accordingly issue a Finding of No Significant Impact (FONSI). This determination will be reviewed based on comments to the Draft EA, and the Final EA will present the final determination.

4.2 Findings and Supporting Reasons

Chapter 11-200.1-13, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

(a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the proposed action on the quality of the environment.

(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:

1. *Irrevocably commit a natural, cultural, or historic resource.* No valuable natural or cultural resource would be committed or lost. Several common native plants are present throughout the 13.346-acre property, but native ecosystems would not be adversely affected, particularly given the limited scale of disturbance. No adverse impact upon vegetation or endangered species should occur, with protection of an endangered grass that will benefit from resident care. An archaeological inventory survey identified several walls, a former house site, a known, cared-for burial plot, and other agricultural features. Coordination with the burial plot family has occurred and a preservation plan including family member access will be developed in full cooperation with the family. No valuable cultural resources and practices such as shoreline access, fishing, gathering, hunting, or access to ceremonial sites would be adversely affected in any way.
2. *Curtail the range of beneficial uses of the environment.* No restriction of beneficial uses would occur by residential use on this lot.
3. *Conflict with the State’s environmental policies or long-term environmental goals established by law.* The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project is environmentally benign and minor, and it is thus consistent with all elements of the State’s long-term environmental policies.

Garrett Single-Family Residence and Farm at Maku'u Environmental Assessment

4. *Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State.* The project would not have any substantial effect on the economic or social welfare of the Big Island community or the State of Hawai'i.
5. *Have a substantial adverse effect on public health.* The project would not affect public health and safety in any way. Wastewater will be disposed of in conformance with State Department of Health regulations.
6. *Involve adverse secondary impacts, such as population changes or effects on public facilities.* The small scale of the proposed project would not produce any major secondary impacts, such as population changes or effects on public facilities.
7. *Involve a substantial degradation of environmental quality.* The project is minor and environmentally benign, and thus it would not contribute to environmental degradation.
8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions.* The adverse effects of building a single-family residence are limited very minor and temporary disturbance to traffic, air quality, noise, and visual quality during construction. This area is fairly isolated from sensitive receptors. The County of Hawai'i occasionally performs road maintenance on Government Beach Road between Hawaiian Paradise Park and Hawaiian Shores. Once or twice a year a home that takes access from this 3-mile long road stretch may be in construction. There are no substantial government or private projects in construction or planning, and no accumulation of adverse construction effects would be expected. Other than the precautions for preventing adverse effects during construction listed above, no special mitigation measures should be required to counteract the small adverse cumulative effect.
9. *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.* The site has been surveyed for threatened and endangered plants, and none are present with the exception of a patch of the endangered shoreline grass, *Ischaemum byrhone*, which is proposed for passive protection measures that will improve on current conditions. Other than Hawaiian hoary bats and Hawaiian hawks, island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal and/or hawk nest survey, no rare, threatened or endangered species of fauna are known to exist on or near the project site, and none would be affected by any project activities.
10. *Have a substantial adverse effect on air or water quality or ambient noise levels.* No substantial effects to air, water, or ambient noise would occur. Brief, temporary effects would occur during construction and would be mitigated. The context of the property's location, with no residences, parks, or other sensitive uses nearby, will help avoid noise impacts. Erosion and sedimentation impacts will be avoided by implementation of Best Management Practices during grading, which will occur in a very limited area.
11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach,*

Garrett Single-Family Residence and Farm at Maku‘u Environmental Assessment

erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. The proposed home site is not located in a flood zone nor would it affect one. The proposed home would be located about 35 feet above sea level, on the *mauka* edge of a low littoral cone, and will not be affected directly by sea level rise. The project has adapted to climate change by accounting for the potential for larger storms, through minimizing hard surfaces that generate runoff. In general, geologic conditions do not impose undue constraints on the proposed action, as much of the Puna District faces similar volcanic and seismic hazard and yet continues to be the fastest growing region of the State. The applicant understands that there are hazards associated with homes in this geologic setting and has made the decision that a residence is not imprudent to construct or inhabit.

12. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.* No protected scenic views are located nearby or would be affected in any way. The proposed use is consistent with other single-family residential and farming uses in the area. It will be in area barely visible from the sea or shoreline and will have the same visibility from 250 feet away on the Government Beach Road through existing hedgerows of trees that the former home had for over five decades, although the view will be blocked below the top of the 6-foot tall solid metal corrugated panel fence. Only minor exterior lighting is planned, and it will be shielded to protect dark skies and transiting seabirds.

13. *Require substantial energy consumption or emit substantial greenhouse gases.* Negligible amounts of energy input and greenhouse gas emission would be required for construction and occupation of the residence as well as farming. The residence is designed as a single structure supporting efficient use of energy and materials and facilitating natural ventilation and lighting. Energy-efficient appliances will be used throughout the house. Generous lanais along the east and west faces and an insulated roof structure will reduce potential solar gain to the home. This together with opportunities for natural ventilation will reduce the need for air conditioning. The home will also have roof-mounted photovoltaic and solar water heating panels, reducing energy use and greenhouse gas emissions. The raising of a portion of the owners' food on the property will also reduce the carbon footprint.

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Garrett Single-Family Residence and Farm at Maku‘u Environmental Assessment

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Environmental Assessment

Garrett Single-Family Residence and Farm in the Conservation District at Maku‘u

APPENDIX 1a Comments in Response to Early Consultation

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DAVID Y. IGE
GOVERNOR OF HAWAII



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 8, 2019

Geometrician Associates, LLC
Attention: Mr. Ron Terry
P.O. Box 396
Hilo, Hawaii 96721

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District located at Puna District, Island of Hawaii; TMK: (3) 1-5-010:009 on behalf of **Bob Garrett**

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

At this time, enclosed are comments from the (a) Engineering Division, (b) Office of Conservation & Coastal Lands, and (c) Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to be "Russell Y. Tsuji", is written over a horizontal line.

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII



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

2019 APR 25 AM 10:35

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 15, 2019

MEMORANDUM

TO:

DLNR Agencies:

- ☒ Div. of Aquatic Resources
☐ Div. of Boating & Ocean Recreation
☒ Engineering Division
☒ Div. of Forestry & Wildlife
☐ Div. of State Parks
☒ Commission on Water Resource Management
☒ Office of Conservation & Coastal Lands
☒ Land Division – Hawaii District
☒ Historic Preservation

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District

LOCATION:

Puna District, Island of Hawaii; TMK: (3) 1-5-010:009

APPLICANT:

Geometrician Associates, LLC on behalf of **Bob Garrett**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **May 7, 2019**.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed:

Carty S. Chang, Chief Engineer

Print Name:

Date:

4/24/19

Attachments

cc: Central Files

**DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION**

LD/Russell Y. Tsuji

Ref: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District

Location: Puna District, Island of Hawaii

TMK(s): (3) 1-5-010:009

Applicant: Geometrician Associates, LLC on behalf of Bob Garrett

COMMENTS

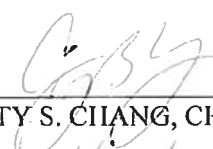
The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 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.hawaiiinfip.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) 241-4846.

Signed: _____


CARTY S. CHANG, CHIEF ENGINEER

Date: _____


4/24/19

DAVID Y. IGE
GOVERNOR OF HAWAII



RECEIVED
LAND DIVISION

MAY -2 AM 10:54



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

2019 APR 16 A 11:01

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 15, 2019

MEMORANDUM

TO:

DLNR Agencies:

- ☒ Div. of Aquatic Resources
- ☐ Div. of Boating & Ocean Recreation
- ☒ Engineering Division
- ☒ Div. of Forestry & Wildlife
- ☐ Div. of State Parks
- ☒ Commission on Water Resource Management
- ☒ Office of Conservation & Coastal Lands
- ☒ Land Division – Hawaii District
- ☒ Historic Preservation

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District

LOCATION:

Puna District, Island of Hawaii; TMK: (3) 1-5-010:009

APPLICANT:

Geometrician Associates, LLC on behalf of **Bob Garrett**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **May 7, 2019**.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Darlene Nakamura at 587-0417 or by email at darlene.k.nakamura@hawaii.gov. Thank you.

- () We have no objections.
- () We have no comments.
- (☒) Comments are attached.

Signed: _____

Print Name: _____

Date: _____

Attachments

cc: Central Files

DAVID Y. IGE
GOVERNOR OF
HAWAII



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

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

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

REF:OCCL:TM

Correspondence: HA 19-159

MAY - 1 2019

Ron Terry
Geometrician Associates, LLC
PO Box 396
Hilo, HI 96721

SUBJECT: Early Consultation for Environmental Assessment for a Proposed Single Family Residence, Barn and Associated Improvements Located at Maku'u, Puna, Hawai'i, TMK: (3) 1-5-010:009

Dear Mr. Terry:

The Office of Conservation and Coastal Lands (OCCL) has reviewed your information regarding the subject matter. The location appears to lie within the Resource subzone of the Conservation District.

A single family residence is an identified land use in the Resource subzone that could be applied for pursuant to the Hawai'i Administrative Rules (HAR) §13-5-24 R-7 SINGLE FAMILY RESIDENCE (D-1) a single family residence that conforms to design standards as outlined in this chapter. This proposed land use requires the filing of a Conservation District Use Application (CDUA) and all required attachments such as an Environmental Assessment and the filing of an HRS, 6E Intake Form for historic preservation compliance.

The proposed land use will require a Board permit, therefore to allow, modify or deny the proposed land use would be at the discretion of the Board of Land and Natural Resources. A barn also appears to be an identified land use pursuant to HAR, §13-5-23 L-1 Agriculture. You may wish to combine these land uses into one CDUA.

The draft Environmental Assessment (EA) should site and describe all improvements for the proposal. This would include the proposed residence, barn, access, utilities, landscaping and any other proposed work including trenching, and grading. Alternatives that may include other possible sites for the residence or other alternatives should be included with the draft. Proposed mitigation and best management practices before, during and after the proposed construction should be described. All proposed landscaping should be native, indigenous and endemic species.

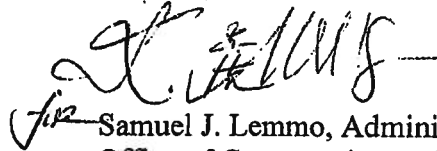
Ron Terry
Geometrician Associates, LLC

Correspondence: HA 19-159

This area appears to be in a moderately high coastal hazard area. Coastal hazards such as sea level rise, tsunami, and volcanic/seismic events in addition to other potential hazards along the coastline should be discussed and addressed in the EA. A certified shoreline most likely will be required for the CDUA.

Should you have any questions regarding this correspondence, contact Tiger Mills of our Office at (808) 587-0382.

Sincerely,

A handwritten signature in black ink, appearing to read "S. Lemmo", with a checkmark to the left.

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

C: County of Hawai'i
-Planning

DAVID Y. IGE
GOVERNOR OF HAWAII



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

April 15, 2019

MEMORANDUM

TO:

DLNR Agencies:

- ☒ Div. of Aquatic Resources
- ☐ Div. of Boating & Ocean Recreation
- ☒ Engineering Division
- ☒ Div. of Forestry & Wildlife
- ☐ Div. of State Parks
- ☒ Commission on Water Resource Management
- ☒ Office of Conservation & Coastal Lands
- ☒ Land Division – Hawaii District
- ☒ Historic Preservation

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District

LOCATION:

Puna District, Island of Hawaii; TMK: (3) 1-5-010:009

APPLICANT:

Geometrician Associates, LLC on behalf of **Bob Garrett**

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- ☐ We have no objections.
- ☒ We have no comments.
- ☐ Comments are attached.

Signed: _____

Print Name: _____

Date: _____

Attachments

cc: Central Files

RECEIVED
LAND DIVISION
2019 MAY -6 AM 11:03
DEPT OF LAND &
NATURAL RESOURCES
STATE OF HAWAII
2019 APR 18 A 10:30
RECEIVED
LAND DIVISION
HONOLULU, HAWAII

DAVID Y. IGE
GOVERNOR OF HAWAII



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

May 9, 2019

Geometrician Associates, LLC
Attention: Mr. Ron Terry
P.O. Box 396
Hilo, Hawaii 96721

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District located at Puna District, Island of Hawaii; TMK: (3) 1-5-010:009 on behalf of **Bob Garrett**

Thank you for the opportunity to review and comment on the subject matter. In addition to our previous comments dated May 8, 2019, enclosed are comments from the Division of Forestry & Wildlife on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to be "Russell Y. Tsuji", is written over a horizontal line.

Russell Y. Tsuji
Land Administrator

Enclosure
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII



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

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

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

May 7, 2019

MEMORANDUM

TO: Russell Y. Tsuji, Land Administrator
c/o Darlene Nakamura, Land Agent

FROM: David G. Smith, Administrator, Division of Forestry and Wildlife ^{DGS}

SUBJECT: Request for Comment for Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District

LOCATION: Maku'u, Puna, Hawai'i, Tax Map key: (3) 1-5-010:009

APPLICANT: Geometrician Associates, LLC on behalf of Bob Garrett

Thank you for the opportunity to review the early consultation letter from Geometrician Associates regarding an Environmental Assessment for their client Bob Garrett's proposed single-family residence in the Conservation District. After reviewing the letter and conducting research, the Hawai'i Island Branch staff have provided the following comments:

Nā Ala Hele Trails and Access Program

The area proposed for construction is known to have been part of a thriving Hawaiian coastal village dating several hundreds of years. An archaeological study of the area can expect to find many sites demonstrating this history. As such, trails are a part of this story. Previous archaeological surveys of nearby parcels have uncovered ancient coastal trails that most likely also crossed the subject parcel. In particular, we suggest your archaeological surveyors consult "A Preservation Plan for a Portion of SIHP Site 18418 Feature A" by Robert B. Rechtman, Ph.D., ASM Project Number 21720.

If you have any questions regarding trails and access matters, please contact Jackson Bauer, Nā Ala Hele Trails Specialist at 808-657-8041 or jackson.m.bauer@hawaii.gov.

Wildlife Program

The area proposed for construction on the Garrett property (TMK: (3) 1-5-010:009} has potential to impact native wildlife to the area including 'io (Hawaiian hawks—listed as endangered) and Hawai'i 'amakihi (a common Hawaiian honeycreeper) that use 'ōhi'a as habitat and for nesting. Seabirds may also use the cliffs along the shoreline, based on landscape and habitat type, but we do not have documented surveys of this. Also based on other researcher's studies (USGS), the 'ōpe'ape'a (Hawaiian hoary bat) occupancy has been found to be moderate

to high for sections of the Kea'au area, but not in the immediate area of the focal property (https://dspace.lib.hawaii.edu/bitstream/10790/2623/1/TR41_Gorresen_Bat_occupancy.pdf).

Nēnē (Hawaiian goose) are known to frequent and perhaps nest on adjacent parcels (i.e., Audrey Wood's property). Also, several pairs of nēnē are known to regularly use adjacent parcels. Please note, grazed and mowed grassy areas may increase nēnē presence and activity in the area; however nēnē have been known to use the oceanside areas of properties in the area.

If you have any questions regarding wildlife matters, please contact Jackie Gaudioso-Levita, East Hawai'i Wildlife Biologist at 808-933-2988 or jackie.m.gaudioso@hawaii.gov.

Forestry Program

The proposed development may impact the federally endangered grass known as Hilo Ischaemum (*Ischaemum byrone*). The grass is known from the Puna coastline from east of Kalapana to as far north as Keaukaha in Hilo. Caution is urged if there is to be any disturbance of vegetation close to the shore. Ideally a botanical survey will be conducted within the subject property prior to any development.

If you have any questions regarding plant and forestry matters, please contact Lyman Perry, Hawai'i District Botanist at 808-974-4221 or lyman.perry@hawaii.gov.

Signature:



Email: david.g.smith@hawaii.gov

DOFAW comment on Early Consult for EA for Proposed Bob Garret residence TMK3-1-5-010:009

Final Audit Report

2019-05-08

Created:	2019-05-07
By:	Jackson Bauer (jackson.m.bauer@hawaii.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAAbel2-4oZJBhJuSVNNJwOg3XOGwB0yxIE

"DOFAW comment on Early Consult for EA for Proposed Bob Garret residence TMK3-1-5-010:009" History

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Signature Date: 2019-05-08 - 3:08:07 AM GMT - Time Source: server- IP address: 98.150.244.4
-  Signed document emailed to all eligible parties.
2019-05-08 - 3:08:07 AM GMT

Harry Kim
Mayor



Michael Yee
Director

Duane Kanuha
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

May 8, 2019

Mr. Ron Terry
Geometrician Associates
P. O. Box 396
Hilo, HI 96721

Dear Mr. Terry:

**SUBJECT: Comments for Early Consultation for Environmental Assessment for
Proposed Single-Family Residence in the Conservation District
Tax Map Key: (3) 1-5-010:009**

This is in response to your letter dated April 6, 2019 requesting early consultation comments for an environmental assessment being prepared for the proposed single-family dwelling and accessory uses, which is located within the State Land Use Conservation district. Real Property Tax records show that the property is owned by Kamahale Farms LLC.

1. The subject property is 13.436 acres in size, is zoned Agricultural-1 Acre (A-1a) by the County of Hawai'i and designated as Conservation by the State Land Use Commission. The proposed dwelling and accessory uses would need approval of a Conservation District Use Permit from the Board of Land and Natural Resources (BLNR).
2. The General Plan Land Use Pattern Allocation Guide (LUPAG) map designations for the property are Open (o).
3. The property is located within the Special Management Area (SMA). The proposed dwelling and accessory uses will require the submittal of a SMA Assessment application. Additionally, the property is located along the shoreline and may require the submittal of a certified shoreline survey as part of the SMA Assessment application.

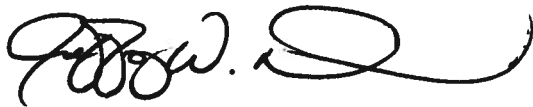
Mr. Ron Terry
Geometrician Associates
Page 2
May 8, 2019

4. The Puna Community Development Plan (CDP) was adopted by the Hawai'i County Council by Ordinance No. 08-116 on September 10, 2008 and has been amended several times. The property is located within the area affected by the Puna CDP.
5. A review of our files indicates that there was a non-conforming structure on the property since 1960. It appears that this structure has been demolished but a slab remains on the property. In 2011, there was a SMA exemption issued from the Planning Department for an as-built single-family residence, which has lapsed. There are also several correspondences from the Department of Land and Natural Resources-Office of Conservation and Coastal Lands (DLNR-OCCL) relating to previous actions for the property, such as submitting an after the fact Conservation District Use Permit for an as built residence.

We have no further comments at this time. Please inform us when the Draft Environmental Assessment is ready for review.

If you have any questions, please feel free to contact Jeff Darrow at 961-8158.

Sincerely,

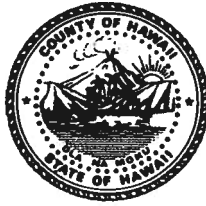


For MICHAEL YEE
Planning Director

JWD:mad

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Harry Kim
Mayor



Paul K. Ferreira
Police Chief

Kenneth Bugado Jr.
Deputy Police Chief

County of Hawai'i

POLICE DEPARTMENT

349 Kapiolani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-8865

June 7, 2019

Mr. Ron Terry, Principal
Geometrician Associates
P. O. Box 396
Hilo, HI 96721

Dear Mr. Terry:

Subject: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District, Puna District, Island of Hawaii; TMK (3rd) 1-5-101:009

Staff, upon reviewing the provided documents, does not anticipate any significant impact to traffic and/or public safety concerns.

Thank you for allowing us the opportunity to comment.

If you have any questions, please contact Captain John Briski, Puna District Commander, at (808) 965-2716.

Sincerely,


JAMES B. O'CONNOR
ASSISTANT POLICE CHIEF
AREA I OPERATIONS

JB:lli/19HQ0418

Environmental Assessment

Garrett Single-Family Residence and Farm in the Conservation District at Maku‘u

APPENDIX 2 Archaeological Inventory Survey

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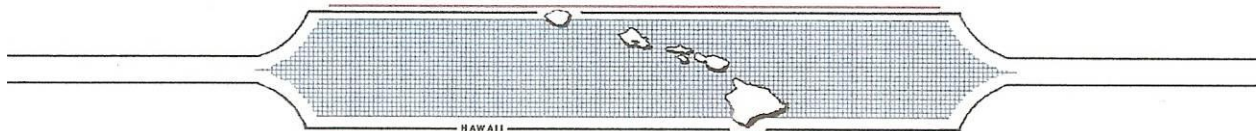
**AN ARCHAEOLOGICAL INVENTORY SURVEY REPORT FOR
A 13.436-ACRE PROPERTY IN KEA'AU, MAKU'U AHUPUA'A,
PUNA DISTRICT, HAWAI'I ISLAND, HAWAI'I
[TMK: (3) 1-5-010:009]**

Prepared By:
Glenn G. Escott, M.A.

NOVEMBER 2019
DRAFT

Prepared for:
Kamahele Farms, LLC
15-2145 Government Beach Road
Kea'au, HI 96749

SCIENTIFIC CONSULTANT SERVICES Inc.



1347 Kapi'olani Boulevard, Suite 408 Honolulu, HI 96814
Hawai'i Island Office: PO Box 155 Kea'au, HI 96749

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ABSTRACT

Under contract to property owner Kamahele Farms, LLC, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of 13.436 acres of land [TMK: (3) 1-5-010:009] located in Maku'u Ahupua'a, Puna District, Island of Hawai'i, Hawai'i.

The property address is 15-2145 Government Beach Road. The property owner's mailing owner's address is 8216 N 14th Street, Phoenix, AZ 85020-3890. The point of contact is Mr. Robert Garrett. Mr. Garrett can be contacted by phone at 623-330-7244 or by email at bellgroup4930@yahoo.com. The property owner is proposing to build a single family dwelling on the property. The AIS study was conducted as supporting documentation for a Special Management Area (SMA) permit application and construction permit application.

Prior to fieldwork, a search of geological maps, aerial photos, historical maps, historical documents, and archaeological reports was conducted. Pedestrian survey and site recording was conducted March and April, 2019 by SCS Senior Archaeologists Glenn Escott M.A. and Suzan Escott, B.A. The fieldwork took a total of 64 person-hours to complete. A series of northwest/southeast transects spaced three meters apart were walked across the entire project area. Ground cover consisted of mown grass, trees and some low ferns and bushes. Ground visibility was very good.

Five archaeological sites were identified on the current project area. The sites were the former Kamahele House location (Site #50-10-45-7476), an agricultural complex of rock walls and rock mounds (Site #50-10-45-18980), a family burial plot (Site #50-10-45-18987), the property boundary rock walls (Site #50-10-45-31111), and a short rock wall segment (Site #50-10-45-TS31112). The sites are the remains of Historic era to Modern era habitation and agriculture. Site 18980 is likely a late pre-Contact era to Historic era site. Site 7476 burned down in 2014 during Hurricane Iselle and is no longer present on the property. The two modern petroglyphs at Site #50-10-45-18981 is not a historic property and the site number should be struck.

All of the sites, except the petroglyphs (Site 18981), are significant under criterion "d" as they are likely to yield information important to history. The Site 18987 family burial plot is also significant under criterion "e" as it has importance to Hawaiian cultural beliefs and practices. Information recorded at the sites during the current study has adequately ascertained the age and function of the sites and documentation contained in this report is sufficient to warrant no further work at four sites. Site 18980 and Site 18987 are recommended for preservation.

This report contains background information outlining the project area environmental and cultural contexts, a presentation of previous archaeological work within the study area and in the immediate vicinity, an assessment of expected archaeological patterns, an explanation of project methods, project findings, significance assessments, recommendations and the proposed project effect determination. The overall proposed project determination is effect with agreed upon mitigation.

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INTRODUCTION

PROJECT AREA DESCRIPTION

Under contract to property owner Kamahale Farms, LLC, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey (AIS) of 13.436 acres of land [TMK: (3) 1-5-010:009] located in Maku‘u Ahupua‘a, Puna District, Island of Hawai‘i, Hawai‘i (Figure 1 through Figure 4). The property address is 15-2145 Government Beach Road. Parcel 009 is located approximately seven miles southeast of Kea‘au town and just south of the Hawaiian Paradise Park (HPP) residential subdivision. The property is bounded on the east by the Pacific Ocean, the west by Government Beach Road, and on the north and south by residential properties.

The property owner is proposing to build a single family dwelling on the property. The AIS study was conducted as supporting documentation for a Special Management Area (SMA) permit application and construction permit application. The property owner point of contact is Mr. Robert Garrett. The property owner’s mailing owner’s address is 8216 N 14th Street, Phoenix, AZ 85020-3890. Mr. Garrett can be contacted by phone at 623-330-7244 or by email at bellgroup4930@yahoo.com.

METHODS

The archaeological inventory survey was undertaken in accordance with Hawai‘i Administrative Rules 13§13-284 and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports contained in Hawai‘i Administrative Rules 13§13-276. The investigation included the following procedures:

1. SCS conducted historical and archaeological archival research including a search of historic maps, aerial photos, written records, Land Commission Award documents, State and County Planning and Tax Records documents, and previous archaeological reports.
2. SCS conducted oral interviews with cultural informants.
3. SCS carried out a 100% pedestrian survey of the project area.
4. SCS conducted subsurface testing.
5. SCS documented all historic properties identified within the project areas.
6. SCS assessed all sites for significance and made recommendations for site disposition.

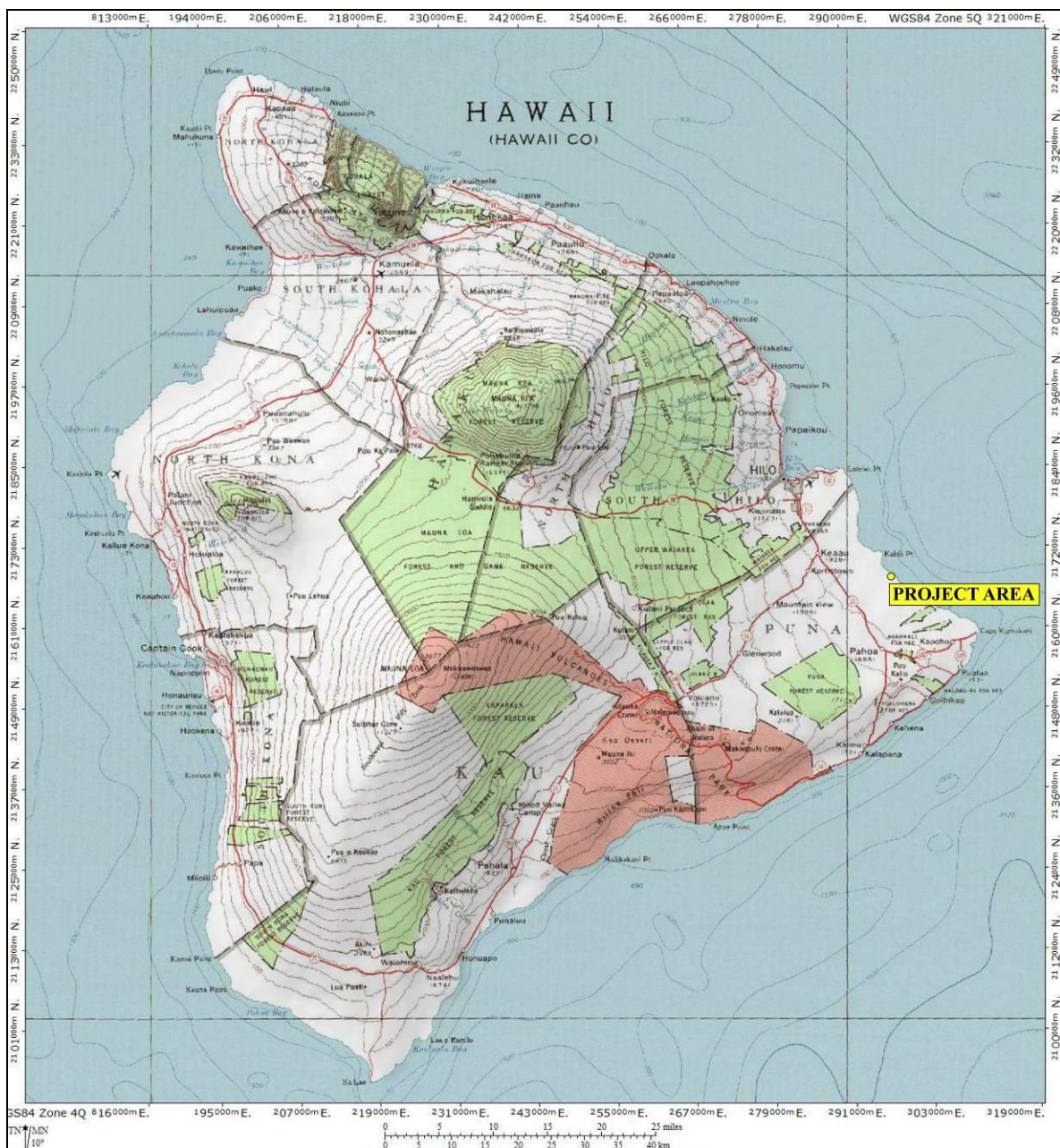


Figure 1: 5,500 K-Series Map of Hawai'i Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

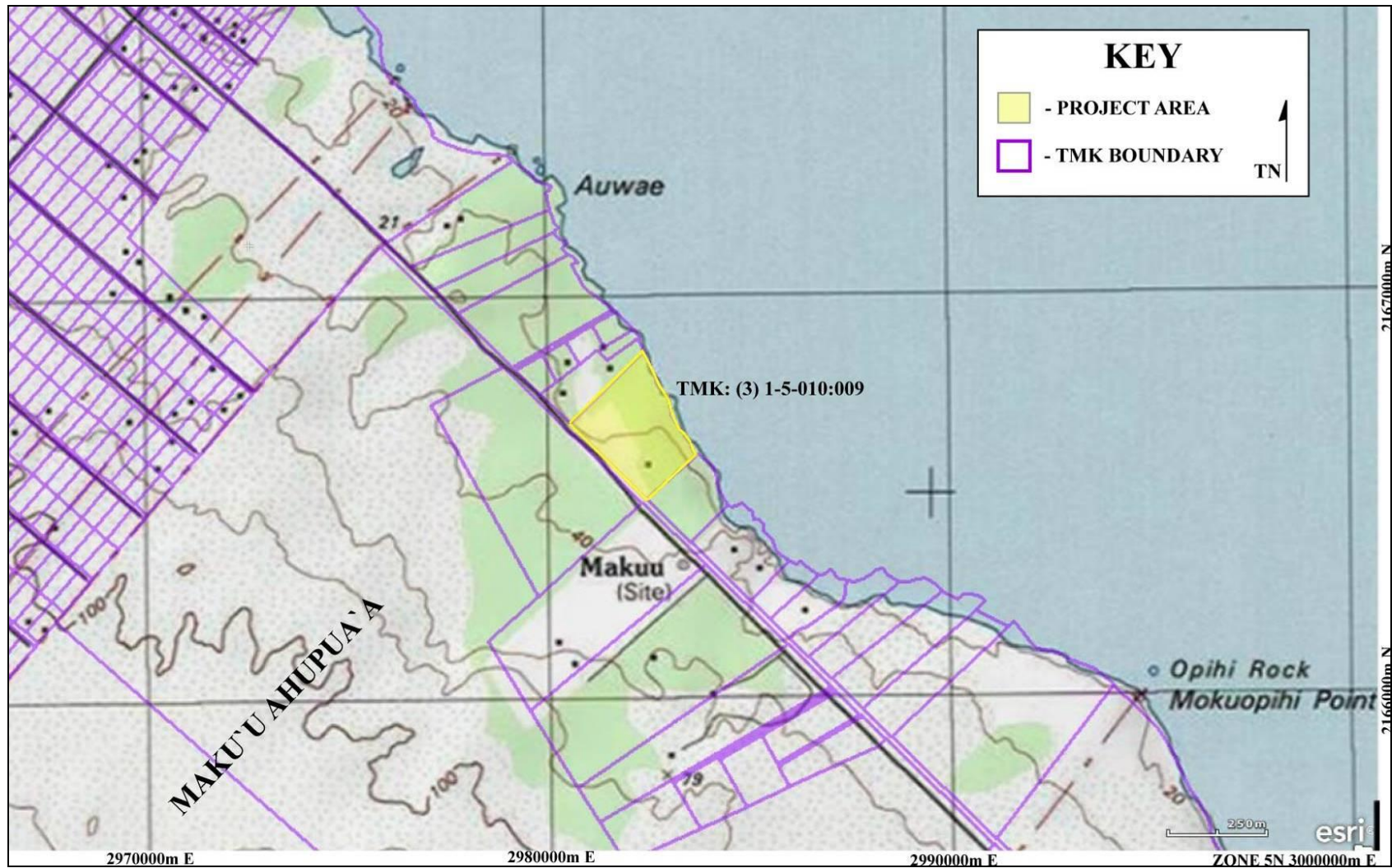


Figure 2: 7.5-Minute Series USGS Topographic Map Showing the Location of Project Area and TMK Parcels (Keaau Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and County of Hawai'i Planning Department, 2019).

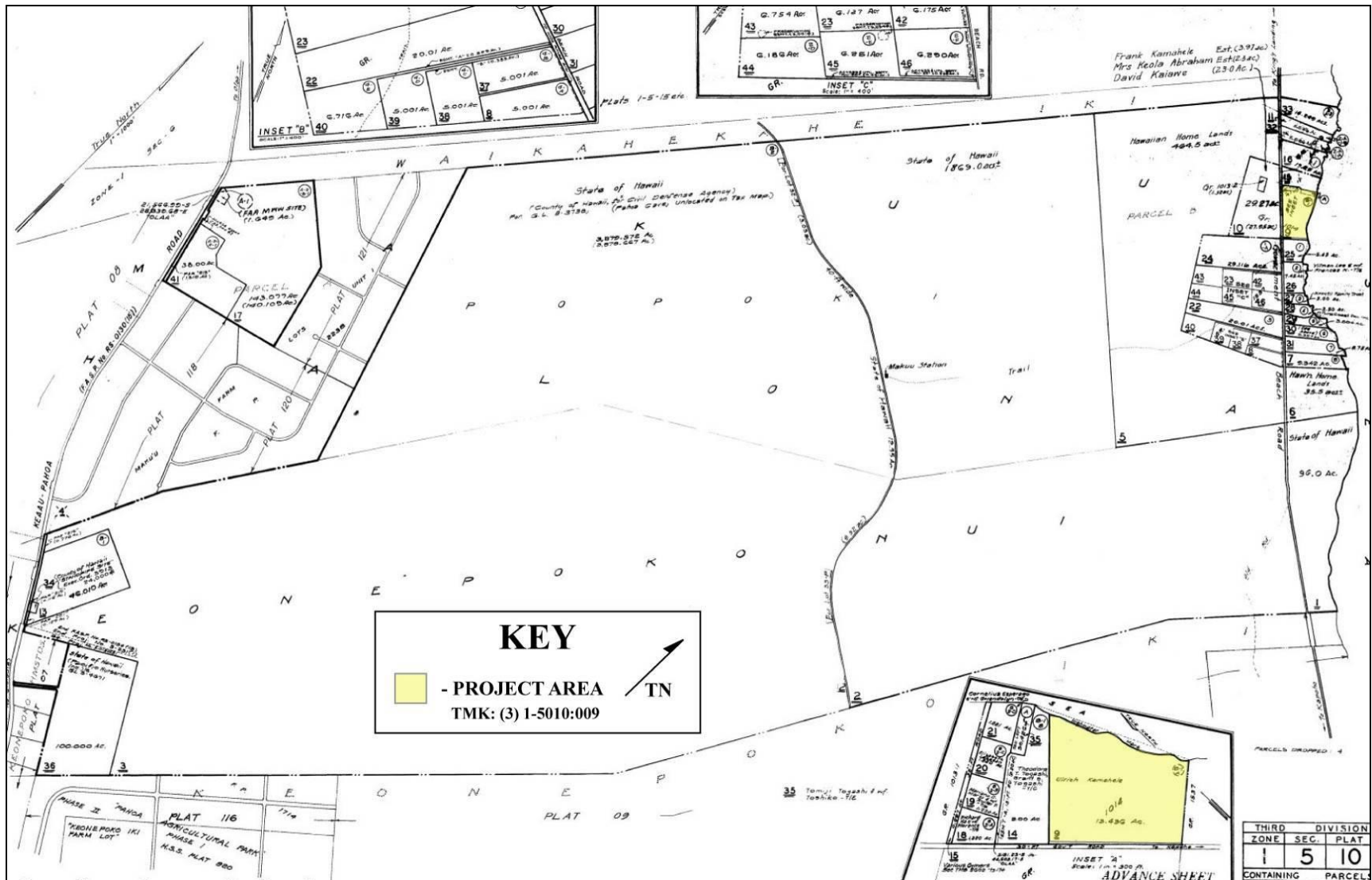


Figure 3: TMK: (3) 1-5-010 Map Showing Location of Project Area (County of Hawai'i Planning Department, 2019).



Figure 4: Aerial Photograph Showing Project Area, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

Prior to fieldwork, a search of geological maps, aerial photos, historical maps, historical documents, Hawai'i County Planning records, and previous archaeological reports was conducted.

A pedestrian survey was conducted March and April, 2019 by SCS Senior Archaeologists Glenn Escott M.A. and Suzan Escott, B.A. The fieldwork took a total of 64 person-hours to complete. A series of northwest/southeast transects spaced three meters apart were walked across the entire project area. Ground cover consisted of mown grass, trees and some low ferns and bushes. Ground visibility was very good. Glenn Escott was the principal investigator and project director for the current study.

Sites were plotted with Global Position System (GPS) using Universal Transverse Mercator (UTM) projection (Zone 5 North) and WGS84 datum. Written descriptions, scale plan view drawings, and photographs were generated for all of the archaeological features identified. Color photographs were taken of individual site features using a 25 cm long north arrow scale divided into 10 cm black and white increments.

Five 0.5 m diameter shovel probes (SP) were excavated at Site #50-10-45-18980. The shovel probes were excavated in natural stratigraphic layers. Matrix removed from shovel probes was screened for cultural material through 1/8th inch mesh.

Four stratigraphic trenches 11.0 to 12.0 meters long by 0.75 meters (45.0 linear meters total) were excavated by backhoe to determine soil stratigraphy at the project area, and to identify subsurface features and diagnostic artifacts. All of the trenches terminated in culturally sterile sediment or on bedrock. Matrix removed from stratigraphic trenches was visually inspected for the presence of artifacts and was not screened. Descriptions of the number and thickness of stratigraphic layers were recorded for each trench. Soil colors were recorded using Munsell color charts, and soil composition was recorded with the aid of the U.S. Department of Agriculture Soil Survey Manual. Profiles were drawn and photographs were taken for all stratigraphic trenches.

CONSULTATION

Members of the Kamahale *'ohana* were interviewed at the property concerning the structures and features that were located on the project area property, as well as activities that took place there.

This report contains background information outlining the project area environmental and cultural contexts, a presentation of previous archaeological work within the study area and in the immediate vicinity, current survey expectations based on the previous work, descriptions of all sites documented during the AIS field work, and significance assessments and recommendations.

ENVIRONMENTAL SETTING

The project area is situated on level to moderately sloping land between 0 feet (0 m) to 30.0 feet (9.0 m) above mean sea level (amsl). The project area substrate is a Kīlauea lava flow dated between 750 and 1,500 years ago (Wolfe and Morris 1996). Soil in the project area is ‘Opihikao series (rOPE) extremely rocky muck overlaying pāhoehoe lava (Sato 1973:43). The soil is thin and well drained with 3% to 25% slopes.

There is a low littoral cinder cone located at the center of the property, in the area of the house (see house location in Figure 4). Soil in the southwest 2/3 of the property has relatively deep cinder soil and was used for watermelon and vegetable farming, as well as pasture for cows, sheep and more recently horses. This area is primarily mown grass for the house yard.

The southwest half of the property is mown grass and ferns, and the northeast half is coconut grove with some native trees. The northeastern edge of the property is pāhoehoe coastal flats flanked by large piles of boulders thrown ashore by storm surge. The southwest half of the property was used in the Modern era as watermelon fields. Rainfall in the project area is between 120 and 200 inches per year. Natural drainage in the area runs from west to east.

Plant communities in southwest half of the project are dominated by grasses, ferns and introduced ornamental and fruit trees including various citrus trees, Cook pine (*Araucaria columnaris*), coconut palm (*Cocos nucifera*), avocado (*Persea americana*), ulu (*Autocarpus altilis*), gunpowder (*Trema orientalis*), Moluccan albezia (*Falcataria moluccana*), and bingabing (*Macaranga mappia*). The coastal half of the property contains coconut palms, *hala* (*Pandanus tectorius*), *naupaka* (*Scaevola taccada*), False *kamani* (*Terminalia catappa*), and *ki* (*Cordyline fruticosa*).

HISTORICAL AND CULTURAL CONTEXTS

Many archaeologists believe that Hawai‘i Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b). An article published in the Journal of Archaeological Science reviewing radiocarbon dates recovered at archaeological sites on the Island of Hawai‘i suggests that, by relying on only carbon samples from short-lived plant remains, the most reliable dates point to initial Polynesian colonization of Hawai‘i Island occurring between A.D. 1220 and 1261 (Reith et al. 2011:2747). Hilo was, by most estimates, one of the first settlements on the Island of Hawai‘i.

The rich marine resources of Hilo Bay and the gently sloping forests of Mauna Loa and Mauna Kea provided abundant resources. Fresh water was available from the Wailoa and Wailuku rivers and smaller streams such as Waiākea, Waiolama, Pukihāe, and ‘Alenaio. The current project area is located in Maku‘u Ahupua‘a, Puna District, roughly twenty kilometers southeast of Hilo (Figure 5).

PRE-CONTACT ACCOUNTS OF SOUTH HILO AND PUNA DISTRICTS

The earliest account of Hilo appears in ‘Umi-a-Liloa’s (1600–1620) conquest of the Island of Hawai‘i, which establishes Hilo as a royal center by the sixteenth century. In the account, ‘Umi-a-Liloa began his conquest of the Island of Hawai‘i by defeating chief Kulukulu‘ā, who lived in Waiākea, and the other chiefs of Hilo (Kamakau 1992:16–17). ‘Umi-a-Liloa’s second son, Keawe-nui-a-‘Umi, ruled Hamākua, Hilo, and Puna from his residence at Hilo (*ibid*: 34). It was from Hilo that he waged war on the Kona chiefs and unified the island. Keawe-nui-a-‘Umi’s descendants single handedly continued rule for many generations from Hilo.

After the death of Keawe-nui-a-‘Umi the kingdom was divided into three parts and was established under warring chiefs; Hilo was ruled by Kumalae-nui-pu‘awa-lau and his son Makua (*ibid*: 45). It was during the period of time that Kamehameha I was born. Kalani‘ōpu‘u’s grandson, Keoua Kuahu‘ula and nephew Kamehameha vied for control over the six chiefdoms constituting the island kingdom and Keoua conquered Hilo chief Keawe-mau-hili and harvested the benefits for a short time only to be vanquished by Kamehameha I late in 1791.

