

Harry Kim  
Mayor

Wil Okabe  
Managing 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**

**FILE COPY**  
MAY - 8 2019  
Michael Yee  
Director  
Duane Kanuha  
Deputy Director

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

April 24, 2019

Scott Glenn, Director  
Office of Environmental Quality Control  
235 S. Beretania Street, Suite 702  
Honolulu, HI 96813

Dear Mr. Glenn,

**Subject: Draft Environmental Assessment (DEA)**  
**Applicant: Kohala Shoreline, LLC**  
**Project: Kohala Shoreline Six-Lot Subdivision**  
**TMK: (3) 5-9-001:008, North Kohala District, Island of Hawaii**

**RECEIVED**  
**19 APR 25 4:34**  
**OFFICE OF ENVIRONMENTAL QUALITY CONTROL**

With this letter, the Hawai'i County Planning Department hereby transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the proposed Kohala Shoreline Six-Lot Subdivision project located on the subject parcel (TMK) in Kohala on the Island of Hawai'i for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, <sup>one</sup> ~~two~~ (2) copies of the DEA-AFONSI, and Adobe Acrobat PDF file of the same, and an electronic copy of the publication in MS Word. Simultaneously with this letter, we have submitted the summary of the action in a text filed by electronic mail to your office.

If you have any question regarding this letter, please contact Alex J. Roy, M.Sc. of our Planning Department staff at (808) 961-8140

Sincerely,

*BY* MICHAEL YEE  
Planning Director

AIR:

**19-338**

## APPLICANT PUBLICATION FORM

Project Name:	Kohala Shoreline Six-Lot Subdivision
Project Short Name:	Kohala Shoreline Six-Lot Subdivision
HRS §343-5 Trigger(s):	Use of State Land
Island(s):	Hawai'i
Judicial District(s):	North Kohala
TMK(s):	(3rd) 5-9-001:008
Permit(s)/Approval(s):	County of Hawai'i, Department of Public Works, Engineering Division: Grading Permit. County of Hawai'i, Planning Department, Variance and/or Planned Unit Development Permit and Subdivision Approval. County of Hawai'i, Leeward Planning Commission: Special Management Area Use Permit and Change of Zone Recommendation. County of Hawai'i, County Council: Change of Zone Approval. State Department of Transportation: Approval for Work within State Roadway Right-of- Way. State of Hawai'i, Department of Health: Underground Injection Control (UIC) permit. National Pollutant Discharge Elimination System (NPDES) permit.
Approving Agency:	Hawai'i County Planning Department
Contact Name, Email, Telephone, Address	Michael Yee, Director <a href="mailto:Michael.Yee@HawaiiCounty.gov">Michael.Yee@HawaiiCounty.gov</a> 808-961-8288 Hawai'i County Planning Dept. 101 Pauahi Street, Suite 3 Hilo HI 96720
Applicant:	Kohala Shoreline, LLC
Contact Name, Email, Telephone, Address	Steven Lim, <a href="mailto:slim@carlsmith.com">slim@carlsmith.com</a> 808-523-2583 121 Waianuenue Avenue Hilo, HI 96720
Consultant:	Geometrician Associates LLC
Contact Name, Email, Telephone, Address	Ron Terry, <a href="mailto:rterry@hawaii.rr.com">rterry@hawaii.rr.com</a> 808-969-7090 P.O. Box 396 Hilo, Hawai'i 96721

**Status (select one)**

X DEA-AFNSI

**Submittal Requirements**

Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.

FEA-FONSI

Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.

FEA-EISPN

Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.

Act 172-12 EISPN  
("Direct to EIS")

Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.

DEIS

Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.

FEIS

Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.

- FEIS Acceptance Determination      The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
- FEIS Statutory Acceptance      The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
- Supplemental EIS Determination      The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
- Withdrawal      Identify the specific document(s) to withdraw and explain in the project summary section.
- Other      Contact the OEQC if your action is not one of the above items.

**Project Summary**

Provide a description of the proposed action and purpose and need in 200 words or less.

Kohala Shoreline, LLC proposes to develop a 6-lot subdivision makai of Akoni Pule Highway on a 37.88-acre parcel 3 miles north of Kawaihae. The owner proposes to downzone from Single-Family Residential (RS-15) to Residential and Agricultural (RA-5a) to permit less dense development. The project includes an existing lateral shoreline access, planned public parking and a mauka-makai shoreline access, and planned accommodation of the Ala Kahakai National Historic Trail on the existing Ala Loa/jeep trail. In contrast to previous proposals on this property, all building sites would be located mauka of the Ala Loa, with the 50 to 250-foot wide shoreline area below dedicated as an easement for public use. No threatened or endangered plant species are present, and wide-ranging endangered vertebrates would be protected by construction timing and project design. Implementation of archaeological preservation, data recovery plans and burial treatment plans will mitigate impacts to historic sites. Cultural impacts on traditional gathering along the shoreline will be avoided by the large shoreline buffer and public access provisions. Due to 25-foot height restrictions, low density and setbacks from both the highway and shoreline, visual effects will be minor. Water quality effects were calculated considering water extraction, wastewater infiltration and irrigation return, and they will be negligible.

# **DRAFT ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

**TMK: (3rd) 5-9-001:008**

**Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i**

**Kohala Shoreline, LLC**

**May 2019**

**Prepared for:  
County of Hawai‘i  
Planning Department  
Aupuni Center, Suite 3  
101 Pauahi Street  
Hilo, HI 96720**



# **DRAFT ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

**TMK: (3rd) 5-9-001:008**

**Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i**

### **APPLICANT:**

Kohala Shoreline, LLC  
c/o Carlsmith Ball  
121 Waianuenu Avenue  
Hilo HI 96720

### **APPROVING AGENCY:**

County of Hawai‘i  
Planning Department  
101 Pauahi Street, Suite 3  
Hilo HI 96720

### **CONSULTANT:**

Geometrician Associates LLC  
PO Box 396  
Hilo HI 96721

### **CLASS OF ACTION:**

Use of State Land

This document is prepared pursuant to:

The Hawai‘i Environmental Policy Act,  
Chapter 343, Hawai‘i Revised Statutes (HRS), and  
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules (HAR).

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APPENDIX 6	Marine Research Consultants Baseline Data, November 2015
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## SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Kohala Shoreline, LLC proposes to develop a 6-lot subdivision *makai* of the Akoni Pule Highway (State Route 270) on a 37.88-acre parcel located approximately three miles north of Kawaihae Harbor. The lots would vary in size from about 5 to 8 acres, with all building sites located *mauka* of the *ala loa* (old coastal trail)/jeep road. The current proposal replaces one from 2015 that had 50 percent more density and included several building sites below the *ala loa*. A Special Management Area Use Permit and a change of zone will be required. The property site is currently zoned Single-Family Residential (RS-15), which would be modified to Residential and Agricultural (RA-5a) to permit larger lots and less dense development when residences are built. Similar developments are located nearby at Kohala Ranch, Kohala Kai Subdivision and at Kohala by the Sea Subdivision. Road access would be from two permitted access locations along the highway, although one of these locations is proposed to be moved to avoid a gulch crossing. The lots would be provided with internal access and underground electricity, telephone and water service from existing lines along the highway. The future homes would utilize individual wastewater systems designed pursuant to State Health Department requirements and would exceed those requirements by installing aerobic treatment systems, which produce a higher quality effluent that can be utilized for irrigation. The project includes public parking and a *mauka-makai* shoreline access, as well as a continuous lateral shoreline access in the form of an existing easement near the shoreline. It is also expected that the Ala Kahakai National Historic Trail will utilize the *ala loa*, which meanders through the *makai* third of the property. To translate the owner's mission statement of sustainable development to practical measures, the project has adopted a number of design and mitigation measures that far exceed requirements related to environmental permits. Covenants, Conditions and Restrictions will require adherence to a set of measures based on Low Impact Design (LID) Guidelines.

A botanical survey conducted on the property found no threatened or endangered plant species. Vegetation consists of introduced species, except for several common plants indigenous to Hawai'i. Implementation of archaeological preservation, data recovery plans and burial treatment plans, in consultation with the State Historic Preservation Division and the Office of Hawaiian Affairs, will mitigate impacts to historic sites. Cultural impacts on traditional and customary gathering rights along the shoreline will be avoided by the large shoreline buffer area below the *ala loa* and public access provisions that will preserve the landscape and cultural uses of the shoreline area. In the unlikely event that additional archaeological resources or human remains are encountered during future development activities, work in the immediate area of the discovery will be halted.

The home sites would be located on land with a moderate slope and scattered *kiawe* trees, a minimum of 150 feet *makai* of the highway, a minimum of 40 feet in elevation, and a minimum of 100 feet from the shoreline, *mauka* of the *ala loa*/jeep road. Covenants will restrict homes to a height of 25 feet as measured according to Chapter 25 of the Hawai'i County Code and will require a color scheme featuring earth-tones to minimize visual impacts. Due to these design features, low density/large lots and the sloping nature of the site, the project would have only minor visual impacts for drivers on Akoni Pule Highway looking toward the sea. The project is not expected to have a negative impact on coastal water resources, as it would be low-density, with homes utilizing

advanced wastewater systems and separated from the ocean by the wide shoreline setback, with substantial measures to control sedimentation to be low current levels.

Kohala Shoreline, LLC, expects that the Hawai'i County Planning Department 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.

## MITIGATION SUMMARY

The following measures have been developed either as intrinsic to the design or as mitigation to avoid, reduce or offset adverse impacts, as discussed in the Draft EA. They are expected to be required as part of conditions for various permit approvals and/or carried forward, as amended by regulators, as Covenants, Conditions and Restrictions (CC&Rs). These measures will be updated as part of the Final EA after review and comment by agencies and the public. They are summarized here for the convenience of regulators for future approvals and for final CC&R formulation.

## WILDFIRE MITIGATION

1. Vegetation at the edge of each building pad will be kept low to act as a fuelbreak in order to reduce the spread of fire on or off the property.
2. The shoulder of the entrance roads will be mowed to reduce fuel buildup, and no parking will be allowed on these roads in order to avoid ignition from catalytic converters.
3. The entrance roads will have fire hydrants to assist in fighting not only house fires but wildfires, should they originate on or off the property.

## FLOODING, WATER QUALITY, AND CLIMATE CHANGE

1. All house pads would be set back from the shoreline at a minimum elevation of about 40 feet above sea level (and generally above 50 feet), outside the VE flood zone.
2. All six residences would be required to utilize advanced individual wastewater treatment units such as the Cyclic Biological Treatment (CBT) system.
3. Information concerning the tsunami and dam hazard zones and appropriate evacuation procedures will be provided to all lot purchasers and an evacuation plan will be developed and included.
4. A detailed drainage study of the development will be submitted for review and approval by the Department of Public Works, in conjunction with submittal of plans for subdivision review. Drainage structures will be constructed to capture and retain the increase in rainfall runoff generated by the development.
5. All homes must be built to withstand Hurricane Category 2 force winds.
6. Any culverts within the subdivision that might be built will be oversized to accommodate the 100-year rather than 50-year storm.

7. In association with grading permits and an NPDES permit, the project engineer will complete a Storm Water Pollution Prevention Plan (SWPPP) that will effectively manage storm water runoff through emplacement of appropriate best management practices (BMPs)
8. In addition, the project will adopt certain protocols for grading of the lots similar to those in the Recommended Construction Best Management Practices (BMPs) for Land Disturbance of Less Than One Acre that was approved by Board of Directors of the Kohala Ranch Community Association, on August 9, 2007.
9. The project engineer will also explore the use of “mini-sediment basins”, as successfully implemented in the Kohala Estates subdivision, in order to achieve the goals of the SWPPP and the additional Recommended Construction Best Management Practices.
10. A variety of additional specific site design measures derived from U.S. Green Building Council (USGBC) requirements, which are consistent with the State CZM Program’s Low Impact Design (LID) Guidelines, will be implemented to specifically accomplish 1) limitation of site disturbance; 2) a less engineered approach to site grading; 3) maximization of percolation and minimization of runoff, including re-direction of roof runoff to storage or use areas; and 4) alternative approaches to slope retention/stabilization.

## BIOLOGY

1. To minimize impacts to the endangered Hawaiian hoary bat, the removal or trimming of woody plants taller than 15 feet will be prohibited from June 1 to September 15 each year.
2. To avoid the potential downing of seabirds by interaction with outdoor lighting, no construction or unshielded equipment maintenance lighting will be permitted after dark between the months of April and October, and all permanent lighting will be shielded in conformance with Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14).

## VISUAL IMPACT

1. Future homes on the lots will be located a minimum of 150 feet *makai* of the highway and 100 feet *mauka* of the shoreline, *mauka* of the *ala loa*/jeep road.
2. All electrical and communication lines within the property will be placed underground.
3. No ground disturbance or structures by the owner or lot owners will be allowed *makai* of the *ala loa* (old coastal trail).
4. The project will include gradual planting of native vines and herbs near the shoreline in order to enhance the biological environment and human enjoyment of the public access area, but there will be no landscaping with trees or shrubs by the developer or property owners *makai* of the *ala loa*.
5. The height of homes will be restricted to 25 feet, and the color scheme for homes and outbuildings will utilize earth-tones.
6. Xerophytic landscaping will be installed along the development’s two internal roadways and also on residents’ lots.

7. Kiawe trees will be retained as practical, and all trees will be limited to a height of 35 feet, similar to the existing kiawe tree landscape, as large trees would be out of place in this xeric landscape and require inordinate amounts of irrigation water.

#### HAZARDOUS MATERIALS

1. During construction, drip pans will be placed beneath vehicles not in use in order to trap vehicle fluids, and any significant leaks or spills that occur will be promptly cleaned with disposal at an approved site.
2. Precautions would be undertaken by contractors in the context of the project construction Best Management Practices for the appropriate response and remediation should any heretofore unknown hazardous, toxic, or radioactive material be encountered during construction of the project.

#### PUBLIC ACCESS AND RECREATION

1. The project includes a four-stall public parking area that would be open from a half-hour before sunrise to a half-hour after sunset, which would access a new 800-foot long, 10-foot wide *mauka-makai* pedestrian trail.
2. The continuous lateral shoreline easement near the shoreline will remain in place, but the development will also cooperate with the National Park Service and DLNR's Na Ala Hele Program so that these agencies may develop the *ala loa* as an additional lateral shoreline access that is expected to become part of the Ala Kahakai National Historic Trail.

#### CULTURAL AND ARCHAEOLOGICAL RESOURCES

1. To avoid potential impacts to the cultural value of burial sites present on the property, a burial treatment plan will be prepared in compliance with HAR §13-300.
2. To avoid potential adverse impacts to the cultural value of the preservation sites, and to enhance the preservation, interpretive and cultural values of these sites, archaeological data recovery and preservation plans will be prepared and implemented.
3. Throughout plan development, native Hawaiian individuals and organizations will continue to be consulted in order to ensure that implementation actions are appropriate.

#### PUBLIC FACILITIES AND SERVICES

1. The owner will make fair share contributions to mitigate the potential regional impacts of the subdivision with respect to parks and recreation, fire, police, solid waste disposal facilities, and roads.
2. The owner will prepare a Solid Waste Management Plan prior to securing Final Subdivision Approval.
3. The owner will make intersection improvements to be determined in consultation with the Department of Transportation.

## **PART 1: PROJECT DESCRIPTION, LOCATION, AND ENVIRONMENTAL ASSESSMENT PROCESS**

### **1.1 Property Ownership and Project Location and Description**

Kohala Shoreline, LLC (“Kohala Shoreline” or “the owner”) proposes to develop a 6-lot subdivision (the project) within its 37.88-acre property at TMK (3) 5-9-001:008 at Kahuāli’ili’i, North Kohala, County and State of Hawai‘i (the “property” or “subject property”) located along Akoni Pule Highway (State Route 270), approximately three miles north of Kawaihae Harbor (Figures 1-4).

The property is within the County’s Special Management Area (SMA), and an SMA Use Permit application will be processed with the Hawai‘i County Leeward Planning Commission (Planning Commission). A change of zone application from the current Single-Family Residential (RS-15) zoning district to the Residential and Agricultural (RA-5a) zoning district will be concurrently processed through the Planning Commission and the County Council. The owner may or may not elect to pursue a variance, Planned Unit Development or any other administrative permit to modify road standards, lot sizes or other design elements during the subdivision or development process.

The current proposal replaces a previous one from 2015. Notice of the Draft EA for the first project was published in the July 8, 2015 edition of *The Environmental Notice*. As part of the review process, the project team received a number of comments on concerns including density, lot configuration, public access, historic sites, cultural practices, water use, drainage and marine water quality. The owner carefully considered the comments and decided not to implement the project as proposed, and instead decided to design a new concept with substantial changes that responded to these concerns. Accordingly, the original Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the project was withdrawn on September 23, 2018.

The current project is substantially different from the one proposed in 2015. The former project had 50 percent more density (9 lots instead of 6) and included several building sites nearer the shoreline *makai* of the *ala loa* (old coastal trail). To further reduce the footprint, all on-site roads, other than the cul-de sac on the north entry and stub road on the south entry, were removed and replaced with driveways, which disturb much less area and decrease potential runoff. The design specifications for the current project express low impact design, and include more safeguards to decrease water use, minimize wastewater impacts and prevent erosion and sedimentation during occupation of the homes. It also proposes to set aside a roughly 10-acre area from the *ala loa*/jeep road to the shoreline as an easement that would serve as a substantial visual buffer for the shoreline area that will support gathering and fishing.

The Mission Statement for the owner of the property expresses the intent to develop and utilize the property with a minimum of impact:

Our mission is to set a new standard of stewardship for new, small-scale, coastal housing clusters for twenty first century Hawai‘i.

Hawai‘i is blessed with pristine beauty and rich biodiversity. Traditionally, its people lived in harmony with the land and the sea, protecting the natural wonderments that make Hawai‘i such an extraordinary place. To this end, we will work to protect and preserve the sensitive natural landscapes and seascapes along the Hawaiian coastline. Furthermore, we will serve as good neighbors to the local communities, respecting their values and cultural traditions. We believe that the built environment must be mindful of its intrusion into, and its framing within, the natural environment. We will build an environmentally healthy house that minimizes its impacts to the earth and possesses an aesthetic beauty in balance with its natural surroundings. To lessen the negative climate impacts caused by conventional structures, we will use best practices in design for energy efficiency and functionality, and for low carbon production and natural resource consumption. Natural materials such as wood and stone will be sustainably harvested, and all manufactured materials used will be environmentally sensitive. We will use construction methods that avoid or mitigate disruptions to the local ecology and wildlife, as well as to the archeological history of those who lived on this land before us.

This mission is a commitment made by ourselves, and by our partners in design and construction. We will ask our future neighbors on the property to join us in following this mission as well.

To translate this mission statement to practical measures, the project will adopt a number of design and mitigation measures that far exceed requirements related to environmental permits. CC&Rs will require adherence to a set of measures based on Low Impact Design (LID) Guidelines (Hawai‘i CZM Program 2006). While not all design guidelines are appropriate to any given site, one principle that connects all LID practices is sustainability:

LID is defined as a more sustainable land development pattern than the conventional method currently used in most areas. It incorporates a suite of landscaping and design techniques known as “Better Site Design” that attempt to maintain the natural, pre-development hydrology of a site and the surrounding watershed. An important LID principle is the idea that stormwater is not merely a waste product to be disposed of, but rather that rainwater is a resource. LID also integrates a range of structural best management practices (BMPs) for road design and stormwater and wastewater management systems that minimize environmental impacts (Hawai‘i CZM Program 2006: 1-2).

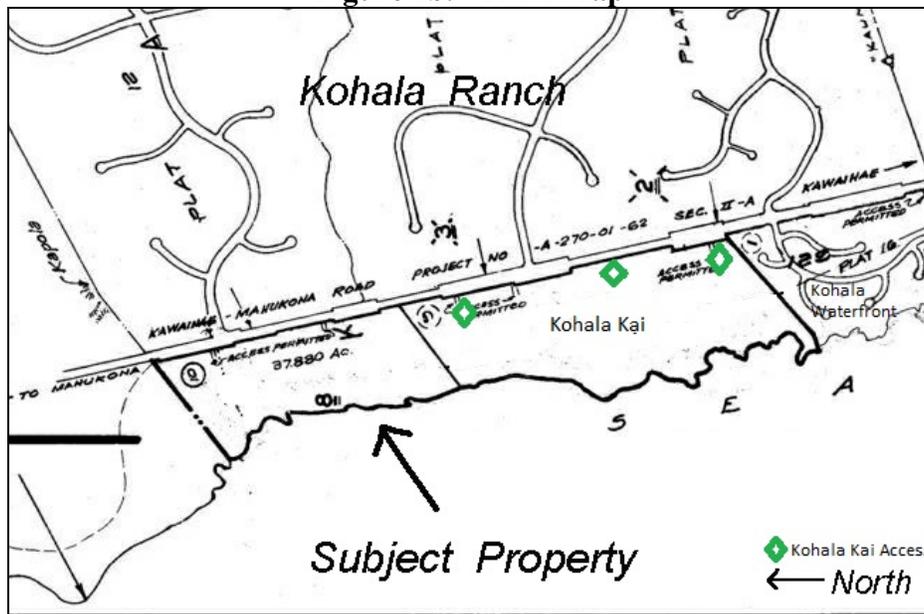
These guidelines seek to prevent environmental impacts rather than having to mitigate for them; minimize the use of regional conveyance systems; preserve natural areas; reduce impact on watershed hydrology; utilize less complex, non-structural methods to lower cost and maintenance; and create a multifunctional landscape.