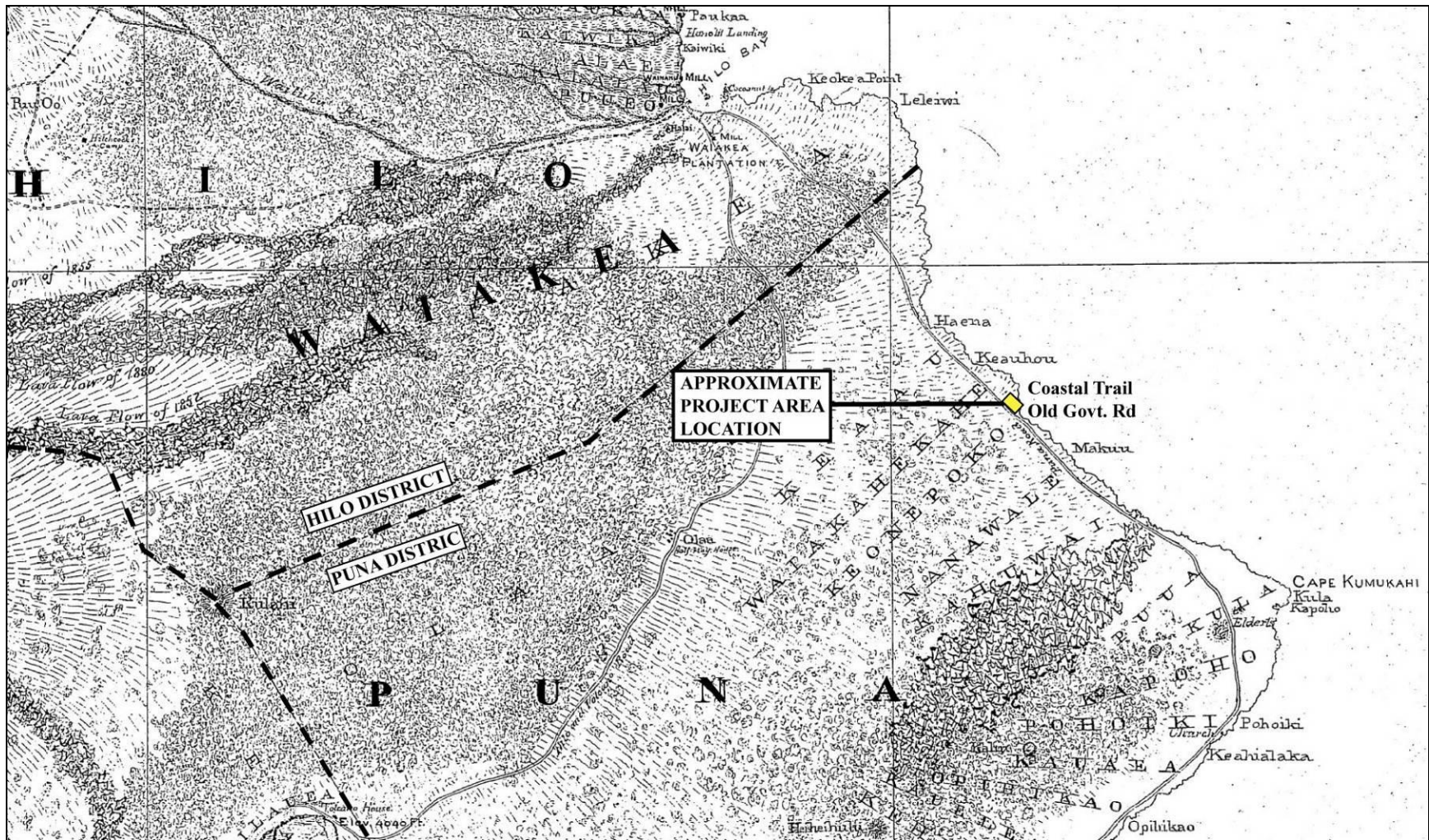


Figure 5: Portion of Map of the Island of Hawai'i Showing the Locations of Project Area and Place Names (Wall 1886).

Kamehameha's son Liholiho was born in Hilo in November 1797 (Kamakau 1992:22). Waiākea was inherited by Lihiliho after Kamehameha's death. The *'ili kūpono* of Pi'opi'o and its royal fishpond were given to his favorite wife, Ka'ahumanu.

Situated along the windward coast of Hawai'i Island, Puna is a verdant and abundant district with good rainfall and rich soils (see Figure 5). However, it is also subject to volcanic eruptions and has been covered by new lava in many places over the last 1,000 years (Cordy 2000:17, and 22). Much of the district's coastal areas have thin soils, and there are no good deep water harbors. The ocean along the Puna coast is often rough and wind-blown.

As a result of these two factors, settlement patterns in Puna tend to be dispersed and without major population centers. Villages in Puna tend to be spread out over larger areas and often are inland, and away from the coast, where the soil is better for agriculture (*ibid*: 45). The lack of population centers also had an effect on the development of a hierarchy of district rulers. Puna was often not strongly tied together by a tight web of allegiances between *ali'i* and *konohiki*. As a result, Puna was often conquered and ruled by stronger district leaders in Hilo or Ka'ū (Kamakau 1992:17 and 77).

Puna District was famous for its valuable products, including "hogs, gray *kapa* cloth (*'eleuli*), tapas made of *mamaki* bark, fine mats made of young pandanus blossoms (*'ahuhinalo*), mats made of young pandanus leaves (*'ahuao*), and feathers of the *'o'o* and *mamo* birds" (*ibid*:106). Puna was also famous for its abundant *ulu* (breadfruit).

Kea'au and neighboring 'Ōla'a Ahupua'a were well known for their valuable natural and hand-made products. Both *ahupua'a* were located along the southern boundary of South Hilo District (see Figure 5). The two *ahupua'a* were often the source of forest products for the Hilo's ruling elite. Moreover, Kea'au cut 'Ōla'a off from the ocean, so that families living along the coast in Kea'au often traded marine resources for upland forest products from family members living in small communities in upland 'Ōla'a.

Historical accounts pertaining to lands of the project area region are scarce but provide some information on traditional residence patterns, land-use, and subsistence. William Ellis passed through Maku‘u Ahupua‘a in 1823 while travelling along the coastal trail from Kilauea to Waiākea Ahupua‘a, Hilo (see Figure 5). Ellis’ journey took him along the coast past the project area. Ellis did not describe the region of Maku‘u Ahupua‘a, but stopped in a small inland village in Honolulu Ahupua‘a, and rested in the shade of a canoe house along the coast of Waiakahiula Ahupua‘a (Ellis 1963:294-295), both south of Maku‘u (Figure 6). Honolulu Village and a nearby village were inland and small, and the population was dispersed.

Ellis also described a village, likely Hā‘ena, in Kea‘au Ahupua‘a, north of Maku‘u (see Figure 5). The village was large and populous with an abundance of taro, sweet potato and sugarcane gardens (Ellis 1963:296). He suggested the area was made more fertile by a flowing stream where he quenched his thirst.

TESTIMONY BEFORE THE COMMISSION TO QUIET LAND TITLES

With the Māhele of 1848 and the two Acts of 1850, authorizing the sale of land in fee simple to resident aliens and the award of *kuleana* lands to native tenants, land tenure in Hawai‘i arrived at a significant turning point (Chinen 1961:13). The *ahupua‘a* of Kea‘au was granted to William C. Lunalilo as part of Land Commission award (LCA) 8559-B.

There were no Land Commission awards made in Maku‘u Ahupua‘a. Three small Land Grants (LG) were purchased along the coast in Maku‘u and Halona Ahupua‘a (Figure 6 and Figure 7). LG 1013 was purchased by D.W. Maiau, LG 1014 was purchased by Kea, and LG 1537 was purchased by Kapohana. D. W. Maiau was a teacher at the nearby Maku‘u schoolhouse. The current project area is the eastern portion of LG 1014 purchased by Kea in 1857.

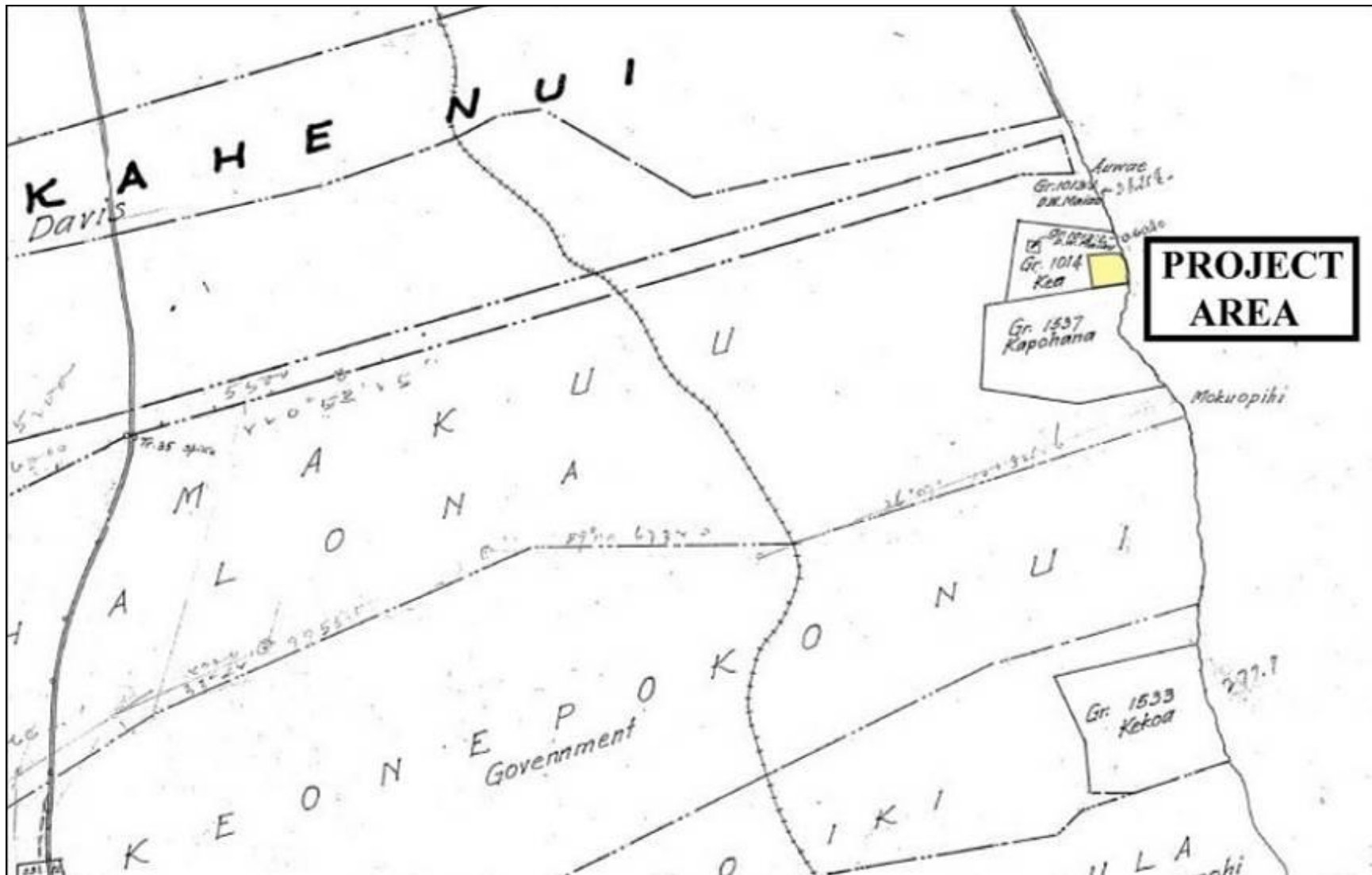


Figure 6: Portion of Map of Puna District Showing Locations of the Project Area and Land Commission Awards (Wall 1927).

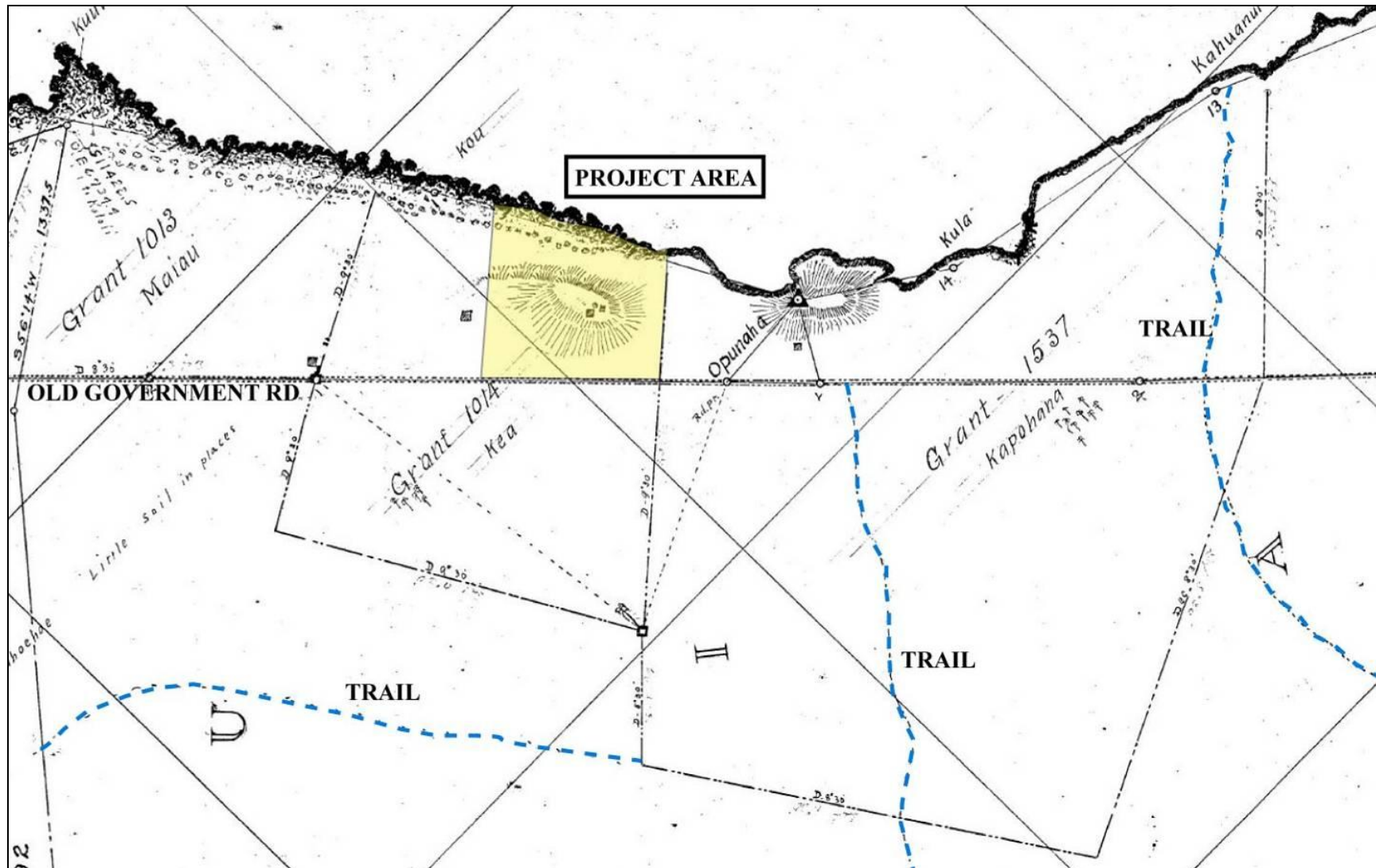


Figure 7: Portion of Map of Puna District Showing Locations of the Project Area and Land Grants (Moragne 1903).

CHANGING RESIDENTIAL AND LAND-USE PATTERNS (1845-1865)

Between 1845 and 1900, traditional land-use and residential patterns began to change drastically. In particular, the regular use of Hilo Bay by foreign vessels, the growth of tourism, the presence of the whaling industry, the establishment of missions in the Hilo area, the legalization of private land ownership, the introduction of cattle ranching, the introduction of sugar cane cultivation, and the construction of Government Roads and railroad lines all brought about changes in settlement patterns and long-established land-use patterns (Kelly *et al.* 1981). Much of the change in residential location and the growth of towns in Puna District were driven by the availability of arable land suited to commercial crops and the location of newly constructed roads.

The traditional travel route through Puna was along the coast (see Figure 5 and Figure 8). The trip was made along a foot trail that led through the coastal and near coastal villages. That trail lead from the modern day Lili'uokalani Gardens area to Hā'ena along the Puna coast. The trail is often called the old Puna Trail and/or Puna Road. There is an historic trail/cart road that is also called the Puna Trail (*Ala Hele Puna*) and/or the Old Government Road that continues from the south end of the Puna Trail through Waiakahiula Ahupua'a heading to points south. Lass (1997) also refers to the entire route from Hilo to Ka'ū as the Puna-Ka'ū trail.

THE PUNA TRAIL AND OLD GOVERNMENT ROAD

There is an historic trail that leads from the modern day Lili'uokalani Gardens in Waiākea to Hā'ena along the Puna coast. The trail is often called the old Puna Trail and/or Puna Road. There is an historic trail/cart road that is also called the Puna Trail (*Ala Hele Puna*) and/or the Old Government Road that continues from the south end of the Puna Trail heading to points south. Lass (1997) also refers to the entire route from Hilo to Ka'ū as the Puna-Ka'ū trail.

Whatever name the trail/cart road alignment is called by, it likely incorporated segments of the traditional Hawaiian trail system often referred to as the *ala loa* or *ala hele* (Hudson 1932:247, Kuykendall 1966:23-25, Lass 1997:15, and Maly 1999:5). Lass suggests the full length of the Puna Trail, or Old Government Road, might have been constructed or improved just before 1840 (Lass 1997:15). The trail was called the Old Government Road, or *Ala Nui Aupuni* (Maly 1999:5). The alignment was first mapped by the Wilkes Expedition of 1804-41 (see Figure 8).

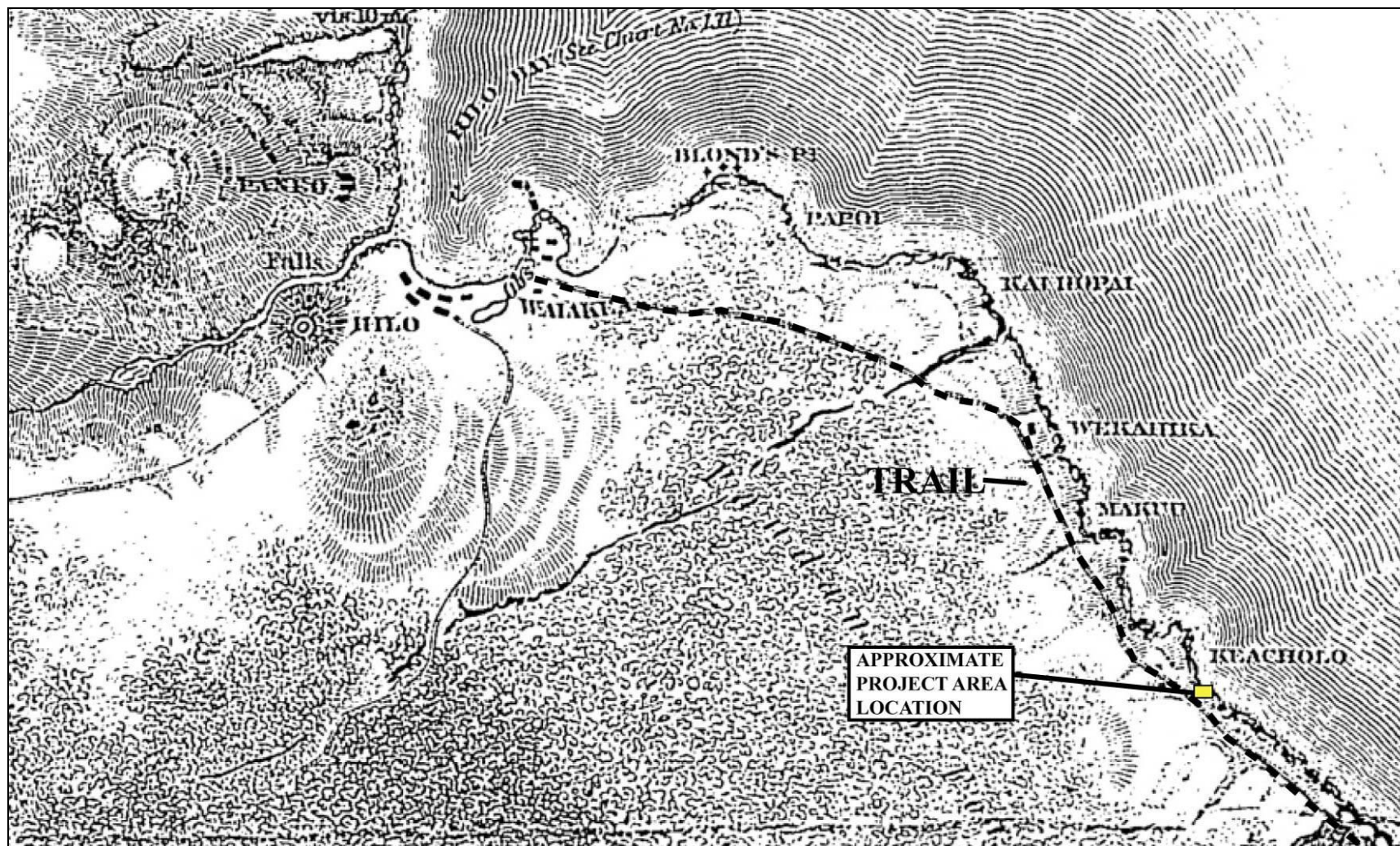


Figure 8: Location of Project Area and Old Government Road from Hilo Bay through Puna District on Portion of Registered Map 424 Drawn by the Wilkes Expedition of 1840-1841.

A general description of the area between the Old Government Road and the newer upper road from Hilo through Kea‘au to Pahoa was recorded in 1889 by the Surveyor General of the Hawaiian Government Survey. The description affords a glimpse into inland and coastal settlement patterns and land use.

The first settlement met with after leaving Hilo by the sea coast road, is at Keaau, a distant 10 miles where there are less than a dozen inhabitants; the next is at Makuu, distant 14 miles where there are a few more, after which there is occasionally a stray hut or two, until Halepuaa and Koae are reached, 21 miles from Hilo, at which place there is quite a village; thence to Kaimu there are only a few scattered settlements here and there. A good many of those living along the lower road have their cultivating patches in the interior, along or within easy accessibility to the new road (Alexander 1891, cited in Maly 1999:107).

The 1889 description contrasts with Ellis' in which he described numerous villages just sixty-six years earlier. The 1889 description suggests depopulation along the majority of the Puna near-coastal area. In both descriptions, the people in this area appear to have lived somewhat inland, between the coast and the inland gardens. In 1889 people were cultivating small patches of *kalo*, *‘awa*, and coffee as well as other food items in the inland gardens. The patches were placed in pockets of soil in holes amidst the lava flows. Additionally, sweet potatoes were grown on rock mounds. By 1889, it appears that very few people lived along the Old Government Road (Maly 1999:6). The Surveyor General stated,

The old sea coast road cannot be kept in repair with the means now at its disposal and its condition each year is becoming more unsafe and ruinous, there is but little travel over it; it has been shown that there is little land capable of cultivation or development either side of it and whatever travel there is now over it would soon be entirely diverted to the upper road (Alexander 1891, cited in Maly 1999:107).

The new road being constructed from Hilo through Kea‘au to Pahoa was designed to allow access to the more arable inland areas. People who traditionally had lived along the Puna coast were moving toward Hilo and into the more fertile upland areas of Puna in

order to find paid work and to produce cash crops for local markets and for export. In particular, people began to work in the inland areas to grow sugarcane.

The same was true of the trail from Hilo, through Kea‘au, and on to Kīlauea Crater (Volcano Road). An improved Volcano Road was built from Hilo to Kīlauea between 1889 and 1893 partly to accommodate tourism, but also to increase access to forest products and agricultural land. Numerous small field parcels belonging to the ‘Ōla‘a Sugar Company and the ‘Ōla‘a Coffee Company were located along this route. The improved Volcano Road is Route 11, though it has been straightened and improved several times since its initial construction.

The modern history of land-use in Kea‘au Ahupua‘a is tied to the development of commercial agriculture and the construction of transportation routes. The potential to use Kea‘au's rich arable land for commercial prospects was recognized as early as the 1870s when it was leased for coffee growing and for cattle grazing. In 1881, the entire *ahupua‘a* was purchased at auction by Samuel Damon, William H. Shipman, and E. Elderts from trustees of the deceased William C. Lunalilo Estate. Shipman bought out the two partners within three years of purchasing the land.

William H. Shipman operated a cattle ranch in Kapoho Ahupua‘a and was the owner of the Waiākea Stock Ranch. Shipman was also co-owner of the Shipman Meat Market, later the Hilo Meat Company. Shipman leased portions of Kea‘au Ahupua‘a to the ‘Ōla‘a Sugar Company beginning in 1899. It was the development of ‘Ōla‘a Sugar Company fields, the construction of the sugar mill in Kea‘au, and the construction of the numerous sugar company camps, that created modern day Kea‘au town as a small commercial and residential center.

SUGARCANE, RAILROADS AND COMMERCE

The ‘Ōla‘a Sugar Company, established in 1899, became the largest sugarcane plantation and milling operation in Puna District. By the 1950s the ‘Ōla‘a Sugar Company was in debt and sugar production and sales were stagnant. The company stockholders changed the company name to the Puna Sugar Company, Ltd. and sold off land to invest in new equipment and upgrade their facilities. By 1966, the company was debt free and making a good profit. American Factors (AMFAC) bought out the minority shareholders in 1969 and Puna Sugar Company became a subsidiary of AMFAC.

AMFAC expanded sugarcane processing in the 1970s through new extraction facilities upgrades at the mill in Kea‘au (‘Ōla‘a Mill) and by building a 15KW bagasse and trash burning power plant next to the mill. Hilo Electric Light Company (HECO) agreed to purchase 12.5KW of power for their customers.

Puna Sugar Company, like many other sugar companies, struggled in the late 1970s and early 1980s due to changes in the sugar market that made sugar production less profitable. By the start of 1982, AMFAC had decided to close Puna Sugar Company. The work of selling off assets and preparing severance packages took three full years. The sugar mill was sold to Fiji Sugar Corporation in 1988 and the power plant operation taken over HECO.

MODERN LAND USE

The project area and surrounding lands were not used for growing sugarcane as the soil is too shallow. The area remained primarily unaltered and undeveloped grasslands with a large variety of introduced and invasive species. The land north of the current project area, 15.6 square miles in total, was purchased by David Watumull from W.H. Shipman, Ltd in 1959. The land was subdivided into nearly 8,800 lots within the newly created Hawaiian Paradise Park (HPP) subdivision.

Currently, the land along the coast near the project area is primarily privately owned. Some of the lots have homes on them and others are still undeveloped. Some of the lands further *mauka* of Government Beach Road are owned by the Department of Hawaiian Homelands (DHHL) and the State of Hawai‘i.

LG 1014 purchased by the Kea family was subdivided and the northeast corner of the property was purchased by the Kamahale-Kamoe family by at least in the first two decades of the 1900s. Frank Kamahale and Ann Kamahale (née Kamoe) had eight children including Ulrich “Sonny” Kamahale. The family was living on the property when Ann passed and she and other Kamoe family members are buried in a family plot (Site #50-10-45-18987) on the property. Sonny (April 15, 1923-November 6, 2002) lived on the property and grew produce there until he passed away. Sonny’s house (Site #50-10-45-7476) and the property were later sold after Sonny passed. Site 7476 burned down in 2014 during Hurricane Iselle and is no longer present on the property.

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

The majority of previous archaeological studies near the project area have been conducted on lands along the coast (Figure 9) and in Kea‘au Ahupua‘a, slightly inland, west of the project area.

There are six coastal Kea‘au archaeological studies conducted northeast of the current project area (Ewart and Luscomb 1974, Hammatt 1978, Hudson 1932, Lass 1997, Stokes 1919, and Thrum 1908). Two literature reviews, one with oral interviews, were also conducted for coastal Kea‘au Ahupua‘a (Maly 1999, McEldowney 1979a and 1979b). Thrum (1908) and Stokes (1919) were the first to record sites in Puna District. They recorded *heiau* in the Puna area but none near the Old Government Road (OGR) or the current project area.

Hudson (1932) conducted an archaeological survey of the east Hawaiian coast. Eighty-five sites were recorded between Hilo and Cape Kumukahi. Hudson described the excellent condition of the portion of the OGR between Kea‘au and Kapoho. He documented several sites in Hā‘ena including a fishpond, a *ko‘a* (fishing shrine) with an upright stone, and another site with two upright stones. Clark (1985), in his book on Hawai‘i Island beaches noted that the site Hudson (1932) had recorded with two upright stones was still present, but that only one stone remained upright. The *ko‘a* recorded by Hudson could not be relocated during a more recent survey of the area (Lass 1997).

Ewart and Luscomb (1974) conducted an archaeological reconnaissance survey along a 16-mile proposed road corridor from the Hilo-Puna district boundary to the south edge of the Hawaiian Beaches subdivision (see Figure 9). The north half of the project corridor was approximately 0.5 to 1.0 mile inland from the coastal cliffs and ran parallel to the coast. The south half of the project corridor, from just south of Pākī Bay to the southern terminus, ran along the coast.

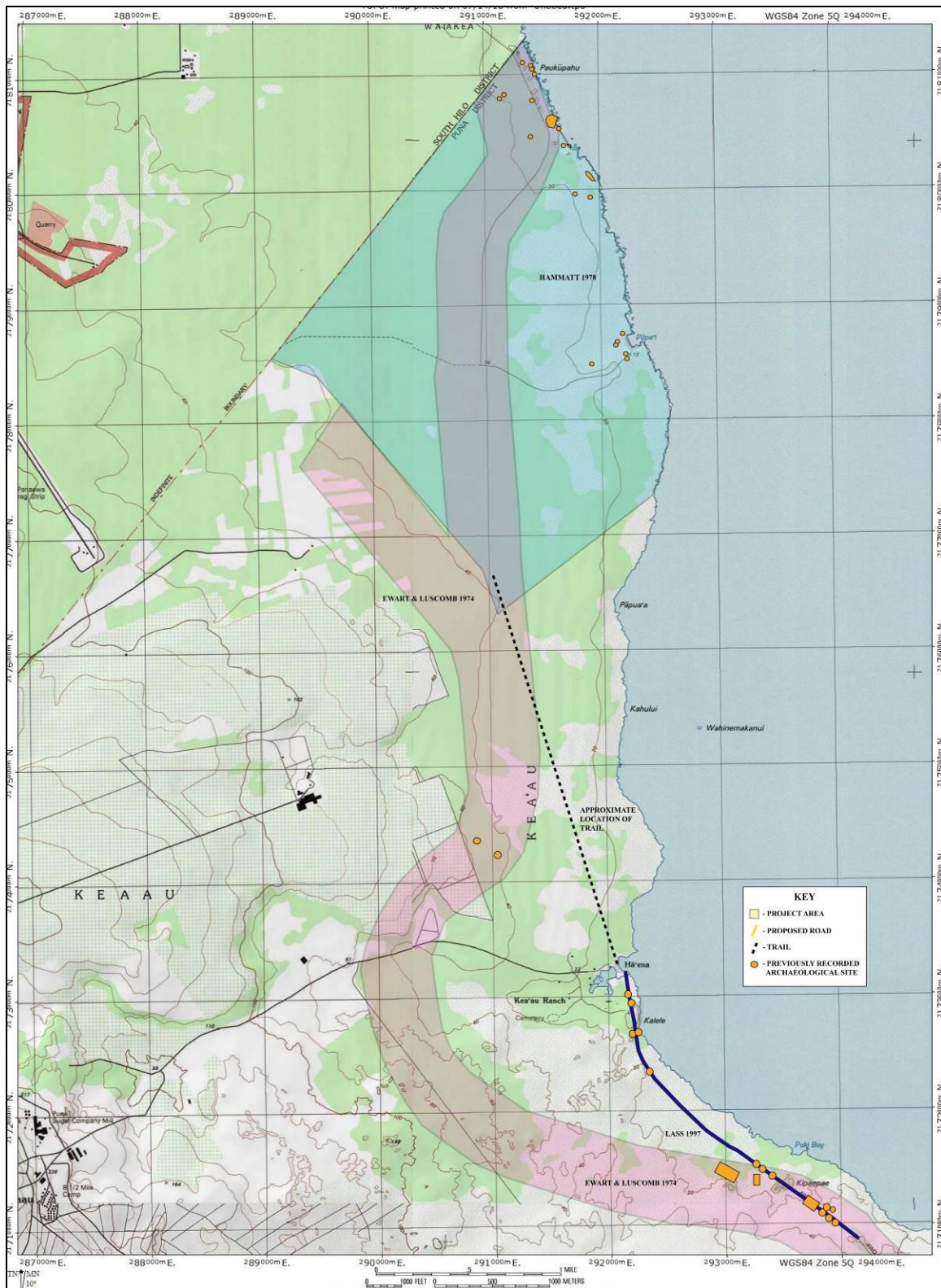


Figure 9: 7.5-Minute Series USGS Topographic Map (Kea'au Ranch Quad) Showing Location of Coastal Kea'au Ahupua'a Previous Archaeological Studies (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

Thirty sites were documented in the Kea‘au Ahupua‘a portion of the survey corridor (Ewart and Luscomb 1974:14). The majority of sites documented in Kea‘au Ahupua‘a were clustered in the northern portion of the study corridor, and along the OGR south of Hā‘ena. Site types included rock walls (n=10), complexes (n=9), enclosures (n=6), a platform (n=1), a rock shelter (n=1), a rock mound (n=1), and L-shape enclosure (n=1), and a modified outcrop (n=1). The age and function of sites was not determined during the brief reconnaissance survey.

The authors recommended a Phase I archaeological survey, suggesting that any future study should focus on variations in prehistoric settlement patterns as they relate to varying coastal topography (Ewart and Luscomb 1974:47). In particular, future study should focus on resources availability and settlement patterns. Resources determining settlement include ground water availability and ocean access for canoes.

Hammatt (1978) conducted an archaeological reconnaissance survey in the northeast corner of Kea‘au Ahupua‘a, approximately two miles north of the current project area (see Figure 9). Twenty seven archaeological and/or historical sites were documented along the coast (Hammatt 1978:3). Sites were classified as either stone structures including walls, platforms, enclosures, *heiau* and small shelters; cultural deposits, mainly midden and other habitation remains; or places of historical significance.

All of the stone structure sites, with the exception of two sites interpreted as *heiau* (Site 6475 and Site 6476), were assessed to be in poor condition and were not recommended for further study. Sites containing midden were recommended for preservation and the historically significant sites were recommended for preservation with interpretive signage. The report also recommended vegetation clearing and resurvey of the coastal portion of the project area to identify additional sites.

McEldowney (1979a and 1979b) conducted a literature review of east Hawai‘i that included the OGR. This work compiled known sites such as the Hā‘ena complex (50-HA-A1-65) and the fishpond at Hā‘ena (50-HA-A1-64). The OGR was referred to as the “Hilo to Puna trail” and was not given a site number. McEldowney noted it as Historic a Historic era site but suggested it likely was constructed from a pre-Contact era trail.

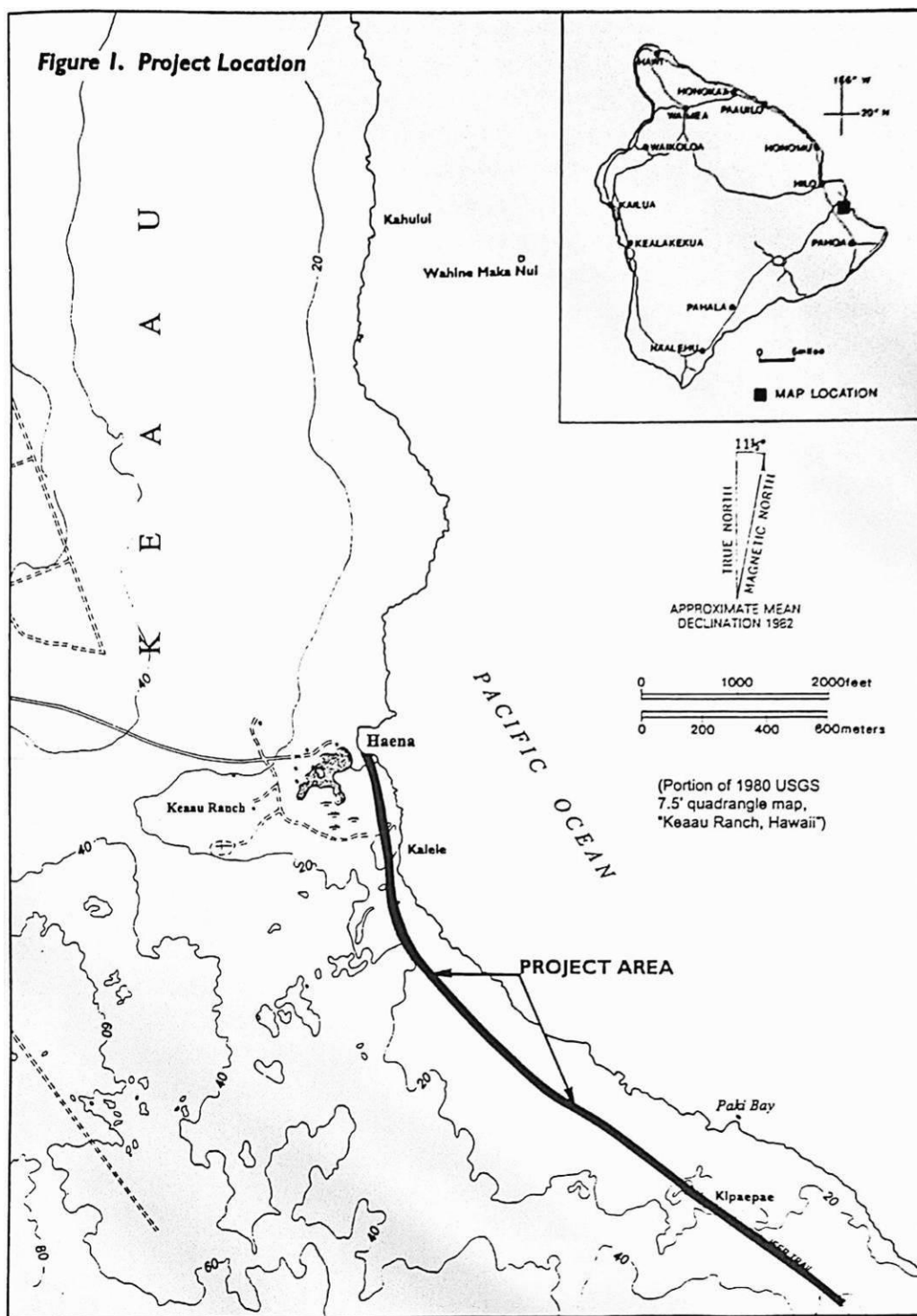
Barbara Lass (1997) conducted an archaeological reconnaissance survey along the OGR from Hā'ena south (see Figure 10 and Figure 11). The study corridor covered approximately three miles of coastline from Hā'ena to Hawaiian Paradise Park (HPP) subdivision. The south end of the study corridor is located approximately ½ mile (0.8km) north of the end of Beach Road. The reconnaissance survey was conducted as part of a proposal to construct a public hiking trail along the OGR.

Lass documented 15 archaeological sites (Table 1), including the OGR (Site #50-10-36-21273). Several sites outside of the project area corridor were identified during the survey, including a *heiau* near Pākī Bay, a possible residential complex near Site #50-10-36-21266, and names scratched into pāhoehoe at Pākī Bay. Lass recommended that a hiking trail would not negatively impact the archaeological sites along the OGR and could be a useful resource for educating the public about the history and archaeology of the area.

Lass's research determined the Old Government Road was under construction around 1868 and the portion within her project area was first referenced in 1869 when a Puna road supervisor planned to work on five miles between Waikahekahe (possibly referenced as Wekahika by Wilkes) and Hā'ena. From researching the road construction documents, Lass states:

After 1881 when the new Puna road was completed, the section of Old Government Road between Hilo and Ha'ena was probably used less often and perhaps even largely abandoned except for casual or local use. The section of Old Government Road within the project area and to the south, however, was not only apparently still used but was probably an important transportation route; otherwise, the new connecting road between the Volcano Road and Kea'au would presumably not have been built (Lass 1997:22).

The majority of the sites documented along the OGR by Lass were interpreted as agricultural features and later military features. Lass concluded Site #50-10-36-21264 may correspond with Site A1-27 as documented by Ewart and Luscomb (1974) and Site A1-17(Ewart and Luscomb 1974) may correspond to either/all of Site #50-10-36-21259, 21260, and/or 21261.



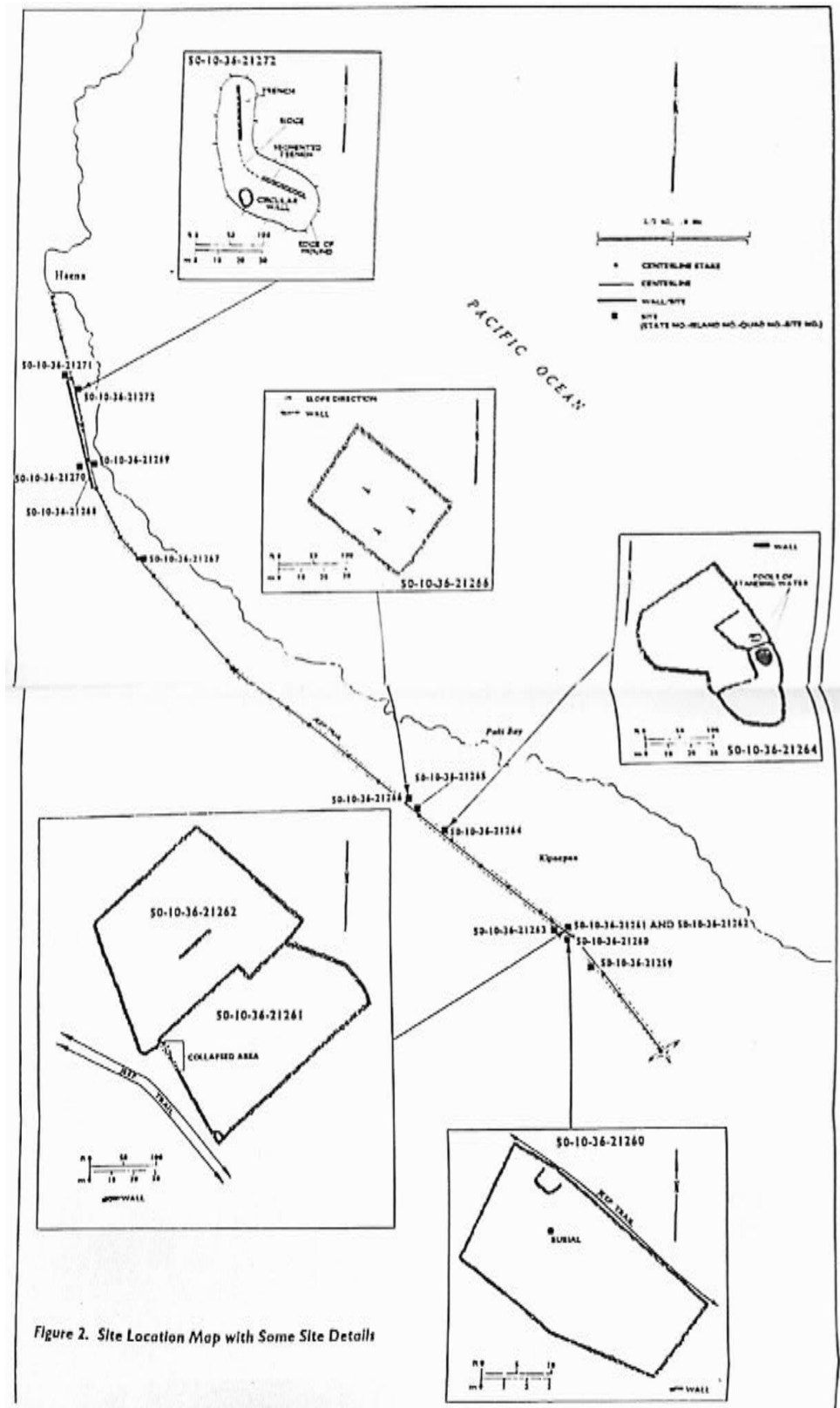


Figure 11: Map of Lass (1997) Project Area Site Locations and Site Plan View Drawings.

Table 1: Site Summaries of Barbara Lass (1997) Archaeological Reconnaissance Survey.

SIHP# 50-10-36:	Site Type	Age	Size	Description
21273	Old Government Road-Puna Trail	Pre-Contact to Historic	-	The main road used by the Puna district in the nineteenth century. The OGR was likely constructed over a pre-Contact/early post-Contact pedestrian trail. The road consists of cobblestone pavement, raised and/filled areas, waterworn rocks (‘ili‘ili), wall sides and curbstone. It is still in good condition.
21259	Rock Wall	Historic	29 m long, 0.6 m wide, and approx. 0.9-0.7 m in height	This wall is adjacent and parallel to the <i>mauka</i> side of the Old Government Road. The wall stands over a meter taller than the OGR on the mauka side indicating the possible function of preventing soil erosion.
21260	Rock wall enclosure with various features	Historic	109 m long on the side near the road, 102 m long on the opposite side, 47 m long on the north end, 37 m long on the south end. 0.5 m wide and 0.8-0.9 m tall.	The features include a rock pile, a smaller walled enclosure, a small segment of retaining wall and a burial platform. It was probably used for horticulture.
21261	Connected (to 21262) rock wall enclosure	Historic	69 m long on the north end, 87 m long on the south end, 50 m long on remaining sides.	These walls are roughly rectangular and run perpendicular to the OGR. Portions of the walls have collapse. The stones were piled. It contains horticultural characteristics
21262	Connected (to 21261) rock wall enclosure	Historic	60 m long on the north end, 73 m long on the south end (shared with 21261), 56 m on the side adjacent to the OGR, 63 m on last side	These walls are roughly rectangular and run perpendicular to the OGR. Portions of the walls have collapse. The stones were piled and appears to have been used for horticulture.
21263	Rock wall	Unknown	16 m long, 0.6 m wide, and 8 m in height	This rock wall is parallel to the OGR.
21264	Rock wall enclosure	Unkown	Approximately 90 m long (parallel to the OGR), 50 m across, 0.5m wide and 0.8-0.9 m in height.	This roughly oval enclosure is on the ocean side of the OGR. Several walls divide the interior of the enclosure into smaller sections. The marshy conditions would allow for the cultivation of taro and other crops.
21265	L-shaped wall	Unknown	10 m long (parallel to the OGR) and 5 m (perpendicular to the OGR), 0.5 m wide and 1 m in height	This site is located 5 m from the OGR on the makai side.

SIHP# 50-10-36:	Site Type	Age	Size	Description
21266	Rock wall enclosure	Historic	50 m long (2 sides parallel to the OGR), 36 m long on one end, and 33 m long on othe other, 0.5 m wide, and 1-1.2 m in height.	This site contains, soil, ti plants and piled rocks. It is located on the makai side of the OGR. Portions of the wall have collapsed. It is interpreted as being used for agriculture.
21267	Modified depression or Kīpuka	Unknown	11 m long, 9.5 m in width, and 1.5 m in depth	The long axis is parallel to the OGR. Parts of the interior are lined with rock. A pedestrian rock entrance is located at the north end. It appears to be agricultural in function.
21268	Rock wall		425 m long, 1.2-1.8 m in height and 0.8 m wide.	This wall is parallel and adjacent to the road. It is on the mauka side. A portion of the wall is breached at 165 m from South end. It leads to Shipman properties including the Shipman cemetery.
21269	Rock wall	Unknown	12.2 m in length (mauka end), 7.6 m of collapse, 15.3 m gap and a large rock on the makai end. It is 1.1 m tall and 1.0 m wide.	Portions of the wall are collapsed. The wall damage is probably due to the high surf.
21270	Concrete trough	Historic, WWII, Modern	2.2 m in length, 2.6 m in width and 1.0 m in height	It is likely the trough was constructed on site due to visible cement layers. The middle of the trough has a raised central platform. Twentieth century debris was present. It was either used for ranching or the military.
21271	Concrete bunker	Historic, WWII	3.5 m on each side in length, 1.9 m from ground to overhang roof.	It is located adjacent to the road. It conatins metal platforms for either gun mounts or obseration instruments. It resembles WWII bunkers seen in Hawai‘i.
21272	Modified trenches	Historic/WWII	North trench: 14.2m long, 2.0 m wide, 1.0 m deep. South trench: 14.5 m long, 1.4 m wide and 1.0 m deep.	Located on the makai side of the OGR. This site is two constructed trenches located on a hill along the coastline which indicates they were for WWII defense or surveillance.

Kepa Maly (1999) conducted historical and archival research, previous archaeological research and collected oral interviews for Kea‘au Ahupua‘a and the Kea‘au portion of the Puna Trail (the Old Government Road), specifically TMK: (3) 1-6-001. Maly determined the agricultural sites reported by Lass (1997) were probably constructed during the pre-Contact era and modified in the 1800s when cattle began to damage gardens and house gardens.

Maly argued that the types of sites present in the overall area, such as habitation, enclosures, near-by *heiau*, possible burials and agriculture, suggest the coastal area surrounding the OGR are the remains of coastal settlements. The oral history component of his study supported this conclusion. He concurred with Lass that the use of the OGR as a public hiking trail would help foster a better historical understanding of coastal Kea‘au Ahupua‘a. Maly recommended preservation treatments for the trail, including not paving the OGR, making the public aware it is illawful to damage or disrespect archaeological and cultural sites, an ongoing effort to consult with lineal and cultural descendents concerning future preservation treatments and access.

Maly’s study also added to Lass’s archaeological work through interviews and research to present a deeper understanding of the previously recorded archaeological sites. Maly determined that Site 21267 is one of two early Historic era schools in Kea‘au Ahupua‘a (School Grant 4, Lot 18). Schools at that time were enclosed by rock walls to keep animals out of the school yard where students cultivated gardens (Maly 1999 citing an 1865 letter from Hitchcock to Bishop).

According to interviews collected by Maly, rock wall Site 21269 was used as both a boundary between the Shipman and Fisher’s properties and for ranching purposes. There was once a gate in the wall that crossed the OGR corridor. The wall continued to the ocean.

Oral interviews indicated that Site 21270 was part of the Fisher’s chicken farm complex (1923-1942). The feature may have been part of processing activities. It was located under one of the long chicken houses. Maly’s interviews stated that Site 21272 was used during WWII primarily as a camp site and Roy Blackshear noted outhouses were possibly built over them. John Ka‘iewe stated that, when he was younger, the site was used as a shelter by fishermen. The flat area on the *makai* side of Site 21272 contains stones which may be remnants of a previous site.

Ewart and Luscomb (1974) recorded 22 archaeological sites along the coast of Waikahekahe and Maku‘u Ahupua‘a (Figure 12 and Table 2). Sites were clustered on either side of Beach Road and consisted of agricultural and habitation complexes. Sites included rock walls, small enclosures and agricultural rock clearing mounds.

Coastal Waikahekahe and Maku‘u archaeological sites were primarily agricultural and habitation complexes containing rock walls, agricultural rock clearing mounds, rock walls, enclosures, pavements, platforms, rock lined wells, and burial features. The sites appear to be primarily pre-Contact to Historic era in age. Site 18975 is a possible *heiau* complex (Figure 13).

RECENT STUDIES IN MAKU‘U AND SURROUNDING AHUPUA‘A

Seventeen archaeological studies have been conducted in Maku‘u, Pōpōki and Halona Ahupua‘a (Figure 14 and Table 3). The studies were conducted in the upland and coastal regions surrounding the current project area and shed light on pre-Contact to Historic era land use. The most striking feature of the studies is the low distribution of archaeological sites documented in the upland project areas. Aside from lava tubes containing pre-Contact era habitation features and burials, only three archaeological features were documented in the upland project areas. Upland features included a possible ceremonial complex (enclosure, platform, rock wall, and rock wall), a rock mound and an agricultural terrace. The lack of sites in the uplands is consistent with early written accounts documenting traditional habitation areas along the coast to a little over one mile inland.

Komori and Peterson (1987) conducted a cultural and biological resources survey along a corridor roughly 2.5 to 3.0 kilometers (1.55 to 1.86 miles) from the coastline. Five agricultural complexes, habitation and burial platforms, burial and refuge caves, and petroglyphs were documented within the project area. All of the sites are pre-Contact to early post-Contact era in age.

Dirks and Rechtman (2013) recorded a pre-Contact era coastal trail segment (Site 18418) and a Historic era rock wall (Site 18419) roughly 350.0 meters southeast of the current project area (Figure 15). The trail was recommended for preservation.

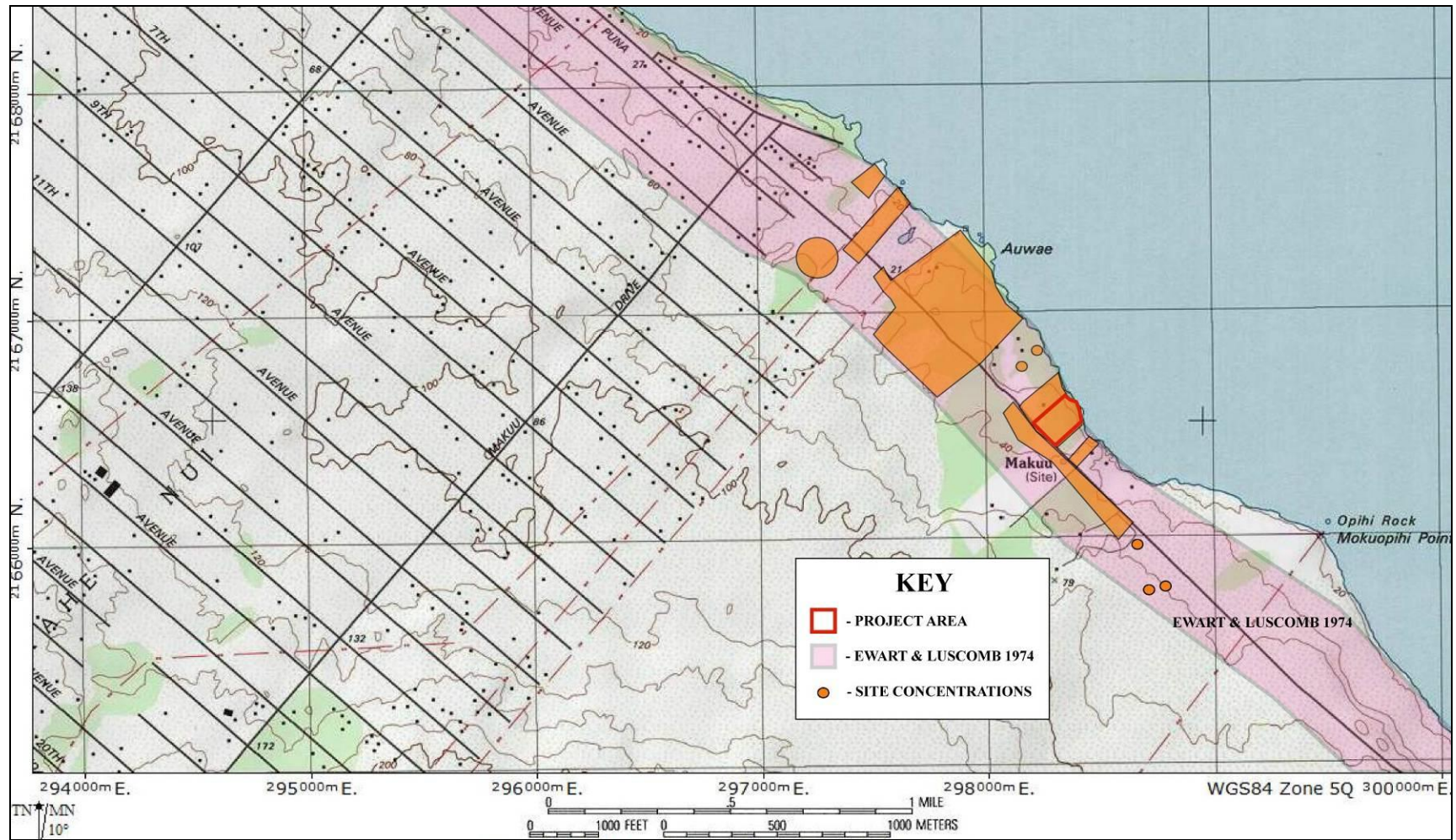


Figure 12: 7.5-Minute Series USGS Topographic Map (Kea'au Ranch Quad) Showing Location of Coastal Sites Recorded in Ewart and Luscomb (1974) (National Geographic Topo!, 2003). Data Sources: National Geographic Society, USGS).

Table 2: Inventory of Waikahekahe and Maku‘u Ahupua‘a Archaeological Sites (Ewart and Luscomb 1974).

SIHP# 50-10- 45:	Site Type	Ahupua‘a	Description	Research Potential
18973	Complex	Waikahekahe	Rock walls, retaining walls, walled depressions, and possible platforms	Good
18974	Complex (Agriculture and Habitation)	Waikahekahe	Rock walls, retaining walls, walled depressions, possible pavements, and platforms	Good
18975	Complex	Waikahekahe	Rock walls, retaining walls, platforms, rock mounds, and possible <i>hieau</i>	Excellent
18976	Complex (Agricultural)	Maku‘u	Free-standing and retaining walls and small mounds	Good
18977	Wall	Maku‘u	Wall	N/A
18978	Complex	Maku‘u	Free-standing and retaining walls, a mound, a possible <i>kuleana</i> wall, and an enclosure	Mediocre
18979	Wall & Enclosure	Maku‘u	Rock wall and enclosure	Some
18980	Complex (Agriculture)	Maku‘u	Rock walls and rock mounds	Good
18981	Petroglyphs	Maku‘u	Modern petroglyphs	N/A
18982	Complex	Maku‘u	Walls, faced areas, a mound with an upright stone, and a rock-lined well	Negligible
18984	Complex (Agriculture and Habitation)	Maku‘u	Trails, several enclosures, and terraces	Excellent
18985	Wall	Maku‘u	Rock wall	Some
18987	Burials	Maku‘u	Historic grave yard	N/A
18987	Complex (Agriculture and Habitation)	Maku‘u	Walls, enclosures, mounds, depressions, and platforms	Good
18988	Complex (Agriculture and Habitation)	Maku‘u	Walls and platforms	No Longer Present
18989	Petroglyph Field	Maku‘u	Petroglyphs	Good
18990	Possible Burial	Maku‘u	Rock mound	N/A
18991	Enclosure	Maku‘u	Rock lined depression	N/A
19005	Possible Burial	Maku‘u	Rock mound	N/A
20598	Trail	Maku‘u	Coastal trail	Good
4222	Petroglyph Field	Maku‘u	Petroglyphs	Good
7476	Kamahele House	Maku‘u	Historic house	No Longer Present

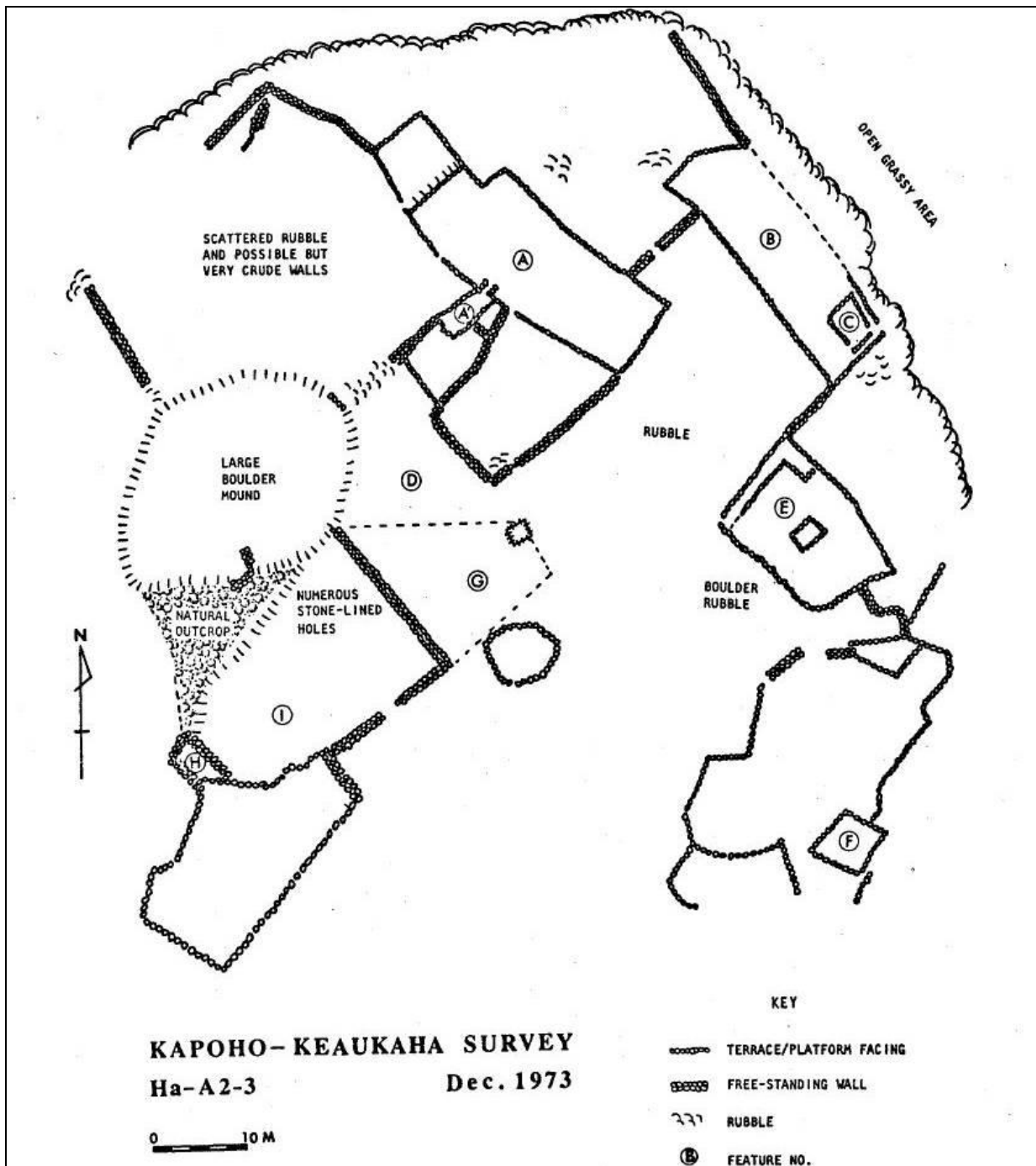


Figure 13: Site 18975 Plan View Map (Ewart and Luscomb 1974:24).

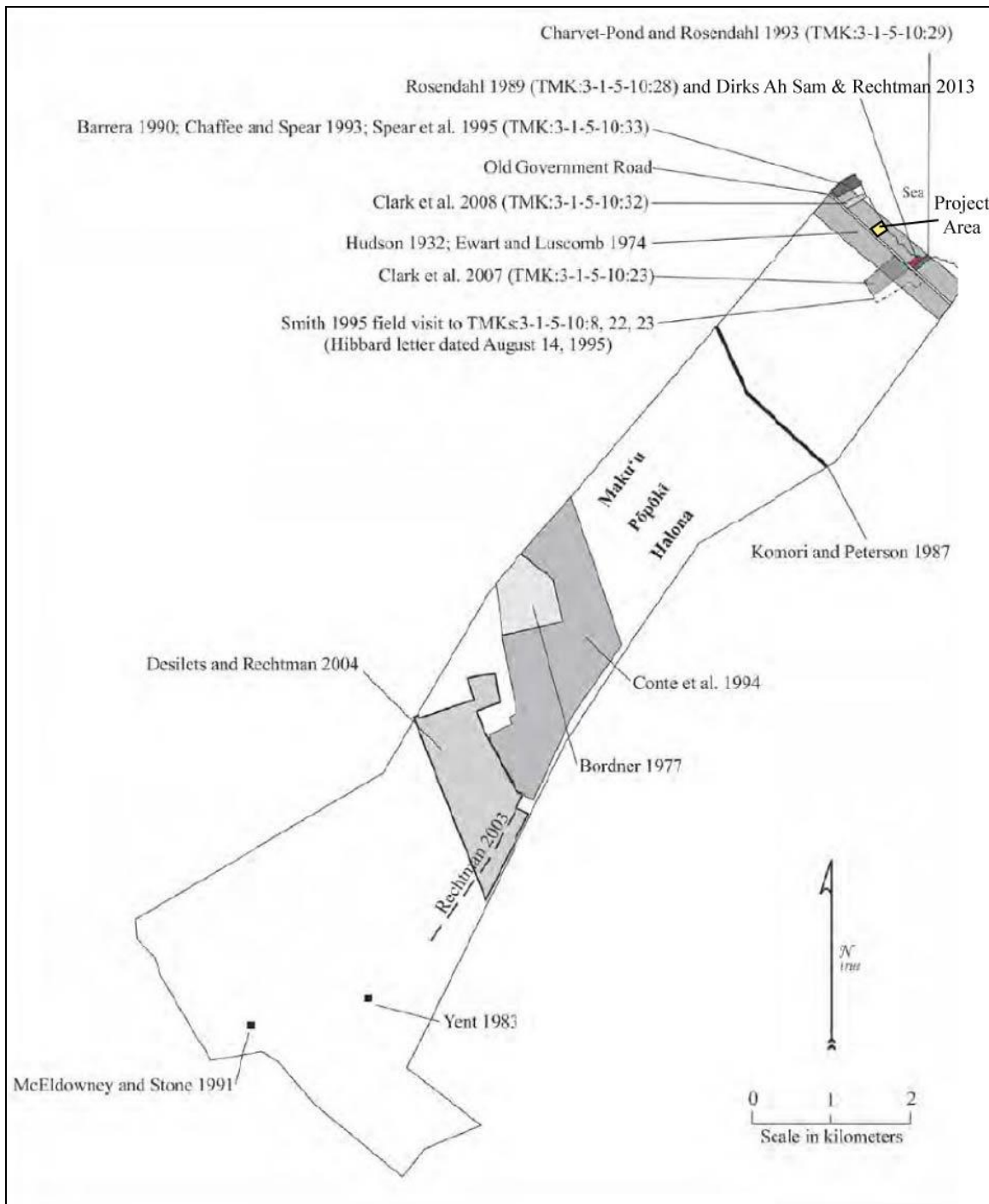


Figure 14: Map Showing Recent Previous Archaeological Studies in Maku'u and Surrounding Ahupua'a (Adapted from Dirks Ah Sam and Rechtman 2013:11).

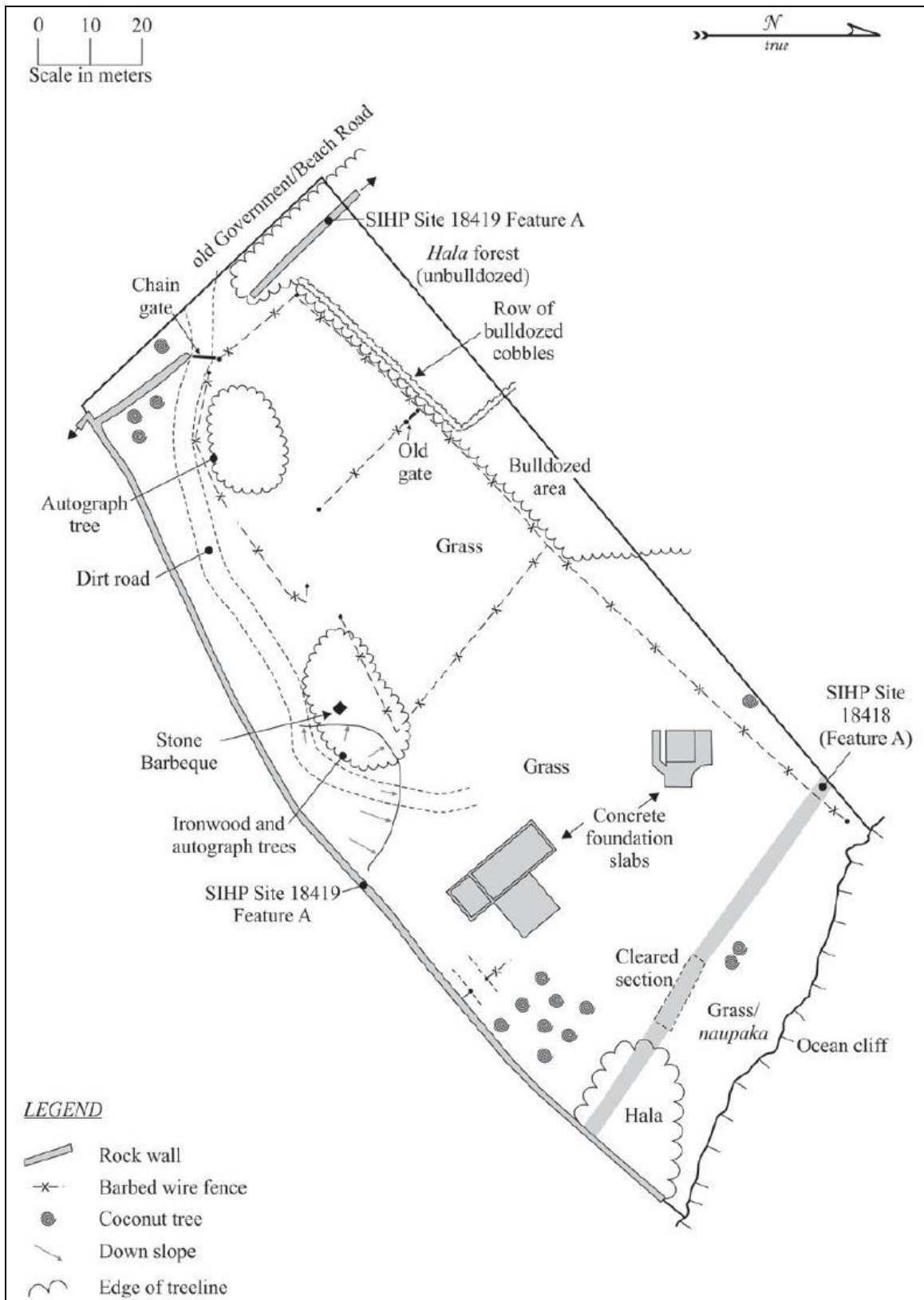


Figure 15: Archaeological Site Plan Map Showing Sites Recorded in Dirks and Rechtman (2013).

Table 3: Previous Archaeological Studies in Maku‘u, Pōpōki and Hālona Ahupua‘a.

Author/Date	Type of Study	Ahupua‘a
Barrera & Lerer 1990	Archaeological Inventory Survey	Maku‘u
Bordner 1977	Reconnaissance Survey	Maku‘u
Chaffee & Spear 1993	Burial Testing	Maku‘u
Clark et al. 2007	Archaeological Inventory Survey	Pōpōkī
Clark et al. 2008	Archaeological Inventory Survey	Maku‘u
Charvet-Pond & Rosendahl 1993	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Conte et al. 1994	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Desilets & Rechtman 2004	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Dirks Ah Sam & Rechtman 2013	Archaeological Inventory Survey	Pōpōkī
Hudson 1932	Archaeological Survey	Various
Ewart & Luscomb 1974	Reconnaissance Survey	Various
Komori & Peterson 1987	Cultural & Biological Resource Survey	Various
McEldowney & Stone 1991	Archaeological/Environmental Survey	Various
Yent 1983	Archaeological Survey	Maku‘u
Rechtman 2003	Archaeological Assessment	Maku‘u, Hālona
Rosendahl 1989	Field Inspection	Maku‘u, Hālona, Pōpōkī
Spear et al. 1995	Data Recovery	Maku‘u

Studies conducted along the coastline documented clusters of pre-Contact to early Historic era habitation and agricultural sites including enclosures, platforms, rock walls, rock mounds, burials, petroglyphs, rock lined springs and water catchments, and remnant trail segments.

PREVIOUS ARCHAEOLOGY WITHIN THE PROJECT AREA

Ewart and Luscomb (1974) recorded six sites within the project area and a single coastal trail segment on the property southeast of the current project area (Table 4 and Figure 16). Sites 18980, 18982 and 18988 were recorded as agricultural complexes, likely pre-Contact to early Historic era, consisting of rock mounds, rock walls, platforms, and a well.

Table 4: Inventory of Previous Documented Sites at the Project Area.

SIHP# 50-10- 45:	Site Type	Description	Research Potential
7476	Kamahele House	Historic house	No Longer Present
18980	Complex (Agriculture)	Rock walls and rock mounds	Good
18981	Petroglyphs	Modern petroglyphs	None
18982	Complex	Walls, faced areas, a mound with an upright stone, and a rock- lined well	Negligible
18987	Burials	Historic graves	N/A
18988	Complex (Ag. & Habitation)	Walls and platforms	Moderate
20598	Trail	Coastal trail	Good

Site 18980 is in the southeast corner of the parcel just *mauka* of the coastal pāhoehoe flats. The site contained agricultural rock mounds and walls. Site 18982 was recorded along the northwest boundary of the property, primarily on the property northwest of the current project area. A shallow well or spring was located on the current project area. Site 18988 was no longer present when the Ewart and Luscomb (1974) survey was conducted, but the property owner, Sonny Kamahele, told the surveyors in 1973 that there were platforms, walls and an enclosure that were removed to expand his watermelon fields.

Site 7476 was the Kamahele and Kamoe house located in the southwest quadrant of the property. The house is listed on the Hawai‘i Register. The house burned down in 2014 during Hurricane Iselle and is no longer present on the property. Site 18987 is the family burial plot containing Sonny’s maternal grandmother (née Kamoe) and six other individuals.

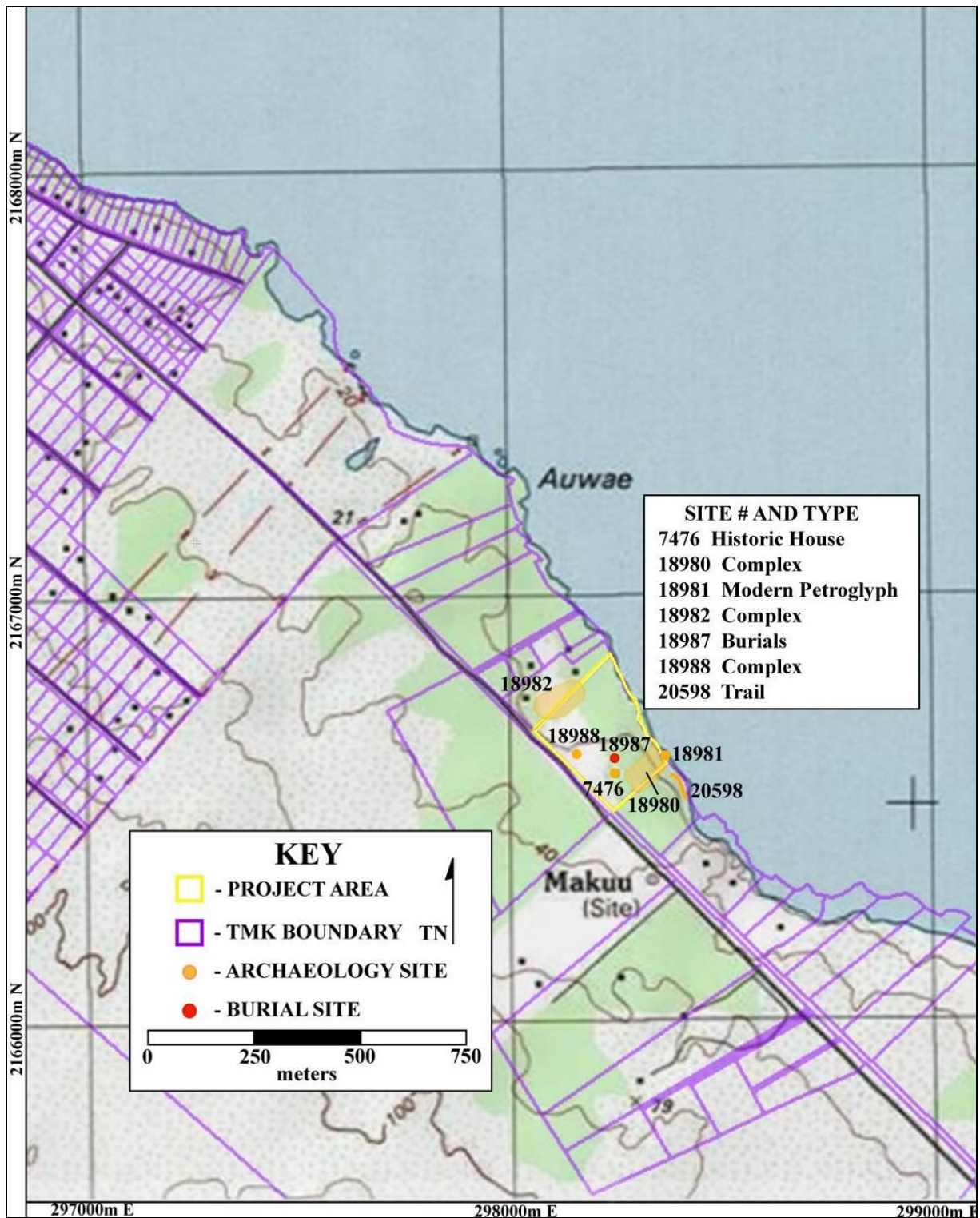


Figure 16: 7.5-Minute Series USGS Topographic Map Showing the Location of Previously Documented Sites on Parcel 009 (Kea‘au Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and Hawai‘i County Planning Department, 2013).

Site 18981 are three modern petroglyphs carved into two large rocks located on the coastal pāhoehoe flat in the south east corner of the property. The petroglyphs read “72 MIKE N TINA,” “72 GUY HA” and “MIKE N TINA.”

Site 20598 is a remnant segment of trail located along the coastal cliff on the property southeast of the project area. The trail is constructed of waterworn boulders placed side by side on to two meters wide (Ewart and Luscomb 1974:28).

The Ewart and Luscomb (1974) study determined that Site Complex 18980 had good research potential while the modern petroglyphs at Site 18981 had no research potential. Site Complex 18982 was determined to have negligible research potential. No intrusive additional research was recommended for Burial Site 18987 and that Site Complex 19988 had only moderate research potential as it is no longer present on the ground surface. No recommendation was made in the report for house Site 7476 and it is no longer present. Trail Site 20598 was determined to have good research potential but is not within the current project area, though a search should be made to determine if it continues onto the current project area.

CONSULTATION

KAMAHELE FAMILY CONSULTATION

Consultation with the Kamahele family was conducted at the property on Saturday April 27, 2019. Seven individuals, including Greg DeConte, Kenneth Ha, Richard Ha, June Ha, Shayne Kamahele, Puanani Mukai, and Darrell Pakele attended and were interviewed. In addition, SCS Senior Archaeologist Glenn Escott spoke to Sheldon Kamahele at an earlier date on the property. Richard Ha has written several posts on his family blog describing Uncle Sonny Kamahele and his watermelon farm at Maku‘u. The following description of Uncle Sonny and his Maku‘u farm includes a summary of the April 27 meeting and Richard Ha’s posts. Figure 17 shows the location of flora zones and land-use areas from Historic to Modern eras.

All of the family members remembered the property well, especially Uncle Sonny Kamahele’s house and farm. Although Uncle Sonny passed away in 2002, many of the family members visited him on his Maku‘u farm from the time they were very young. It seemed for a long time that Uncle Sonny’s farm was far away from Pāhoa and most places as the road access was limited. Richard, whose maternal grandmother was Sonny’s sister, writes

My extended Kamahele family came from Maku‘u. When we were small kids, Pop took us in his ‘51 Chevy to visit.

He turned left just past the heart of Pāhoa town, where the barbershop is today. We drove down that road until he hit the railroad tracks, and then turned left on the old railroad grade back toward Hilo. A few miles down the railroad grading was the old Maku‘u station. It was an old wooden shack with bench seats, as I recall. That is where the train stopped in the old days. A road wound around the pāhoehoe lava flow all the way down the beach to Maku‘u. That was before there were the Paradise Park or Hawaiian Beaches subdivisions.

We did not know there was a district called Maku‘u; we thought the family compound was named Maku‘u. Of the 20-acre property, maybe 10 acres consisted of a kipuka where the soil was ten feet deep. The 10 acres on the Hilo side were typical pāhoehoe lava. The property had a long oceanfront with a coconut grove running the length of the oceanfront. It was maybe 30 trees deep and 50 feet tall.



Figure 17: Aerial Photograph Showing Project Areas, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

The old-style, two-story house sat on the edge of a slope just behind the coconut grove. If I recall correctly, it had a red roof and green walls. Instead of concrete blocks as supports for the posts, they used big rocks from down the beach.

There was no telephone, no electricity and no running water. So when we arrived it was a special occasion. We kids never, ever got as welcome a reception as we got whenever we went to Maku‘u.

The person who was always happiest to see us small kids was tutu lady Meleana, my grandma Leihulu’s mom. She was a tiny, gentle woman, maybe 100 pounds, but very much the matriarch of the family. She spoke very little English but it was never an issue. We communicated just fine.

We could not wait to go down the beach. Once she took us kids to catch ‘ohua—baby manini. She used a net with coconut leaves as handles that she used to herd the fish into the net. I don’t recall how she dried it, but I remember how we used to stick our hands in a jar to eat one at a time. They were good.

She would get a few ‘opihi and a few haukeuke and we spent a lot of time poking around looking at this sea creature and that.

Between the ocean in the front and the taro patch, ulu trees, bananas and pig pen in the back, there was no problem about food. I know how Hawaiians could be self-sufficient because I saw it in action.

The house was full of rolls of stripped lauhala leaves. There were several lauhala trees and one was a variegated type. I don’t recall if they used it for lauhala mats but it dominated the road to the house.

There were lauhala mats all over the place, four and five thick. There was a redwood water tank, and a Bull Durham bag hung on the kitchen water pipe as a filter [Richard Ha January 2, 217 blog post].

Family members recalled that the kitchen was outside along the north side of Sonny’s house. There was a cast iron wood burning stove in the kitchen. The floor of the house was made of wooden boards over the bare earth ground. Sonny had a wooden bed on which he laid *lauhala* mats for the mattress. The bathroom was a separate

structure north of the kitchen. Sonny had a water catchment and an electric generator for power.

Sonny kept pigs and cows and would net *nenu* and other fish to supplement the vegetables he grew on his property. Sonny would also go to town most Friday's for anything else he needed. Sonny was a well known farmer and he made an annual income growing watermelons up until 2000. People would come from all over to buy his watermelons. Sonny had about twelve hills of watermelons with four plants growing in each hill (Richard Ha January 30, 2017 blog post). In addition, he grew tomatoes, corn, *ulu*, *kalo*, coconuts, and bananas.

Puanani, Uncle Sonny's primary caretaker when he was older, remembered that Sonny's maternal grandmother was buried at the family grave plot northeast of the house. She thought that one of the grandmother's sons who had died during the war might also be buried there. She didn't know the names of the other individuals buried there but was certain they were from the Kamoe and Kamahale family. She thought it was possible that some of the deceased family members' ashes might have been scattered off the coastline of the property.

Family members remembered most fondly fishing and swimming along the shoreline. They remembered that there was a shallow spring along the northwest edge of the property that Sonny dug out and made a shallow well. The well had a pump that Sonny installed. They also remembered that Uncle Sonny kept the west half of the property around the house and watermelon fields well maintained by cutting the grass often and weeding. None of the family members were aware of any cultural practices, other than fishing, that occurred on the property.

LUI FAMILY CONSULTATION

Consultation with the Lui family was conducted at the property on Wednesday October 30, 2019. Mr. Ramon Lui, his wife Agnes and daughter Nicole were present. The Lui family is descended from Kea who first owned L.G. 1014. Nicole shared genealogy documents for the Kea family. L.G. 1014 was a 56.4 acre property purchased in 1852. The current project area is the southeast corner of the land grant.

Kea passed in July 1871 and the property was inherited by his wife, Kaohumalu and his five children, Jokepa, Kahokumaka, Kaluahine, Kekuewa, and Kaholowaa. Jokepa was appointed the estate administrator. The family later sold off the property in smaller portions. The Lui family believes that members of their family are present at the burial plot (Site 18987) on the property.

EXPECTED ARCHAEOLOGICAL PATTERNS

Based on previous archaeological studies, historical research and family interviews it is expected that pre-Contact to early Historic era agricultural and habitation features will be located on the current project area. The features will likely include rock walls, rock clearing mounds, possible enclosures, and the Kamahale house Site 7476. It is also possible that coastal trail Site 20598 might continue onto the current project area.

RESULTS OF FIELDWORK

Five archaeological sites were identified in the project area (Table 5 and Figure 18). Three of the sites (Site #50-10-45-7476, 18980 and 18987) were previously recorded in Ewart and Luscomb (1974) and two sites are previously undocumented. The three previously identified sites include a cement foundation at the Kamahele House (Site 7476), an agricultural complex (Site 18980) and the family burial plot (Site 18987). Two newly recorded sites include the rock wall along the boundary of Parcel 009 (Site 31111) and a short rock wall segment (Site 31112) in the southeast corner of the project area. Site 18981 recorded in Ewart and Luscomb (1974) is two modern petroglyphs and is not a historic property.

Table 5: Inventory of Archaeological Sites Identified Within the Project Area.

SIHP #50-10-45:	SITE TYPE	SITE FUNCTION	SITE AGE
7476	Kamahele House	Habitation	Historic era
18980	Complex (Agriculture)	Rock walls and rock mounds	Pre-Contact to early post-Contact era
18987	Burials	Historic graves	Historic era
31111	Rock Wall	Property Boundary	Historic era
31112	Rock Wall	Road edge	Historic era

SITE 07476

KAMAHELE HOUSE FOUNDATION

FUNCTION:

Habitation

AGE:

Modern

DIMENSIONS:

10.37 m NW/SE by 6.1 m by 16 cm Height

CONDITION:

Poor

INTEGRITY:

Lacks Integrity

SURFACE ARTIFACTS:

Modern Debris

EXCAVATION:

None

DESCRIPTION:

Site 7476 is the foundation located where the Kamahele House once stood (see Figure 18). The foundation is toward the center of the project area in an area of mown grass, northeast of two avocado trees, and northwest of a large stand of Cook pines (Figure 19). The concrete foundation is 10.37 m (34 ft) long by 6.1 m (20 ft) wide and is raised approximately 16 cm (6.3 inches) above ground surface (Figure 20 and Figure 21). The house burned down in 2014 during Hurricane Iselle and is no longer present. Family members remembered the house was a post-and-pier wood structure with wood floors boards. They didn't recall a cement foundation and this might have been poured by the subsequent owner. Site 7476 was destroyed by an accidental house fire in 2014, is in poor condition, is no longer present and lacks formal integrity. No further work is recommended at Site 7476.