Low Impact Design Guidelines design measures will be adopted in road design, home site locations, gulch buffers, general erosion and sedimentation control, re-direction of roof runoff to storage or use areas, wastewater treatment, and native landscaping. The reader is referred to Sections 3.1.2, 3.1.3, 3.1.4, 3.3.1 and 3.3.2 for detailed discussion.

**Figure 1a. General Location Map**



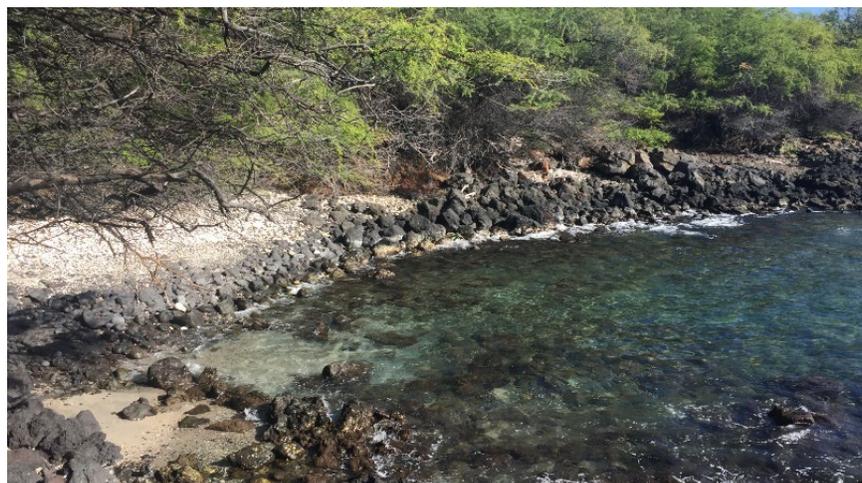
**Figure 1b. TMK Map**



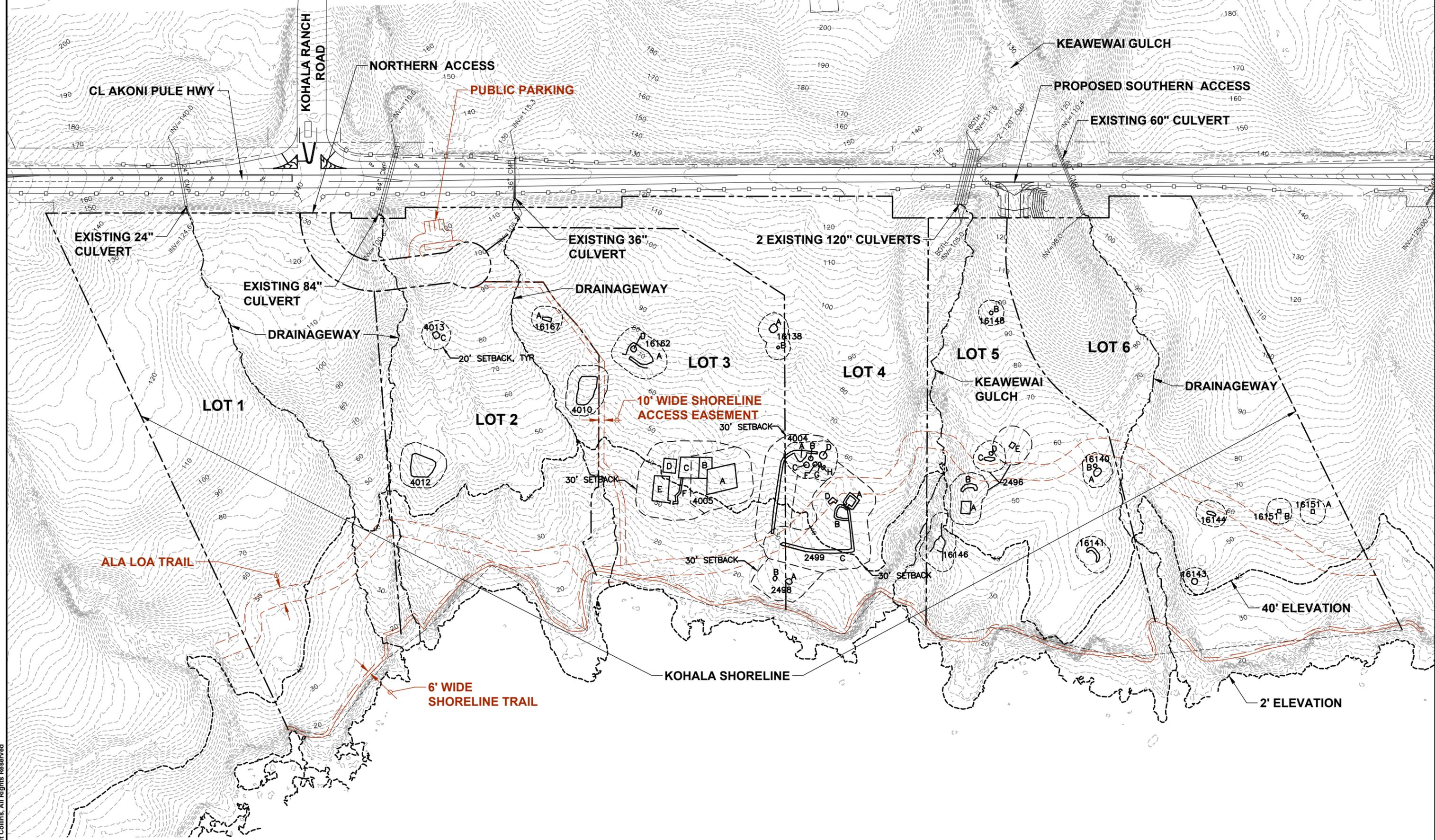
**Figure 2. Property Photos**



**a. Typical Landscape, with *ala loa*/jeep road ▲ ▼ b. HPA Students Investigating Site Meteorology**



**c. Shoreline ▲**



**FIGURE 3 - CONCEPTUAL SITE PLAN**

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**NORTH**

0 40 80 160  
SCALE IN FEET

**DRAINAGEWAY NOTE:**  
DRAINAGE EASEMENT AND 20-FOOT LANDSCAPE BUFFER TO BE DETERMINED.

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**Fig. 4a Landscape Concept**

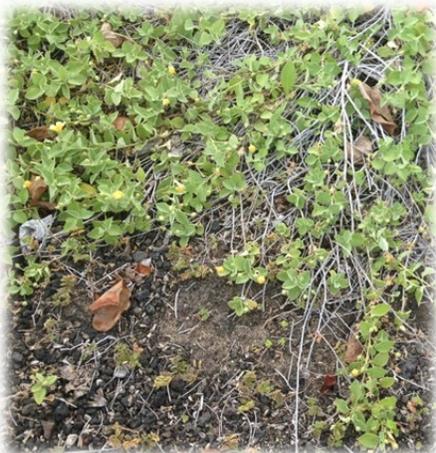


*Kauna'oa and Pōhuehue,  
spreading over near-  
shoreline wave deposits*

*(Cuscuta sandwichiana and  
Ipomoea pes-caprae)*

*Akulikuli and Ōhelo Kai,  
low-lying on bare rock*

*(Sesuvium portulacastrum and Lycium  
sandwicense)*



*'Ilima, low stature or  
spreading*

*(Sida fallax)*

**Fig. 4b Landscape Concept**



*Pā'ū-O-Hi'iaka draping  
over low cliffs near  
shoreline*

*(Jacquemontia ovalifolia)*

*Endangered 'Ihi with white  
flowers*

*(Portulaca villosa)*

*Photo courtesy Forest and Kim Starr*



**Fig. 4c Landscape Concept**



*Alena sprawling  
and draping over rocks*

*(Boerhavia repens)*  
Photo courtesy Forest and Kim  
Starr

*Low bushes of silvery  
hinahina*

*(Heliotropium anomalum)*  
Photo courtesy Forest and Kim Starr



The property is currently zoned Single-Family Residential, with a minimum lot size of 15,000 square feet (RS-15), under Rezoning Ordinance No. 97-02. SMA Permit 379, which allowed for development of a 50-lot subdivision, was issued for the property but is in technical default for failure to timely comply with certain conditions of approval. Table 1 provides a history of zoning and SMA actions for the property. Upon reviewing the property and development options, the owner determined that a less dense development would be more in keeping with surrounding zoning and land uses and his Mission Statement. The owner is therefore proposing a change of zone to Residential and Agricultural 5-acres (RA-5a), which would decrease potential density from 50 lots on which residences would eventually be built down to six lots, ranging in size from about 5 to 8 acres, reducing the impacts associated with denser development. The scale of the lots and would be similar to the A-3a and A-5a zoned lots immediately upslope at Kohala Ranch.

Road access would be from two locations along the highway, as shown in Figure 3. The project has two existing permitted access points, one opposite Kohala Ranch Road and the other approximately 980 feet to the south. Because the southern third of the property is separated from the remainder by Keawewai Gulch, which, under the present access situation, would require construction of a bridge or large culvert, the plan calls for relocating the southern road access point approximately 300 feet further south. The project would be served with underground water, electrical, and telephone service from existing lines located within a utility easement along Akoni Pule Highway. For wastewater treatment and disposal, all six residences would be required by Covenants, Conditions and Restrictions (CC&Rs) to utilize advanced individual wastewater treatment units such as the Cyclic Biological Treatment (CBT) system. These systems meet and exceed the requirements of the State Department of Health, reduce the level of residual nutrients, and also produce a higher quality effluent that can be utilized for irrigation, further reducing the subsidy of nutrients to the groundwater.

A number of design features combined with the natural landscape will help avoid visual impacts for motorists on the highway and those on the shoreline. CC&Rs that are proposed to be further codified within future change of zone and SMA approval conditions will require future homes on the lots to be located a minimum of 150 feet *makai* of the highway and 100 feet *mauka* of the shoreline, *mauka* of the *ala loa*/jeep road. CC&Rs will also restrict the homes' height to 25 feet as measured according to Chapter 25 of the Hawai'i County Code and mandate a color scheme featuring earth-tones to minimize visual impacts. This land has a moderate slope and scattered *kiawe* trees that will assist in obscuring the homes.

Landscaping will be installed by the owner along the subdivision's entry gate area and two short entrance roadways, and by residents on their lots, subject to CC&Rs that would also require that trees be limited to a height of 35 feet, similar to the existing *kiawe* tree landscape. Large trees would be out of place in this xeric landscape and require inordinate amounts of irrigation water, which is not in keeping with the owner's sustainable mission statement. Note that the erosion and sedimentation measures that will be adopted as part of the CC&Rs would also require retaining *kiawe* trees to the maximum practicable degree. The project includes public parking and a *mauka-makai* shoreline access, as well as a continuous lateral shoreline access in the form of an existing easement near the shoreline. Based on the history of coordination with the National Park Service, it is also expected that the Ala Kahakai National Historic Trail will utilize the *ala loa*, which

**Table 1. Chronological Summary of Land Use History of Property Since 1997**

No.	Date	Action
1	July 14, 1997	Effective date for Change of Zone Ordinance No. 97-102, which rezoned 37.88 acres of land from Agricultural 5-acre (A-5a) to a Single-Family Residential (RS-15) zoned district.
2	August 8, 1997	SMA Use Permit No. 379 granted by the Planning Commission (PC) to allow the development of a 50-lot single family residential subdivision and related improvements
3	May 31, 2007	Letter informing the applicant that the Planning Director (PD) will be initiating the rezoning of the property from a RS-15 to a Residential and Agricultural 5-acre (RA-5a) district and will initiate the revocation of SMA Use Permit No. 379.
4	June 5, 2007	Kohala LLC submitted a request for a 5-year time extension from July 14, 2007 until July 14, 2012 to comply with Condition C (secure Final Subdivision Approval) of Change of Zone Ordinance No. 97-102 and Condition No. 4 (secure Final Subdivision Approval) of SMA Use Permit No. 379.
5	July 7, 2007	The PC Commission considered Kohala LLC's request for a 5-year extension for Condition No. 4 (secure Final Subdivision Approval) of SMA Use Permit No. 379. A motion was made to approve the PD's denial recommendation, which did not pass. Additionally, the PC considered the PD-initiated request to revoke SMA 379. A motion was made to approve the PD's initiated revocation, which did not pass. The PC voted to continue the matters until August 31, 2007.
6	August 31, 2007	Kohala LLC requested a continuance until the next PC hearing in October to allow time to review information received from the Planning Department. The next Kona meeting was held on December 12, 2007.
7	December 12, 2007	The PC voted to continue Kohala LLC's amendment request of Condition No. 4 (secure Final Subdivision Approval) of SMA Use Permit 379 and the Planning Director's initiated request to revoke SMA Use Permit No. 379 until March 20, 2008 to allow both parties to submit proposed Findings of Fact, Conclusions of Law and Decision and Order.
8	March 20, 2008	The PC voted to continue Kohala LLC's amendment request of Condition No. 4 (secure Final Subdivision Approval) of SMA Use Permit 379 and the PD-initiated request to revoke SMA Use Permit No. 379 until April 18, 2008.
9	April 18, 2008	The PC considered the applicant's request for an amendment to Condition C (time to secure Final Subdivision Approval) of Change of Zone Ordinance No. 97-102. A motion to send a favorable recommendation to the County Council did not pass. Additionally, the PC considered the request for an amendment to Condition 4 (time to secure Final Subdivision approval) of Special Management Area (SMA) Use Permit No. 379, which allowed the development of a 50-lot single family residential subdivision. A motion to deny the request did not pass. The applicant requested an opportunity for final reconsideration of this matter pursuant to PC Rule No. 9-11(F)(3).
10	May 22, 2008	The PC Chairman deferred the reconsideration of the amendment request for Condition No. 4 of SMA 379 and the PD-initiated revocation of SMA No. 379 until the County Council decides on its initiation of rezoning the subject parcel from a Single-Family Residential-15,000 square foot (RS-15) to a Residential and Agricultural-15 acre (RA-15a) zoned district.
11	September 24, 2008	The Hawaii County Council passed the second and final reading of Bill 237 (Draft 2), which repealed Change of Zone Ordinance No. 97-102 and changed the zoning from RS-15 to RA-15a.
12	October 13, 2008	Mayor Harry Kim vetoed Bill 237 (Draft 2) stating his reasons and requested that the Council reconsider the RA-5a zoning.
13	November 7, 2008	The Hawaii County Council failed to override the Mayor's veto.
14	November 24, 2008	The PC Chairman deferred the reconsideration of the amendment request for Condition No. 4 of SMA 379 and the PD-initiated revocation of SMA 379 until such time that the rezoning of the property is decided upon by the County Council or by the August 2009 Leeward Planning Commission meeting, whichever occurs first.
15	July 27, 2009	The applicant submitted a letter regarding the status of applications to the Planning Department.

meanders through the *makai* third of the property (see Figure 3). This will provide a critical public trail connection from trail segments that extend from the private lands in the Kawaihae area north to State lands in North Kohala. No homes or any other construction would be permitted *makai* of the *ala loa*. The project will also include gradual landscaping in selected areas near the shoreline intended to restore native herbs and vines in order to enhance the biological environment and human enjoyment of the area (Figure 4).

## 1.2 Environmental Assessment Process

Because the project involves discretionary permits in the form of a Change of Zone and a Special Management Area Use Permit, its use of land within State rights-of-way for utility and access connections triggers the need for an Environmental Assessment analyzing these connections and the associated development pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS), Hawai‘i’s EIS law. This Environmental Assessment (EA) process is being conducted in accordance with HRS Chapter 343. This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai‘i. According to HRS 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 findings that no significant impacts are expected to occur; Part 5 lists each criterion and presents the preliminary findings for each made by the County of Hawai‘i Planning Department, the approving agency. If, after considering comments to the Draft EA, the approving agency concludes that, as anticipated, no significant impacts would be expected to occur, the agency will issue a Finding of No Significant Impact (FONSI), and the action will be permitted to proceed to necessary permits and approvals. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, an Environmental Impact Statement (EIS) will be prepared.

## 1.3 Public Involvement and Agency Coordination

Based on jurisdiction, expertise, and expressed interest, the following agencies and organizations were consulted in various stages of the development of the environmental assessment:

Federal:

National Park Service, Ala Kahakai National Historic Trail

State:

Department of Land and Natural Resources

Department of Health

Department of Transportation, Highways Division, Hawai‘i District

Office of Hawaiian Affairs, Honolulu and West Hawai‘i

State Historic Preservation Division

County:

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

Private:

Sierra Club, Moku Loa Group  
North Kohala Community Access Group  
North Kohala Community Development Plan Action Committee  
Kailapa Community Association  
South Kohala Hawaiian Civic Club

Residents:

Jack Hoyt	Susan Wells Fischer	Diane Kāneali‘i
Keoni Mackillop	Keith Wallis	Toni Withington

Copies of communications received during early consultation are contained in Appendix 1a. As discussed in Section 3.2.3, throughout the history of the original project and continuing to the present project, the project team has attended several meetings of the North Kohala Community Access Group and held several field visits for this and other community groups.

## **PART 2: ALTERNATIVES**

### **2.1 Proposed Project**

As detailed in Section 1.1, the *proposed project* is development of a 6-lot subdivision and related improvements, with vehicular access and utility connections within the State of Hawai‘i’s Akoni Pule Highway right-of-way (see Figure 3 for conceptual lot layout). It would involve a change of zone from Single-Family Residential minimum lot size 15,000 square feet (RS-15) to Residential-Agricultural minimum lot size 5 acres (the original zoning density of the property before it was changed to RS-15) and a Special Management Area Use Permit. It is expected that each lot would eventually be developed with a residence and accessory uses.

### **2.2 No Action**

Under the No Action Alternative, development of the property as discussed above would not occur. This would avoid any adverse environmental impacts related to the development. It would also preclude economic benefits including jobs, income, and tax revenues associated with the development; environmental benefits such as sediment reduction and native species revegetation; and social benefits such as enhancement of public access on an improved trail parallel to the shoreline. The No Action Alternative forms the baseline against which environmental impacts associated with the proposed action are measured.

### **2.3 Alternatives Evaluated and Dismissed from Further Consideration**

As stated in Section 1.1, the property is currently zoned Single-Family Residential, with minimum lot size of 15,000 square feet (RS-15), which could allow up to 110 dwelling units. The Planning Commission previously issued SMA Use Permit No. 379 (SMA 379) allowing a 50-lot single-family residential subdivision (see Table 1). SMA 379 is in technical default for failure to timely comply with certain conditions of approval. Upon reviewing the property and development options, the owner determined that a less dense development alternative of 6 lots would decrease many of the impacts associated with the density permitted under RS-15 zoning and would also be more in keeping with his Mission Statement and the surrounding zoning and land uses. Therefore, a higher density alternative using existing zoning is not being considered at the present time and is not being advanced in this Environmental Assessment.

If the proposed rezoning is not approved, the owner may in the future consider a higher-density development consistent with the current RS-15 zoning, at which time the owner would comply with all applicable requirements of HRS Chapter 343.

The owner does not envision any other development scenarios that could reasonably satisfy its objectives and vision for the property, and therefore none are advanced or analyzed. As stated previously, a project previously proposed by Kohala Shoreline LLC was 50 percent more dense, with nine lots, and included several building sites near the shoreline *makai* of the *ala loa*. This design concept would be much less satisfactory in meeting the environmental and community goals of the project and is no longer under consideration as an alternative.

## **PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES**

### *Basic Geographic Setting*

The Kohala Shoreline, LLC property is referred to throughout this EA as the *property*. The term *project area* is used to describe the general environs in this area of Kohala.