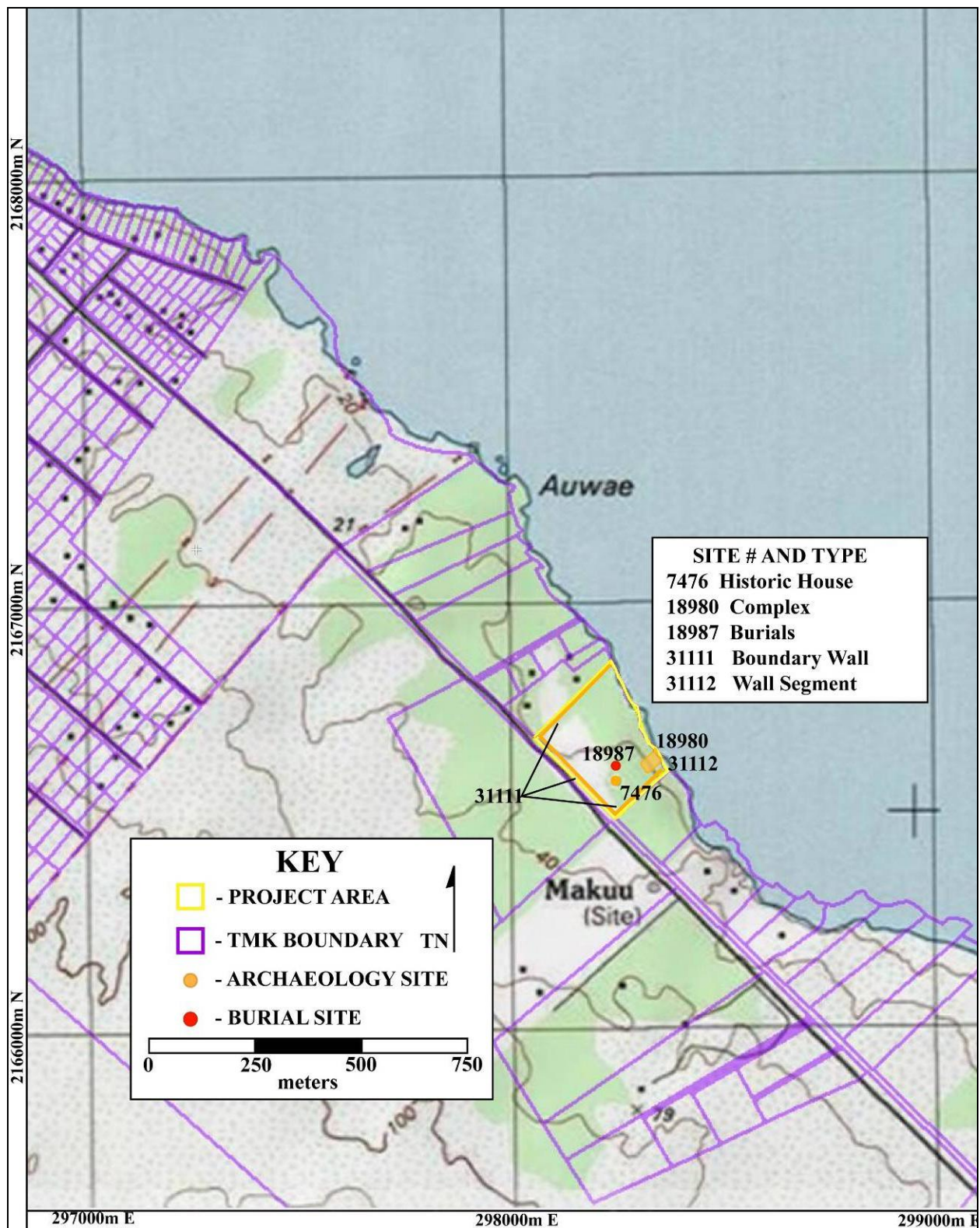


Figure 18: 7.5-Minute Series USGS Topographic Map Showing the Location of Archaeological Sites Documented on Parcel 009 (Kea‘au Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and Hawai‘i County Planning Department, 2013).



Figure 19: Aerial Photograph of Site 7476 Kamahale House, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

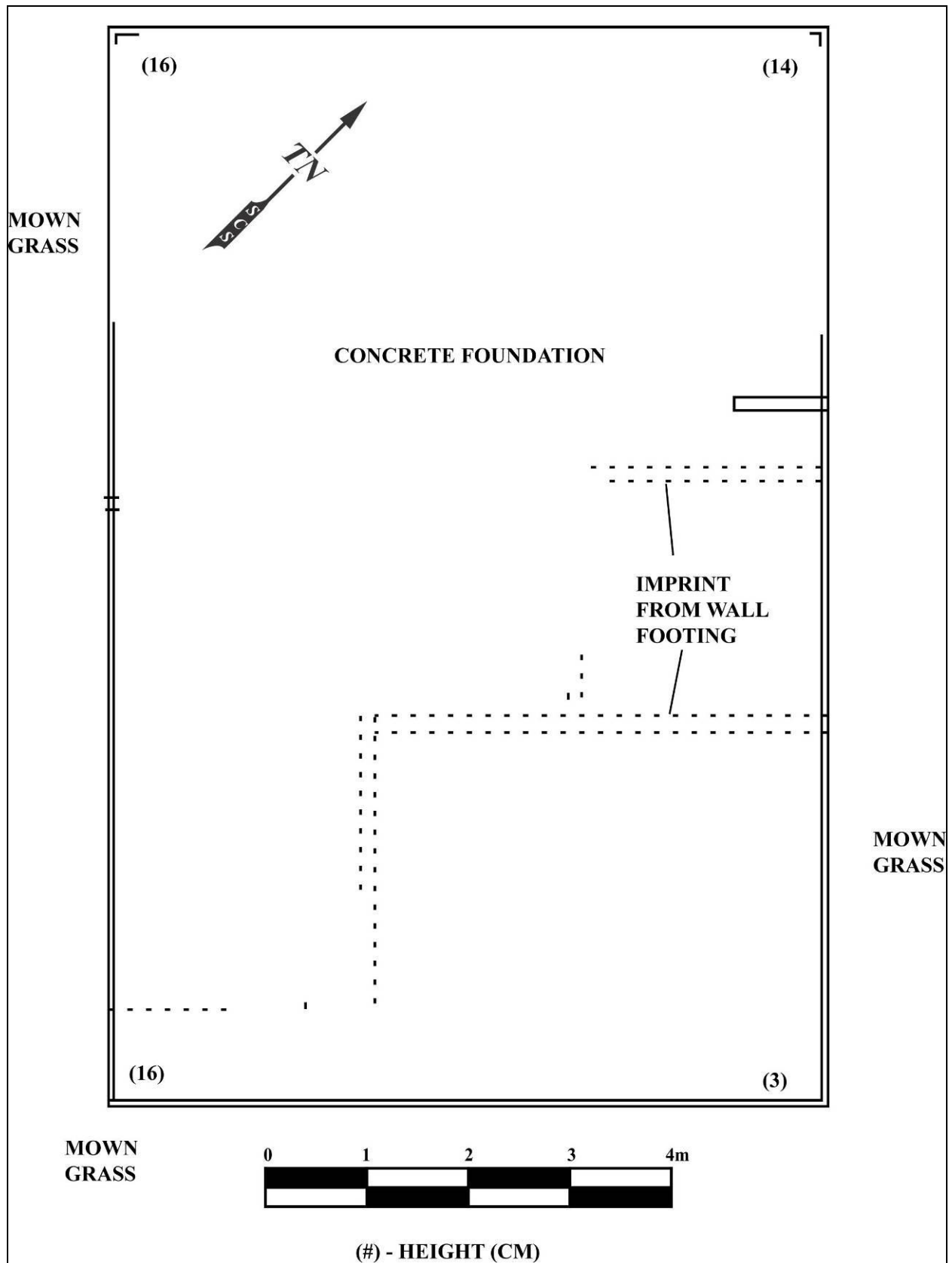


Figure 20: Site 7476 Foundation Plan View Map.



Figure 21: Photograph of Site 7476 Foundation Looking North.

SITE 18980**AGRICULTURAL COMPLEX**

FUNCTION:	Agriculture
AGE:	Pre-Contact to Historic Era
DIMENSIONS:	45.0 m N/S by 20.0 m
CONDITION:	Good
INTEGRITY:	Unaltered: retains integrity of location, setting, materials, and workmanship
SURFACE ARTIFACTS:	Modern Trash
EXCAVATION:	Five Shovel Probes
DESCRIPTION:	Site 18980 is an agricultural complex located in the southeast quadrant of the property (see Figure 18). The complex consists of seven features located in a level thin soil area with <i>hala</i> tree, palm trees, <i>ti</i> plants, and ferns (Figure 22). The site is bordered on the east by a linear pile of boulders thrown up by storm surge. The ground surface slopes gently upwards to the west.

Feature 1 is a low linear rock mound at the south end of Site 18980. Feature 1 is 15.0 m long (E/W) by 0.7 to 1.1 m wide and has a maximum height of 0.38 m (Figure 23 and Figure 24). The rock mound is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface. There is no stacking or facing evident in the feature construction. The rock mound was constructed to delineate space, possibly marking the edge of a garden area. Feature 1 appears to be unaltered and is in good condition.

Feature 2 is a low linear rock mound 5.4 m north of Feature 1. Feature 2 is 6.8 m long (NW/SE) by 1.1 to 2.5 m wide and has a maximum height of 0.62 m (Figure 25 and Figure 26). The rock mound is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface. There is no stacking or facing evident in the feature construction. The rock mound appears to be a clearing or planting, possibly a sweet potato planting mound. Feature 2 appears to be unaltered and is in good condition.

Feature 3 is a low linear rock mound 1.7 m north of Feature 2. Feature 3 is 4.8 m long (NW/SE) by 2.3 m wide and has a maximum height of 0.54 m (see Figure 24 and Figure 27). The rock mound is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface. There is no stacking or facing evident in the feature construction. The rock mound appears to be a clearing or planting, possibly a sweet potato planting mound. Feature 3 appears to be unaltered and is in good condition.

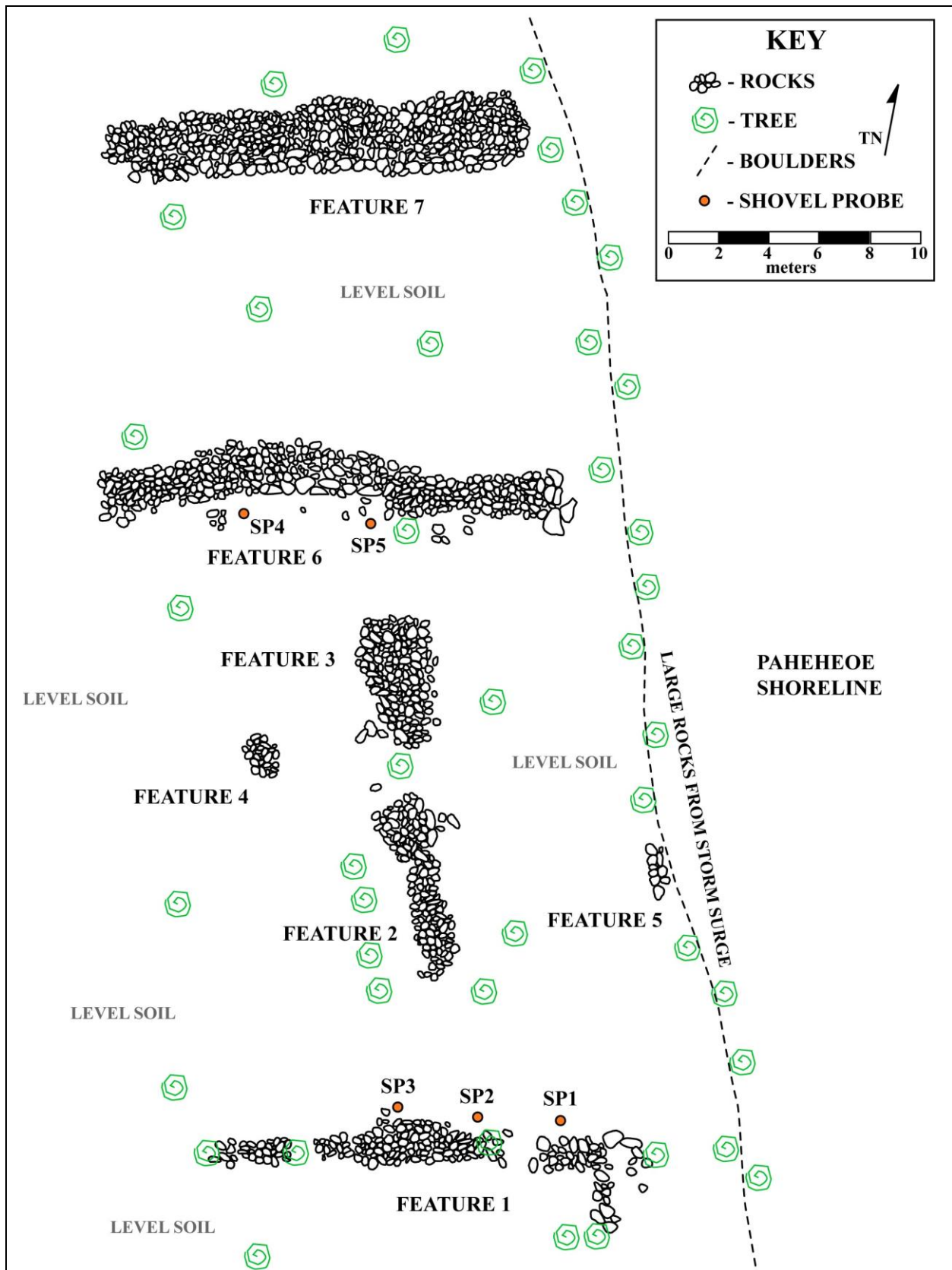


Figure 22: Site 18980 Plan View Map.

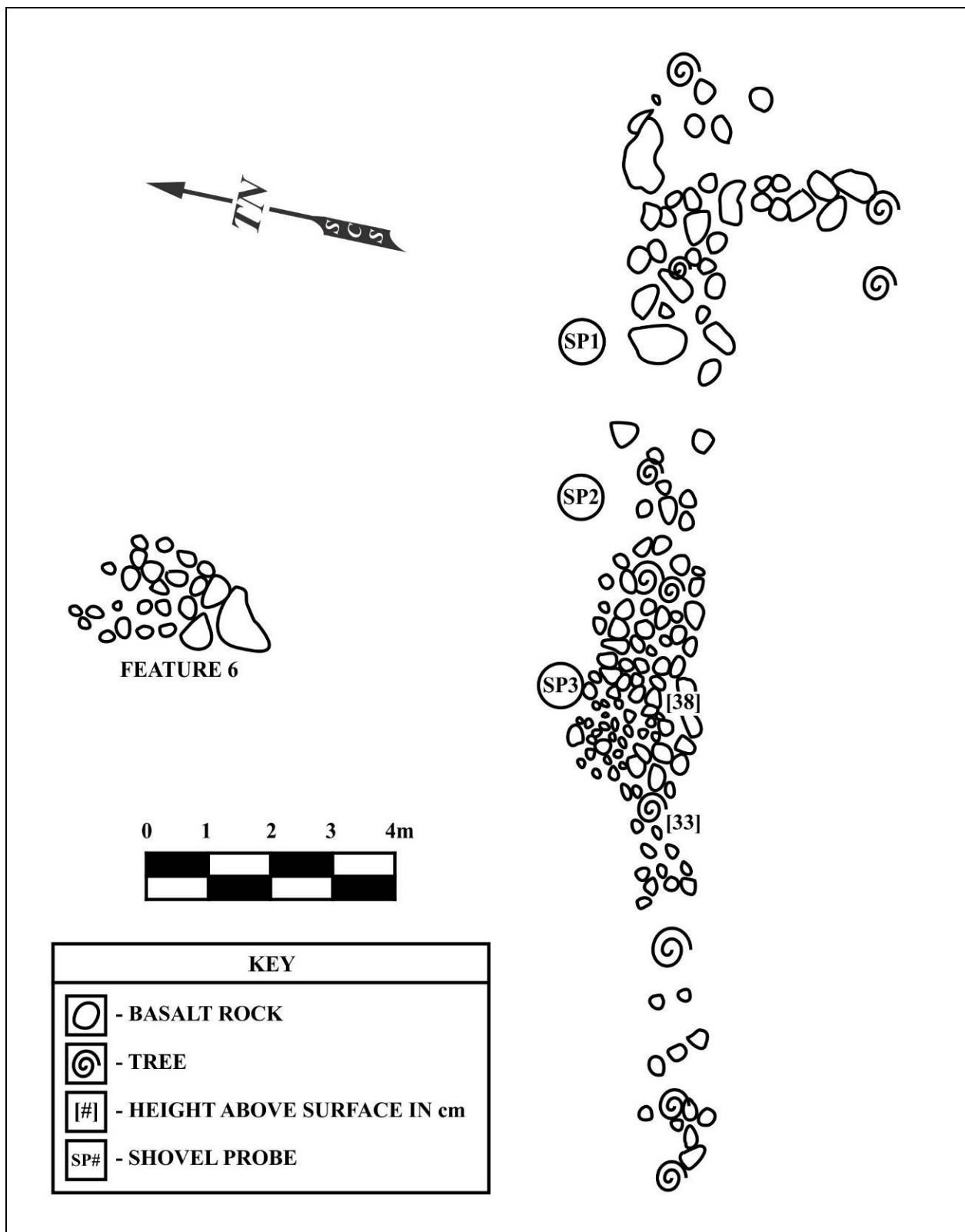


Figure 23: Site 18980, Feature 1 Plan View Map.



Figure 24: Photograph of Site 18980 Feature 1 Linear Rock Mound Looking South.

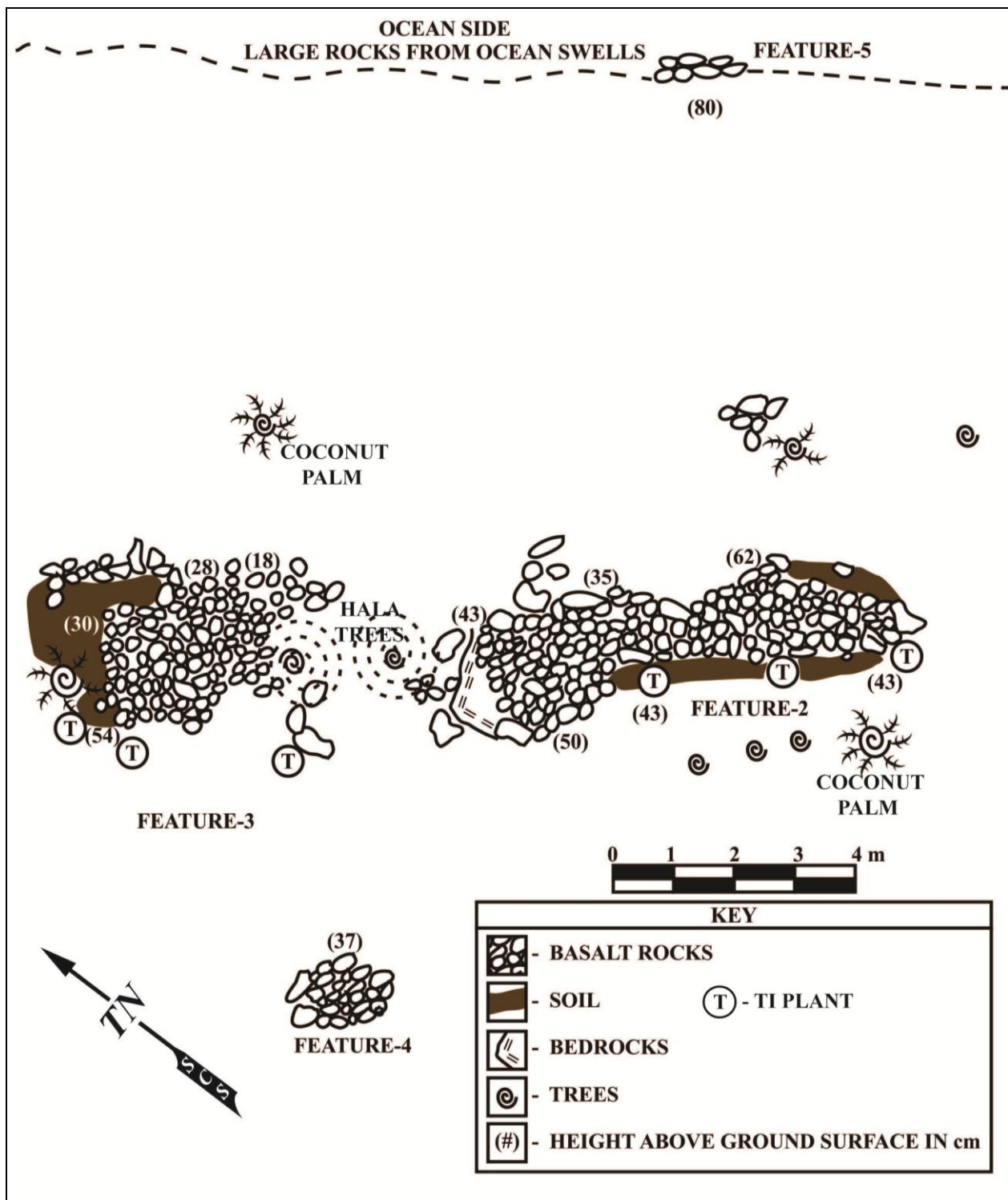


Figure 25: Site 18980, Feature 2 through Feature 5 Plan View Map.



Figure 26: Photograph of Site 18980 Feature 2 Rock Mound Looking West.



Figure 27: Photograph of Site 18980 Feature 3 Rock Mound Looking South.

Feature 4 is a low rectangular rock mound 4.2 m southwest of Feature 3. Feature 4 is 1.5 m long (NW/SE) by 1.0 m wide and has a maximum height of 0.37 m (see Figure 25). The rock mound is constructed of angular and subangular basalt cobbles and small boulders piled on the ground surface. There is no stacking or facing evident in the feature construction. The rock mound is a rock clearing mound within the surrounding garden space. Feature 4 appears to be unaltered and is in good condition.

Feature 5 is a rock facing along a bedrock outcrop 8.0 m east of Feature 2. Feature 5 is approximately 1.0 m long (NW/SE) by 0.4 m wide and has a maximum height of 0.80 m (see Figure 25). Feature 5 is constructed of angular and subangular basalt cobbles and small boulders stacked four courses high and one to two courses wide on the ground surface. The feature delineates the eastern boundary of the garden space at Site 18980. Feature 5 appears to be unaltered and is in good condition.

Feature 6 is a rock wall located 5.2 m north of Feature 3. Feature 6 is 19.4 m long (E/W) by 1.4 to 2.0 m wide and has a maximum height of 0.90 m (Figure 28 and Figure 29). The rock wall is constructed of angular and subangular basalt cobbles and small boulders stacked three to five courses high on the ground surface. The wall is bi-faced with slightly larger rocks, and filled with rocks that are slightly smaller (not true cobble core fill) than the facing rocks. The north edge of the wall is raised higher above the ground surface than is the south edge. The largest rocks in the wall are along the base of the north edge. Those rocks were placed with their flattest largest sides facing the outside edge (north edge) of the wall. The rock mound was constructed to delineate space, possibly marking a division in the garden area. Feature 6 is partially collapsed in places (Figure 30) and is in good condition.

Feature 7 is a rock wall located 12.0 m north of Feature 6. Feature 7 is 16.8 m long (E/W) by 1.1 to 2.3 m wide and has a maximum height of 0.74 m (Figures 31, 32 and 33). The rock wall is constructed of angular and subangular basalt cobbles and small boulders stacked four to five courses high on the ground surface. The wall is bi-faced with slightly larger rocks, and filled with rocks that are slightly smaller (not true cobble core fill) than the facing rocks. The largest rocks in the wall are along the base of the wall. Those rocks were placed with their flattest largest sides facing the outside edge (north and south edges) of the wall. The rock mound was constructed to delineate space, possibly marking the northern boundary of the garden area. The west end of the rock wall is covered by fallen trees and dense vegetation. Feature 7 appears to be unaltered and is in good condition.

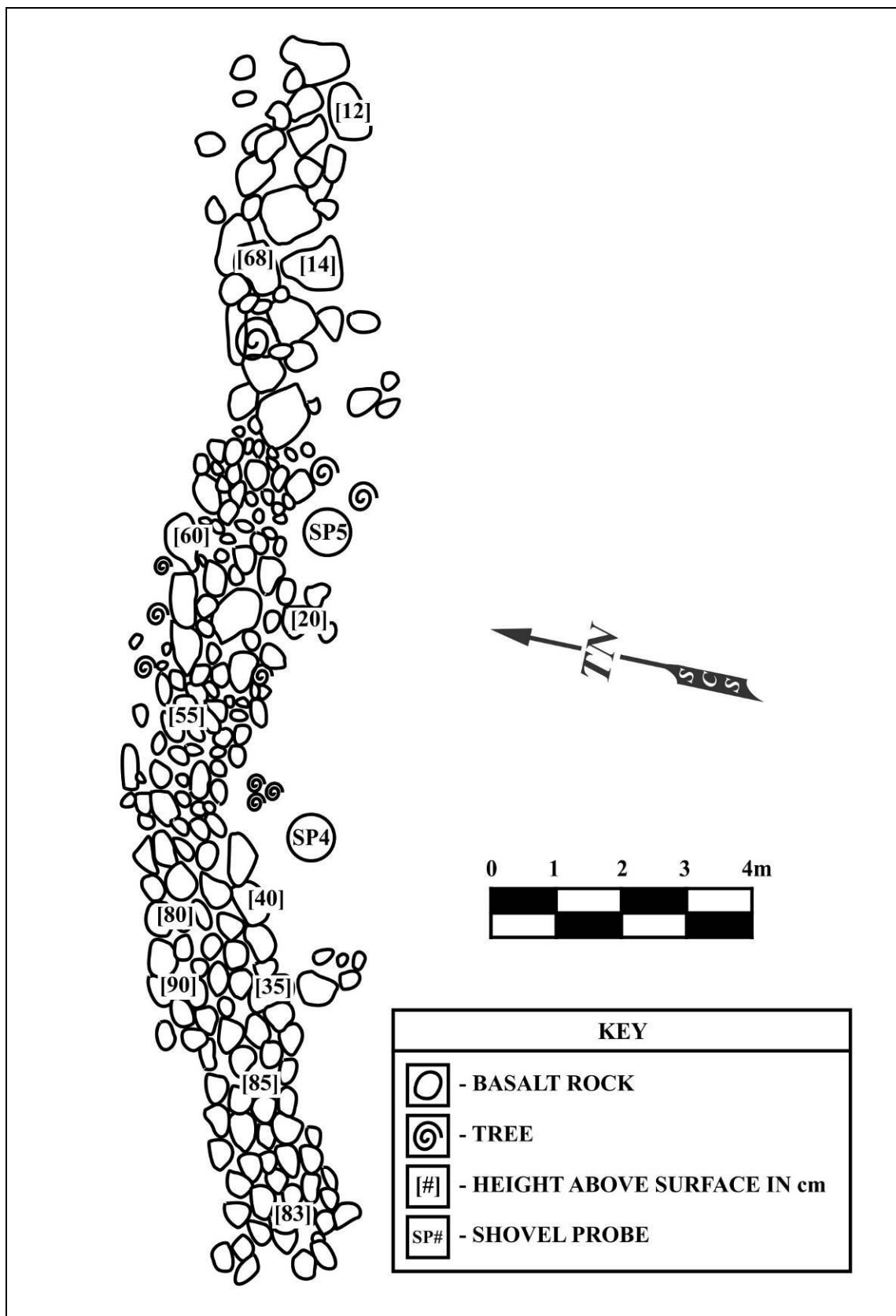


Figure 28: Site 18980, Feature 6 Plan View Map.



Figure 29: Photograph of Site 18980 Feature 6 Rock Wall, Overview Looking Southwest.



Figure 30: Photograph of Site 18980 Feature 6 Rock Wall Showing Partial Collapse, Looking West.

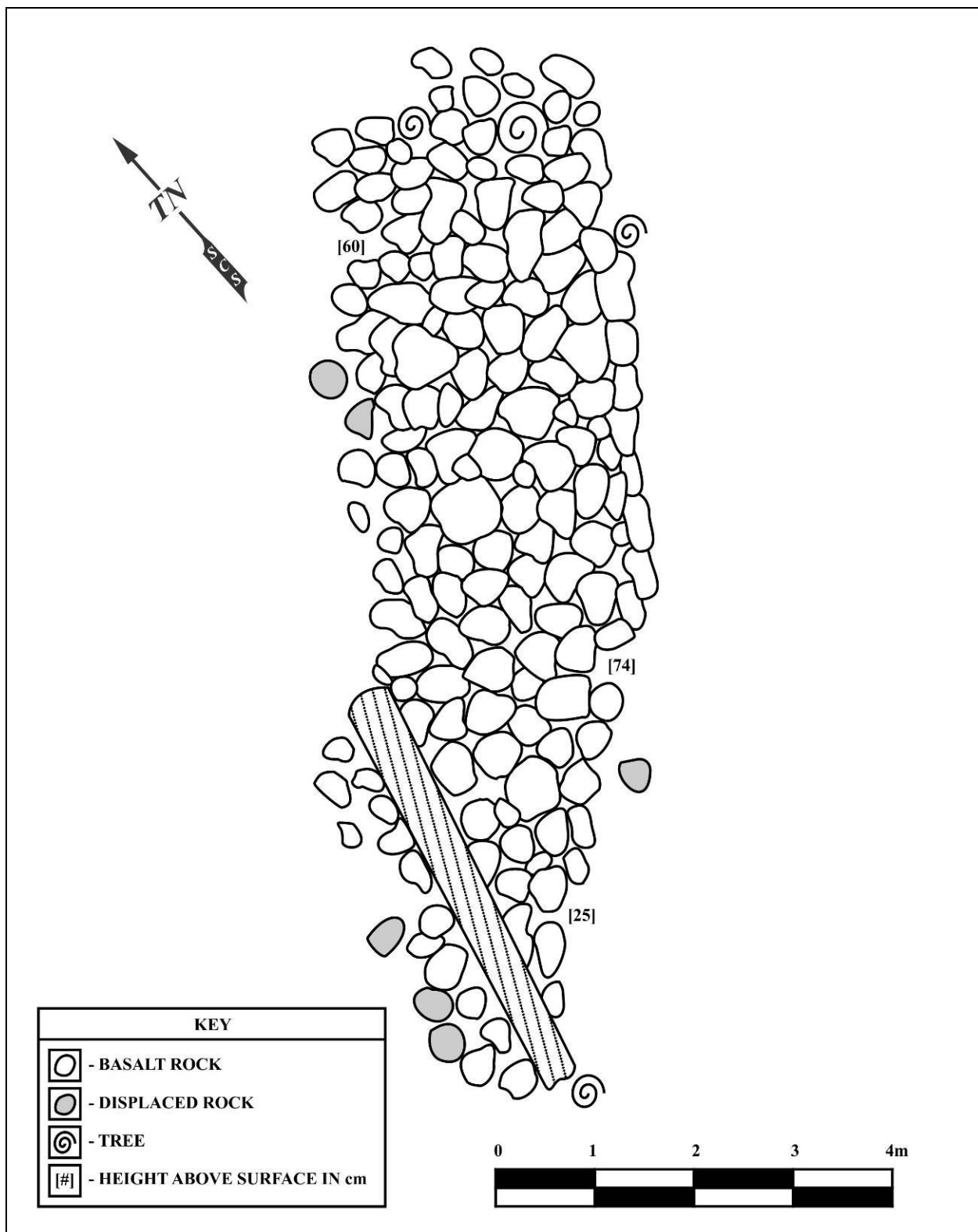


Figure 31: Site 18980, Feature 6 Plan View Map.



Figure 32: Photograph of Site 18980 Feature 7 Rock Wall, Overview Looking Northeast.



Figure 33: Photograph of Site 18980 Feature 7 Rock Wall, South Edge, Looking Southwest.

SITE 18980 SHOVEL PROBE TESTING

Five shovel probes (SP) were excavated at Site 18980 to determine the function and age of the site (see Figure 22). SP1, SP2 and SP3 were excavated along the north edge of Features 1 and SP4 and SP5 were dug along the south edge of Feature 6. Shovel probes were excavated to a maximum depth of 0.4 meters and terminated on bedrock or large rocks. Stratigraphy consisted of a single layer of soft, dark brown (7.5YR3/3) silt loam with less than 5% gravels, and 1% fine rootlets. There were no artifacts or subsurface deposits encountered in the shovel probes.

SITE 18980 SUMMARY

The seven features at Site 18980 are the remains of a small garden area. The southernmost linear rock mound (Feature 1) and northernmost rock wall (Feature 7) mark the boundaries of the garden area. Rock wall Feature 6 delineates space within the garden. It is likely that sweet potatoes were grown on the rock mounds (Features 3 and 4) in the southern $\frac{3}{4}$ of the garden area and taro, or another crop, was grown in the northern $\frac{1}{4}$ of the garden, between Feature 6 and Feature 7. Feature 4 is a rock clearing mound, and all of the features were constructed of rocks removed from the garden area, and so, in some measure, they function as rock clearing features. It is possible that Site 18980 has a pre-Contact era component. It is also likely that the garden was improved and enlarged during the early post-Contact and Historic eras. The large, well-constructed rock walls (Features 6 and 7) are characteristic of post-Contact and Historic era rock walls.

Site 18980 is only slightly altered by storm surges and modern activities, and is in good condition. The property owner has expressed a wish to preserve Site 18980. Site 18980 is recommended for preservation in-place.

SITE 18987**FAMILY BURIAL PLOT**

FUNCTION:	Burial
AGE:	Historic Era
DIMENSIONS:	22.2 m NW/SE by 9.6 m by 0.77 m max. height
CONDITION:	Good
INTEGRITY:	Unaltered: retains integrity of location, setting, feeling, materials, and workmanship
SURFACE ARTIFACTS:	None
EXCAVATION:	None
DESCRIPTION:	Site 18987 is a family graves plot located near the center of the property (see Figure 18). It is located in an area of mown grass under coconut palms. The plot is 22.20 m long (NW/SE) by 9.6 m long and has an average height of about 0.23 m (Figure 34). There is a large upright heart-shape rock set on the middle of the southwest edge that is 0.77 m above the ground surface. The plot is trapezoidal in shape with a rectangular extension along the center of the northeast side. The plot is constructed of a perimeter of angular and subangular cobbles and small boulders stacked one to two courses high and one to two courses wide on the ground surface (Figure 35 and Figure 36). The top surface of the plot is level with low cut grass growing on it. There is a pile of loose cobbles and small boulders piled against a palm tree from rock clearing that is not part of the grave plot.

Puanani, Uncle Sonny's primary caretaker when he was older, remembered that Sonny's maternal grandmother was buried at the family grave plot northeast of the house. She thought that one of the grandmother's sons who had died during the war might also be buried there. She didn't know the names of the other individuals buried there but was certain they were from the Kamoe and Kamahele family.

The family burial plot is a Historic to early modern feature. Site 18987 appears to be unaltered and is in good condition. The family burial plot will be preserved in place according to a Burial Site Component of a Preservation Plan (BSCPP) to be written.

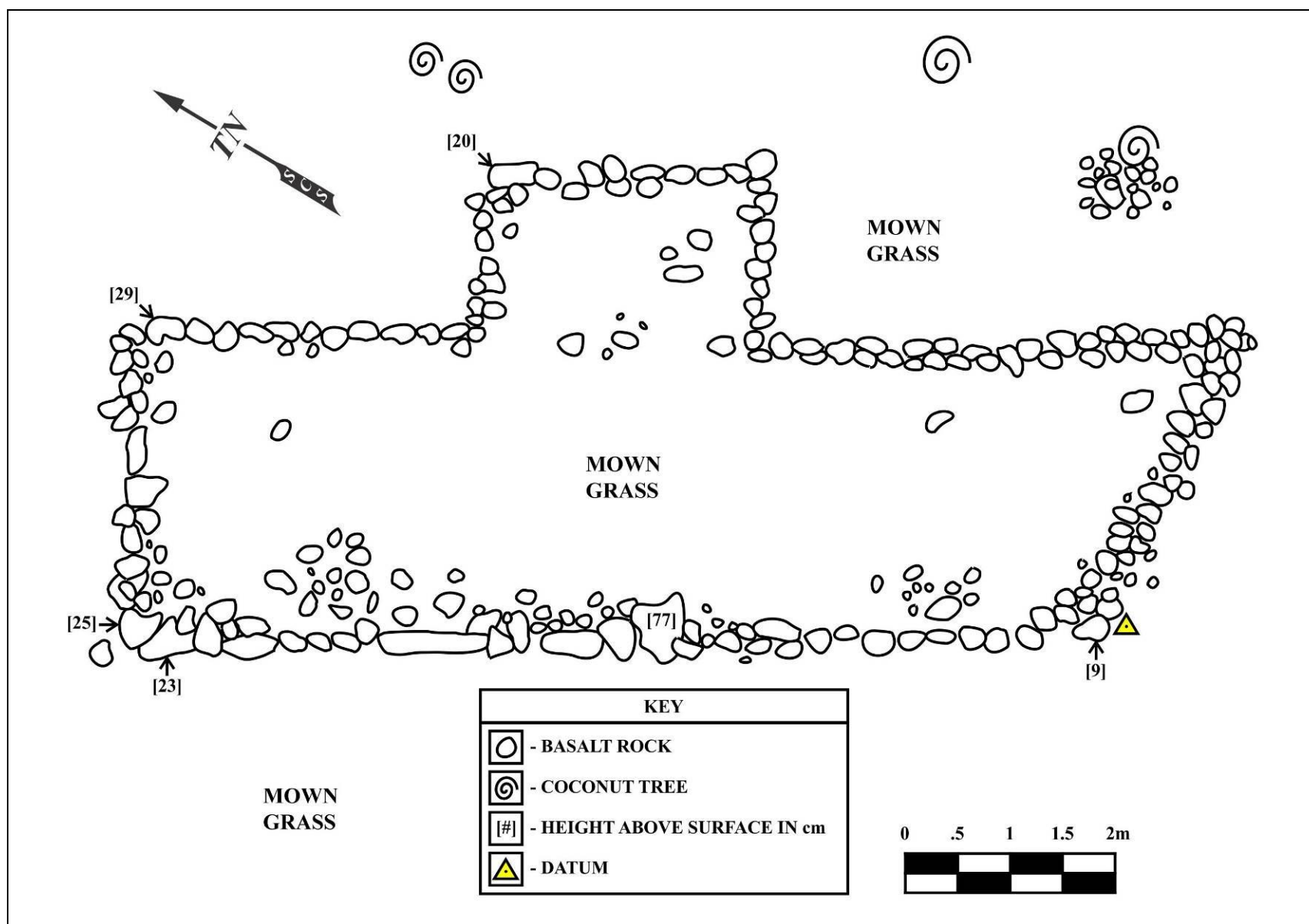


Figure 34: Site 18987 Family Burial Plot Plan View Map.



Figure 35: Photograph of Site 18987 Family Burial Plot Looking North.



Figure 36: Photograph of Site 18987 Family Burial Plot Looking Southeast.

SITE 31111**ROCK WALL**

FUNCTION: Property Boundary Marker

AGE: Historic Era to Modern Era

DIMENSIONS: 670.0 m long by 1.1 m wide (max.) by 0.91 m height (max.)

CONDITION: Good

INTEGRITY: Unaltered: retains integrity of location, setting, materials, and workmanship

SURFACE ARTIFACTS: None

EXCAVATION: None

DESCRIPTION: Site 31111 is a Historic era rock wall along the southeast, southwest and northwest boundaries of Parcel 009 (see Figure 18). The wall is approximately 670.0 m long by 0.5 m to 1.1 m in maximum height. The wall is constructed of angular and subangular cobbles and small boulders stacked up to five courses high (Figure 37 through Figure 41). The wall is bi-faced with good facing. The wall is primarily perpendicular to the ground surface and slopes very slightly inward toward the top in places. There are two entrance gates in the wall, the main entrance-driveway gate along the southwest wall, and a small wooden gate along the southeast wall. The wall is partially collapsed in places and is in good condition. No further work is recommended at Site 31111.

SITE 31112**ROCK WALL**

FUNCTION: Property Boundary Marker

AGE: Historic Era to Modern Era

DIMENSIONS: 15.0 m long by 1.0 m wide (max.) by 0.91 m height (max.)

CONDITION: Good

INTEGRITY: Unaltered: retains integrity of location, setting, materials, and workmanship

SURFACE ARTIFACTS: None

EXCAVATION: None

DESCRIPTION: Site 31112 is a Historic era rock wall segment located in the southeast quadrant of Parcel 009 (see Figure 18). The wall is 15.0 m long by 0.7 to 1.0 m wide and is 0.91 m in maximum height (Figures 42, 43 and 44). The wall is constructed of angular and subangular cobbles and small boulders stacked up to four courses high. The wall is bi-faced with good facing. The wall is along the southeast edge of a short dirt road leading from the old house site to the coastline. The wall is partially collapsed in places and is in good condition. No further work is recommended at Site 31112.

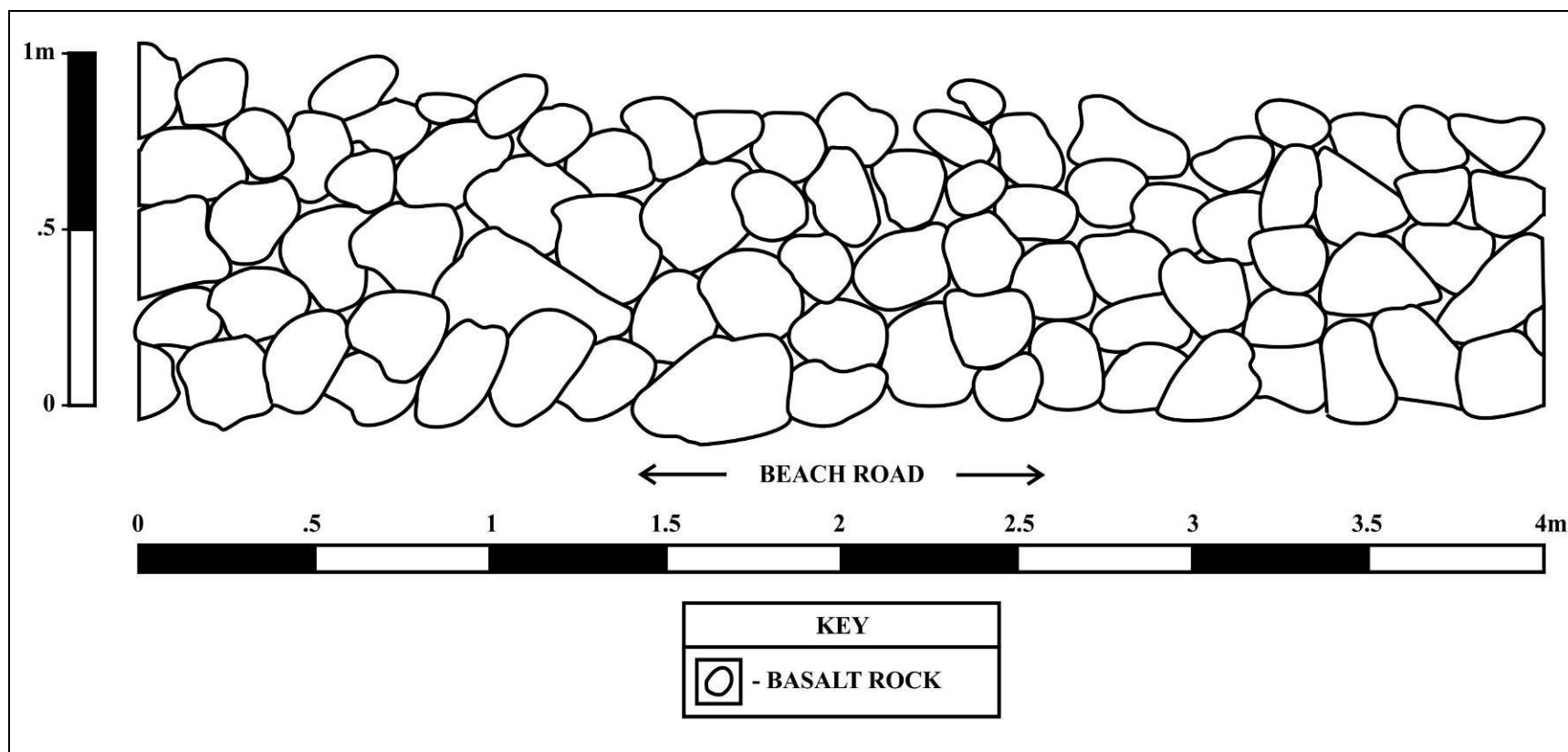


Figure 37: Site 31111 Southwest Rock Wall Profile Showing Typical Wall Construction.