The property is a 37.88-acre parcel in the State Land Use Urban District, located approximately three miles north of Kawaihae Harbor. It reaches from the shoreline to approximately 160 feet above sea level, *makai* of the State-owned Akoni Pule Highway (see Figures 1-3). Adjacent land use is primarily rural residential and agricultural lots, with scattered undeveloped properties. The surface of the project area has been partially disturbed previously by ranching and fire, and the vegetation is composed of almost entirely of two non-native species, *kiawe* trees and buffel grass. The property is bounded by Akoni Pule Highway and Kohala Ranch subdivision to the east, the sea to the west, undeveloped State land to the north, and the Kohala Kai subdivision to the south.

### **3.1 Physical Environment**

#### **3.1.1 Geology, Soils and Natural Hazards**

##### *Environmental Setting*

Geologically, the property is located on the flanks of Kohala Volcano. The surface consists of a lava flow that erupted more than 120,000 years before the present (Wolfe and Morris 1996). The property soil is classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as Kawaihae very rocky, very fine sandy loam (KOC). The KOC soil is typically found up to 2 inches thick, underlain by up to 31 inches of stony loam, on slopes of 6 to 12 percent. This pH neutral soil typically contains up to 30% rock outcroppings. Permeability and erosion hazard are moderate, and runoff is medium. The capability subclass for KOC is *VIIIs*, which denotes soils with very severe limitations that make them very unsuited for cultivation and restrict their use to mainly pasture and woodland (U.S. Soil Conservation Service 1973). It is unclassified in the Agricultural Lands of Importance in the State of Hawai‘i maps, and the Land Study Bureau classifies the land as E or “Very Poor.” Both ratings indicate the land’s poor agricultural potential.

The Island of Hawai‘i experiences high seismic activity and is at risk from major earthquake damage (USGS 2000), especially to structures that are poorly designed or built. On October 15, 2006, two damaging earthquakes of magnitude 6.7 and 6.0 struck the west side of Hawai‘i Island, causing extensive damage in West Hawai‘i. An even stronger magnitude 6.9 quake occurred under Kilauea Volcano on May 3, 2018. None of these earthquakes caused more than minimal damage to the property. Volcanic hazard as assessed by the U.S. Geological Survey at the property is Zone 9, on a scale of ascending risk from 9 to 1 (Heliker 1990:23). The low hazard risk is based on the fact that Kohala Volcano, the oldest volcano on the island, has not erupted for 60,000 years and is possibly extinct. The property does not appear to be subject to subsidence, landslides or other forms of mass wasting.

Wildfire is an important concern in this part of North Kohala, which has burned on several occasions owing to arson, car exhaust, campfires and firecrackers, among other causes. Fires started on this property may harm not only the owner's property but nearby land as well, including Kohala Ranch and State lands immediately adjacent to the north.

### *Impacts and Mitigation Measures*

In general, soil and geologic conditions impose no constraints, and the proposed use is reasonable. Appropriate seismic standards would be adhered to during construction, per building codes.

Vegetation at the edge of each building pad will be kept low to act as a fuelbreak to reduce the spread of fire on or off the property. Entrance road shoulders will be mowed to reduce fuel buildup, and no parking will be allowed on these roads in order to avoid ignition from catalytic converters. Finally, the entrance roads will have fire hydrants to assist in fighting not only house fires but wildfires, should they originate on or off the property. Water service will be provided to each lot for potable and irrigation uses, and irrigated vegetation will have less potential to ignite or spread fires.

## **3.1.2 Climate, Drainage and Flood Hazards**

### *Existing Environment*

The climate in the project area is mild and arid, with a mean annual rainfall of about 10 inches and a mean annual temperature of 75 degrees (Giambelluca et al 2014; U.H. Hilo-Geography 1998:57). Maps of wind energy potential produced by Hawaiian Electric indicate that this area of Kohala has average wind speeds of less than 12 mph 20 mph at 50 meters in height ([https://www.hawaiianelectric.com/documents/clean\\_energy\\_hawaii/renewable\\_energy\\_sources/hawaii\\_county\\_hawaii\\_island\\_SPD\\_50m\\_19\\_july\\_04.pdf](https://www.hawaiianelectric.com/documents/clean_energy_hawaii/renewable_energy_sources/hawaii_county_hawaii_island_SPD_50m_19_july_04.pdf)) As discussed in detail below in this section, the world's climate is changing and requires consideration in any development.

The Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM) 1551660128C (9/16/1988) indicates that the majority of the property is in Flood Zone X, areas of minimal flood hazard (Figure 5a). A narrow portion of the shoreline along the property is in Flood Zone VE, indicating the 100-year flood coastal, high-hazard floodplain, incorporating storm surge inundation. The base flood elevation is 35 feet. No home development is planned within this area, which is well below the minimum elevation of approximately 40 feet for all proposed home sites.

The project area has no perennial freshwater bodies, but the property has five gulches with ephemeral streams. Only Keawewai Gulch is named. Four single culverts and one double culvert carry storm runoff from *mauka* lands under Akoni Pule Highway across the property and into the normally dry gulches towards the shoreline. These deep gulches do not overflow their banks, represent only minimal flood hazard, and are not mapped on the FIRMs. Preliminary consultation with the U.S. Army Corps of Engineers (ACOE) indicates that Keawewai Gulch and one of the unnamed gulches are jurisdictional waters of the U.S. under Section 404 of the Clean Water Act. Any work resulting in the discharge and/or placement of fill within a jurisdictional water requires a Section 404 permit. Permitting is treated in the impacts discussion in this section.

**Figure 5a. Flood Insurance Rate Map**





## Flood Hazard Assessment Report

www.hawaiiifip.org

**Property Information**

COUNTY: HAWAII  
 TMK NO: (3) 5-9-001:008  
 WATERSHED: KEAWANUI  
 PARCEL ADDRESS: 59-485 AKONI PULE HIGHWAY  
 KAMUELA, HI 96743

**Notes:**

FIRM INDEX DATE: SEPTEMBER 29, 2017  
 LETTER OF MAP CHANGE(S): NONE  
 FEMA FIRM PANEL: 1551660155F  
 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: YES (HA-0147)  
 FOR MORE INFO, VISIT: <http://dlnreng.hawaii.gov/dam/>

**Flood Hazard Information**

FIRM INDEX DATE: SEPTEMBER 29, 2017  
 LETTER OF MAP CHANGE(S): NONE  
 FEMA FIRM PANEL: 1551660155F  
 PANEL EFFECTIVE DATE: SEPTEMBER 29, 2017

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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	
<small>(Note: legend does not correspond with NFHL)</small>	
<b>SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD</b> - 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.
<b>NON-SPECIAL FLOOD HAZARD AREA</b> - 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.
<b>OTHER FLOOD AREAS</b>	
	Zone D: Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase apply, but coverage is available in participating communities.

Source: <http://gis.hawaiiifip.org/FHAT/>. Note: Area X now defined by FEMA as "Area of Minimal Flood Hazard"

Maps printed by the Pacific Tsunami Warning Center and the Hawai'i County Civil Defense Agency indicate that areas *makai* of Akoni Pule Highway should be evacuated during a tsunami warning (<http://www5.hawaii.gov/tsunami/maps.asp>). Large extents of Hawai'i Island, including the project area, have been struck by highly destructive tsunami in historic times. The April 1, 1946 tsunami had a runup near Waiaka'ilio Bay of 12 feet (*Atlas of Hawai'i*, 3<sup>rd</sup> edition) (far below the 40-foot minimum elevation of all future home sites).

As with much of the area – including the two large State properties to the north and many properties in Kohala Ranch – the property is subject to dam evacuation from Punawai Reservoir. This 10 million-gallon, earthen irrigation reservoir is 6.45 miles east, *mauka* of Kohala Mountain Road.

### *Impacts and Mitigation Measures*

The area proposed for homes and improvements is outside the designated flood zone, and no flood zone impacts will occur. All house pads would be set back from the shoreline at a minimum elevation of about 40 feet above sea level (and generally above 50 feet), outside the VE flood zone.

This location also prevents exposure in the near and medium term, at least, to tsunami of the scale experienced in human history. The National Weather Service of the National Oceanic and Atmospheric Administration operates the Pacific Tsunami Warning Center and Alaska Tsunami Warning Center, which monitors sudden earth movements throughout the Pacific Basin. A tsunami from earth movements in South America would allow for as much as 15 hours warning time, and 4.5 hours for events in the Aleutian Islands, providing sufficient time for evacuation of island residents. Warning sirens are present in Kawaihae but are not readily audible at the property. The Hawai'i County Civil Defense Agency recommends that residents in areas of the island where sirens are not audible sign up for mobile alerts. Sudden movement along faults close to Hawai'i are unpredictable and would allow for a few minutes to perhaps an hour of warning time, and evacuation would be more problematic.

The Hawai'i County Civil Defense Agency will provide alerts in the event of a dam emergency at Punawai Reservoir, and their evacuation procedures would be followed. If the subdivision into six lots is ultimately approved, the hazard zone and appropriate evacuation procedures would be provided to all lot purchasers and an evacuation plan will be developed and included in the Project CC&Rs.

Culverts or bridges will be constructed at locations where roadways cross gullies or gulches. As discussed previously, two of the five intermittent gulches have initially been determined to be waters of the U.S. per Section 404 of the Clean Water Act, under the jurisdiction of the U.S. Army Corps of Engineers (ACOE). Project plans avoid any crossing one of these jurisdictional gulches, Keawewai Gulch. Any work that discharges and/or places fill within a jurisdictional water requires a Section 404 permit. During the design phase, project engineers will work with the ACOE to confirm the permit requirements for each gulch; if a bridge is constructed on a jurisdictional water, it is likely that no Section 404 permit will be required. A culvert would require a permit.

Concerning drainage, per the Hawai'i County Code on Subdivision, Section 23-92. "Drainage, flood, and erosion mitigation measures":

- a) The subdivider shall construct a storm water disposal system to contain runoff caused by the subdivision improvements within the boundaries of the subdivision, up to the expected one-hour, ten year storm event, as shown in Plate 1 of the Department of Public Works "Storm Drainage Standards", dated October 1970, or any approved revisions, unless those standards specify a greater recurrence interval, in which case, the greater interval shall be used. The amount of expected runoff shall be calculated according to the Department of Public Works "Storm Drainage Standards", dated October 1970, or any approved revisions thereto, or by any nationally-recognized method meeting with the approval of the director of public works. Runoff calculations shall include the effects of all required subdivision improvements, and lot improvements that may be allowed by existing zoning.
- (b) Storm water shall be disposed into drywells, infiltration basins, or other infiltration methods. The subdivision shall not alter the general drainage pattern above or below the subdivision.
- (c) Subdivider shall also comply with the requirements of chapter 27, Hawai'i County Code.

Chapter 27 and the County's Storm Drainage Standards require that all increases in runoff due to a project's development must be captured and disposed of. Rainfall runoff for a six-lot subdivision on the property was calculated by Belt Collins Hawaii (BCH) civil engineers using the Storm Drainage Standards. The total increase in rainfall runoff was calculated to be 6 cubic feet per second (cfs) based on the following calculations:

**Formula for Runoff Quantity,  $Q = ciA^1$**

- Runoff Coefficient,  $c = 0.24$  for pre-developed areas<sup>2</sup>,  $= 0.9$  for hardscaped areas<sup>3</sup>,  $= 0.29$  weighted average for post-developed areas
- Rainfall Intensity,  $i = 3.1$  inches<sup>4</sup>
- Area,  $A = 37.88$  acres

<sup>1</sup>  $Q$  (existing) = 28.2 cfs ( $0.24 \times 3.1 \times 37.88$ );  $Q$  (post-development) = 33.7 ( $0.29 \times 3.1 \times 37.88$ )

<sup>2</sup> Based on: low infiltration, hilly relief, good vegetal cover and agriculture development type

<sup>3</sup> New hardscape comprised of: 117,000 sf of pavement and 24,000 sf of homesite hardscape

<sup>4</sup> Using Plate 4; based on:  $i=1.5$  inch per Plate 1, 10-year, 1-hour storm intensity and 10-minute time of concentration.

If the subdivision is approved, drainage structures will be constructed to capture and retain the increase in rainfall runoff generated by the development. Drainage structures may include lava sumps, seepage drains, structures not requiring underground injection control permits, and/or drywells. A typical seepage drain structure has a percolation rate of 2 cfs, whereas a typical drywell structure has a percolation rate of 6 cfs. Given that the subdivision improvements (public parking and driveway pavements) and home sites will be constructed separately, it is conceivable that the installed drainage structures will consist of two seepage drain/drywell for the subdivision improvements and six (one for each lot) seepage drains/drywells for the home sites.

The above calculations assume a worst-case homesite hardscape of 24,000 square feet. CC&Rs will require adherence to a set of measures based on Low Impact Design Guidelines (Hawai'i CZM Program, 2006), which were part of the basis for Best Management Practices specifically designed

for the current site by landscape architect Leonard Bisel of B+K Design Group. These measures will act to reduce the quantity of hardscape, increase the infiltration capacity of the open areas on the lot, and reduce erosion and sedimentation. These measures, primarily designed to protect water quality, are detailed in Section 3.1.3, below.

In this and other appropriate resource sections of the EA, relevant conditions that were imposed by the Hawai‘i County Planning Commission and/or Hawai‘i County Council as part of SMA 379 and Rezoning Ordinance No. 97-102 have been identified and considered.

Condition 9 of SMA 379 and Condition J of Rezoning Ordinance No. 97-02 required a drainage study of the project site for review and approval by the Department of Public Works, in conjunction with submittal of plans for subdivision review. A similar condition is expected to be imposed as part of the new Special Management Area Use Permit, Rezoning Ordinance and subdivision approval.

### *Climate Change and Sea Level Rise*

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the UN’s 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.

For subdivisions near the shoreline in leeward Hawai‘i, key considerations are the potential for increased runoff from storms, increased fire risk from droughts, higher wind loads from more frequent hurricanes, and most importantly, rising sea levels.

No one can predict with any certainty how high sea levels will rise within 10 years, 20 years or 50 years. An overall global rise in sea level of 3.3 feet by the end of the 21st century was proposed by Fletcher (2010) and others. A 2012 scientific assessments (e.g., Rahmstorf et al 2012) posited 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 3.3 feet of sea level rise (DeConto and Pollard 2016). Relative sea-level rise, of course, is a result of the combined water rise and land subsidence. The Big Island of Hawai‘i 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/year related to isostatic sinking has been determined by submersible studies of drowned reefs off West Hawai‘i (Moore and Fornari 1984).

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 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 was estimated that at least 130 existing structures would experience chronic flooding if there were 3.2 feet of sea level rise.”

A sea level rise viewer from the Pacific Island Ocean Observing System (<https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/>) provides graphic representation of how regions will be affected by sea level rise (Figure 5b). As the slope in the area is relatively steep, and elevations rise to 10 feet or more above sea level with a few feet of the shoreline, sea level rise in itself will only inundate relatively small areas directly adjacent to the shoreline. This is unlike Waikiki, e.g., where a 10-foot rise in sea level would inundate large areas.

However, aside from simple inundation, a rise in sea level also raises the level of attack for high waves and tsunami. As reported in the online Science Daily based on an article in the Nature journal, *Scientific Reports* (<https://www.sciencedaily.com/releases/2018/09/180927164230.htm>), a research team including UH Manoa and DLNR determined that much sea level rise effects will be much more wide reaching. “By including models of dynamical physical processes such as erosion and wave run-up, a team of researchers has determined that land area in Hawai‘i vulnerable to future sea level rise may be double previous estimates.”

The proposed lots range in elevation from sea level to 160 feet above sea level. No home sites will be allowed *makai* of the *ala loa*/jeep road. In the portions of the lots *mauka* of the *ala loa*/jeep road, archaeological sites and buffers occupy the lower elevations, which are restricted to Lots 3 and 4 (see Figure 3). The combination of these factors constrains potential home sites to areas higher than 40 feet above sea level, and generally above 50 feet. As such, future homes site will have no exposure to areas subject to 3 to 10 or even 20 feet of sea level rise. To provide context, if sea level were to rise 20 feet, Kawaihae Harbor, all of Puako, Waikiki, and most of downtown Honolulu, Hilo and Kailua would be completely submerged. All future homes within the proposed subdivision would still be at least 20 feet above sea level.

Climate change may also induce larger storms, with greater rainfall on an hourly, daily, seasonal or annual basis. This can lead to increased runoff and gulch flow. The property’s steeply incised gulches itself will generally prevent gulch overflow except near the ocean, where no development is planned. Any culverts within the subdivision would be obligated by CC&Rs to be oversized to accommodate the 100-year storm, rather than the required 50-year storm, in order to account for future potential increases in runoff. Larger storms may also lead to higher winds. To account for this, CC&Rs will also require that homes be built to withstand Hurricane Category 2 force winds.

Uncertainties regarding regional circulation make it possible that instead of more annual rainfall, climate change may also involve long droughts and even overall drier conditions, increasing wildfire risk. The precautions to prevent and adapt to wildfire risk discussed in Section 3.1.1 will mitigate additional potential risk.

Figure 5b Sea Level Rise Exposure Map



### 3.1.3 Water Quality

Water quality in the nearshore waters of leeward North Kohala is determined by inputs from both overland flow into nearshore surface waters and groundwater flowing out to sea. Background information concerning these two sources are discussed separately below, followed by a discussion of impacts to surface waters and groundwater.

#### *Surface Waters*

In this part of North Kohala, overland water flows primarily in the steep, parallel gulches described in Section 3.1.2 during infrequent heavy rainfall episodes. Even under natural conditions there is a high erosion rate on the steep, dry slopes. Although recent efforts by area landowners have substantially mitigated the problem, flows have historically been muddy and turbid, full of sediment derived from overland sheet and rill flow across partly vegetated areas denuded by former and current cattle grazing, exacerbated by frequent fire and goat grazing. This type of flow delivers sediment that in large quantities can be very harmful and even destroy coral communities.

Almost all of the sediment in the gulches is derived from sheet flow and gully erosion from locations *mauka* and *outside* the property, where the vast majority of the drainage basin for each gulch is contained. For example, Keawewai Gulch, the largest gulch on the property, drains the northern part of the property and empties into the ocean just south of the Waiaka‘ilio Bay (Fig. 6).

According to the Division of Aquatic Resources (DAR), the watershed's area is 6 square miles, with a maximum elevation of 4,701 feet; land use in the basin is grassland, shrub/scrub and bare land. (<http://hawaiiwatershedatlas.com/watersheds/hawaii/85022.pdf>). As illustrated in the Google Earth © aerial images in Figure 7, heavy rainfall events transport sediment derived from upland areas and deposit it in the shoreline area. Only 3 percent of the drainage basin, which represents the source of the sediment in the gulch, is within the Kohala Shoreline property.

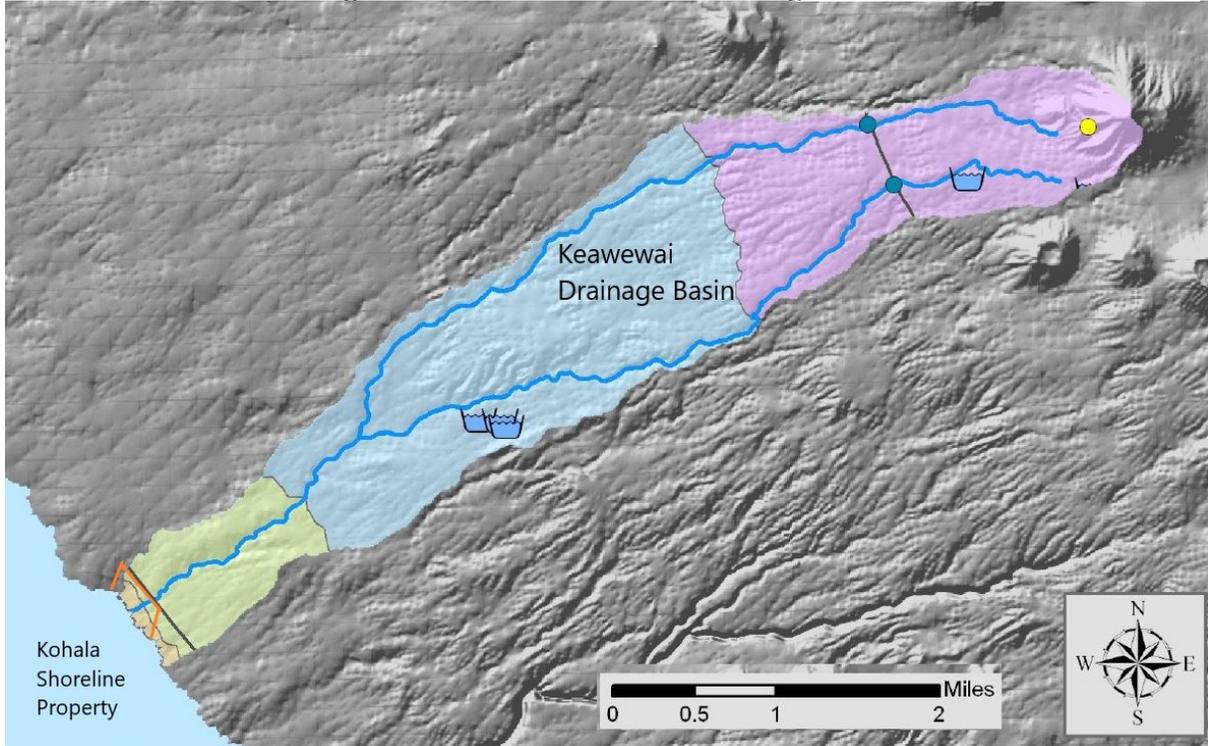
Some degree of sediment input to coastal waters is natural – the gulches that pass through the property were carved out over geologic time by flood events that inexorably carry sediment laden water. Although the marine environment may be adapted to long-term periodic stress from sedimentation events, clearly such adaptation has its limits. Excessive sedimentation is a problem in some locations, and development must not ignore the potential for increased sedimentation. In the big picture in North Kohala, however, the main culprit responsible for excessive sedimentation is overgrazing by cattle and feral ungulates on typically dry lands. When combined with the twin and interrelated scourges of wildfire and fire-adapted alien grasses, sediment discharge to the ocean following periodic severe rainfall events can be substantial.