Figure 38: Photograph of Site 31111 East End of South East Wall, Near Ocean, Looking Southeast.



Figure 39: Photograph of Site 31111 Southeast Wall Near South Corner, Looking Southeast.



Figure 40: Photograph of Site 31111 West Wall along Beach Road, Looking North.



Figure 41: Photograph of Site 31111 Northwest Wall, Looking Northwest.

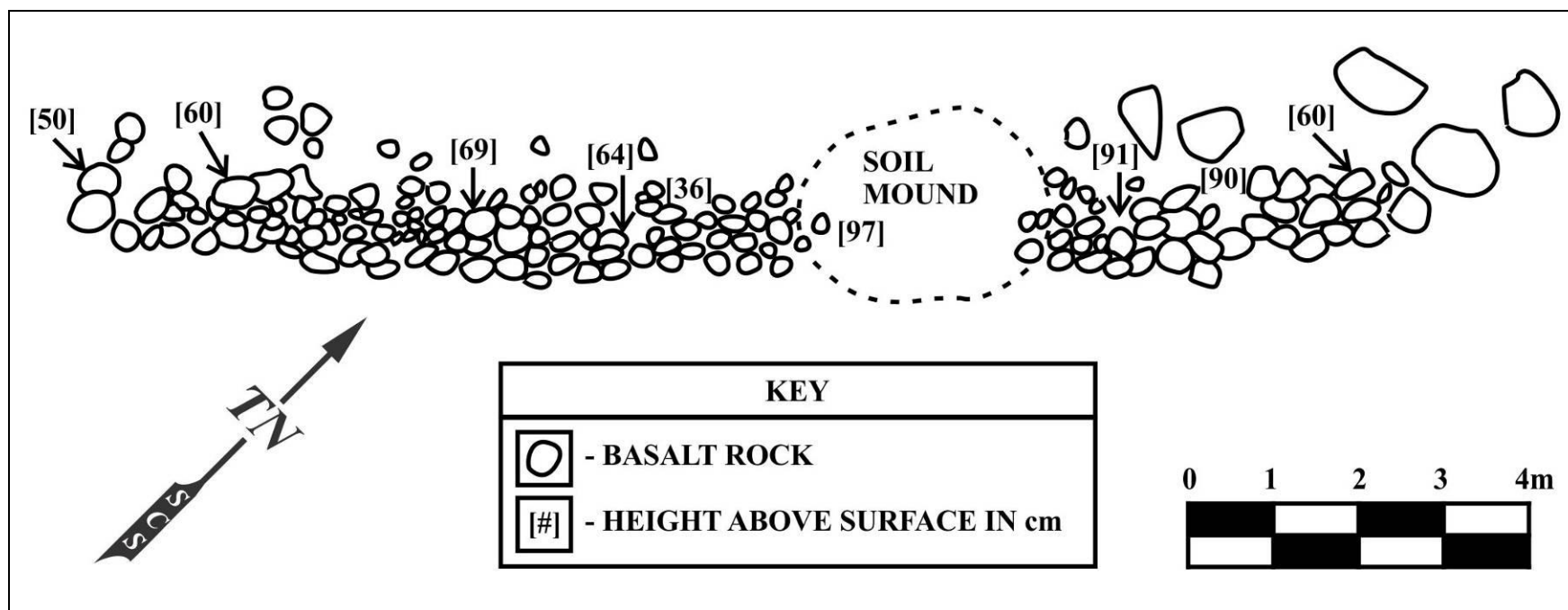


Figure 42: Site 31112 Rock Wall Segment Plan View Map.



Figure 43: Photograph of Site 31112 Rock Wall Segment, Looking South.



Figure 44: Photograph of Site 31112 Rock Wall Segment, Looking South.

PROJECT AREA BACKHOE TRANCHING

Four stratigraphic trenches (ST) 11.0 to 12.0 meters long by 0.75 meters (45.0 linear meters total) were excavated by backhoe to determine soil stratigraphy at the project area (Figure 45) and to identify subsurface features and diagnostic artifacts that might be present at Sites 18982 and 18988.

Site 18982 was recorded along the northwest boundary of the property (Ewart and Luscomb 1974), primarily on the property northwest of the current project area. A shallow well or spring was located on the current project area. Site 18982 surface features were no longer present during the current AIS study.

Site 18988 was no longer present when the Ewart and Luscomb (1974) survey was conducted, but the property owner, Sonny Kamahale, told the surveyors in 1973 that there were once platforms, walls and an enclosure that were removed to expand his watermelon fields.

Stratigraphic Trench-1

ST-1 was excavated in the project area south corner to record project area stratigraphy (See Figure 45). ST-1 was not located in an area known to have archaeological sites or features. ST-1 was a 12.0 m long trench excavated to a maximum depth of 53.0 cmbs (Figure 46). ST-1 contained two natural stratigraphic layers and terminated in culturally sterile Layer II sediment (Figure 47).

Layer I (10 to 30 cm thick) was soft, dark brown (7.5YR 3/3) sandy loam with less than 1% gravels and 1% fine rootlets. The base of Layer I was clear and wavy, and terminated on Layer II sediment. Layer II (10 to 40 cm thick) was soft, yellowish red (5YR 5/6) sandy cinder. Layer II is sediment from the littoral cinder cone at the central of the property. There were no artifacts, subsurface features or cultural deposits identified in Layer I or Layer II.

Stratigraphic Trench-2

ST-2 was excavated along the western edge of the project area (see Figure 45) in the location where Site 18988 was said to have once existed. ST-2 was excavated to identify Site 18988 subsurface features or cultural deposits. ST-2 was an 11.0 m long trench excavated to a maximum depth of 70.0 cmbs (Figure 48). ST-2 contained two natural stratigraphic layers and terminated in culturally sterile Layer II sediment (Figure 49).

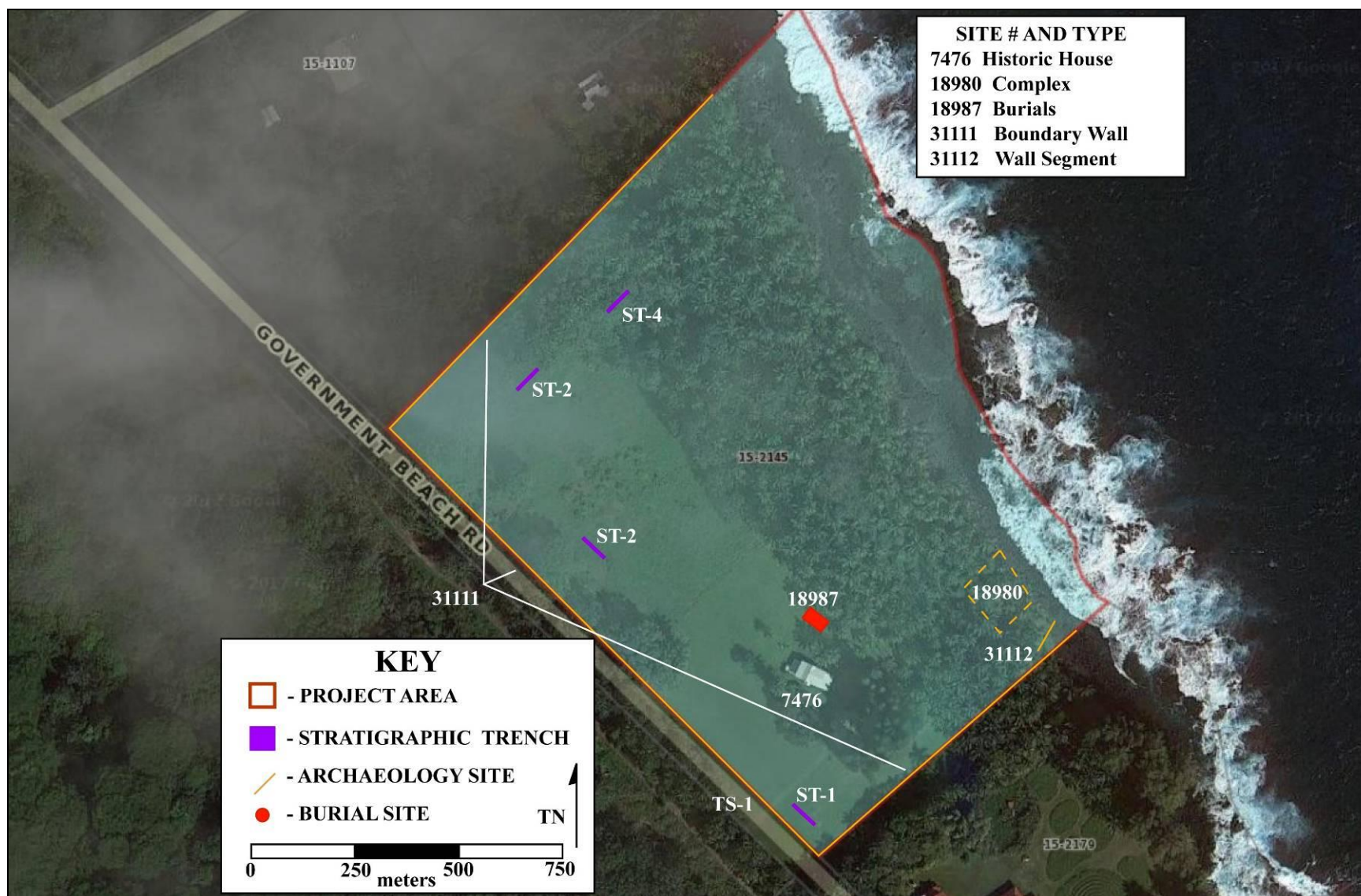


Figure 45: Aerial Photograph Showing Project Area, Sites and Stratigraphic Trenches, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

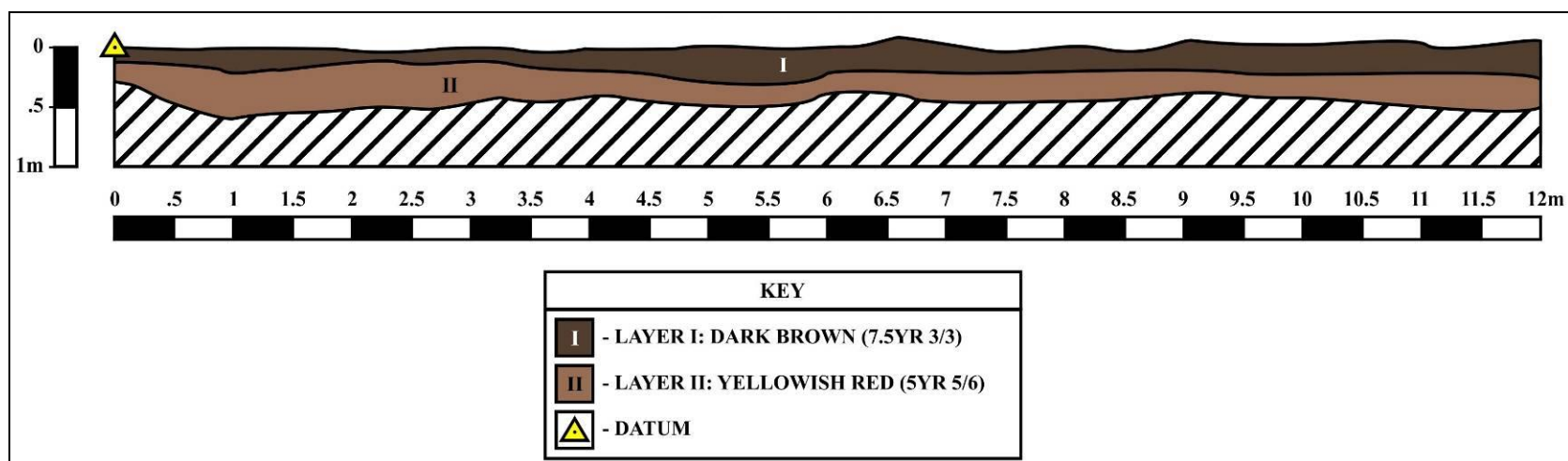


Figure 46: Stratigraphic Trench 1 Northeast Profile.



Figure 47: Photograph of Center of Stratigraphic Trench 1 Northeast Profile, Looking Northeast.

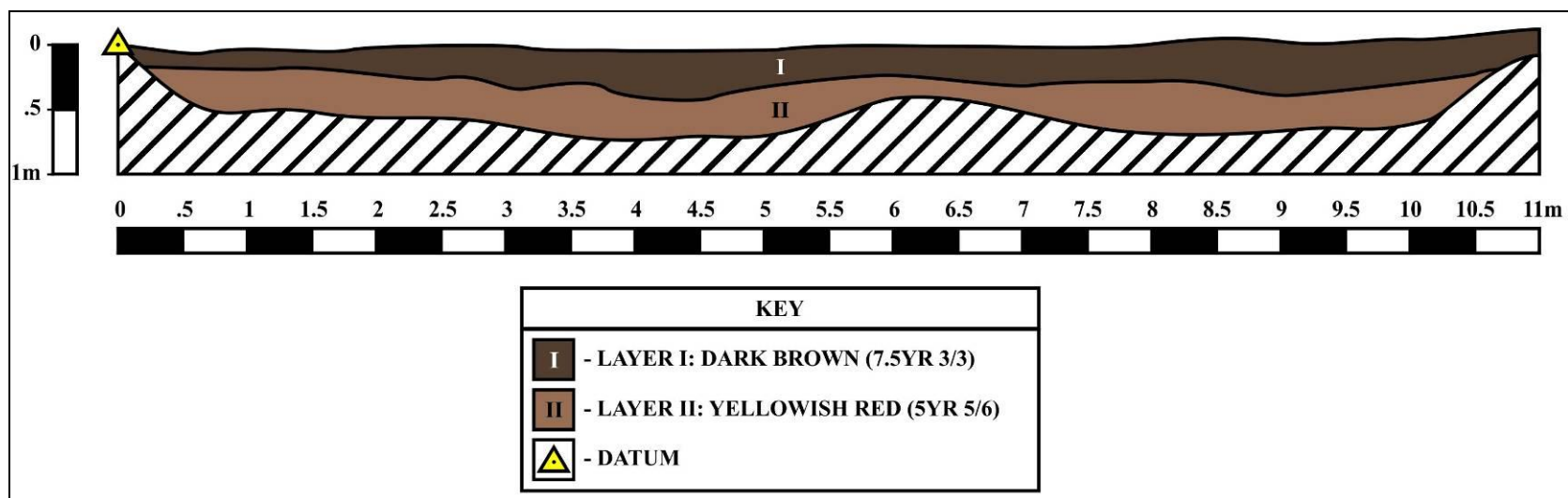


Figure 48: Stratigraphic Trench 2 Northeast Profile.



Figure 49: Photograph of Center of Stratigraphic Trench 2 Northeast Profile, Looking Northeast.

Layer I (12 to 38 cm thick) was soft, dark brown (7.5YR 3/3) sandy loam with less than 1% gravels and 1% fine rootlets. The base of Layer I was clear and wavy, and terminated on Layer II sediment. Layer II (20 to 40 cm thick) was soft, yellowish red (5YR 5/6) sandy cinder. Layer II is sediment from the littoral cinder cone at the center of the property. There were no artifacts, subsurface features or cultural deposits identified in Layer I or Layer II.

Stratigraphic Trench-3

ST-3 was excavated in the project area west quadrant in the location where Site 18982 was previously recorded (see Figure 45). ST-3 was excavated to identify Site 18982 subsurface features or cultural deposits. ST-3 was a 10.0 m long trench excavated to a maximum depth of 30.0 cmbs (Figure 50). ST-3 contained on natural stratigraphic layer and terminated on level pāhoehoe bedrock (Figure 51).

Layer I (10 to 30 cm thick) was soft, dark brown (7.5YR 3/3) sandy mucky loam with less than 1% gravels and 1% fine rootlets. The base of Layer I was abrupt and level, and terminated on bedrock. There were no artifacts, subsurface features or cultural deposits identified in Layer I.

Stratigraphic Trench-4

ST-4 was excavated along the project northwest boundary in the location where Site 18982 was previously recorded (see Figure 45). ST-4 was excavated to identify Site 18982 subsurface features or cultural deposits. ST-4 was an 11.0 m long trench excavated to a maximum depth of 27.0 cmbs (Figure 52). ST-4 contained on natural stratigraphic layer and terminated on level pāhoehoe bedrock (Figure 53).

Layer I (12 to 27 cm thick) was soft, dark brown (7.5YR 3/3) sandy mucky loam with less than 1% gravels and 1% fine rootlets. The base of Layer I was abrupt and level, and terminated on bedrock. There were no artifacts, subsurface features or cultural deposits identified in Layer I.

There were no artifacts, subsurface features or cultural deposits identified in any of the four stratigraphic trenches. There were no Site 18982 or Site 18988 subsurface artifacts or cultural deposits identified in ST-2, ST-3, or ST-4. It is likely that modern clearing for farming removed any remains that were once present. A comparison of stratigraphy all four trenches shows the limits of the red cinder soil from the littoral cinder cone at the center of the property (see Figure 17).

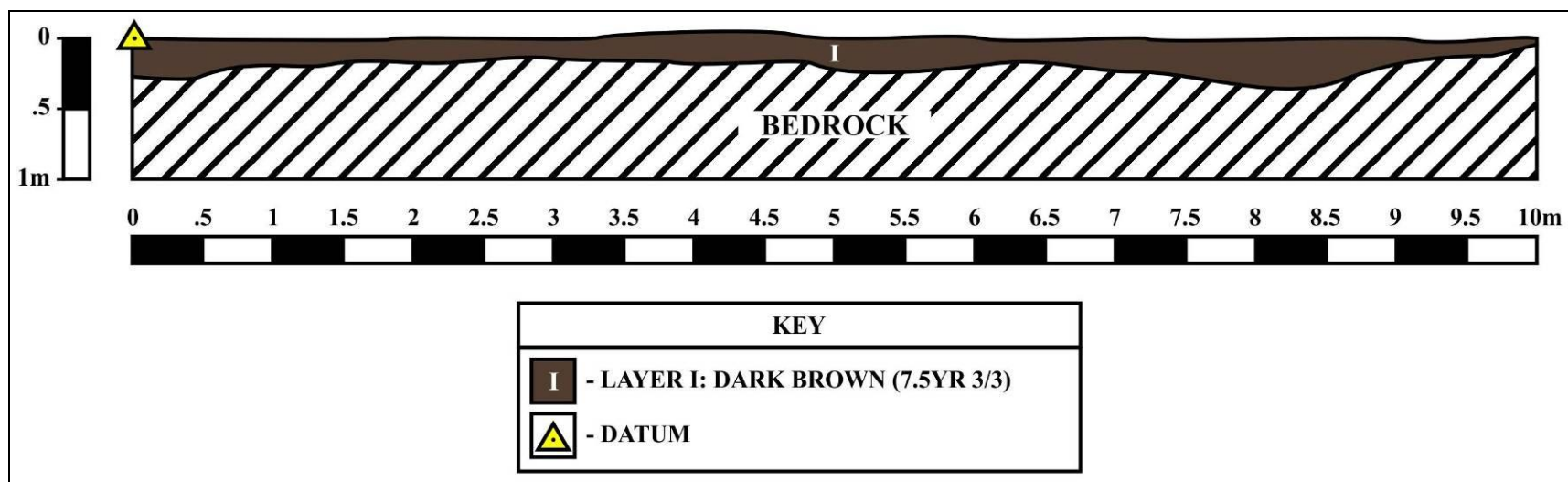


Figure 50: Stratigraphic Trench 3 Southeast Profile.



Figure 51: Photograph of Stratigraphic Trench 3 Overview, Looking South.

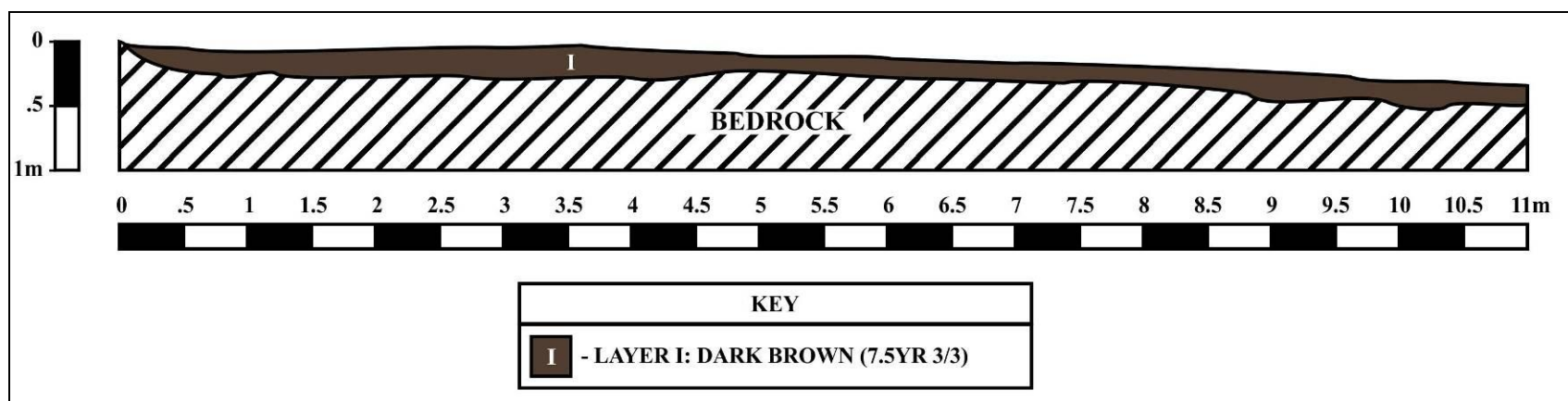


Figure 52: Stratigraphic Trench 4 Northwest Profile.



Figure 53: Photograph of Stratigraphic Trench 3 Overview, Looking South.

CONCLUSION

Five archaeological sites were identified in the project area. Three of the sites (Site #50-10-45-7476, 18980 and 18987) were previously recorded in Ewart and Luscomb (1974) and two were previously undocumented sites. The three previously identified sites include a cement foundation at the Kamahele House (Site 7476), an agricultural complex (Site 18980) and the family burial plot (Site 18987). Two newly recorded sites include the rock wall along the southeast, southwest and northwest boundaries of Parcel 009 (Site 31111) and a short rock wall segment (Site 31112) in the southeast corner of the project area.

Site 31111 is the rock wall along Old Government Beach Road and is similar to rock wall Site 18419 recorded in Dirks and Rechtman (2013). The coastal trail segment (Site 18418) recorded in Dirks and Rechtman (2013) was not present on the current project area.

The sites recorded at the project area are primarily Historic era in age, though Site 18980, an agricultural complex, could possibly have a pre-Contact era component. The Site 18980 features are constructed in the manner of, and have characteristics common to, Historic era features. It is likely that Site 18982 and Site 18988 were pre-Contact era agricultural and habitation sites, but they are no longer present on the property. There were no subsurface remains of the sites within the stratigraphic trenches excavated during the current study.

Sites identified on the project area were constructed by the Kea, Kamahele and Kamoe families as part of a working farm and home. The sites were used up through the modern era. It is likely that Sites 18982 and 18988 were removed during clearing for the farm fields.

SIGNIFICANCE ASSESSMENT & RECOMMENDATIONS

The five archaeological sites (Sites 7476, 18980, 18987, 31111, and 31112) identified during the AIS study were assessed for significance as outlined in Hawai'i Administrative Rules §13-284-6. To be significant, a historic property shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criteria [§13-284-6(b)]:

- (a) It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property [§13-284-6(b)(1)].
- (b) It must be associated with the lives of persons significant in the past property [§13- 284-6(b)(2)].
- (c) It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction property [§13-284-6(b)(3)].
- (d) It must have yielded or may be likely to yield, information important in prehistory or history property [§13-284-6(b)(4)].
- (e) Have an important value to 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, oral accounts--these associations being important to the group's history and cultural identity property [§13-284-6(b)(5)].

All five sites (Sites 7476, 18980, 18987, 31111, and 31112) are significant under criterion "d" as they are likely to yield, or have yielded, information important to history (Table 6). All of the sites have yielded information important to understanding early Historic to early Modern era farms and homesteads along the coast in Puna District. Site 18987 is also significant under criterion e, as it has importance to traditional Hawaiian cultural beliefs and practices.

Table 6: Site Significance and Recommended Treatments.

SIHP #50-10- 45:	TYPE	FUNCTION	SITE AGE	SIGNIFICANCE CRITERIA	RECOMMENDED TREATMENT
7476	Kamahele House	Habitation	Historic Era	d	No Further Work
18980	Complex (Agriculture)	Rock walls and rock mounds	Pre-Contact to early post-Contact Era	d	Preservation
18987	Burials	Historic graves	Historic Era	d, e	Preservation
31111	Rock Wall	Property Boundary	Historic Era	d	No Further Work
31112	Rock Wall	Road edge	Historic Era	d	No Further Work

No further work is recommended at Sites 7476 (no longer present), Site 31111 and Site 31112. Information collected during the AIS study and recorded in this AIS report is sufficient to warrant no further work.

Preservation in-place is recommended at Site 18980 and Site 18987. Preservation at Site 18980 and Site 18987 shall consist of avoidance and protection (conservation) per HAR §13-277-3(1). Site 18980 will be preserved in accordance with an Archaeological Preservation Plan (PP) to be written. Site 18987 will be preserved in accordance with a Burial Site Component of a Preservation Plan (BSCPP) to be written. The overall proposed project determination is **effect with agreed upon mitigation**.

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Environmental Assessment

Garrett Single-Family Residence and Farm in the Conservation District at Maku‘u

APPENDIX 3 Cultural Impact Assessment

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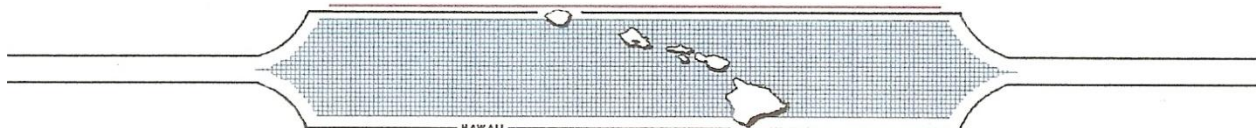
**A CULTURAL IMPACT ASSESSMENT FOR
A 13.436-ACRE PROPERTY IN KEA'AU, MAKU'U AHUPUA'A,
PUNA DISTRICT, HAWAI'I ISLAND, HAWAI'I
[TMK: (3) 1-5-010:009]**

Prepared By:
Glenn G. Escott, M.A.

NOVEMBER 2019
DRAFT

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INTRODUCTION

Under contract to property owner Kamahele Farms, LLC, Scientific Consultant Services, Inc. (SCS) conducted a Cultural Impact Assessment (CIA) for the lands of TMK: (3) 1-5-010:009 located in Maku‘u Ahupua‘a, Puna District, Island of Hawai‘i, Hawai‘i (Figure 1 through Figure 4). Parcel 009 is located approximately seven miles southeast of Kea‘au town and just south of the Hawaiian Paradise Park (HPP) residential subdivision. The property is bounded on the east by the Pacific Ocean, the west by Government Beach Road, and on the north and south by residential properties.

The property owner is proposing to build a single family dwelling on the property. The AIS study was conducted as supporting documentation for a Special Management Area (SMA) permit application and construction permit application. The property owner point of contact is Mr. Robert Garrett. The property owner’s mailing owner’s address is 8216 N 14th Street, Phoenix, AZ 85020-3890. Mr. Garrett can be contacted by phone at 623-330-7244 or by email at bellgroup4930@yahoo.com.

The Constitution of the State of Hawai‘i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 requires the State to “protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua‘a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778” (2000). In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the people's traditional right to subsistence.

As a result, in 1850 the Hawaiian Government confirmed the traditional access rights to native Hawaiian *ahupua‘a* tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawai‘i Revised Statutes (HRS) 7-1. In 1992, the State of Hawai‘i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, “native Hawaiian rights...may extend beyond the *ahupua‘a* in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner” (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

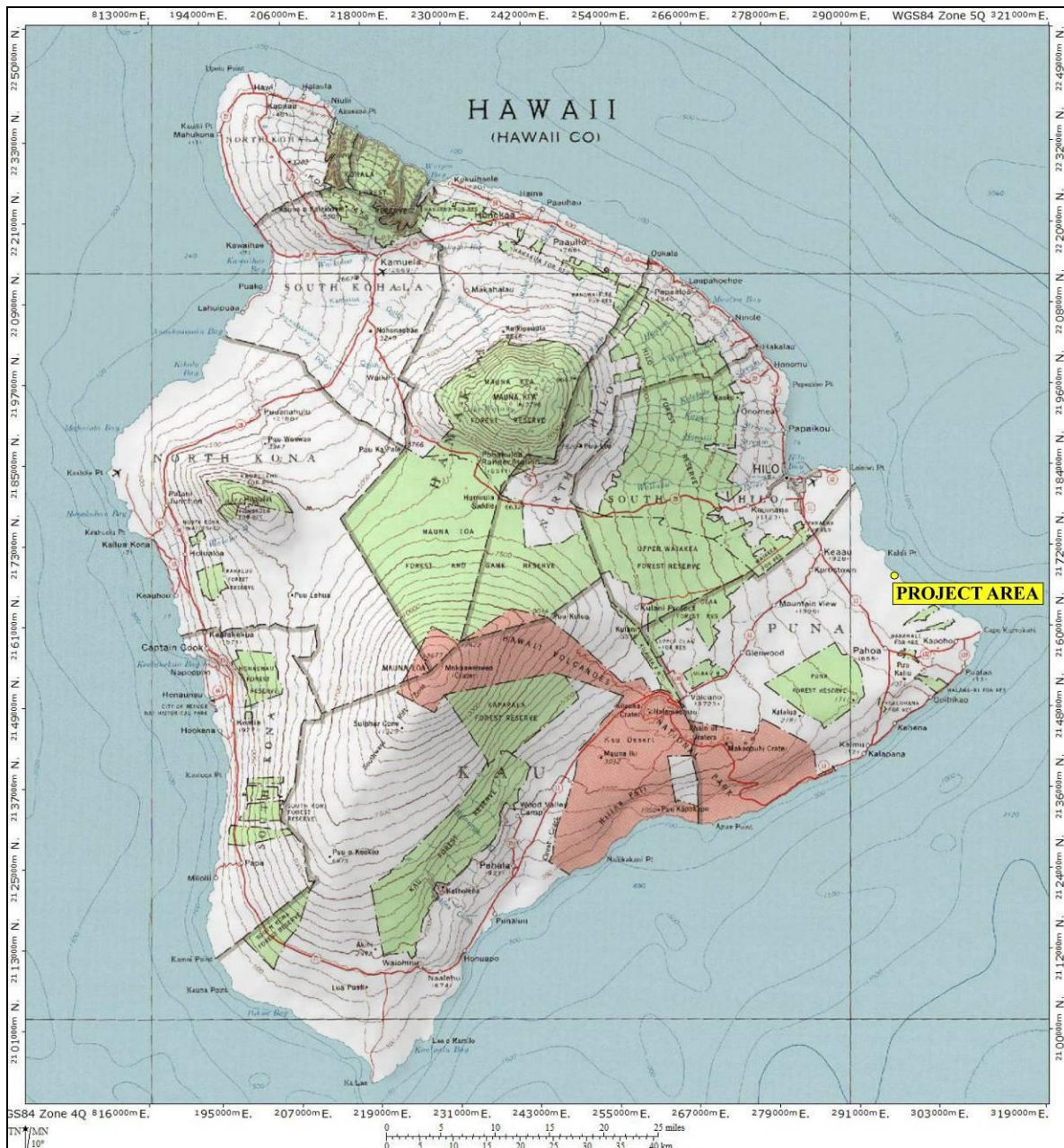


Figure 1: 5,500 K-Series Map of Hawai'i Showing Location of Project Area (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

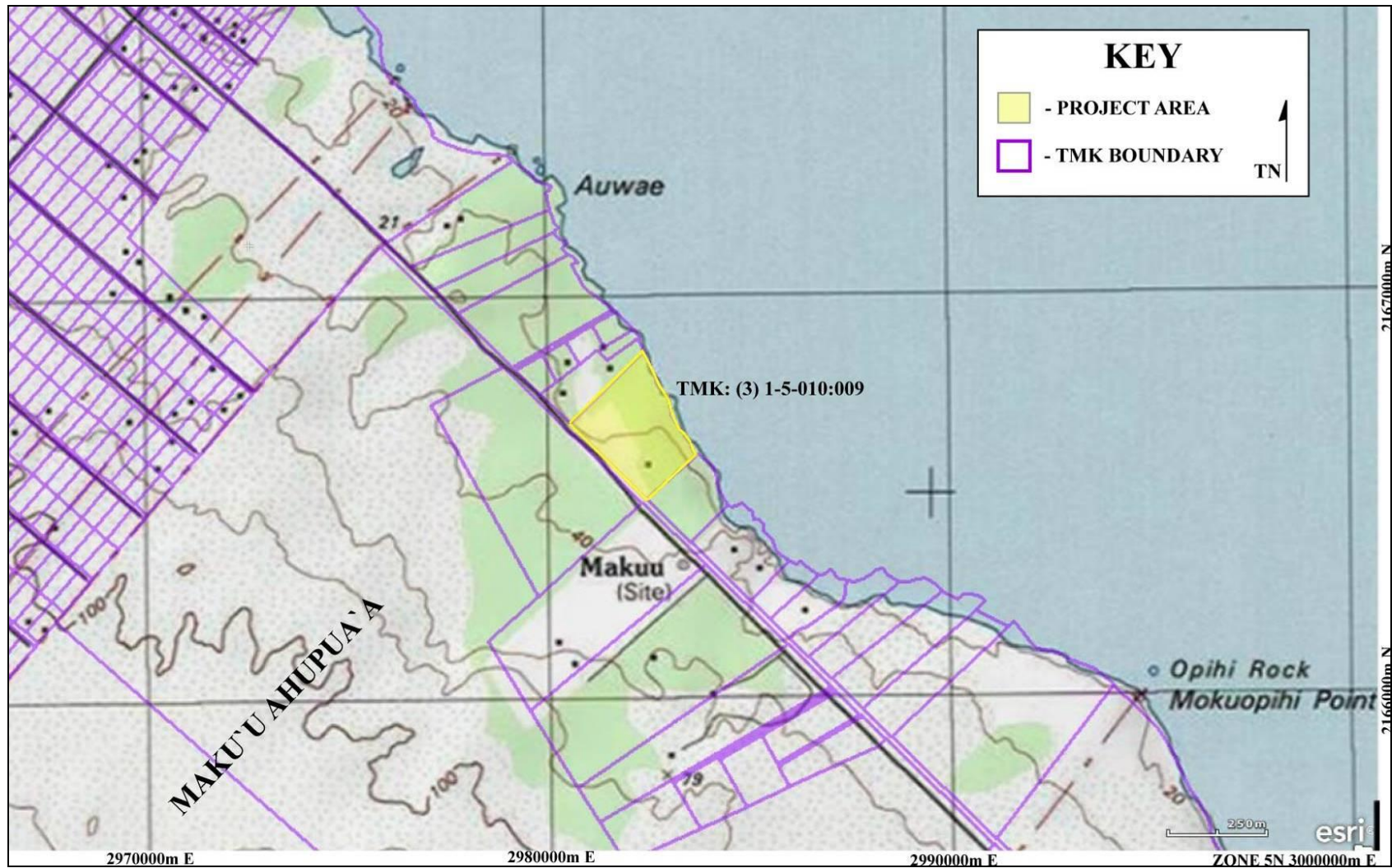


Figure 2: 7.5-Minute Series USGS Topographic Map Showing the Location of Project Areas and TMK Parcels (Keaau Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and County of Hawai'i Planning Department, 2019).

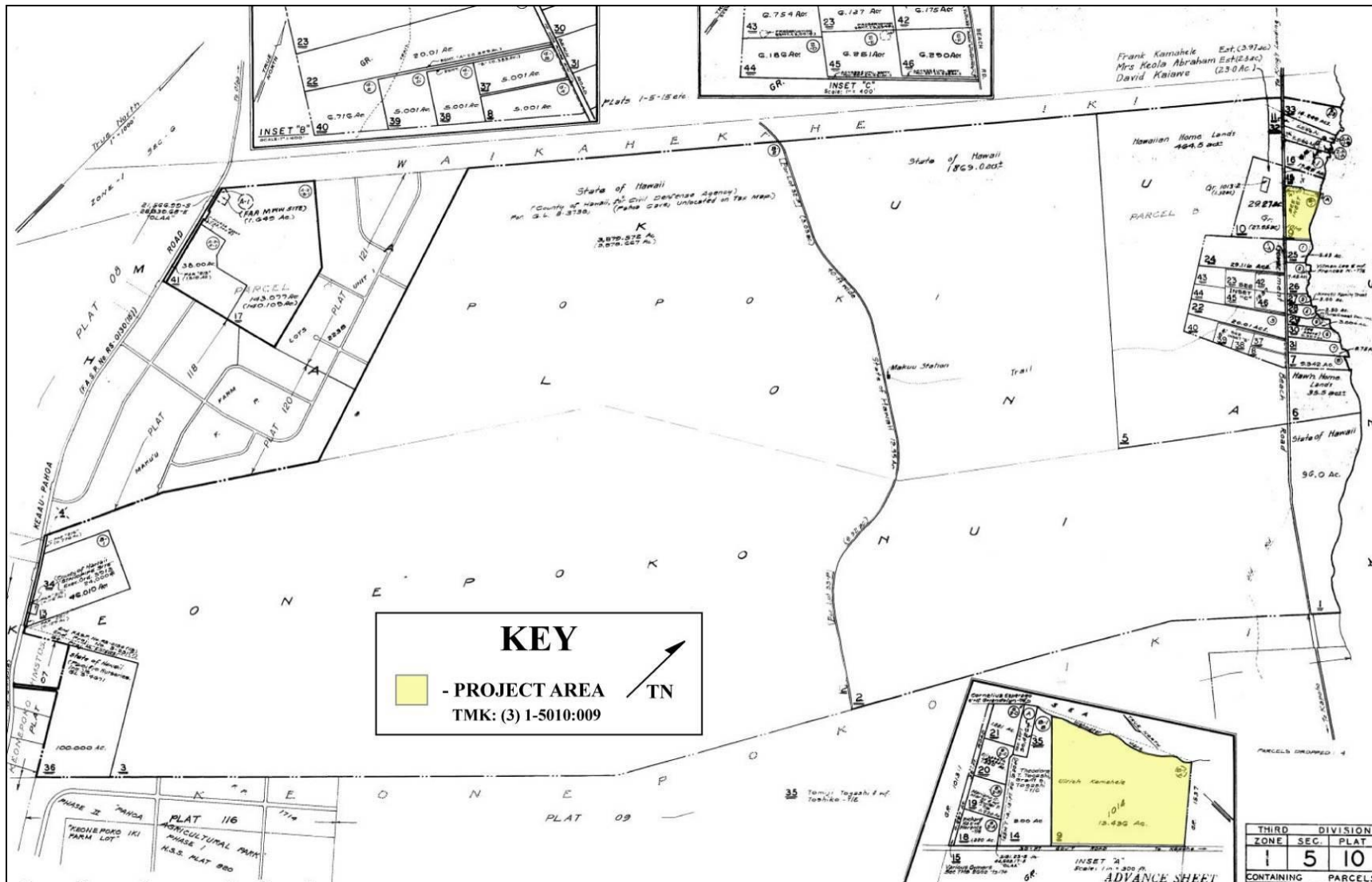


Figure 3: TMK: (3) 1-5-010 Map Showing Location of Project Area (County of Hawai'i Planning Department, 2019).



Figure 4: Aerial Photograph Showing Project Areas, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

Act 50, enacted by the Legislature of the State of Hawaii (2000) with House Bill 2895, relating to Environmental Impact Statements, proposes that:

...there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai'i's culture, and traditional and customary rights... [H.B. NO. 2895].

Act 50 requires state agencies and other developers to assess the effects of proposed land use or shoreline developments on the “cultural practices of the community and State” as part of the HRS Chapter 343 environmental review process (2001).

Its purpose has broadened, “to promote and protect cultural beliefs, practices and resources of native Hawaiians [and] other ethnic groups, and it also amends the definition of ‘significant effect’ to be re-defined as “the sum of effects on the quality of the environment including actions that are...contrary to the State’s environmental policies...or adversely affect the economic welfare, social welfare, or cultural practices of the community and State” (H.B. 2895, Act 50, 2000).

Thus, Act 50 requires an assessment of cultural practices to be included in the Environmental Assessments and the Environmental Impact Statements, and to be taken into consideration during the planning process. The concept of geographical expansion is recognized by using, as an example, “the broad geographical area, e.g. district or *ahupua‘a*” (OEQC 1997). It was decided that the process should identify ‘anthropological’ cultural practices, rather than ‘social’ cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice. According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control:

The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both manmade and natural, which support such cultural beliefs (OEQC 1997).

This Cultural Impact Assessment involves evaluating the probability of impacts on identified cultural resources, including values, rights, beliefs, objects, records, properties, and stories occurring within the project area and its vicinity (H.B. 2895, Act 50, 2000).

METHODOLOGY

This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). In outlining the “Cultural Impact Assessment Methodology”, the OEQC states: ...information may be obtained through scoping, community meetings, ethnographic interviews and oral histories... (1997).

The report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. This Cultural Impact Assessment was prepared in accordance with the methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997). The assessment concerning cultural impacts should address, but not be limited to, the following matters:

- (1) a discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints of limitations with might have affected the quality of the information obtained;
- (2) a description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken;
- (3) ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained;
- (4) biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area;
- (5) a discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken, as well as the particular perspective of the authors, if appropriate, any opposing views,

and any other relevant constraints, limitations or biases;

- (6) a discussion concerning the cultural resources, practices and beliefs identified, and for the resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site;
- (7) a discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project;
- (8) an explanation of confidential information that has been withheld from public disclosure in the assessment;
- (9) a discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs;
- (10) an analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place, and;
- (11) the inclusion of bibliography of references, and attached records of interviews, which were allowed to be disclosed.

Based on the inclusion of the above information, assessments of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps and land records such as Land Commission Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological project reports.

INTERVIEW METHODOLOGY

Interviews are conducted in accordance with applicable state laws and guidelines. Individuals and/or groups who have knowledge of traditional practices and beliefs associated with a project area or who know of historical properties within a project area are sought for consultation. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the

project area are invited to share their relevant information. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs, historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input, and suggest further avenues of inquiry, as well as specific individuals to interview.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the information available for this study. When telephone interviews occur, a summary of the information is often sent for correction and approval, or dictated by the informant and then incorporated into the document. Key topics discussed with the interviewees vary from project to project, but usually include: personal association to the *ahupua'a*, land use in the project's vicinity; knowledge of traditional trails, gathering areas, water sources, religious sites; place names and their meanings; stories that were handed down concerning special places or events in the vicinity of the project area; evidence of previous activities identified while in the project vicinity.