### *Groundwater*

In the Hawaiian Islands in general, precipitation that is not cycled into evapotranspiration or conducted through streams into the ocean percolates into the ground to collect in the aquifers under the island before slowly making its way to the sea. Water may be trapped between vertical confining layers such as dikes or perched above horizontal confining layers such as volcanic ash soil, forming high level aquifers. If water continues to diffuse through the layers of rock, sand, soil and gravel, it will reach sea level. Fresh water has a lower density than seawater and floats above the salt water-permeated rock in a body shaped much like a lens, most of which exists below sea level. Due to the difference in densities, for every foot the lens extends above sea level it extends 40 feet below sea level, although the lower areas contain a zone of mixing. Basal water tables have inland gradients that can rise as much as four feet per mile in high rainfall areas. This freshwater-permeated rock is the source of most of the State's groundwater. A basal aquifer underlies the dry coastal areas of North Kohala and is the source of fresh water here as well. This thin, brackish to saline lens overlies saltwater at depth and is in hydraulic contact with seawater at the shoreline. Excessive withdrawals from groundwater can change salinity levels in estuaries, anchialine ponds, and wetlands; excessive nutrients in groundwater derived from infiltration of wastewater and fertilizer can also be a concern. The adverse effects of nutrients are of somewhat less concern for the deep, wave-affected coastlines of leeward North Kohala, where brackish waters emerging from the basal lens mix almost instantly with the background ocean waters, but the concern remains.

Investigations by hydrologist Tom Nance Water Resource Engineering for the current project contained in Appendix 7 and by marine biologist Steve Dollar for a previous project (Marine Research Consultants [MRC] 2010) evaluated in depth the hydrological factors, water chemistry dynamics and marine habitat of the area. This was supplemented by unpublished research by MRC in October 2015. MRC's maps, data and photographs are included as Appendix 6. A summary of

**Figure 6. Keawewai Gulch Drainage Basin**



**Figure 7. Sedimentation into Ocean after Rain Event from Gulches on Kohala Mountain**



these surveys and analysis is presented in this section, which deals with water quality, and in Section 3.1.4 in the context of biology.

On a day to day basis, the primary factor that distinguishes the nearshore marine waters from deeper ocean waters is the steady input of groundwater through percolation from the basal lens. The way to establish the chemistry of the groundwater, especially as it affects marine organisms, is to sample both wells and nearshore marine waters. Samples were taken in 2010 from two high level wells located *mauka* of the property, and three marine transect survey sites were established in the vicinity of the Kohala Shoreline property (Figure 8). Water quality parameters evaluated included the ten specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (d)(Area-Specific criteria for the Kona (west) coast of Island of Hawai‘i). Open Coastal waters) of the State of Hawai‘i Department of Health (DOH) Water Quality Standards. These criteria include total dissolved nitrogen (TDN), nitrate + nitrite nitrogen ( $\text{NO}_3^- + \text{NO}_2^-$ , hereafter referred to as  $\text{NO}_3^-$ ), ammonium nitrogen ( $\text{NH}_4^+$ ), total dissolved phosphorus (TDP), orthophosphate phosphorus ( $\text{PO}_4^{3-}$ ), Chlorophyll a (Chl *a*), turbidity, temperature, pH and salinity. In addition, silica (Si) was also reported because this parameter is a sensitive indicator of biological activity and the degree of groundwater mixing. Groundwater sampling excluded chlorophyll and turbidity.

The well sample results (Table 2) reflect the baseline water chemistry of the water prior to leaking out into the nearshore waters, where it mixes with seawater, with some constituents taken up in biological processes. These samples assisted in analysis of the water chemistry of the nearshore waters.

**Table 2. Lab Results of Well Water Chemistry Samples**

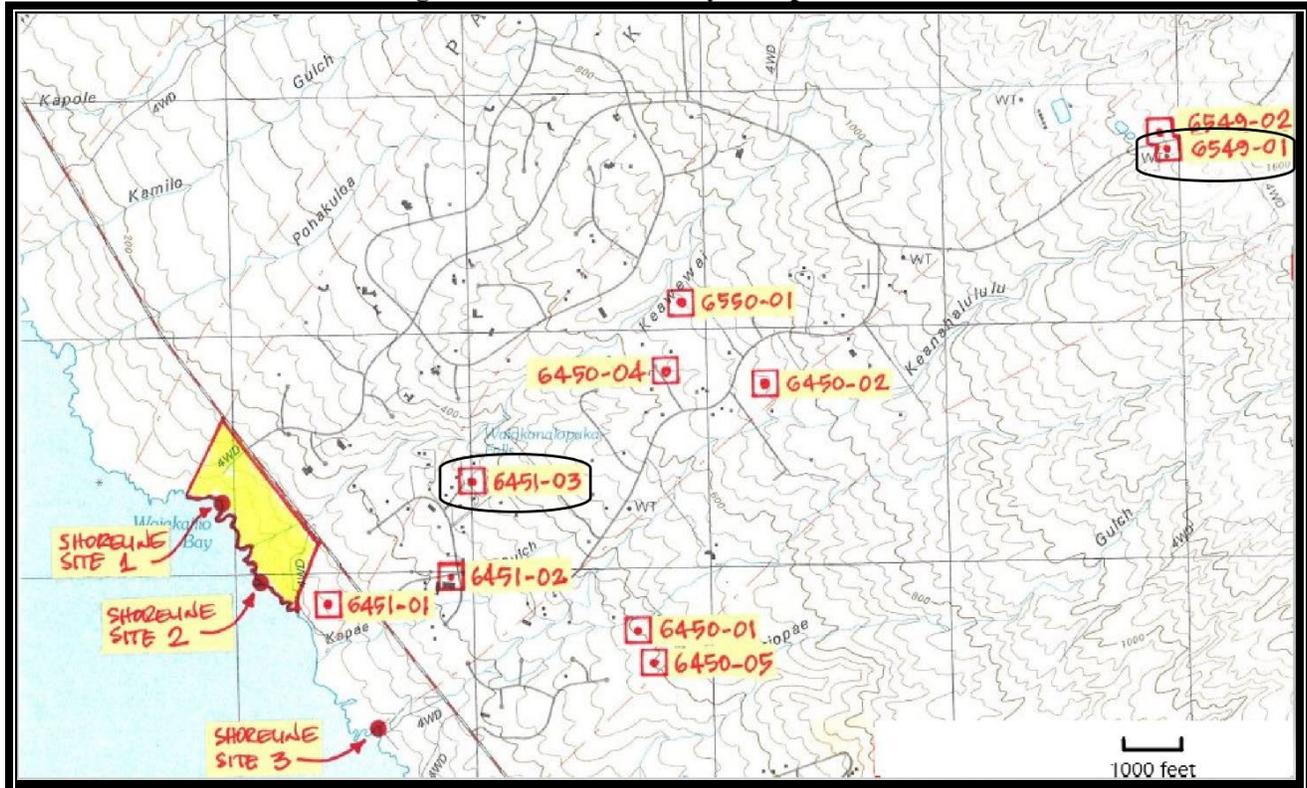
Sample Location	NO <sub>3</sub> (μM)	NH <sub>4</sub> (μM)	DON (μM)	TN (μM)	PO <sub>4</sub> (μM)	DOP (μM)	TP (μM)	Silica (μM)	Salinity (PPT)
Well 6549-01	70.4	1.05	12.0	83.5	3.30	0.15	3.45	875	0.228
Well 6451-03	92.1	1.30	1.75	1.50	95.1	0.65	2.15	962	1.712

Source: TNWRE 2015

- Notes: 1. Samples collected on December 17, 2009 by Tom Nance.  
 2. Laboratory analyses by Marine Analytical Specialists (EPA Labcode: HI 00009).  
 3. Results presented in micro-molar (μM) units can be converted to milligrams per liter by multiplying by the atomic weight and dividing by 1000.

For the marine transects, Site 1 was located off the northern portion of the property in Waiaka‘ilio Bay; Site 2 was located off the southern portion of the property, and Site 3 was located in a small embayment approximately 2,000 feet south of the southern property boundary. As Site 3 is well removed from the property, it served as both as a comparison site to evaluate any unique characteristics at the property and as a control site for any future monitoring that may be required for implementation of the project. All three survey sites were sampled in December 2009 and March 2015 in identical manners.

**Figure 8. Water Quality Sample Sites**



Water quality was evaluated on marine transects that were oriented perpendicular to the shoreline and depth contours. Water samples were collected at ten locations on each transect from just seaward of the shoreline to approximately 200 meters (m) offshore (0, 1, 2, 3, 4, 5, 10, 50, 100 and 200 m). The sampling scheme was designed to span the greatest range of salinity with respect to potential freshwater efflux at the shoreline. Sampling was more concentrated in the nearshore zone because this area receives the majority of groundwater discharge, and hence is most important with respect to identifying the effects of shoreline modification.