In this case, letters with maps and descriptions the project area were sent to individuals and organizations whose jurisdiction includes knowledge of the area with an invitation for consultation. Consultation was sought from Kamaile Puluole-Mitchell, Office of Hawaiian Affairs (OHA) East Hawai'i Island Representative; Jordan Kea Calpito, SHPD Burial Sites Specialist; Sean Naleimaile, State Historic Preservation Division (SHPD) Hawai'i Island Archaeologist; and Kalena Blakemore, Hawai'i Island Burial Council (HIBC) Member. Consultation was also conducted at the project area with members of the Kamahale and Lui families.

If cultural resources are identified based on the information received from these organizations and/or additional informants, an assessment of the potential effects on the identified cultural resources in the project area and recommendations for mitigation of these effects can be proposed. Public notices (Appendix A) were placed in the June 2019 issue of the Office of Hawaiian Affairs (OHA) Ka Wai Ola Newspaper. Public notices were also published in the Honolulu Star-Advertiser, and the Hawai'i Tribune Herald.

PROJECT AREA NATURAL ENVIRONMENT

The project area is situated on level to moderately sloping land between 0 feet (0 m) to 30.0 feet (9.0 m) above mean sea level (amsl). The project area substrate is a Kīlauea lava flow dated between 750 and 1,500 years ago (Wolfe and Morris 1996). Soil in the project area is 'Opihikao series (rOPE) extremely rocky muck overlaying pāhoehoe lava (Sato 1973:43). The soil is thin and well drained with 3% to 25% slopes.

There is a low littoral cinder cone located at the center of the property, in the area of the house (see house location in Figure 4). Soil in the southwest 2/3 of the property has relatively deep cinder soil and was used for watermelon and vegetable farming, as well as pasture for cows, sheep and more recently horses. This area is primarily mown grass for the house yard.

The southwest half of the property is mown grass and ferns, and the northeast half is coconut grove with some native trees. The northeastern edge of the property is pāhoehoe coastal flats flanked by large piles of boulders thrown ashore by storm surge. The southwest half of the property was used in the Modern era as watermelon fields. Rainfall in the project area is between 120 and 200 inches per year. Natural drainage in the area runs from west to east.

Plant communities in southwest half of the project are dominated by grasses, ferns and introduced ornamental and fruit trees including various citrus trees, Cook pine (*Araucaria columnaris*), coconut palm (*Cocos nucifera*), avocado (*Persea americana*), ulu (*Autocarpus altilis*), gunpowder (*Trema orientalis*), Moluccan albezia (*Falcataria moluccana*), and bingabing (*Macaranga mappa*). The coastal half of the property contains coconut palms, *hala* (*Pandanus tectorius*), *naupaka* (*Scaevola taccada*), False *kamani* (*Terminalia catappa*), and *ki* (*Cordyline fruticosa*).

HISTORICAL AND CULTURAL CONTEXTS

Many archaeologists believe that Hawai‘i Island was first settled around A.D. 1,000 by people sailing from the Marquesas (Athens et al. 2014; Dye 2011; Kahn et al. 2014; Kirch 2011; Kirch and McCoy 2007; Mulrooney et al. 2011; Reith et al. 2011; Wilmhurst et al. 2011a and 2011b). An article published in the *Journal of Archaeological Science* reviewing radiocarbon dates recovered at archaeological sites on the Island of Hawai‘i suggests that, by relying on only carbon samples from short-lived plant remains, the most reliable dates point to initial Polynesian colonization of Hawai‘i Island occurring between A.D. 1220 and 1261 (Reith et al. 2011:2747). Hilo was, by most estimates, one of the first settlements on the Island of Hawai‘i.

The rich marine resources of Hilo Bay and the gently sloping forests of Mauna Loa and Mauna Kea provided abundant resources. Fresh water was available from the Wailoa and Wailuku rivers and smaller streams such as Waiākea, Waiolama, Pukihāe, and ‘Alenaio. The current project area is located in Maku‘u Ahupua‘a, Puna District, roughly twenty kilometers southeast of Hilo (Figure 5).

PRE-CONTACT ACCOUNTS OF SOUTH HILO AND PUNA DISTRICTS

The earliest account of Hilo appears in ‘Umi-a-Liloa’s (1600–1620) conquest of the Island of Hawai‘i, which establishes Hilo as a royal center by the sixteenth century. In the account, ‘Umi-a-Liloa began his conquest of the Island of Hawai‘i by defeating chief Kulukulu‘ā, who lived in Waiākea, and the other chiefs of Hilo (Kamakau 1992:16–17). ‘Umi-a-Liloa’s second son, Keawe-nui-a-‘Umi, ruled Hamākua, Hilo, and Puna from his residence at Hilo (*ibid*: 34). It was from Hilo that he waged war on the Kona chiefs and unified the island. Keawe-nui-a-‘Umi’s descendants single handedly continued rule for many generations from Hilo.

After the death of Keawe-nui-a-‘Umi the kingdom was divided into three parts and was established under warring chiefs; Hilo was ruled by Kumalae-nui-pu‘awa-lau and his son Makua (*ibid*: 45). It was during the period of time that Kamehameha I was born. Kalani‘ōpu‘u’s grandson, Keoua Kuahu‘ula and nephew Kamehameha vied for control over the six chiefdoms constituting the island kingdom and Keoua conquered Hilo chief Keawe-mau-hili and harvested the benefits for a short time only to be vanquished by Kamehameha I late in 1791.

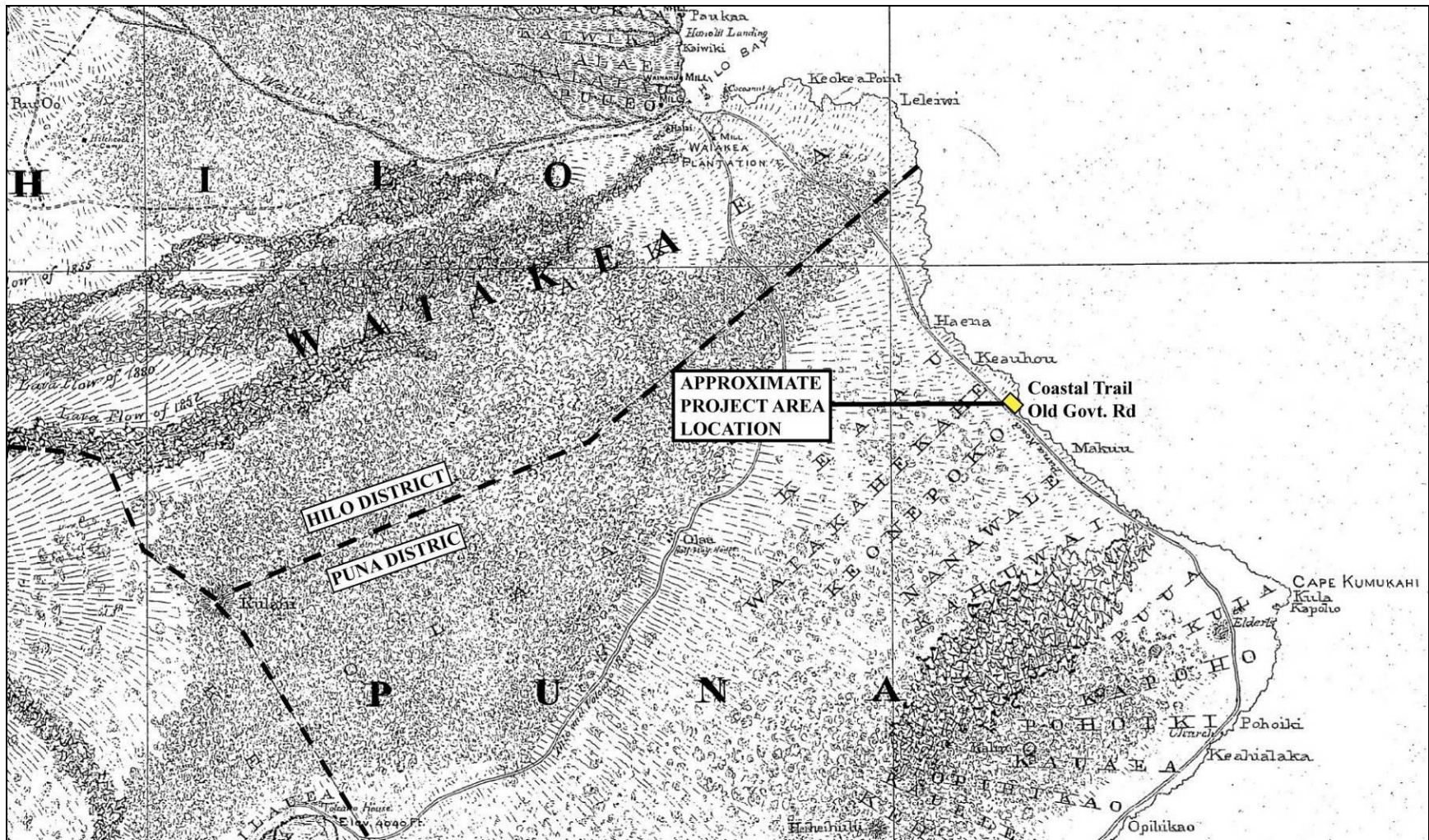


Figure 5: Portion of Map of the Island of Hawai'i Showing the Locations of Project Area and Place Names (Wall 1886).

Kamehameha's son Liholiho was born in Hilo in November 1797 (Kamakau 1992:22). Waiākea was inherited by Lihiliho after Kamehameha's death. The *'ili kūpono* of Pi'opi'o and its royal fishpond were given to his favorite wife, Ka'ahumanu.

Situated along the windward coast of Hawai'i Island, Puna is a verdant and abundant district with good rainfall and rich soils (see Figure 5). However, it is also subject to volcanic eruptions and has been covered by new lava in many places over the last 1,000 years (Cordy 2000:17, and 22). Much of the district's coastal areas have thin soils, and there are no good deep water harbors. The ocean along the Puna coast is often rough and wind-blown.

As a result of these two factors, settlement patterns in Puna tend to be dispersed and without major population centers. Villages in Puna tend to be spread out over larger areas and often are inland, and away from the coast, where the soil is better for agriculture (*ibid*: 45). The lack of population centers also had an effect on the development of a hierarchy of district rulers. Puna was often not strongly tied together by a tight web of allegiances between *ali'i* and *konohiki*. As a result, Puna was often conquered and ruled by stronger district leaders in Hilo or Ka'ū (Kamakau 1992:17 and 77).

Puna District was famous for its valuable products, including "hogs, gray *kapa* cloth (*'eleuli*), tapas made of *mamaki* bark, fine mats made of young pandanus blossoms (*'ahuhinalo*), mats made of young pandanus leaves (*'ahua'o*), and feathers of the *'o'o* and *mamo* birds" (*ibid*:106). Puna was also famous for its abundant *ulu* (breadfruit).

Kea'au and neighboring 'Ōla'a Ahupua'a were well known for their valuable natural and hand-made products. Both *ahupua'a* were located along the southern boundary of South Hilo District (see Figure 5). The two *ahupua'a* were often the source of forest products for the Hilo's ruling elite. Moreover, Kea'au cut 'Ōla'a off from the ocean, so that families living along the coast in Kea'au often traded marine resources for upland forest products from family members living in small communities in upland 'Ōla'a.

Historical accounts pertaining to lands of the project area region are scarce but provide some information on traditional residence patterns, land-use, and subsistence. William Ellis passed through Maku‘u Ahupua‘a in 1823 while travelling along the coastal trail from Kilauea to Waiākea Ahupua‘a, Hilo (see Figure 5). Ellis’ journey took him along the coast past the project area. Ellis did not describe the region of Maku‘u Ahupua‘a, but stopped in a small inland village in Honolulu Ahupua‘a, and rested in the shade of a canoe house along the coast of Waiakahiula Ahupua‘a (Ellis 1963:294-295), both south of Maku‘u (Figure 6). Honolulu Village and a nearby village were inland and small, and the population was dispersed.

Ellis also described a village, likely Hā‘ena, in Kea‘au Ahupua‘a, north of Maku‘u (see Figure 5). The village was large and populous with an abundance of taro, sweet potato and sugarcane gardens (Ellis 1963:296). He suggested the area was made more fertile by a flowing stream where he quenched his thirst.

TESTIMONY BEFORE THE COMMISSION TO QUIET LAND TITLES

With the Māhele of 1848 and the two Acts of 1850, authorizing the sale of land in fee simple to resident aliens and the award of *kuleana* lands to native tenants, land tenure in Hawai‘i arrived at a significant turning point (Chinen 1961:13). The *ahupua‘a* of Kea‘au was granted to William C. Lunalilo as part of Land Commission award (LCA) 8559-B.

There were no Land Commission awards made in Maku‘u Ahupua‘a. Three small Land Grants (LG) were purchased along the coast in Maku‘u and Halona Ahupua‘a (Figure 6 and Figure 7). LG 1013 was purchased by D.W. Maiau, LG 1014 was purchased by Kea, and LG 1537 was purchased by Kapohana. D. W. Maiau was a teacher at the nearby Maku‘u schoolhouse. The current project area is the eastern portion of LG 1014 purchased by Kea in 1857.

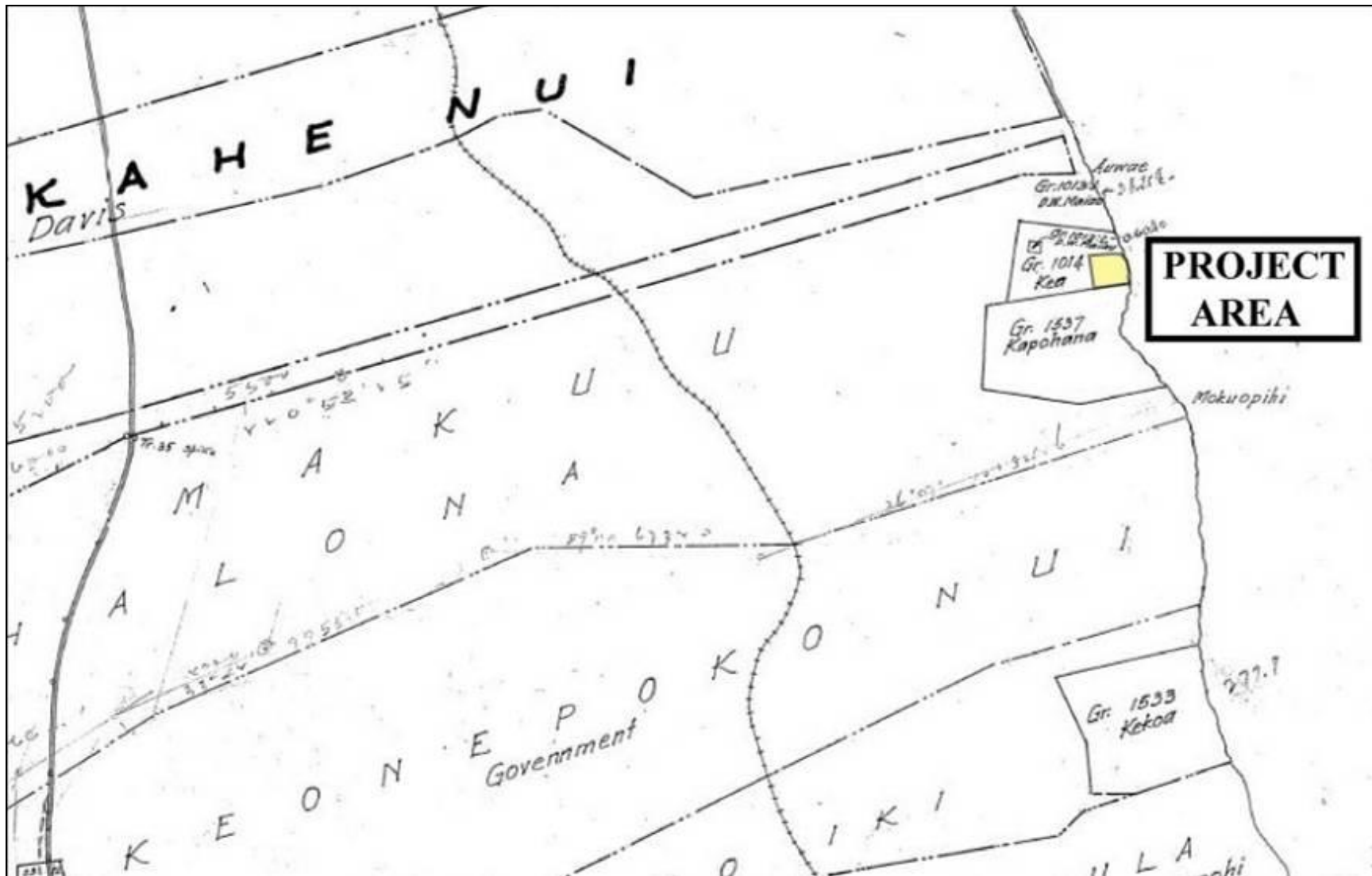
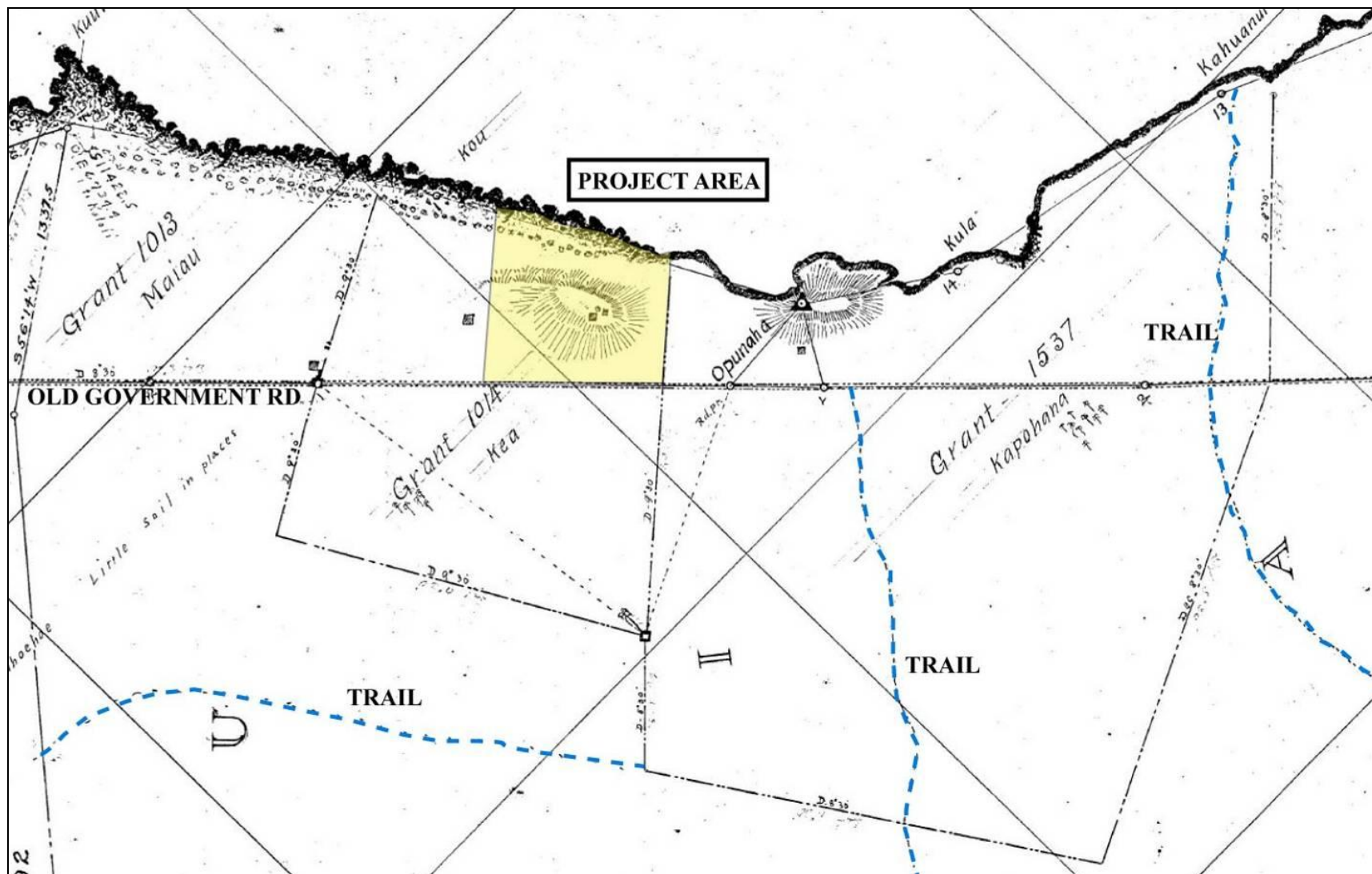


Figure 6: Portion of Map of Puna District Showing Locations of the Project Area and Land Commission Awards (Wall 1927).



CHANGING RESIDENTIAL AND LAND-USE PATTERNS (1845-1865)

Between 1845 and 1900, traditional land-use and residential patterns began to change drastically. In particular, the regular use of Hilo Bay by foreign vessels, the growth of tourism, the presence of the whaling industry, the establishment of missions in the Hilo area, the legalization of private land ownership, the introduction of cattle ranching, the introduction of sugar cane cultivation, and the construction of Government Roads and railroad lines all brought about changes in settlement patterns and long-established land-use patterns (Kelly *et al.* 1981). Much of the change in residential location and the growth of towns in Puna District were driven by the availability of arable land suited to commercial crops and the location of newly constructed roads.

The traditional travel route through Puna was along the coast (see Figure 5 and Figure 8). The trip was made along a foot trail that led through the coastal and near coastal villages. That trail lead from the modern day Lili‘uokalani Gardens area to Hā‘ena along the Puna coast. The trail is often called the old Puna Trail and/or Puna Road. There is an historic trail/cart road that is also called the Puna Trail (*Ala Hele Puna*) and/or the Old Government Road that continues from the south end of the Puna Trail through Waiakahiula Ahupua‘a heading to points south. Lass (1997) also refers to the entire route from Hilo to Ka‘ū as the Puna-Ka‘ū trail.

THE PUNA TRAIL AND OLD GOVERNMENT ROAD

There is an historic trail that leads from the modern day Lili‘uokalani Gardens in Waiākea to Hā‘ena along the Puna coast. The trail is often called the old Puna Trail and/or Puna Road. There is an historic trail/cart road that is also called the Puna Trail (*Ala Hele Puna*) and/or the Old Government Road that continues from the south end of the Puna Trail heading to points south. Lass (1997) also refers to the entire route from Hilo to Ka‘ū as the Puna-Ka‘ū trail.

Whatever name the trail/cart road alignment is called by, it likely incorporated segments of the traditional Hawaiian trail system often referred to as the *ala loa* or *ala hele* (Hudson 1932:247, Kuykendall 1966:23-25, Lass 1997:15, and Maly 1999:5). Lass suggests the full length of the Puna Trail, or Old Government Road, might have been constructed or improved just before 1840 (Lass 1997:15). The trail was called the Old Government Road, or *Ala Nui Aupuni* (Maly 1999:5). The alignment was first mapped by the Wilkes Expedition of 1804-41 (see Figure 8).

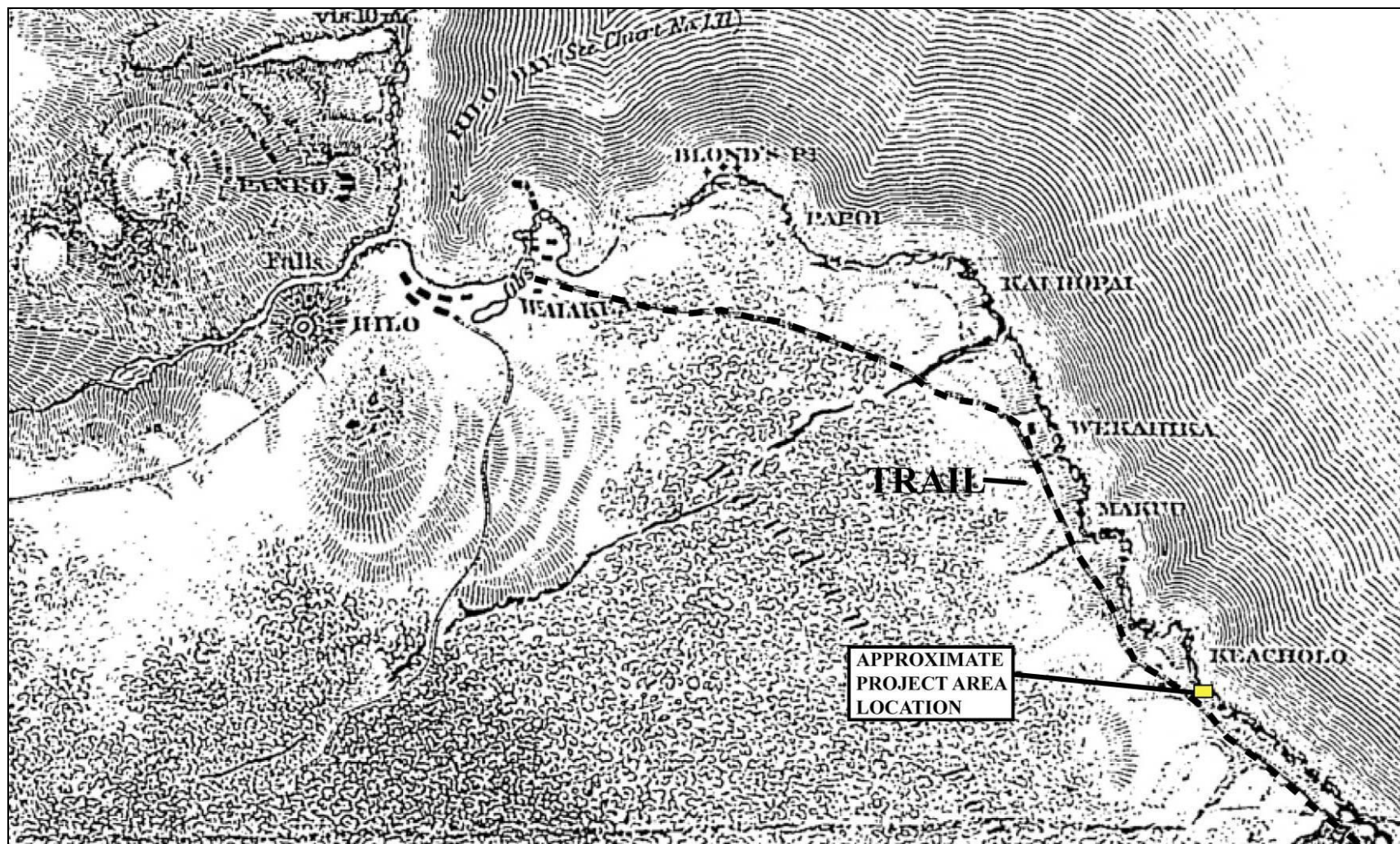


Figure 8: Location of Project Area and Old Government Road from Hilo Bay through Puna District on Portion of Registered Map 424 Drawn by the Wilkes Expedition of 1840-1841.

A general description of the area between the Old Government Road and the newer upper road from Hilo through Kea‘au to Pahoa was recorded in 1889 by the Surveyor General of the Hawaiian Government Survey. The description affords a glimpse into inland and coastal settlement patterns and land use.

The first settlement met with after leaving Hilo by the sea coast road, is at Keaau, a distant 10 miles where there are less than a dozen inhabitants; the next is at Makuu, distant 14 miles where there are a few more, after which there is occasionally a stray hut or two, until Halepuaa and Koae are reached, 21 miles from Hilo, at which place there is quite a village; thence to Kaimu there are only a few scattered settlements here and there. A good many of those living along the lower road have their cultivating patches in the interior, along or within easy accessibility to the new road (Alexander 1891, cited in Maly 1999:107).

The 1889 description contrasts with Ellis' in which he described numerous villages just sixty-six years earlier. The 1889 description suggests depopulation along the majority of the Puna near-coastal area. In both descriptions, the people in this area appear to have lived somewhat inland, between the coast and the inland gardens. In 1889 people were cultivating small patches of *kalo*, *‘awa*, and coffee as well as other food items in the inland gardens. The patches were placed in pockets of soil in holes amidst the lava flows. Additionally, sweet potatoes were grown on rock mounds. By 1889, it appears that very few people lived along the Old Government Road (Maly 1999:6). The Surveyor General stated,

The old sea coast road cannot be kept in repair with the means now at its disposal and its condition each year is becoming more unsafe and ruinous, there is but little travel over it; it has been shown that there is little land capable of cultivation or development either side of it and whatever travel there is now over it would soon be entirely diverted to the upper road (Alexander 1891, cited in Maly 1999:107).

The new road being constructed from Hilo through Kea‘au to Pahoa was designed to allow access to the more arable inland areas. People who traditionally had lived along the Puna coast were moving toward Hilo and into the more fertile upland areas of Puna in

order to find paid work and to produce cash crops for local markets and for export. In particular, people began to work in the inland areas to grow sugarcane.

The same was true of the trail from Hilo, through Kea‘au, and on to Kīlauea Crater (Volcano Road). An improved Volcano Road was built from Hilo to Kīlauea between 1889 and 1893 partly to accommodate tourism, but also to increase access to forest products and agricultural land. Numerous small field parcels belonging to the ‘Ōla‘a Sugar Company and the ‘Ōla‘a Coffee Company were located along this route. The improved Volcano Road is Route 11, though it has been straightened and improved several times since its initial construction.

The modern history of land-use in Kea‘au Ahupua‘a is tied to the development of commercial agriculture and the construction of transportation routes. The potential to use Kea‘au's rich arable land for commercial prospects was recognized as early as the 1870s when it was leased for coffee growing and for cattle grazing. In 1881, the entire *ahupua‘a* was purchased at auction by Samuel Damon, William H. Shipman, and E. Elderts from trustees of the deceased William C. Lunalilo Estate. Shipman bought out the two partners within three years of purchasing the land.

William H. Shipman operated a cattle ranch in Kapoho Ahupua‘a and was the owner of the Waiākea Stock Ranch. Shipman was also co-owner of the Shipman Meat Market, later the Hilo Meat Company. Shipman leased portions of Kea‘au Ahupua‘a to the ‘Ōla‘a Sugar Company beginning in 1899. It was the development of ‘Ōla‘a Sugar Company fields, the construction of the sugar mill in Kea‘au, and the construction of the numerous sugar company camps, that created modern day Kea‘au town as a small commercial and residential center.

SUGARCANE, RAILROADS AND COMMERCE

The ‘Ōla‘a Sugar Company, established in 1899, became the largest sugarcane plantation and milling operation in Puna District. By the 1950s the ‘Ōla‘a Sugar Company was in debt and sugar production and sales were stagnant. The company stockholders changed the company name to the Puna Sugar Company, Ltd. and sold off land to invest in new equipment and upgrade their facilities. By 1966, the company was debt free and making a good profit. American Factors (AMFAC) bought out the minority shareholders in 1969 and Puna Sugar Company became a subsidiary of AMFAC.

AMFAC expanded sugarcane processing in the 1970s through new extraction facilities upgrades at the mill in Kea‘au (‘Ōla‘a Mill) and by building a 15KW bagasse and trash burning power plant next to the mill. Hilo Electric Light Company (HECO) agreed to purchase 12.5KW of power for their customers.

Puna Sugar Company, like many other sugar companies, struggled in the late 1970s and early 1980s due to changes in the sugar market that made sugar production less profitable. By the start of 1982, AMFAC had decided to close Puna Sugar Company. The work of selling off assets and preparing severance packages took three full years. The sugar mill was sold to Fiji Sugar Corporation in 1988 and the power plant operation taken over HECO.

MODERN LAND USE

The project area and surrounding lands were not used for growing sugarcane as the soil is too shallow. The area remained primarily unaltered and undeveloped grasslands with a large variety of introduced and invasive species. The land north of the current project area, 15.6 square miles in total, was purchased by David Watumull from W.H. Shipman, Ltd in 1959. The land was subdivided into nearly 8,800 lots within the newly created Hawaiian Paradise Park (HPP) subdivision.

Currently, the land along the coast near the project area is primarily privately owned. Some of the lots have homes on them and others are still undeveloped. Some of the lands further *mauka* of Government Beach Road are owned by the Department of Hawaiian Homelands (DHHL) and the State of Hawai‘i.

LG 1014 purchased by the Kea family was subdivided and the southeast corner of the property was purchased by the Kamahale-Kamoe family by at least in the first two decades of the 1900s. Frank Kamahale and Ann Kamahale (née Kamoe) had eight children including Ulrich “Sonny” Kamahale. The family was living on the property when Ann passed and she and other Kamoe family members are buried in a family plot (Site #50-10-45-18987) on the property. Sonny (April 15, 1923-November 6, 2002) lived on the property and grew produce there until he passed away. Sonny’s house (Site #50-10-45-7476) and the property were later sold after Sonny passed. Site 7476 burned down in 2014 during Hurricane Iselle and is no longer present on the property.

PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS

The earliest archaeological study written by Ewart and Luscomb (1974) recorded 22 archaeological sites along the coast of Waikahekahe and Maku‘u Ahupua‘a (Figure 9 and Table 1). Sites were clustered on either side of Beach Road and consisted of agricultural and habitation complexes. Sites included rock walls, small enclosures and agricultural rock clearing mounds.

Coastal Waikahekahe and Maku‘u archaeological sites were primarily agricultural and habitation complexes containing rock walls, agricultural rock clearing mounds, rock walls, enclosures, pavements, platforms, rock lined wells, and burial features. The sites appear to be primarily pre-Contact to Historic era in age. Site 18975 is a possible *heiau* complex (Figure 10).

RECENT STUDIES IN MAKU‘U AND SURROUNDING AHUPUA‘A

Seventeen archaeological studies have been conducted in Maku‘u, Pōpōki and Halona Ahupua‘a (Figure 11 and Table 2). The studies were conducted in the upland and coastal regions surrounding the current project area and shed light on pre-Contact to Historic era land use. The most striking feature of the studies is the low distribution of archaeological sites documented in the upland project areas. Aside from lava tubes containing pre-Contact era habitation features and burials, only three archaeological features were documented in the upland project areas. Upland features included a possible ceremonial complex (enclosure, platform, rock wall, and rock wall), a rock mound and an agricultural terrace. The lack of sites in the uplands is consistent with early written accounts documenting traditional habitation areas along the coast to a little over one mile inland.

Komori and Peterson (1987) conducted a cultural and biological resources survey along a corridor roughly 2.5 to 3.0 kilometers (1.55 to 1.86 miles) from the coastline. Five agricultural complexes, habitation and burial platforms, burial and refuge caves, and petroglyphs were documented within the project area. All of the sites are pre-Contact to early post-Contact era in age.

Dirks and Rechtman (2013) recorded a pre-Contact era coastal trail segment (Site 18418) and a Historic era rock wall (Site 18419) roughly 350.0 meters southeast of the current project area (Figure 12). The trail was recommended for preservation.

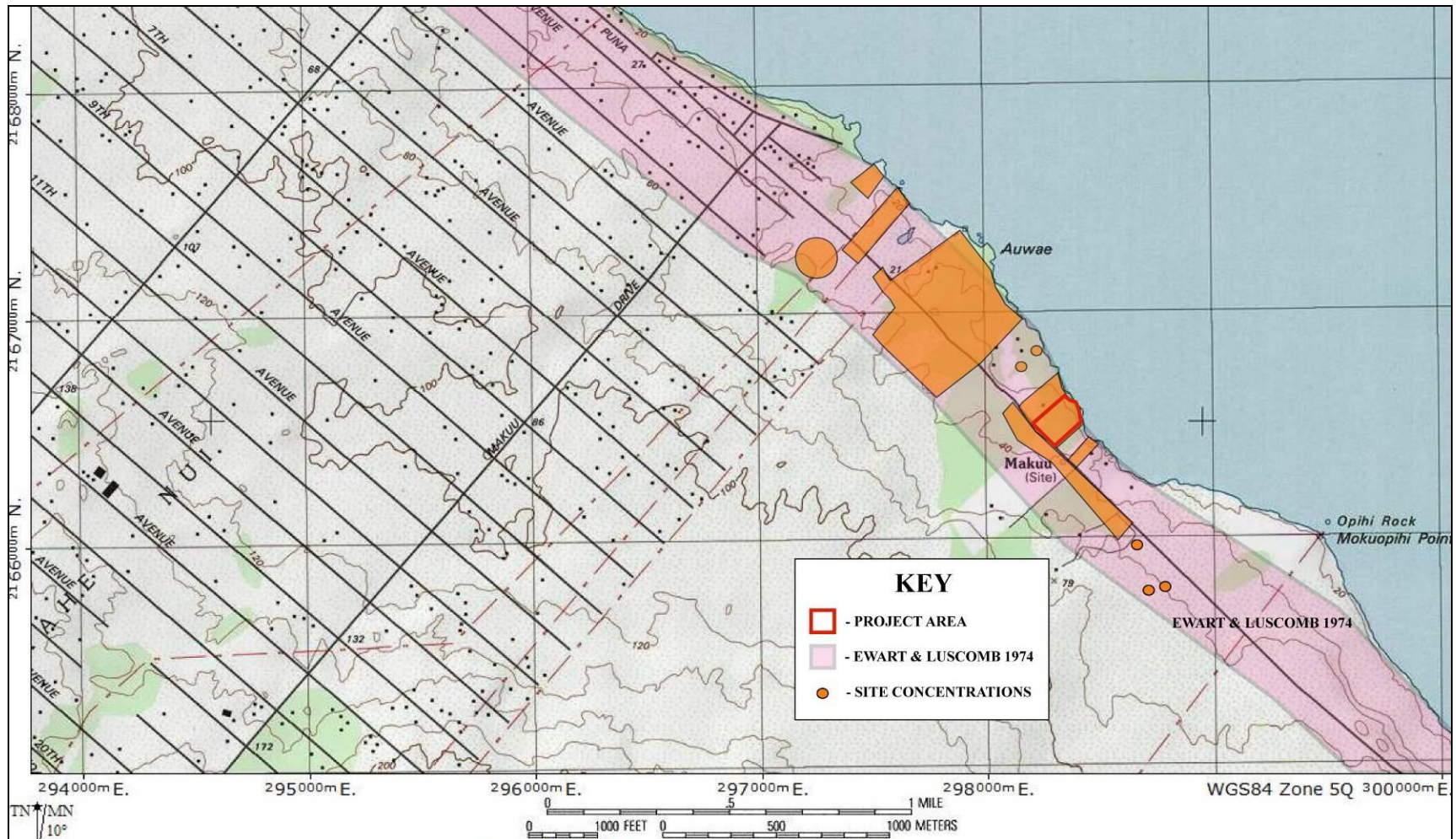


Figure 9: 7.5-Minute Series USGS Topographic Map (Kea'au Ranch Quad) Showing Location of Coastal Sites Recorded in Ewart and Luscomb (1974) (National Geographic Topo!, 2003. Data Sources: National Geographic Society, USGS).

Table 1: Inventory of Waikahekahe and Maku‘u Ahupua‘a Archaeological Sites (Ewart and Luscomb 1974).

SIHP# 50-10- 45:	Site Type	Ahupua‘a	Description	Research Potential
18973	Complex	Waikahekahe	Rock walls, retaining walls, walled depressions, and possible platforms	Good
18974	Complex (Agriculture and Habitation)	Waikahekahe	Rock walls, retaining walls, walled depressions, possible pavements, and platforms	Good
18975	Complex	Waikahekahe	Rock walls, retaining walls, platforms, rock mounds, and possible <i>hieau</i>	Excellent
18976	Complex (Agricultural)	Maku‘u	Free-standing and retaining walls and small mounds	Good
18977	Wall	Maku‘u	Wall	N/A
18978	Complex	Maku‘u	Free-standing and retaining walls, a mound, a possible <i>kuleana</i> wall, and an enclosure	Mediocre
18979	Wall & Enclosure	Maku‘u	Rock wall and enclosure	Some
18980	Complex (Agriculture)	Maku‘u	Rock walls and rock mounds	Good
18981	Petroglyphs	Maku‘u	Modern petroglyphs	N/A
18982	Complex	Maku‘u	Walls, faced areas, a mound with an upright stone, and a rock-lined well	Negligible
18984	Complex (Agriculture and Habitation)	Maku‘u	Trails, several enclosures, and terraces	Excellent
18985	Wall	Maku‘u	Rock wall	Some
18987	Burials	Maku‘u	Historic grave yard	N/A
18987	Complex (Agriculture and Habitation)	Maku‘u	Walls, enclosures, mounds, depressions, and platforms	Good
18988	Complex (Agriculture and Habitation)	Maku‘u	Walls and platforms	No Longer Present
18989	Petroglyph Field	Maku‘u	Petroglyphs	Good
18990	Possible Burial	Maku‘u	Rock mound	N/A
18991	Enclosure	Maku‘u	Rock lined depression	N/A
19005	Possible Burial	Maku‘u	Rock mound	N/A
20598	Trail	Maku‘u	Coastal trail	Good
4222	Petroglyph Field	Maku‘u	Petroglyphs	Good
7476	Kamahele House	Maku‘u	Historic house	No Longer Present

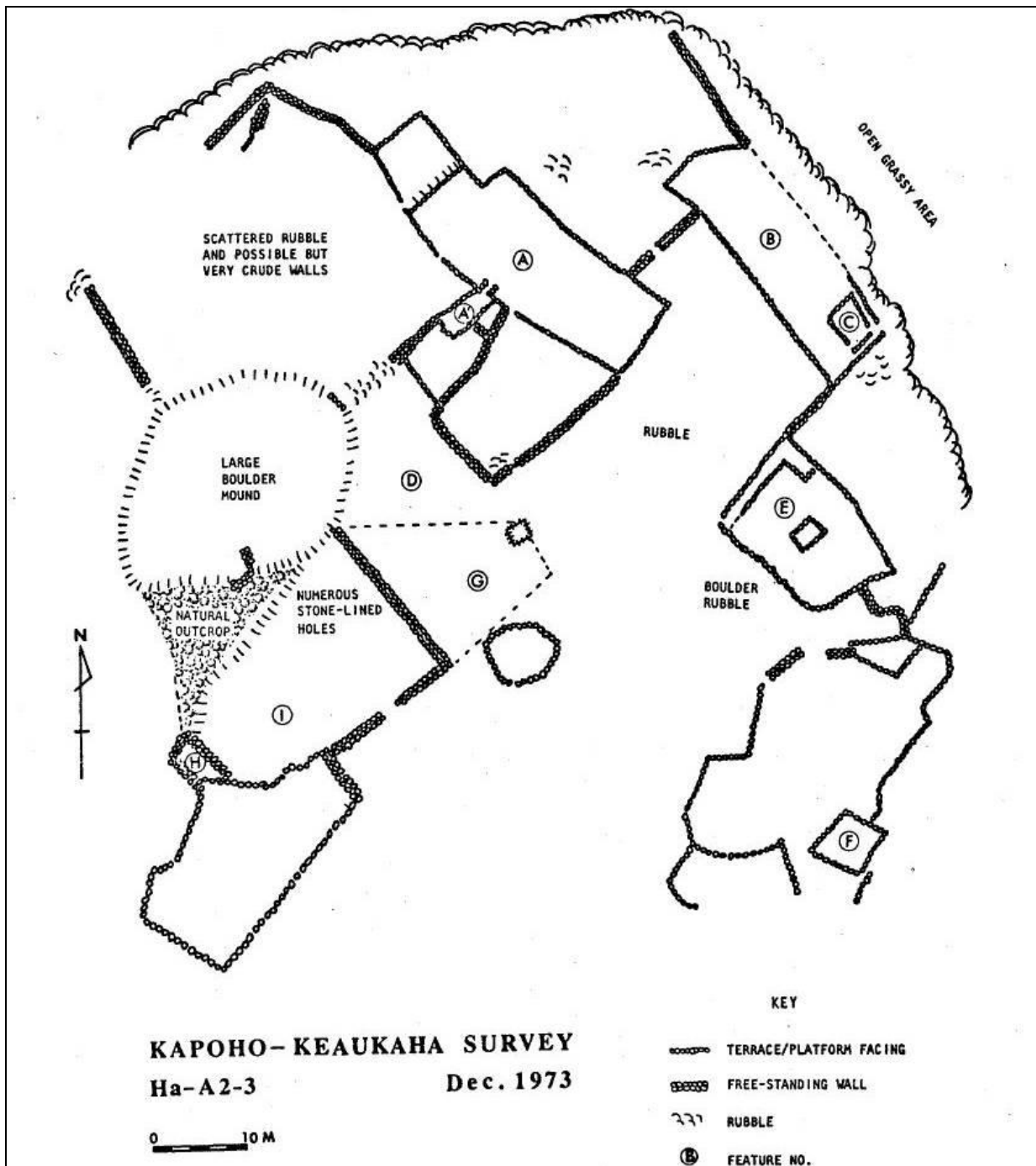


Figure 10: Site 18975 Plan View Map (Ewart and Luscomb 1974:24).

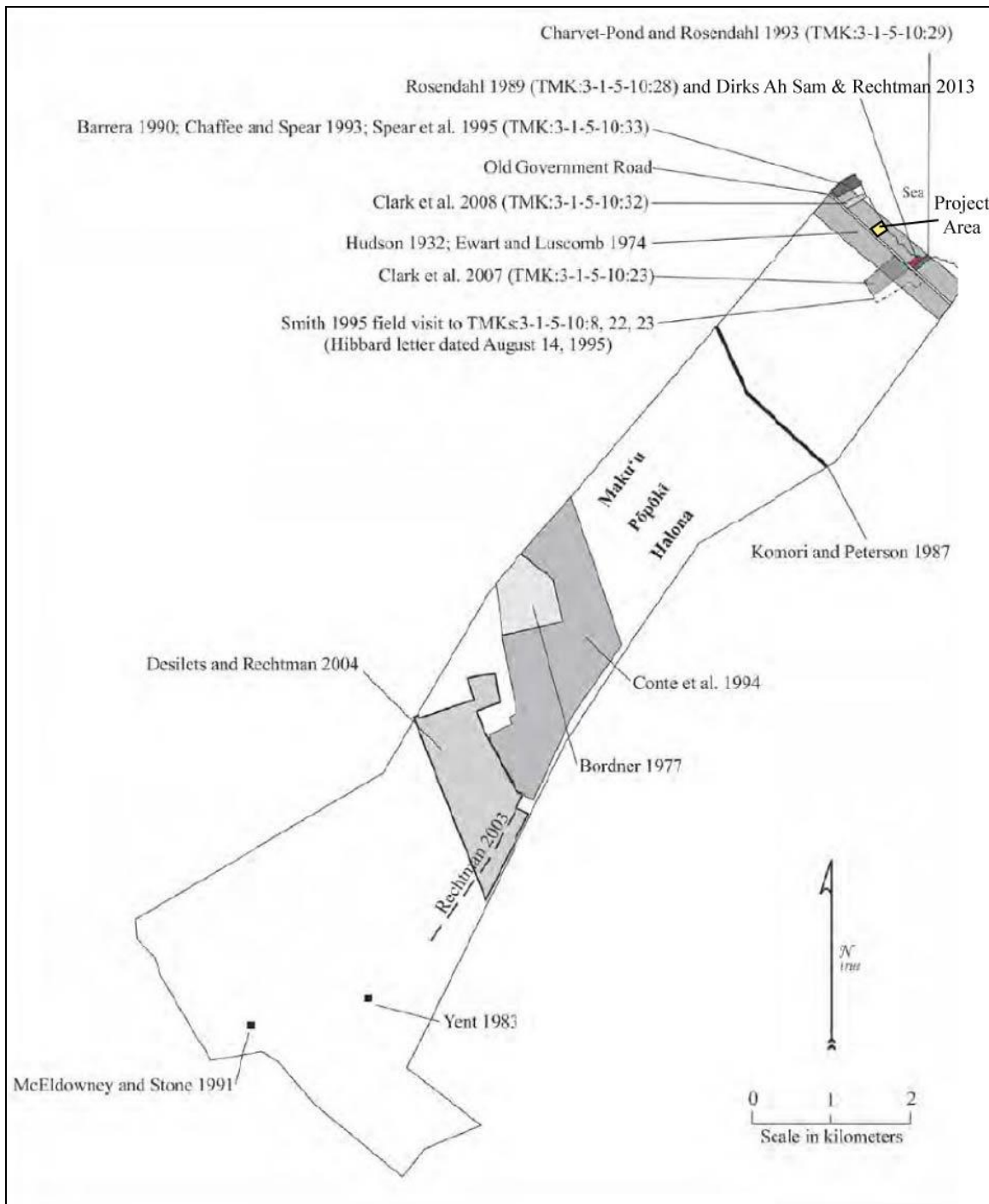


Figure 11: Map Showing Recent Previous Archaeological Studies in Maku'u and Surrounding Ahupua'a (Adapted from Dirks Ah Sam and Rechtman 2013:11).

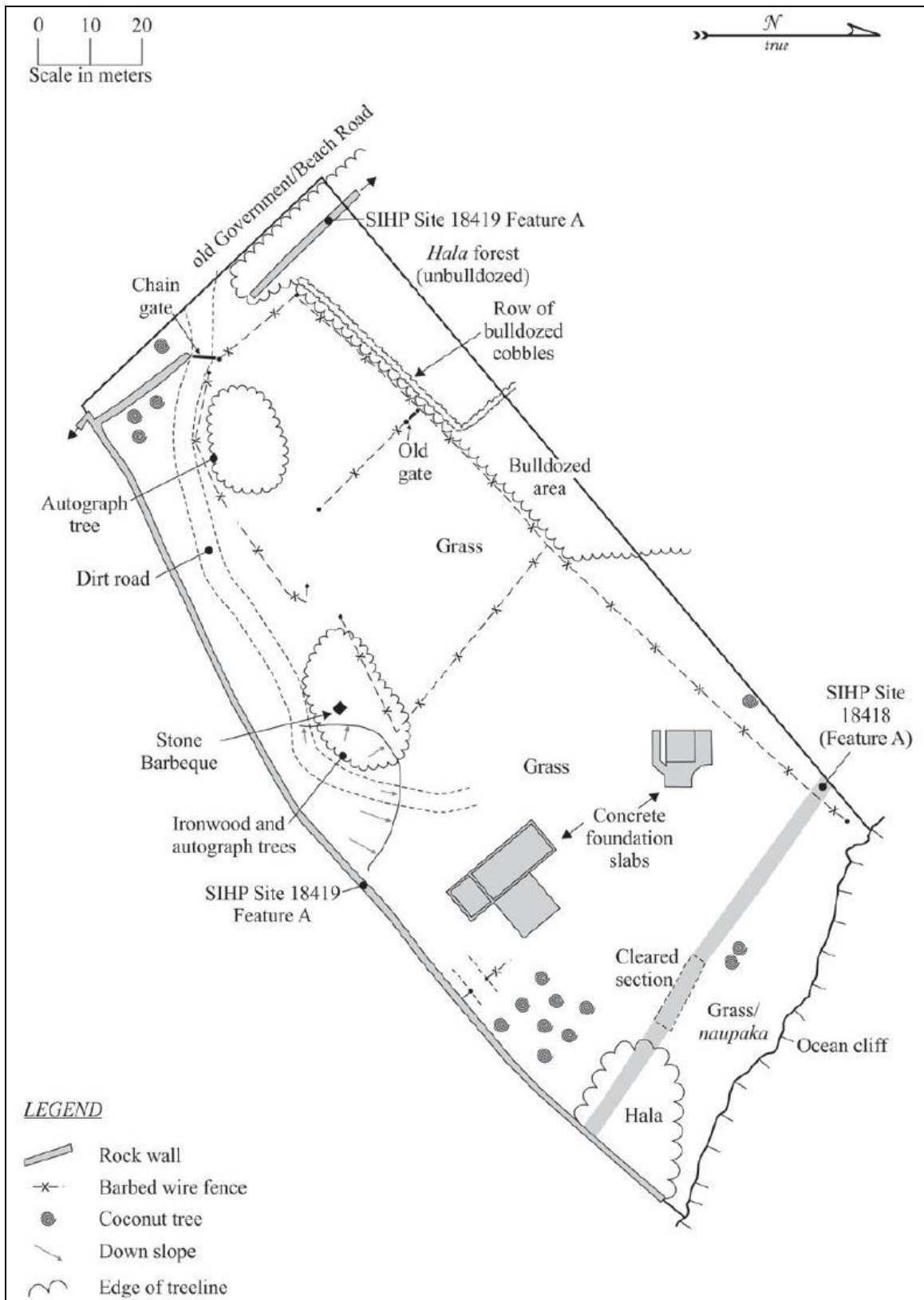


Figure 12: Archaeological Site Plan Map Showing Sites Recorded in Dirks and Rechtman (2013).

Table 2: Previous Archaeological Studies in Maku‘u, Pōpōki and Hālona Ahupua‘a.

Author/Date	Type of Study	Ahupua‘a
Barrera & Lerer 1990	Archaeological Inventory Survey	Maku‘u
Bordner 1977	Reconnaissance Survey	Maku‘u
Chaffee & Spear 1993	Burial Testing	Maku‘u
Clark et al. 2007	Archaeological Inventory Survey	Pōpōkī
Clark et al. 2008	Archaeological Inventory Survey	Maku‘u
Charvet-Pond & Rosendahl 1993	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Conte et al. 1994	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Desilets & Rechtman 2004	Archaeological Inventory Survey	Maku‘u, Hālona, Pōpōkī
Dirks Ah Sam & Rechtman 2013	Archaeological Inventory Survey	Pōpōkī
Hudson 1932	Archaeological Survey	Various
Ewart & Luscomb 1974	Reconnaissance Survey	Various
Komori & Peterson 1987	Cultural & Biological Resource Survey	Various
McEldowney & Stone 1991	Archaeological/Environmental Survey	Various
Yent 1983	Archaeological Survey	Maku‘u
Rechtman 2003	Archaeological Assessment	Maku‘u, Hālona
Rosendahl 1989	Field Inspection	Maku‘u, Hālona, Pōpōkī
Spear et al. 1995	Data Recovery	Maku‘u

Studies conducted along the coastline documented clusters of pre-Contact to early Historic era habitation and agricultural sites including enclosures, platforms, rock walls, rock mounds, burials, petroglyphs, rock lined springs and water catchments, and remnant trail segments.

PREVIOUS ARCHAEOLOGY WITHIN THE PROJECT AREA

Ewart and Luscomb (1974) recorded six sites within the project area and a single coastal trail segment on the property southeast of the current project area (Table 3 and Figure 13). Sites 18980, 18982 and 18988 were recorded as agricultural complexes, likely pre-Contact to early Historic era, consisting of rock mounds, rock walls, platforms, and a well.

Table 3: Inventory of Previous Documented Sites at the Project Area.

SIHP# 50-10- 45:	Site Type	Description	Research Potential
7476	Kamahele House	Historic house	No Longer Present
18980	Complex (Agriculture)	Rock walls and rock mounds	Good
18981	Petroglyphs	Modern petroglyphs	None
18982	Complex	Walls, faced areas, a mound with an upright stone, and a rock- lined well	Negligible
18987	Burials	Historic graves	N/A
18988	Complex (Ag. & Habitation)	Walls and platforms	Moderate
20598	Trail	Coastal trail	Good

Site 18980 is in the southeast corner of the parcel just *mauka* of the coastal pāhoehoe flats. The site contained agricultural rock mounds and walls. Site 18982 was recorded along the northwest boundary of the property, primarily on the property northwest of the current project area. A shallow well or spring was located on the current project area. Site 18988 was no longer present when the Ewart and Luscomb (1974) survey was conducted, but the property owner, Sonny Kamahele, told the surveyors in 1973 that there were platforms, walls and an enclosure that were removed to expand his watermelon fields.

Site 7476 was the Kamahele and Kamoe house located in the southwest quadrant of the property. The house is listed on the Hawai‘i Register. The house burned down in 2014 during Hurricane Iselle and is no longer present on the property. Site 18987 is the family burial plot containing Sonny’s maternal grandmother (née Kamoe) and six other individuals.

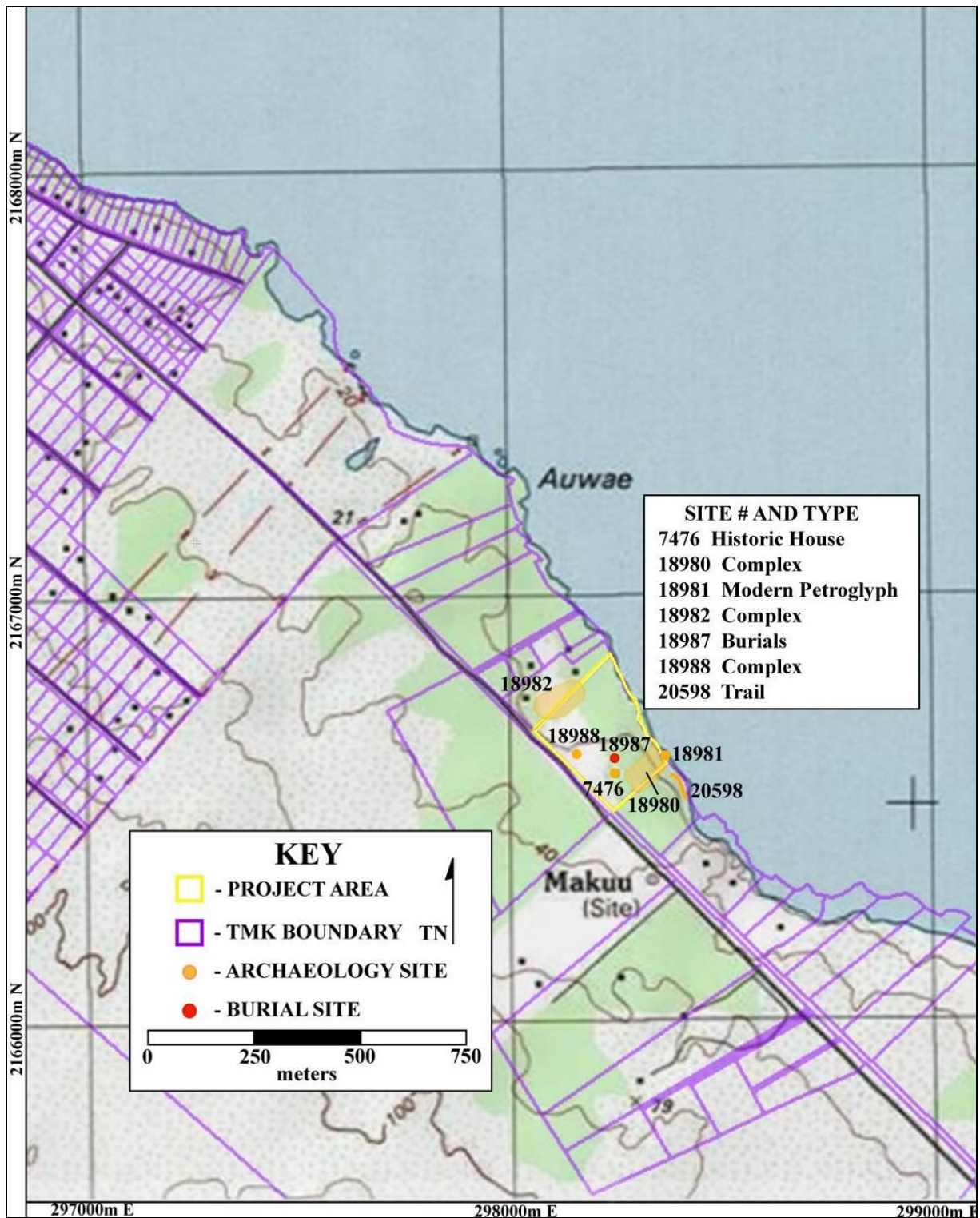


Figure 13: 7.5-Minute Series USGS Topographic Map Showing the Location of Previously Documented Sites on Parcel 009 (Kea‘au Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and Hawai‘i County Planning Department, 2013).

Site 18981 are three modern petroglyphs carved into two large rocks located on the coastal pāhoehoe flat in the south east corner of the property. The petroglyphs read “72 MIKE N TINA,” “72 GUY HA” and “MIKE N TINA.”

Site 20598 is a remnant segment of trail located along the coastal cliff on the property southeast of the project area. The trail is constructed of waterworn boulders placed side by side on to two meters wide (Ewart and Luscomb 1974:28).

The Ewart and Luscomb (1974) study determined that Site Complex 18980 had good research potential while the modern petroglyphs at Site 18981 had no research potential. Site Complex 18982 was determined to have negligible research potential. No intrusive additional research was recommended for Burial Site 18987 and that Site Complex 19988 had only moderate research potential as it is no longer present on the ground surface. No recommendation was made in the report for house Site 7476 and it is no longer present. Trail Site 20598 was determined to have good research potential but is not within the current project area, though a search should be made to determine if it continues onto the current project area.

The most recent AIS conducted by SCS (Escott 2019 Draft) identified five archaeological sites in the project area (Table 4 and Figure 14). Three of the sites (Site #50-10-45-7476, 18980 and 18987) were previously recorded in Ewart and Luscomb (1974) and two sites were previously undocumented. The three previously identified sites include a cement foundation at the Kamahale House (Site 7476), an agricultural complex (Site 18980) and the family burial plot (Site 18987). Two newly recorded sites include the rock wall along the boundary of Parcel 009 (Site TS1) and a short rock wall segment (Site TS2) in the southeast corner of the project area. Site 18981 recorded in Ewart and Luscomb (1974) is two modern petroglyphs and is not a historic property.

Table 4: Inventory of Archaeological Sites Identified Within the Project Area.

SIHP #50-10-45:	SITE TYPE	SITE FUNCTION	SITE AGE
7476	Kamahale House	Habitation	Historic era
18980	Complex (Agriculture)	Rock walls and rock mounds	Pre-Contact to early post-Contact era
18987	Burials	Historic graves	Historic era
31111	Rock Wall	Property Boundary	Historic era
31112	Rock Wall	Road edge	Historic era

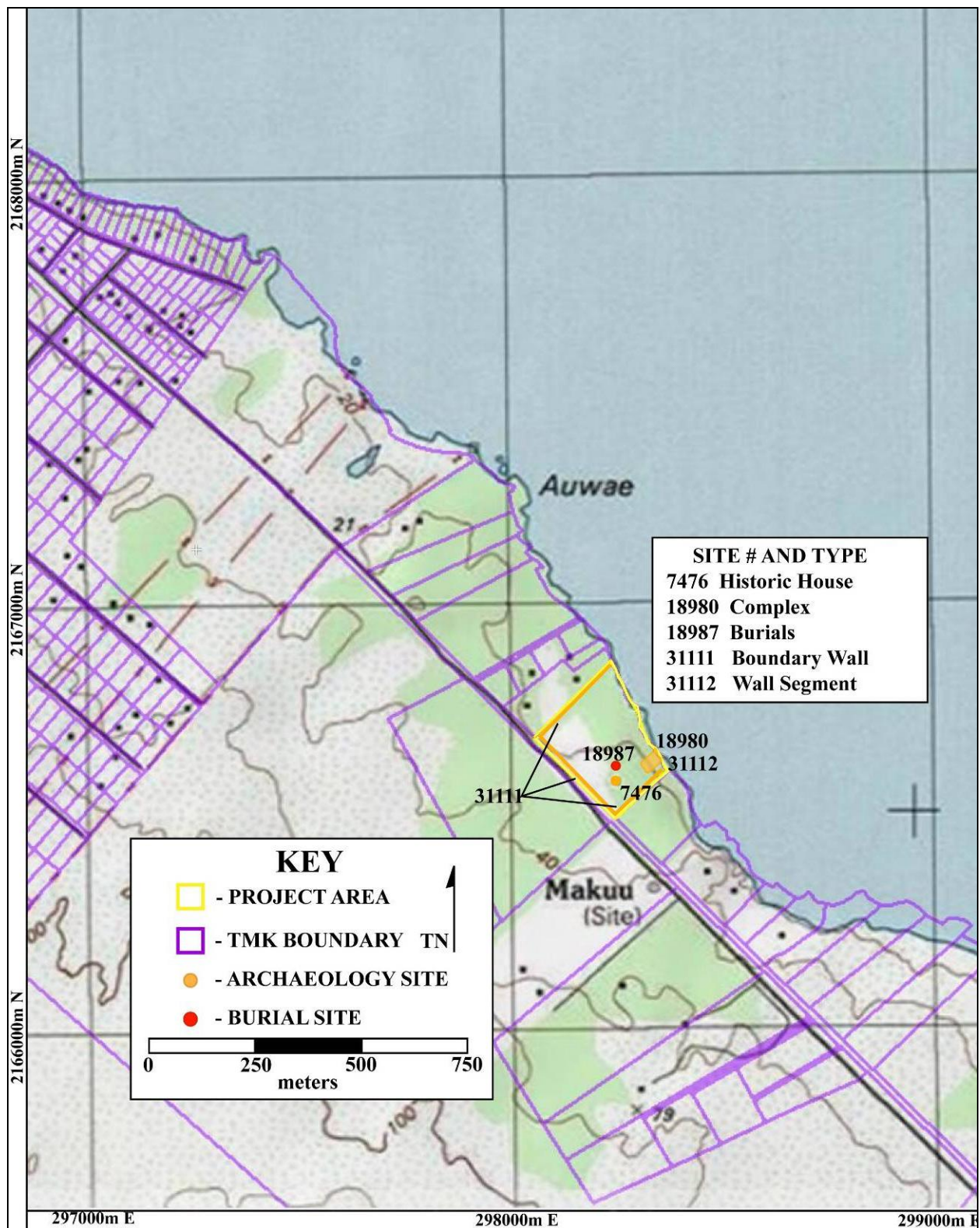


Figure 14: 7.5-Minute Series USGS Topographic Map Showing the Location of Archaeological Sites Documented on Parcel 009 (Kea‘au Ranch Quadrangle. ESRI, 2013. Data Sources: National Geographic and Hawai‘i County Planning Department, 2013).

Sites recorded at the project area are primarily Historic era in age, though Site 18980, an agricultural complex, could possibly have a pre-Contact era component. The Site 18980 features are constructed in the manner of, and have characteristics common to, Historic era features. It is likely that Site 18982 and Site 18988 were pre-Contact era agricultural and habitation sites, but they are no longer present on the property. There were no subsurface remains of the sites within the stratigraphic trenches excavated during the current study. The coastal trail segment (Site 18418) recorded in Dirks and Rechtman (2013) was not present on the current project area.

Sites identified on the project area were constructed by the Kea, Kamahele and Kamoe families as part of a working farm and home. The sites were used up through the modern era. It is likely that Sites 18982 and 18988 were removed during clearing for the farm fields.

Preservation in-place was recommended at Site 18980 and Site 18987. Preservation at Site 18980 and Site 18987 shall consist of avoidance and protection (conservation) per HAR §13-277-3(1). Site 18980 will be preserved in accordance with an Archaeological Preservation Plan (PP). Site 18987 will be preserved in accordance with a Burial Treatment Plan (BTP).

CULTURAL INFORMANT INTERVIEWS

Consultation was sought from Kamaile Puluole-Mitchell, Office of Hawaiian Affairs (OHA) East Hawai‘i Island Representative; Jordan Kea Calpito, SHPD Burial Sites Specialist; Sean Naleimaile, State Historic Preservation Division (SHPD) Hawai‘i Island Archaeologist; and Kalena Blakemore, Hawai‘i Island Burial Council (HIBC) Member (Table 5). Consultation was also conducted at the project area with members of the Kamahele and Lui families.

Table 5: Individuals Responses to CIA Consultation Request.

Name	Affiliation	Responded	Has Knowledge	Cultural Practices
Kalena Blakemore	HIBC Representative	Yes	Some	No
Kamaile Puluole-Mitchell	OHA East Hawai‘i	No	-	-
Sean Naleimaile	SHPD Archaeologist	No	-	-
Jordan Kea Calpito	SHPD Burial Sites Specialist	No	-	-
Greg DeConte	Kamahele Family Member	Yes	Yes	Yes
Kenneth Ha	Kamahele Family Member	Yes	Yes	Yes
Richard Ha	Kamahele Family Member	Yes	Yes	Yes
June Ha	Kamahele Family Member	Yes	Yes	Yes
Shayne Kamahele	Kamahele Family Member	Yes	Yes	Yes
Darrell Pakele	Kamahele Family Member	Yes	Yes	Yes
Puanani Mukai	Sonny Kamahele’s Caretaker	Yes	Yes	Yes
Ramon Lui	Kea Family Descendant	Yes	Yes	Yes
Agnes Lui	Kea Family Descendant	Yes	Yes	Yes
Nicole Lui	Kea Family Descendant	Yes	Yes	Yes

KAMAHELE FAMILY CONSULTATION

Consultation with the Kamahele family was conducted at the property on Saturday April 27, 2019. Seven individuals, including Greg DeConte, Kenneth Ha, Richard Ha, June Ha, Shayne Kamahele, Puanani Mukai, and Darrell Pakele attended and were interviewed. In addition, SCS Senior Archaeologist Glenn Escott spoke to Sheldon Kamahele at an earlier date on the property. Richard Ha has written several posts on his family blog describing Uncle Sonny Kamahele and his watermelon farm at Maku‘u. The following description of Uncle Sonny and his Maku‘u farm includes a summary of the April 27 meeting and Richard Ha’s posts. Figure 15 shows the location of flora zones and land-use areas from Historic to Modern eras.

All of the family members remembered the property well, especially Uncle Sonny Kamahele's house and farm. Although Uncle Sonny passed away in 2002, many of the family members visited him on his Maku'u farm from the time they were very young. It seemed for a long time that Uncle Sonny's farm was far away from Pāhoa and most places as the road access was limited. Richard, whose maternal grandmother was Sonny's sister, writes

My extended Kamahele family came from Maku'u. When we were small kids, Pop took us in his '51 Chevy to visit.

He turned left just past the heart of Pāhoa town, where the barbershop is today. We drove down that road until he hit the railroad tracks, and then turned left on the old railroad grade back toward Hilo. A few miles down the railroad grading was the old Maku'u station. It was an old wooden shack with bench seats, as I recall. That is where the train stopped in the old days. A road wound around the pāhoehoe lava flow all the way down the beach to Maku'u. That was before there were the Paradise Park or Hawaiian Beaches subdivisions.

We did not know there was a district called Maku'u; we thought the family compound was named Maku'u. Of the 20-acre property, maybe 10 acres consisted of a kipuka where the soil was ten feet deep. The 10 acres on the Hilo side were typical pāhoehoe lava. The property had a long oceanfront with a coconut grove running the length of the oceanfront. It was maybe 30 trees deep and 50 feet tall.

The old-style, two-story house sat on the edge of a slope just behind the coconut grove. If I recall correctly, it had a red roof and green walls. Instead of concrete blocks as supports for the posts, they used big rocks from down the beach.

There was no telephone, no electricity and no running water. So when we arrived it was a special occasion. We kids never, ever got as welcome a reception as we got whenever we went to Maku'u.

The person who was always happiest to see us small kids was tutu lady Meleana, my grandma Leihulu's mom. She was a tiny, gentle woman, maybe 100 pounds, but very much the matriarch of the family. She spoke very little English but it was never an issue. We communicated just fine.



Figure 15: Aerial Photograph Showing Project Areas, Kea'au, HI, Zone 5 North, 298310 m E, 2166660 m N. (Google Earth, 2013 Image. Data Sources: Digital Globe, GeoEye, Earthstar, USDA, and USGS).

We could not wait to go down the beach. Once she took us kids to catch ‘ohua—baby manini. She used a net with coconut leaves as handles that she used to herd the fish into the net. I don’t recall how she dried it, but I remember how we used to stick our hands in a jar to eat one at a time. They were good.

She would get a few ‘opihi and a few haukeuke and we spent a lot of time poking around looking at this sea creature and that.

Between the ocean in the front and the taro patch, ulu trees, bananas and pig pen in the back, there was no problem about food. I know how Hawaiians could be self-sufficient because I saw it in action.

The house was full of rolls of stripped lauhala leaves. There were several lauhala trees and one was a variegated type. I don’t recall if they used it for lauhala mats but it dominated the road to the house.

There were lauhala mats all over the place, four and five thick. There was a redwood water tank, and a Bull Durham bag hung on the kitchen water pipe as a filter [Richard Ha January 2, 2017 blog post].

Family members recalled that the kitchen was outside along the north side of Sonny’s house. There was a cast iron wood burning stove in the kitchen. The floor of the house was made of wooden boards over the bare earth ground. Sonny had a wooden bed on which he laid *lauhala* mats for the mattress. The bathroom was a separate structure north of the kitchen. Sonny had a water catchment and an electric generator for power.

Sonny kept pigs and cows and would net *nenue* and other fish to supplement the vegetables he grew on his property. Sonny would also go to town most Friday’s for anything else he needed. Sonny was a well known farmer and he made an annual income growing watermelons up until 2000. People would come from all over to buy his watermelons. Sonny had about twelve hills of watermelons with four plants growing in each hill (Richard Ha January 30, 2017 blog post). In addition, he grew tomatoes, corn, *ulu*, *kalo*, coconuts, and bananas.

Puanani, Uncle Sonny's primary caretaker when he was older, remembered that Sonny's maternal grandmother was buried at the family grave plot northeast of the house. She thought that one of the grandmother's sons who had died during the war might also be buried there. She didn't know the names of the other individuals buried there but was certain they were from the Kamoe and Kamahele family. She thought it was possible that some of the deceased family members' ashes might have been scattered off the coastline of the property.

Family members remembered most fondly fishing and swimming along the shoreline. They remembered that there was a shallow spring along the northwest edge of the property that Sonny dug out and made a shallow well. The well had a pump that Sonny installed. They also remembered that Uncle Sonny kept the west half of the property around the house and watermelon fields well maintained by cutting the grass often and weeding. None of the family members were aware of any cultural practices, other than fishing, that occurred on the property.

LUI FAMILY CONSULTATION

Consultation with the Lui family was conducted at the property on Wednesday October 30, 2019. Mr. Ramon Lui, his wife Agnes and daughter Nicole were present. The Lui family is descended from Kea who first owned L.G 1014. Nicole shared genealogy documents for the Kea family. L.G. 1014 was a 56.4 acre property purchased in 1852. The current project area is the southeast corner of the land grant.

Kea passed in July 1871 and the property was inherited by his wife, Kaohumalu and his five children, Jokepa, Kahokumaka, Kaluahine, Kekuewa, and Kaholowaa. Jokepa was appointed the estate administrator. The family later sold off the property in smaller portions. The Lui family believes that members of their family are present at the burial plot (Site 18987) on the property.

Nicole Lui, a traditional cultural practitioner and historian also knows that Maku'u Ahupua'a and its residents were known for the practices of the "dark arts." The Lui family members were not aware of any cultural practices conducted specifically on the current project area.

SUMMARY

The “level of effort undertaken” to identify potential effect by a project to cultural resources, places or beliefs (OEQC 1997) has not been officially defined and is left up to the investigator. A good faith effort can mean contacting agencies by letter, interviewing people who may be affected by the project or who know its history, research identifying sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential.

In the case of the present parcel, consultation was sought from Kamaile Puluole-Mitchell, Office of Hawaiian Affairs (OHA) East Hawai‘i Island Representative; Jordan Kea Calpito, SHPD Burial Sites Specialist; Sean Naleimaile, State Historic Preservation Division (SHPD) Hawai‘i Island Archaeologist; and Kalena Blakemore, Hawai‘i Island Burial Council (HIBC) Member (Table 5). Consultation was also conducted at the project area with members of the Kamahele and Lui families.

Public notices were published in the Office of Hawaiian Affairs Ka Wai Ola Newspaper, and were published in the Honolulu Star-Advertiser and the Hawai‘i Tribune Herald.

Historical and cultural source materials were extensively used and can be found listed in the References Cited portion of the report. Such scholars as I‘i, Kamakau, Chinen, Kame‘eleihiwa, Fornander, Kuykendall, Kelly, Handy and Handy, Puku‘i and Elbert, Thrum, and Cordy have contributed, and continue to contribute to our knowledge and understanding of Hawai‘i, past and present. The works of these and other authors were consulted and incorporated in the report where appropriate. Land use document research was supplied by the Waihona ‘Aina 2007 Data Base.

CIA INQUIRY RESPONSE

As suggested in the “Guidelines for Accessing Cultural Impacts” (OEQC 1997), CIAs incorporating personal interviews should include ethnographic and oral history interview procedures, circumstances attending the interviews, as well as the results of this consultation. It is also permissible to include organizations with individuals familiar with cultural practices and features associated with the project area.

As stated above, consultation was conducted with members of the Kamahele and Lui families. Public notices were printed in the Office of Hawaiian Affairs (OHA) Ka Wai Ola Newspaper. Public notices were also published in the Honolulu Star-Advertiser, and the Hawai‘i Tribune Herald. The public notices did not generate responses from the public. This fact is not surprising since it is unlikely as there no known inland locations in Hilo town where gathering or cultural practices occur.

An analysis of the potential effect of the proposed construction of residences on cultural resources, practices or beliefs, its potential to isolate cultural resources, practices or beliefs from their setting, and the potential of the project to introduce elements which may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). To our knowledge, the only cultural practice associated with the project area fishing. The property owner has stated that the Kamahele and Lui families are welcome on the property at any time, and he will not prevent access for fishing along the property shoreline. Based on historical research and responses from the above listed contacts, it is reasonable to conclude that, there will be no traditional cultural practices affected and there will be no direct adverse effect upon cultural practices or beliefs in the broader project area region.

CULTURAL ASSESSMENT

Based on the results of an Archaeological Assessment of the project area, the results of previous archaeological studies, as well as organizational response, individual cultural informant responses, and archival research, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by development activities on this parcel. The proposed project is not a location for past or ongoing cultural practices. The proposed undertaking will not produce adverse effects to any native Hawaiian cultural practices within the project area or in the broader region.

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APPENDIX A: PUBLIC NOTICES AND AFFIDAVITS

**CULTURAL IMPACT
ASSESSMENT NOTICE**

Information requested by Scientific Consultant Services, Inc. of past and ongoing cultural practices on 13.436 acres of land in coastal Maku'u Ahupua'a, Puna District, Island of Hawai'i, TMK: (3) 1-5-010:009. Please respond within 30 days to Glenn Escott at (808) 938-0968. ■

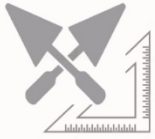
June 2019 Ka Wai Ola Public Notice.

Environmental Assessment

Garrett Single-Family Residence and Farm in the Conservation District at Maku‘u

APPENDIX 4 Coastal Erosion Study

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COASTAL EROSION AND SHORELINE HAZARDS STUDY FOR THE “KAMAHELE FARM” - GARRETT PROPERTY

Makuu Ahupua`a, Puna District, Island of Hawai`i
TMK: (3) 1-5-10:009

Prepared by:
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July 18, 2019

Executive Summary

A geological survey of the Kamahele Farms property was conducted in order to calculate a site-specific Average Annual Erosion Rate (AAER), identify any erosion prone areas, and evaluate the risk posed by other potential coastal hazards. This survey has been prepared in support of Conservation District Use Permit Application (CDUA) and Environmental Assessment (EA) being prepared for the owner, Bob Garrett, who intends to develop a single-family dwelling and barn and continue the farm uses on the property. The geological development of the littoral cone and seaward bench are explained. Historical photos of the coastline are evaluated for measureable change. We conclude with an overall AAER = 2.58 inches per year, emphasizing its variable nature over geological time and the influence of sea level rise on its intensity. This establishes a minimum setback line 55.05 ft. (40 ft. plus 70 times 2.58 inches) from the certified shoreline.

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The Hawaii Administrative Rules concerning Conservation Districts (Title 13, Subtitle 1, Chapter 5, adopted August 12, 2011) state that applicants for Single Family Residential construction in coastal Conservation Districts must consider rates of coastal erosion affecting their properties in order to determine minimum shoreline setbacks for permitting. DLNR established a requirement that the Average Annual Coastal Erosion Rate must be determined, based on formal “Coastal Erosion Studies” which are to be carried out following the guidelines in the Hawaii Coastal Hazard Mitigation Guidebook (Hwang 2005). This report satisfies these requirements.

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Changes in the coastline over time are the product of a complex and long-term interplay between powerful geological forces, particularly so in Hawai`i. The combined effects of volcanism, erosion, sedimentation, sea-level change, island subsidence, and even bio-genic production over millennia will influence the nature and durability of the coast as we now see it. These processes of both construction and destruction must be accounted for in any evaluation of coastal dynamics (Ramalho, et al., 2013). Volcanic action, mostly new lava flows, build out the island, and then coastlines retreat as mass wasting, marine and fluvial erosion reshape the landscape.

This is a very difficult process to quantify and summarize, especially on the younger of the Hawaiian Islands which, in their youth, may not yet have reached a long-term, stable equilibrium. Thorne Abbott (2013) reviews several problematic aspects in determining the AAER for planning purposes. These difficulties in measuring erosion rates on lengths of coastline on Maui, apply directly to the Big Island. The difficulties include issues with irregular shaped properties and erosion in multiple directions (which we are not concerned with, in this case) but also the problematic nature of erosion-resistant hard coasts as opposed to soft linear beaches, where shorelines can suddenly change because of the movement of sand (Abbott 2013:17).

Despite these drawbacks, an empirically based and quantitative estimate of the erosion rates is possible. This report also seeks to delineate any erosion-prone or otherwise hazardous areas along this small section of coastline as well. As used throughout this report, the “shoreline” denotes the highest wash of waves and is usually defined by the line of permanent vegetation, whereas, the “coastline” is a more general term used in this report for the most seaward edge of land at high tide.

Property Location and Physical Setting

The Kamahele Farm Property is a parcel of oceanfront land between the “Old Government Beach Road” and the sea. It is near the ancient village of Makuu in lower Puna District. The property is about halfway between the subdivision of Hawaiian Paradise Park and Mokuopihi Point (see Figure 2). A notable feature of the property is the high hill or “pu`u” that fills the greater part of the southeast portion. This feature (a “littoral cone”) can be seen on the USGS topographic map (Figure 2),



Figure 2 “Pahoa North” (USGS 1994), approx. property boundaries in red.

The property has approximately 915 ft. of ocean frontage (see Figure 3). The coastline is characteristic of the low-lying rocky geology of this part of Puna. There are no perched sand beaches above the high tide line. The water’s edge can be perilous especially during episodes of large surf. The pahoehoe lava extends out a large distance from the vegetation-defined shoreline (a minimum of 195 ft. and a maximum of 242 ft. as measured from aerial photographs), and ends abruptly in deep water. This bench lies less than 3 ft. above the waterline at high tide and contains numerous tide pools (visible in Figure 3). The southern third of the property’s coastline contrasts with the former. A boulder beach has formed on top of this bench at this end. In Figure 3, the bench can be seen extending out from the “boulder beach” to a similar width, though it is now partially submerged.



Figure 3 Google image (March 16, 2017) with approximate subject property boundaries in red.

Photo 1, below is an overview of the Kamahale shoreline taken from a sea cliff at the extreme southeast corner of the property. This cliff is formed by a more recent lava flow that just covered this portion of the property (see Geology, below). As such, it stands 12 ft. above the ocean surface (at high tide, see below Marine Conditions). Photo 1 also shows the boulder beach and its stable angle of repose of 35 degrees). In the distance, on the right of the photo the pahoe-hoe bench mentioned above is notable.

Another feature of note is the high hill behind the shore, also visible in Photo 1. It rises abruptly from about 80 ft. behind the shoreline (the vegetation line) to an elevation almost 40 ft. above sea level. The tall palm trees and lush vegetation attest to the relative stability of the strip behind the beach and create a “littoral terrace” between the shoreline and the pu`u. The cliff, boulder beach and coastal bench all provide ample buffer to the littoral terrace from all but the most extreme events. These are discussed in more detail below.



Photo 1 The Kamahele property coastline, view to northwest from southeast corner

Geological Background

The geological units that make up the Kamahele Farm property are illustrated below in Figure 4. Understanding the sequence of geological events on site provides a fundamental framework from which inferences concerning erosion rates are based.

The coastal shelf extending makai (ie. seaward) of the shoreline is the oldest exposed lava on the property, with an estimated age of between 750 and 1,500 years ago (Moore and Trusdell 1991 unit “p3”) derived from the summit area of Kilauea volcano. These lavas are not shown on the large scale geological map (Trusdell et al. 1994; Moore and Trusdell 1991, or on Figure 4). The lava flow “p3” is also exposed mauka (ie landward) of the Property as an isolated kipuka. Where this flow reached the sea violent steam explosions formed a littoral cone and widespread cinder deposits (Moore and Trusdell’s 1991 unit “p4d”) resulting from the interaction of molten lava with seawater (Figure 4). Then between 450 and 750 years ago another lava flow surrounded, but did not inundate, the pu`u (“p4o”). Most recently the entire area was again surrounded by a widespread `Aila`au lava flow with an estimated age of 200-350 years ago (Unit “p4”).

The Kamahele Farm consists largely of portions of “p4d”, which are littoral cone cinder deposits. It is one of few littoral cone formations on Kilauea’s coastline. Due to Kilauea’s frequent activity in historic times, these formations are well described geologically (Moore and Ault 1965). The process has also been described for the larger scale but similar littoral features of Mauna Loa volcano (Jurado-Chichay, Rowland and Walker 1996).



Figure 4 Portion of Geologic Map (Trusdell et al. 2006) with property boundary in red.

Marine Conditions and Wave Climate

The coast of this part of the Puna District faces the open ocean with no submerged barriers such as offshore reefs or sand bars. The submarine slope is approximately 1300 ft/mile for a distance of roughly 6 miles, descending into the deep water Puna Canyon. The extremely long fetch of waves crossing the Pacific creates a situation where big, long period swells rising to significant heights slam into the island's flank. Large waves reaching the coast are predominantly related to trade wind conditions, though the coastline is also exposed directly to the largest North Pacific swells (Figure 5).

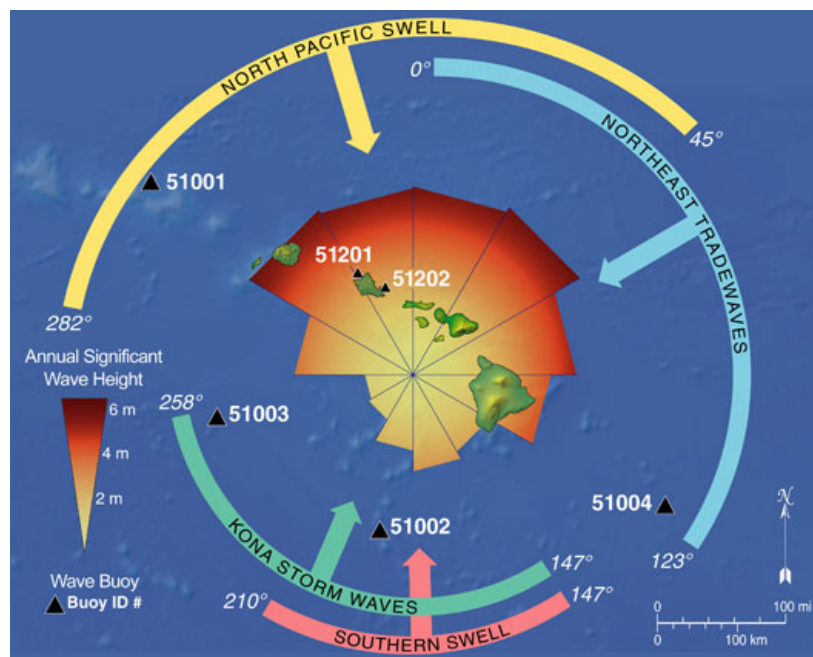


Figure 5 Frequency and magnitude of waves affecting Hawaii (www.soest.hawaii.edu).

The coastline at the Kamahele Farm property faces approximately 50 deg., slightly east of north-east. This is significant relative to typical incoming waves. Note on Figure 5 that the largest waves of all come from the north-north-east, north or north-north-west direction. These North Pacific swells can reach significant heights of 20+ ft. and are the major contributor to coastal erosion as well as storm damage. The Kamahele Farm property is oriented obliquely to this incoming wave energy.

It is beyond the scope of this study to quantify changes in storminess or significantly higher wave heights due to climate change. A precise forecast of these positively contributing variables is impossible. However, their potential effects on erosion are considered in our overall conclusions.

Rising sea surface temperatures in Hawaiian waters could, for example, influence hurricane storm tracks impacting the islands (Businger, 1998). The recurrence and intensity of wave energy focused on the coastline is obviously a critical factor in the discussion of erosion along any coast. Merrifield and Maltrud (2011) noted that trade winds have intensified across the

Pacific gradually since the early 1990s, e.g. This trend in sea level rise is more pronounced in western Pacific waters, relative to other regions in the World Ocean, with some rates of rise as much as three times the global average. The probability and extent of sea level rise at the Kamahele Farm property is discussed in a separate section. For tropical waters, the incidence of “one-in-ten year” extreme waves impacting shorelines may double or triple as a consequence of the wind intensification described above (Wang and others, 2014). Substantial wave height increases—by as much as 40%—have also been observed along some Pacific shores, though to what extent this relates to climate change or pulsating phenomena as the Pacific Decadal Oscillation is unclear (e.g.—Ruggiero and others, 2010). Hypothetically, the incidence of hurricanes in the eastern Pacific may actually *decrease* with warming climate, but the strongest storms will likely become even more intense (e.g.—Grinsted, 2012; Holland and Bruyère, 2013).

Tidal conditions for this part of the island are summarized in Figure 6. These are based upon data collected in nearby Hilo Bay, the closest continuously monitored tidal station to the property. The magnitudes of these relative elevations are an important reference for assessing the importance of any measured changes or, in particular their impacts outside the normal range.

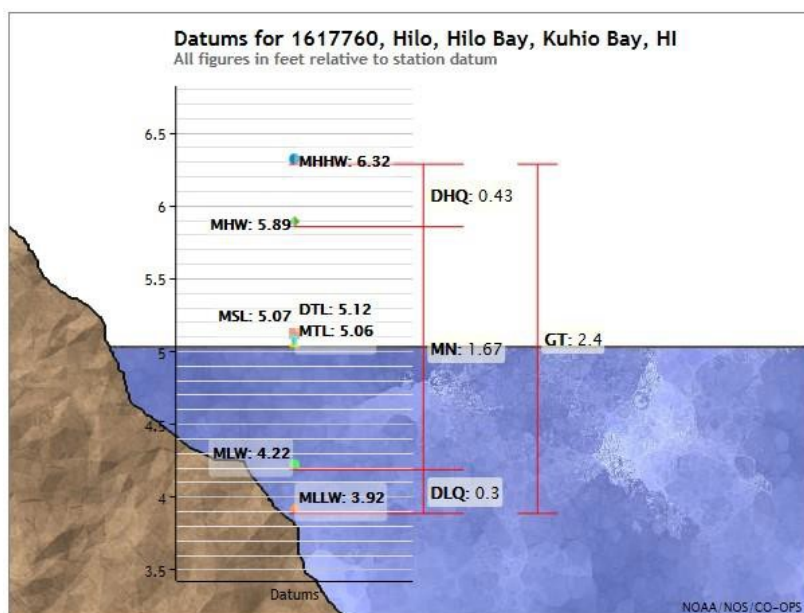


Figure 6 Tidal data for Hilo Bay (in ft.).

The mean range of tidal change (MN) is 1.67 ft. with a Great Diurnal Range (GT) of 2.4 ft. Tidal heights are given as positive and negative values relative to the Mean Lowest Low Water (3.92 ft.). Understanding the tidal variation throughout the year is important as any instantaneous “snapshot” of the coastline at a given tide can be misleading on the whole. The field inspection coincided with a 1.97 ft. high tide. Therefore, observations during that time represented a level near the Mean Highest High Water.

Field Inspection and Shoreline Findings

The shoreline is legally defined in Hawaii as “the upper reaches of the wash of the waves, other than storm and seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves, ...” (HAR §13-5-2).

Given the complexity of interacting volcanic and coastal formation processes, in order to assess the historical and prehistorical movement of the shoreline and identify areas prone to erosion, a simple sedimentary “facies” model was constructed. This is a recommended means of assessing complex geomorphic situations in Hawaii. For example, Felton (2002) uses this method to distinguish storm derived and tsunami emplaced debris, describe the potential mobility of any beach deposits and their nature, account for isostatic changes and quantify other depositional processes. At the Kamahele Farm Property efforts were made to evaluate the grain size and roundness/sphericity of eroded materials, evaluate the matrix and macro-mineralogical composition of lava flows present, and evaluate geomorphology and the associated sedimentary structures (boulder beach, shoreline berm, reworked storm deposits, etc.) within the project area.

Lithology and Structure

Lava flows making up the coastal shelf can often be distinguished by their mineralogy. The flows that make up the pahoehoe bench (“p3”) and those that compose the younger higher sea cliff (“p4o”) at the southeast were examined with low magnification hand-lens. The younger stacked layers of lava are typical fine, vesicular tholeiitic basalts, in this case almost devoid of olivine and containing abundant but very fine plagioclase crystals. Pipe vesicles, suggestive of interaction with seawater, were noted in several exposures.

The formations (represented by “p1d3”) are typical of hydrovolcanic eruptions described for Kilauea volcano’s littoral cones (Mattox and Mangan 1997). The nature of these deposits and those seaward, which are not illustrated on the geologic map are key to our interpretations.

It is axiomatic that littoral cones form on the coast. There is ample physical evidence at Kamahele to substantiate this. The following photos (2, 3 and 4) illustrate a spatter bomb, ash layering, and glassy fragments that are typical of hydrovolcanic interactions. Together this evidence suggests that this littoral cone formed at the ocean entry, although it is *further* from the ocean today than when it formed (see Evolution of Kamahele Coastline, below).



Photo 2 Spatter bomb embedded in Kamahele Ash



Photo 3 Indurated and weak layering



Photo 4 Fine glassy spatter fragments in Kamahele ash

The ash and cinder from the Kamahele littoral cone have been altered and redeposited. The discovery of ash deposits in the interstices and matrix of conglomerate *on top* of the coastal bench gave another clue to the evolutionary processes active on this coastline. Placing these events in time and space is critical to the model presented below and employed in estimating the overall erosion rate on site.



Photo 5 Redeposited Kamahele ash

There is abundant evidence that the lava flows along this shoreline were also emplaced very near or at the coast. This implies that little erosion of the original deposits has occurred. For example, Photos 6 and 7 show two different results when hot lava encounters seawater. The first are several pits in the pahoehoe that have been literally blasted out with the force of steam explosions. The second is a similar less intensive disruption of viscous flow by the introduction of water. The “frothy” pahoehoe pictured in Photo 7 is a result.



Photo 6 Steam explosion pit



Photo 7 Frothy pahoehoe



Photo 8 Ponded pahoehoe and fossil gas bubbles.

Photo 8 illustrates another example of the interaction of water and hot lava. These indications were ubiquitous on the coastal shelf. The image is of the top of thick, ponded pahoehoe layer at northwest margin of Property. “Fossil gas bubbles” are shown, suggesting this flow overlay seawater. The seawater rose to the surface of the flow as steam forming bubbles where it encountered an impermeable surface layer of quenched glassy basalt. This surface layer has since been eroded away, revealing the underlying bubble.



Photo 9 Columnar jointing on coastal shelf, view southeast

Photo 9 shows weakly developed columnar jointing of the bedrock (note the hexagonal pattern of fracture on the ground in the photo). These structures indicate the relatively great thickness of this lava flow, which is also revealed in some tide pools where vertical exposures of pahoehoe layers were greater than 3 ft. thick. This is abnormal for a lava flow unless it has been obstructed and begins to pond. In this case, the evidence suggests that these lavas formed by ponding near the coastal delta when emplaced.

The Evolution of the Kamahele Coastline

Based on the above examination of the structure and geometry of lava flows and distribution of other deposits across the site, the following model of the evolution of the Kamahele coastline was constructed. This model and the geologically evidenced events it chronicles provides us with the framework upon which a quantifiable estimate of overall erosion can be made.

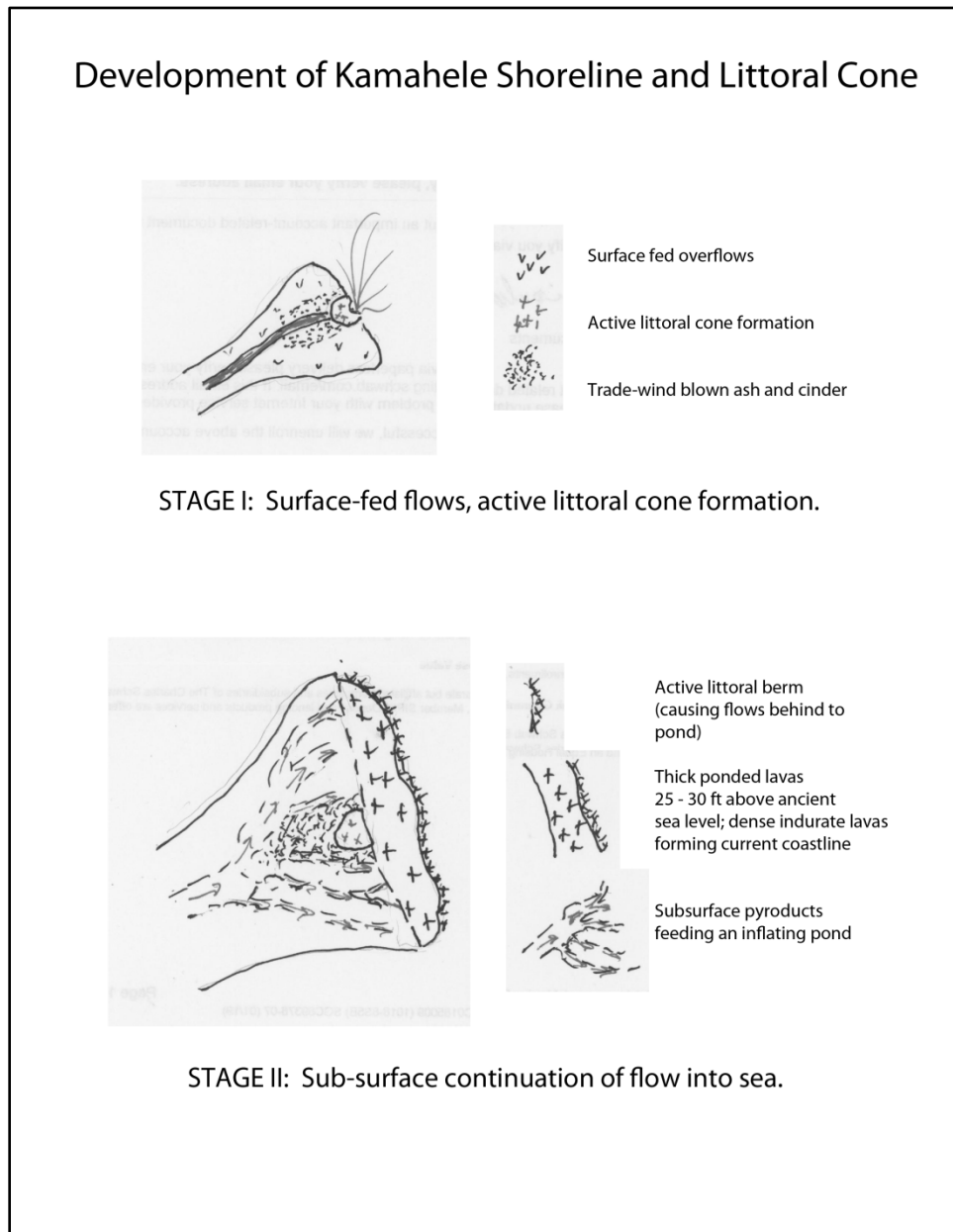


Figure 7 Illustration of the geological development of the Kamahele flow (“p3”).

Our reconstruction of geological events at the Kamahele coast is shown in Figure 7. In Stage I, the “p3’ flow is active, littoral cone formation begins where a concentrated flow enters the sea. After formation of the cone, less dramatic non-explosive Stage II subsurface emplacement of lava represents the continuing more mature eruption phase when subsurface pyroducts fed the flow and again built ponded coastal deltas, bound seaward by a coastal berm of explosive debris that has since been eroded away. At the time (more than 1,000 years before the present), sea levels were about 30 ft. lower. We suggest that this is when the current “coastline” developed, and the first shorelines formed and began to erode.

The profile of the current coastline is depicted in profile below (this hypothetical cross-section runs through the middle of the property). The cross-section is vertically exaggerated four-times to emphasize the vertical relationships between units. Our cross section shows the subsequent Aila’au flow (“p4o”) on the left, overlying the Kamahele littoral deposits. It is only at the extreme southeast of the property that these flows reached the ocean.

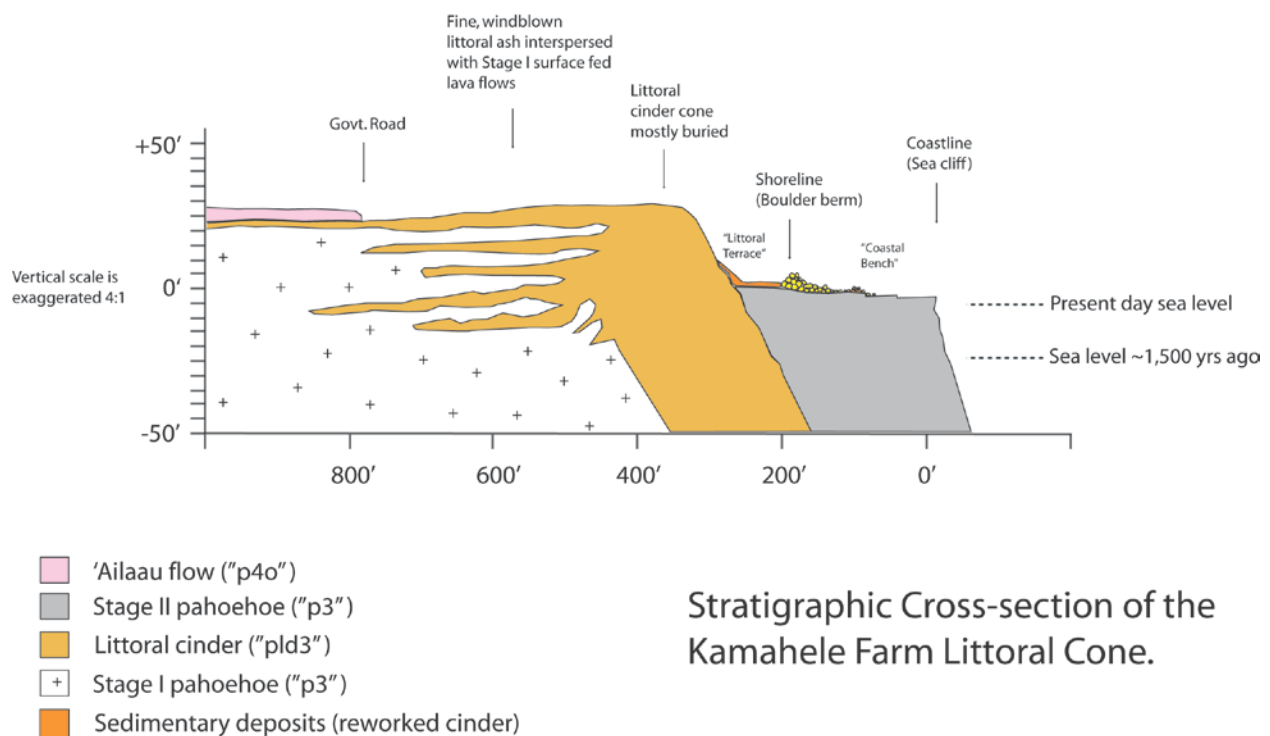


Figure 8 Schematic cross-section of Kamahele stratigraphy

Erosion Processes

Coastlines can be classified, generally, into “soft” and “hard,” depending upon whether they consist of sands and related fine, easily transportable sediments or of solid less easily weathered substrate. Almost all shoreline change studies focus on soft coasts, including quite recently within the Hawaiian Islands (e.g.—Anderson *et al.*, 2015), and available data are otherwise scarce. The coastline at the property is of the ‘hard’ variety.

Several key processes are at work contributing to erosion of this and all typical hard coasts. Wave energy impacting the bluff loosens masses of rock by compressing air within fractures, while the drag of moving water abrasively grinds smaller fragments at the shore. Wind and gravity can loosen free pieces of breccia as well. Storm seas timed with extreme tides can be especially erosive. There is no way to definitely quantify the relative contributions of these processes, though it is reasonable to say that the energy released by wave action is probably the main cause of shoreline retreat at this locality.

Different portions of the shoreline are more or less prone to erosion as a result of the volcanic forces that shaped them in combination with the marine conditions. In this case, the unique combination of physical forces and variety of substrate create five types of natural erosional formations. These include the remnant coastline, the current shoreline, a boulder beach and back-beach berm, and a littoral bench. These features are illustrated on Figure 9 and are described below.

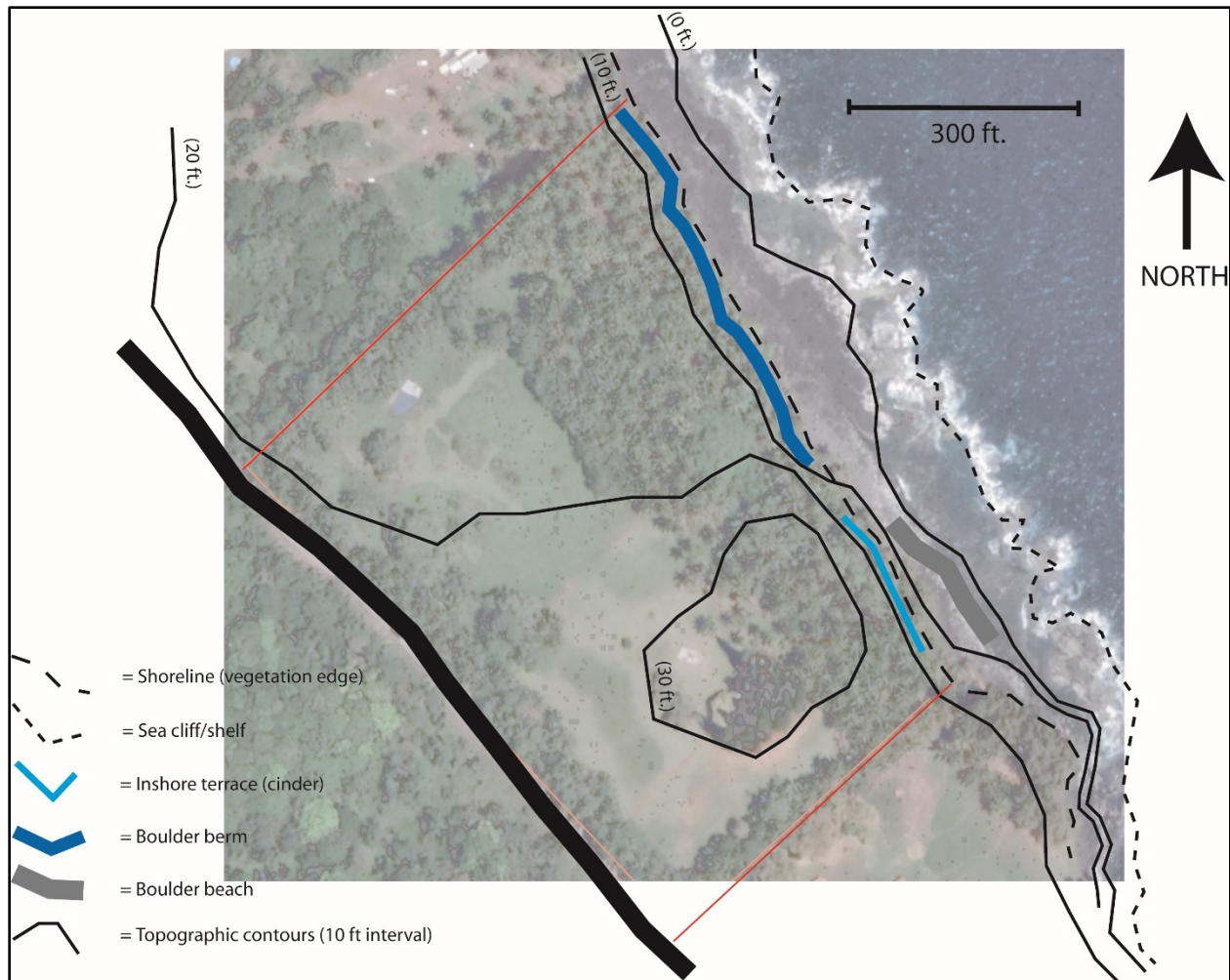


Figure 9 Summary site illustration.

The sea cliff at the southeast, formed by multiple pahoehoe overflows during one of the youngest ‘Aila’au eruptions, is subject to mechanical to erosion, although none occurs during normal sea conditions. During times of major storms, the impact of waves can cause mechanical erosion, although even this is usually negligible. Cracks near the edge of the sea cliff in several places (Figure 10) indicate where the cliff edge is unstable, and susceptible to failure when impacted by powerful storm waves, which inject water between flow layers, causing hydraulic fracturing. The boulders fronting this cliff largely consist of sub-angular blocks derived from cliff erosion.

These cliffs are the remains of the most recent lava flow (“p4o”) to have impacted the property and are they are limited to a small corner of the property.



Photo 10 Sea Cliffs at southeast property corner, view south

The boulder beach occupying the southern third of the property's ocean frontage (Figure 11) is about 300 ft. long. Closer inspection revealed large, well rounded boulders atop scoured pahoehe bedrock. The boulders are very well sorted and it seems these boulders absorb a great deal of energy from pounding waves. However, their organization and regular slope (angle of repose) indicate some equilibrium has been achieved. Examination of a 63 year old aerial photo bears this conclusion out (see below).



Photo 11 Boulder Beach, view west-northwest

Behind the boulder beach and extending the length of the property is a significant berm of boulders and cobbles. The berm is 500 ft., or more, long extending beyond the northern property boundary. It is less conspicuous behind the boulder beach, but remnants are indicated (see below). The berm is between 15 – 20 ft. wide and at least 6 ft. high. Its origin relates to periodic storm waves that wash materials up the beach and stack them further inland, much like a levee forms alongside a periodically overbanking river. The berm's linearity and regularity suggest that along with the boulder beach it also has formed over a significant amount of time and is not eroding. It is largely covered with vegetation, and presumably marks the "shoreline".



Photo 12 Boulder Berm, view southwest



Photo 13 Back beach storm boulders, view southwest

Behind this berm is an area of scattered boulders. These rocks are similarly well rounded and indicative of being worn by the water. Unlike the organized linear pile of stones making up the back-beach berm, these boulders are haphazardly strewn up to 60 ft. inland. This is particularly true at the northwest corner of the property. These rocks were most likely tossed beyond the berm into this low-lying area during extreme storm events.



Photo 14 Littoral bench, view west-northwest

One would expect to find similar storm tossed boulders behind the beach at the south end. However, the littoral bench – a strip of level land between the shoreline and the pu`u has been heavily modified by human habitation for an unknown period of time. This is another indication that the landform is relatively stable. Recall that in our facies model, presented in the prior section on Shoreline Findings, this bench represents continued eruption of Kilauea after the formation of the littoral cone. Extreme storm events may wash laterally over this area when large waves overtop the boulder beach. Boulders, tossed by extreme storms behind the berm to the north, are abundant. This has not happened recently as is clear from the mature vegetation and developed soil.

Quantification of Erosion Rate

Historical Aerial Photos

Aerial imagery was examined for evidence of major changes in shoreline profile during historic times. The oldest image found included one captured by the Navy in 1954 (#1756 23/35, on 12 November) of the Makuu coastline. A 1965 photo (6270 EKL12cc-31 on 6 February) taken 53 years earlier in a USDA series was also examined and both were compared to a 2017 Google Earth image.

Careful inspection of these aerial photographs and measurements of shoreline positions relative to internal fixed distances (between roads, e.g.) did not indicate any erosion of the coastline had occurred. The scale of the photos and the precision of even digital measurements allowed only very general conclusions. When enlarged to a scale appropriate for our analysis each pixel on the 1965 photo was in excess of 10 ft. The larger scale 1954 image was even more “grainy” with pixels equivalent to 20 ft. or more. Both images were acquired at 600 dpi.

Shading and resolution differences can easily obscure important smaller-scale details such as the shifting of a boulder here or modest collapse of a ledge there. Imagery registered over this period of 63 years show no evident changes; no quantifiable change in coastline morphology or location could be determined. In fact, an argument for stasis can be made based on the general shape and configuration of the coast and shore. The same boulder beach is distinguishable, as is the wide coastal shelf (see Figure 10).

Unknown differences in tidal level and surf conditions at the times individual photography was obtained also contribute to the lack of precision. The average diurnal range of tides is 1.67 ft.; on a beach with a slope of 30% (1:3) this translates to approximately 5 ft. of horizontal change, adding another confounding variable to our photogrammetric methods. It is thus doubtful that horizontal changes of less than 10 ft. can be documented with this method over this period of time. Changes of a greater magnitude should be obvious, however, and none were noted.

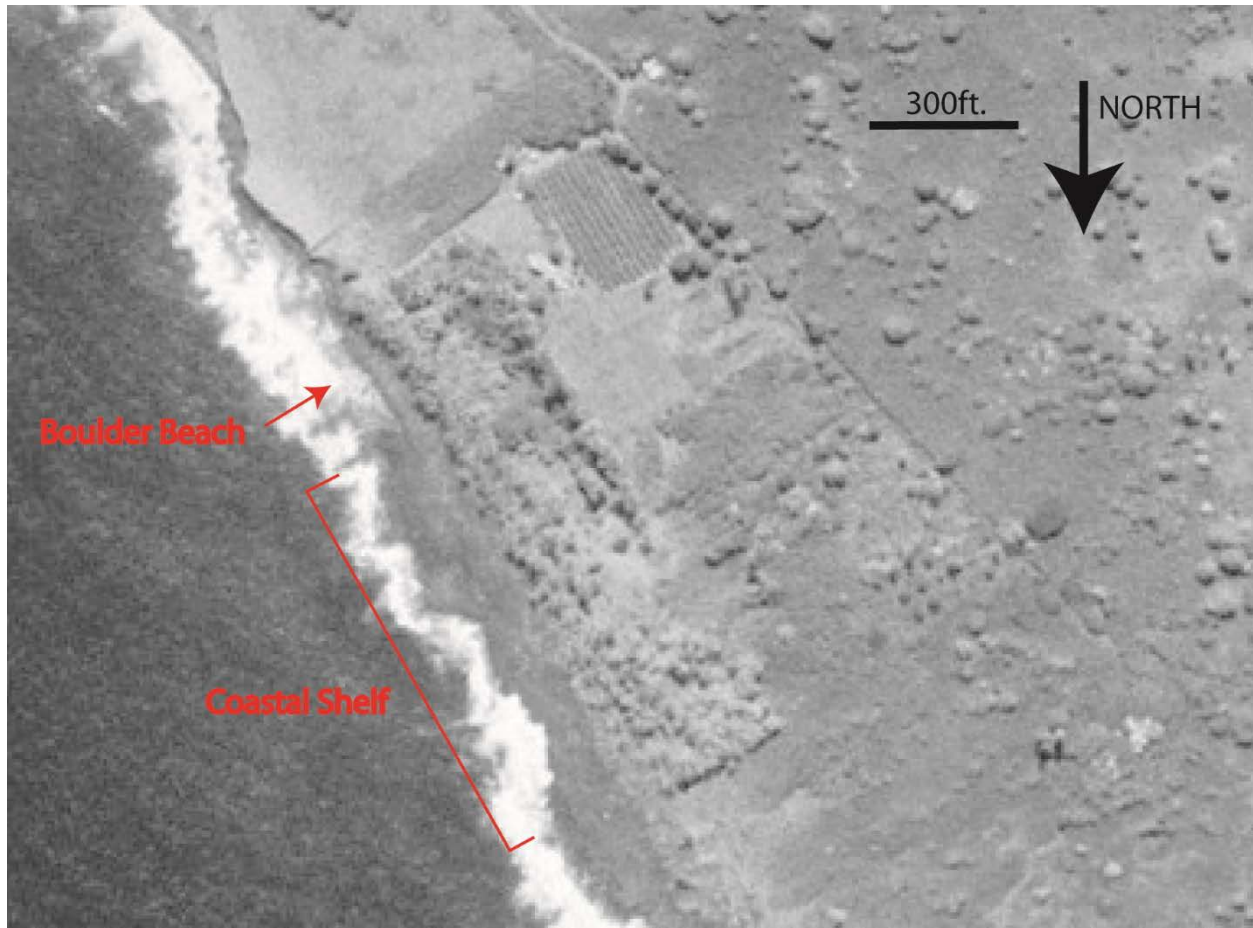


Figure 10 1954 aerial photo with approximate subject property boundaries in red.

Thus, based on the available aerial photo data and its limits, a minimum and a maximum range of possible difference can be established. The minimum, with no noted distinctions would be 0 in/yr. The maximum, however, is defined by what the coarse imagery might be “hiding”. A value equal to the possible error (given their scale and resolution, 20 ft. in the case of the 1954 photo, or 10ft. for the 1965 photo) divided by the period of analysis. Therefore a rate of between 0 – 2.2 inches per year is justified based on the 1965 photo. While the 1954 photo provides us the greatest longitudinal age range, normally lending more confidence, its larger scale leaves us with a greater *potential* maximum rate of 3.8 inches per year.

Geo-historic inference

Given the ambiguity of the photogrammetric approach, an additional method was employed. Using the framework and assumptions of the geological data presented above, an independent evidence-based inference can be made. In order to do so, our assumptions regarding the formation of the littoral bench must be accepted and its date accepted as between 750 – 1,500

years ago. If so, the current width between what was the leading edge of lava flow “p3” and the current shoreline represents the sum total of erosion since the formation of the current coast.

This width was measured digitally from current (Google) aerial photos at ten locations along the property’s ocean frontage, approximately every 100 ft. A minimum width of 195 ft. was obtained and a maximum of 242 ft. The average width of the coastal shelf was 215 ft., with a standard deviation of 16 ft.

This geo-historical method results in an AAER of a minimum of 1.68 inches/year (for a 1,500 yr interval); maximum = 3.48 inches per year (if “p3” is in fact closer to 750 years old). The mid-point of this estimate yields a rate of 2.58 inches per year.

Table 1, below, summarizes the above results.

Source	Minimum (inches/year)	Maximum (inches/year)
1954 aerial photo	0	3.8
1965 aerial photo	0	2.2
“p3” geology	1.68	3.48

Table 1 Summary of Average Erosion Hazard Rates for the Kamahele Farms property.

This method of erosion rate calculation is problematic because the actual rate is constantly changing with conditions. The migration of the “shoreline” (berm) only began when the original sea cliff could be overtopped by waves, refer to Figure 8. 1,750 years ago sea level was 25-30 ft. lower than today, the coastal cliff would not have been overtopped and very little erosion would have occurred. Late Holocene sea level rise accelerated erosion by allowing ever more frequent overtopping of storm waves. The berm at the shoreline is a result of this cumulative process. If sea levels were to rise above the low coastal bench (another 3 ft., perhaps) it would have dramatic consequences for future erosion rates. We turn to a discussion of the importance of seal level changes below.

Effects of Subsidence and Sea Level Rise (SLR) on Shoreline

Predicting Sea Level Rise (SLR) is a notoriously difficult task. Hwang *et al.* (2007) use a figure of 0.16 inches per year in their assessments of present-day SLR for Oahu, but an overall global rise in sea level of 40 inches by the end of the 21st century has been proposed by Fletcher (2010) and others. Over a period of 81 years this translates to a rate of .49 in/yr. SLR for any particular area depends heavily on local factors (water temperatures, ocean currents, salinity, etc.) and Anderson and others (2015) predict a doubling of SLR rates for Hawaii within 30 years.

Sea level rises' effect on the erosion of sandy beaches has been predicted to be two orders of magnitude greater than the amount of rise. This general prediction is borne out by mathematical models of the interaction between sea level and sedimentary equilibria (Bruun 1962). In a confirmation of these theoretical effects based on the evaluation of continental scale historical data sets and the operationalization of the model, Zhang et al. (2004) conclude that there is a "multiplicative association" between climate change, resultant sea level rises, and coastal erosion. Their modeling leads them to conclude that the effect of coastal erosion, already severe in the 20th C., will be much worse in the 21st. While their discussion focuses on sandy beaches, the theory holds for hard coasts as well – though the response times would differ.

A "worst-case" eustatic sea-level rise estimate of 78 inches by the end of this century (.96 in/yr) is given by Pfeffer (2008). Another estimate puts the rise at 40 inches, a more conservative estimate (Solomon, 2007) and in-line with Fletcher's (2010) estimate above. The greatest rate of SLR will take place during the second half of this century according to recent modelling (e.g.--Cazenave and Le Cozannet, 2014).

Total sea level, of course, is a result of the combined changes in elevation of both water and land. Therefore, we must distinguish between eustatic and isostatic change. Eustatic changes are due to a greater or lesser volume of water in the oceans globally which is affected by global warming. Isostatic changes are locally affected by crustal movements and land subsidence or accretion.

The Big Island of Hawaii is sinking into the Earth's mantle because of the gravitational isostatic load of its growing volcanoes. A subsidence rate of (0.08 - 0.12 inches per year) related to isostatic sinking has been determined by submersible studies of drowned reefs off west Hawaii (Moore and Fornari 1984), but that rate must be higher for the Puna coastline, where volcanic loading activity is greater (Moore 1970).

Coastline subsidence can be accelerated by sudden events such as the 1975 Kalapana earthquake that caused land in Kapoho to suddenly drop 0.8 ft. (based on Hawaii Volcano Observatory (USGS) data in Hwang and Brooks (2007). Such *episodic* seismic induced subsistence is impossible to anticipate or measure. On the basis of InSAR (Synthetic Aperture Radar Interferometry) remote sensing data, Hwang and Brooks (*ibid.*) state that the coastline at Kapoho may be subsiding at a *continuous* rate of between .31 – .67 in/yr. Rates of subsidence at the Property, 7 - 8 miles to the northwest of the East Rift Zone, are necessarily much lower as a result of their distance from Kilauea's tectonically active rift zone.

The potential changes in eustatic SLR must be added to predicted isostatic changes in crustal subsidence rates for easternmost Puna. These changes are summarized in Table 2, below.

	MINIMUM (inches per year)	MAXIMUM (inches per year)
Land subsidence (positive isostatic change) Hwang et al 2007.	0.31	0.67
Global Sea-level rise (positive eustatic change) Fletcher 2010, Solomon 2007 and Pfeffer 2008.	0.49	0.96
Sea-level rise (sum)	0.80	1.63

Table 2 Summary of potential sea level rise.

The durability and height of the coastal sea cliff on the southeast corner of the property (greater than 12 ft. at high tide) ensures that combined sea level change and land subsidence will not cause significant shoreline transgression in this area, although it will slowly increase the erosive action of storm waves over the next several decades and centuries. However, at the northwest corner low lying land behind the low coastal bench and protected only by the boulder berm will be subject to increasing inundation events.

Anderson and others (2015) studied this phenomenon in the context of low-lying “soft” coasts (beaches) throughout the Hawaiian Islands and concluded that average rates of shoreline recession would double by the year 2050, and increase to 2.5 times present and historically measured values by 2100, with shoreline retreats of as great as 190 ft. possible in some places. The relevancy of this study to “hard” substrates such as those at this location is minimal. However, if and when sea levels do rise above the current “hard” bench (a rise of even a foot or two might suffice) effects behind those barriers could be swift and dramatic. This is something to consider in planning for the low-lying inland areas of the northern portions of the property.

General Coastal Zone Hazards

Hwang (2005) recommends that all hazards facing coastal areas should be considered when planning for land-use zoning in Hawaii, and not just erosion. Fletcher *et al.* (2002:150) portray highly generalized hazards assessments for significant stretches of Hawaii's coastlines; they rate the specific hazards for the area of Puna fronting the Property. These hazards are rated on an ascending scale from 1 (low) to 4 (high) as shown in the following Table:

Hazard Type	Relative Threat
Tsunami (1-4)	4
Stream Flooding (1-4)	4
High Waves (1-4)	4
Storms (1-4)	3-4
Erosion (1-4)	3
Sea Level Change (1-4)	3-4
Volcanic/Seismic (1-4)	4
Overall Hazard Assessment (1-7)	6-7

Table 3 Summary of coastal hazards present at the Kamahale Farm property.

Elevated threats of the “Volcanic/Seismic” type are due to the Makuu coast's susceptibility to lava flows and the periodic morphological changes caused by Kilauea's active East Rift Zone (ERZ). Kilauea's south flank has generated many historic earthquakes and despite a current pause in eruptive activity, it will feel them in the future as well. For example, three more recent earthquakes in 1954, 1975 and 1989 registered 6.5, 7.2 and 6.1 on the Richter scale of magnitude (not to mention the most recent M=5.4 and 6.9 pair of tremblors that hit May 4, 2018 - which was felt strongly in this area). A hazard intensity rank of 4 indicates “frequent” seismic activity and recommends for a UBC seismic zone factor of ≥ 2 (Fletcher et al. 2002:3).

Other volcanic hazards include the threat of inundation by lava flows. The Kamahale Farm property lies in a USGS defined hazard zone 3 (Wright *et al.* 1992). It is a fair distance from the active East Rift Zone or summit of Kilauea (Zone 1). In addition, the elevated topography affords some protection from future flows. As occurred in the past, lava flows may surround, but perhaps not inundate, the high lying areas of the property.

There is a possibility of tsunamis threatening this coastline, and the hazard rank of 4 reflects this

fact. The high rating is a result of the historical occurrence of tsunami as well as the low slope of the coastline. Exceedingly large “tidal waves” generated by local or wide ranging Pacific-Rim volcanic movements can severely impact this region. Data are available for historic tsunami heights from Hilo as well as from Cape Kumukahi (the property lies approximately half-way between the two). In 1946 a tsunami reached 26 ft above normal sea level in Hilo and 19 ft. Cape Kumukahi. Similarly, in 1957 waves of 13 and 12 ft. (respectively) were recorded. One of the largest tsunami of modern time to hit the island came in 1960 when a 35 ft. high wall of water, focused by Hilo Bay, completely decimated the low-lying coastal areas of Hilo. The effects of a tsunami are highly variable, dependent on both local and extra-regional factors. For example, on the southeast shore this wave amounted to only 13 ft in height (Fletcher et al. 2002:7).

The coastal plain has a slope of only 2% (a gradient of 1:50). Therefore, for every one foot of vertical wave height above the elevated cliff, wave run-up could be as much as 50 ft. horizontally – this would hold especially true for the northwestern portion of the property which is largely low-lying. This does not account for additional surge and momentum. There is, however, no indication or historic recording of the 1960 tsunami or any previous one overrunning the property area. The higher ground of the littoral cone would mitigate some of these effects locally if such a tsunami were to occur. It is, however, for this reason that Fletcher’s sea-level change risk rating is 3-4 for the reference area of Makuu.

Erosion is seen as a moderate concern in the project area, generally, with a rank of 3. Fletcher explains that erosion in the area is “chronic”. While this generalization is based on broad agreement that beaches and seawalls have suffered historical losses, those losses are site specific.

Fletcher et al. (*ibid.*) also rank the property relatively high in risk for high wave damage and storm impacts. As discussed above, this portion of the Hawaiian island is subject to rapidly building swells of greater than 12 ft. in height that occur with seasonal frequency. The storm risk ranking of 3 – 4 indicates that over-wash of the shoreline is frequent. Flood impacts from large storm events or tsunami are likely to impact the northwest half of the property disproportionately, as the elevated littoral hill (cone) provides a physical barrier to inland encroachment. This threat is not to be taken lightly. The 4 rating corresponds to the properties location in a watershed which can receive greater than 7.9 inches of rain per month and has few mitigation measure in place in the event of a flood (Fletcher et al. 2002:3). No evidence of past flooding was observed, although water can be expected to pond for short periods in low-lying areas.

Overall, the Kamahale property is in a relatively risky zone, with a myriad of hazards to contend with. Fletcher et al. rank this area with an overall hazard assessment (OHA) of “high”, between 6 -7 on a scale of 7. This would seem alarming. However, in a national assessment of coastal vulnerability conducted by Woods Hole for the United States Geological Survey six variables were examined in the construction of an alternate, “Coastal Physical Vulnerability Index” or, CVI (Thieler Hammer-Klose 2000). These include mean tidal range, coastal slope, rate of relative sea-level rise, shoreline accretion and erosion rates, mean wave height and geomorphology. The geomorphology, calculated erosion rate, mean tidal range and coastal slope variables can be considered in this case as moderate, while two of the factors listed might cause some concern, sea-level rise and significant wave events.

Summary

The Kamahele Farm property, like all land on Kilauea volcano is unique in character due to the specific physical setting and historical impact of volcanic activity molded over the eons by the action of the ocean.

As a hard rock coast, it is difficult to assess in the same terms used for the many beaches and soft sand shorelines of the older islands of Hawaii. Hard coastlines are at one extreme of a “sensitivity scale” in this regard - they are slow responding systems (Hansom 2001). Coastlines such as those at the Kamahele Farm are susceptible to particular types of High Magnitude – Low Frequency (HMLF) events. For coasts on this end of the sensitivity scale “low frequency” needs to be better defined. This can only be done with longer term studies of a scope that extends beyond a single parcel. Ideally, monitoring studies would include highly accurate means of terrain mapping such as is available today with LiDAR technology (Rosser 2005).

Several independently derived erosion rate estimates were calculated based on historical and geological data. These were derived empirically and treated in as quantitative a manner as the data permitted. We arrive at a final AAER for the Kamahele Property of **2.58 inches/year**. While the erosion rate here represents an average annual rate based on estimated changes measured over large spans of time, the actual erosion rate for any given year may vary greatly based on extreme weather or geologic events that could impact the property coastline at any given time. We conclude that the present shoreline is currently stable. However, the annual erosion rate could change dramatically, especially in face of the changing climate conditions. These changing climate conditions are certain to exacerbate storm-wave and potential flooding in the northeast portion of the property.

The proposed house site is located on the backside of the littoral cone, 30 feet or more above sea level. No structures of any type are planned for the shoreline area. From the author’s perspective and given the results of this study, this is the safest area for construction.

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