Owing to the shallow depth of the nearshore shelf, at stations from the shoreline extending to 4 m from shore, a single sample was collected within 20 centimeters (cm) of the sea surface by swimmers working from shore. At stations 5 to 200 m from the shoreline, samples were collected at two depths; a surface sample was collected within approximately 20 cm of the sea surface, and a bottom sample was collected within 1m of the sea floor.

Surface water samples were collected by filling pre-rinsed, 1-liter polyethylene bottles. Deep water samples were collected using a Niskin-type oceanographic sampling bottle. The bottle is lowered to the desired sampling depth (approximately 1-2 m off the bottom) with spring-loaded endcaps held open so water can pass freely through the bottle. At the desired sampling depth, a weighted messenger released from the surface triggers closure of the endcaps, isolating a volume of water.

Subsamples for nutrient analyses were immediately placed in 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice. Analyses for Si,  $\text{NH}_4^+$ ,  $\text{PO}_4^{3-}$ , and  $\text{NO}_3^-$  were performed on filtered subsamples with a Technicon Autoanalyzer using standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TDN and TDP were analyzed in a similar fashion following digestion. Dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated as the difference between TDN and dissolved inorganic N, and TDP and dissolved inorganic P, respectively.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Chl *a* was measured by filtering 300 ml of water through glass-fiber filters; pigments on filters were extracted in 90% acetone in the dark at -20°C for 12-24 hours. Fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer. Salinity was determined using an AGE Model 2100 laboratory salinometer with a readability of 0.00011 parts per thousand (ppt). Turbidity was determined using a 90-degree nephelometer and reported in nephelometric turbidity units (NTU) (precision of 0.01 NTU). Vertical profiles of salinity, temperature and depth were acquired using an RBR-620 CTD calibrated to factory standards.

All fieldwork for both surveys was conducted by Dr. Steven Dollar. All laboratory analyses were conducted by Marine Analytical Specialists in Honolulu, HI (Labcode: HI 00009). This analytical laboratory possesses acceptable ratings from EPA-compliant proficiency and quality control testing.

Within Appendix 6, Tables 1 and 2 of show results of all water chemistry analyses for samples collected off the property in March 18, 2015, while Tables 3 and 4 show similar results for December 2009. Table 1 shows concentrations of dissolved nutrients in micromolar ( $\mu\text{M}$ ) units; Table 2 shows concentrations in micrograms per liter ( $\mu\text{g/L}$ ). Concentrations of eight dissolved nutrient constituents in surface and deep samples are plotted as functions of distance from the shoreline in Figures 2 (2015) and 3 (2009). Values of salinity, turbidity, Chl *a* and turbidity as functions of distance from shore are shown in Figures 4 (2015) and 5 (2009).

Several patterns of distribution are evident in Tables 1-4 and Figures 2-5 of Appendix 6. It can be seen in Figures 2 and 3 that at all three transects, the dissolved nutrients Si  $\text{NO}_3^-$  and TN display distinctly elevated concentrations in the samples collected within about 5 m from the shoreline at transect sites 2 and 3. The peak values at the shoreline were at the shoreline at Transect 1 in 2015, although no such distinct nearshore peak is evident for these nutrients at transect site 1 in 2009. Salinity displays the opposite trend, with sharply lower concentrations in the nearshore samples at all sites in 2015, and at sites 2 and 3 in 2009 (Appendix 6, Figures 4 and 5).

These patterns are a result of concentrated input of groundwater to the ocean near the shoreline. Low salinity groundwater, which typically contains high concentrations of Si and  $\text{NO}_3^-$ , percolates to the ocean at the shoreline, resulting in a nearshore zone of mixing. In many areas of the Hawaiian Islands, such groundwater percolation results in steep horizontal gradients of increasing salinity and decreasing nutrients moving seaward.  $\text{PO}_4^{3-}$  is also generally elevated in groundwater relative to ocean water. However, during both sampling years, the patterns of horizontal gradients of concentrations of  $\text{PO}_4^{3-}$  do not show the same uniformly progressive decreases with distance from shore as Si and  $\text{NO}_3^-$ . Horizontal gradients of TN and TP reflect the patterns of  $\text{NO}_3^-$  and  $\text{PO}_4^{3-}$ ,

respectively. Horizontal gradients of  $\text{NH}_4^+$  were evident close to the shoreline during both years of sampling, but much less pronounced than for inorganic nutrients.

At the open coastal sampling locales off the property, the zone of mixing is small, extending only several meters from shore. These gradients are far less pronounced than at other areas of West Hawai'i where either semi-enclosed embayments occur or mixing processes are less vigorous.

Water chemistry parameters that are not associated with groundwater input (TON, TOP) do not show a sharp gradient of decreasing concentration with respect to distance from the shoreline. Rather, these constituents show no consistent pattern across the horizontal ranges of the sampling area.

Similar to the patterns of dissolved inorganic nutrients (Si and  $\text{NO}_3^-$ ), the distribution of Chl *a* and turbidity also display peaks near the shoreline, with rapidly diminishing values seaward of the shoreline (Tables 1-4, Figures 4 and 5 of Appendix 6). Beyond 10 m from the shoreline, the concentration of Chl *a* in surface waters is essentially constant across the sampling scheme at values below 0.2  $\mu\text{g/L}$  in 2015 (Figure 4) and 0.1  $\mu\text{g/L}$  in 2009 (Figure 5). Turbidity displays the same trend with peak values near the shoreline and rapidly diminishing values beyond about 10 m from the shoreline which extend across the remainder of the sampling regime (Figures 4 and 5).

It can be seen in Tables 1-4 of Appendix 6 that chemical concentrations at the most seaward sampling stations (200 m from shore) at all three sites are similar and represent open coastal ocean waters with little influence from land.

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. The concept of using such mixing models which scale nutrient concentrations to salinity is utilized by the Hawai'i State DOH for establishing a unique set of water quality standards for the West Coast of the Island of Hawai'i [Hawai'i Administrative Rules Chapter 11-54-06 (d)]. As the northern limit of these regulations is Malae Point in North Kohala, the shoreline area containing the Kohala Shoreline property is included in the West Hawai'i criteria.

Figures 6 and 7 of Appendix 6 show plots of the concentrations of Si,  $\text{NO}_3^-$ ,  $\text{PO}_4^{3-}$ , and  $\text{NH}_4^+$  as functions of salinity for the samples collected at each transect site off the Kohala Shoreline property in 2015 and 2009, respectively. Each graph also shows two conservative mixing lines constructed by connecting the endmember concentrations of open ocean water and groundwater from two high level potable wells located upslope of the property (TNWRE 2010).

Comparison of the curves produced by the distribution of data with conservative mixing lines provides an indication of the origin and fate of the material in question. If the parameter in question displays purely conservative behavior (i.e., no input or removal from any process other than physical mixing), data points should fall on, or near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to

groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as biological uptake, data points will fall below the mixing line.

Dissolved Si represents a check on the method, as this material is present in high concentrations in groundwater, low concentration in open coastal waters, and is not a major component of fertilizer or sewage effluent. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figures 6 and 7 of Appendix 6 that all data points for all three transect sites fall in a linear array on the conservative mixing line created with end-point concentrations from the two wells. In 2014, data points for Transect 1 fell close to the mixing line for Well 6451-03, while data points for Transect 3 lie closer to the mixing line for Well 6451-03. Data points for Transect 2 fall slightly below both mixing lines. In 2009, data points for Transect 2 fall on the mixing line for Well 6451-03. While there are slight variations between transects, and between sampling years, the straight lines prescribed by the data points lying close to the mixing lines support the contention that Si is behaving as a conservative tracer and that well water sampled from the upslope wells is similar in composition to groundwater entering the ocean off the Kohala Shoreline property.

The plots of  $\text{NO}_3^-$  versus salinity show a somewhat dissimilar distribution to that of Si. While data points for Transects 1 and 2 fall near the mixing line, data points for Transect 3 deviate in a linear array above the mixing line. These patterns indicate that on Transect 3 there is a subsidy of  $\text{NO}_3^-$  in the nearshore ocean relative to what would be predicted from mixing of natural groundwater and open coastal water. Such subsidies may result from either different composition of groundwater entering the ocean at the shoreline than in upslope wells, or from groundwater nutrient subsidies from developments upgradient of the Kohala Shoreline property (i.e., Kohala Ranch and Kohala Estates). Concentrations of  $\text{NO}_3^-$  on Transect 2 were substantially higher in 2009 compared to 2015.

While  $\text{PO}_4^{3-}$  is also generally found in groundwater in higher concentrations than open coastal water, it occurs in far lower concentrations compared to  $\text{NO}_3^-$ , owing in part to a high absorptive affinity of phosphorus in soils or rock. It can be seen in Figures 6 and 7 of Appendix 6 that when plotted as functions of salinity, concentrations of  $\text{PO}_4^{3-}$  do not prescribe linear patterns similar to Si and  $\text{NO}_3^-$ . Some of the highest values are at the highest salinities, while some of the lowest values are at the lower salinities.

Plots of concentrations of  $\text{NH}_4^+$  versus salinity show similar relationship as  $\text{PO}_4^{3-}$ . Plots of concentrations of  $\text{NH}_4^+$  versus salinity exhibit no linear trends with respect to salinity (Figures 6 and 7). As with  $\text{PO}_4^{3-}$  some of the highest values of  $\text{NH}_4^+$  occurred at the highest salinities, suggesting that the source of most of the  $\text{NH}_4^+$  in the nearshore ocean is not from the land but rather from biological processes occurring in the ocean.

The West Coast of the Island of Hawai'i has area-specific water quality standards [Chapter §11-54-6(d)]. The major difference between these specific criteria and the general criteria for open coastal waters for the rest of the state is the consideration that high nutrient groundwater mixes with oceanic water within the nearshore zone. As a result, area-specific criteria for nutrients that occur in high concentrations in groundwater relative to ocean water ( $\text{NO}_3^-$ , TDN,  $\text{PO}_4^+$ , and TDP) are

evaluated by two criteria based on salinity. In areas where nearshore marine water salinity is greater than 32‰, specific criteria for geometric means apply. Geometric means are calculated at each sampling station from three values collected on three sampling dates, spaced within a 14-day period. For samples with salinity below 32‰, compliance with the DOH criteria is defined by the slope of the regression line of the nutrient concentration as a function of salinity. Slopes greater than the “not to exceed” values stated in the standards are deemed out of compliance. (Note that for the present assessment, three separate samplings within a 14-day period were not conducted).

In Appendix 6, it can be seen in Tables 1-4 that in 2015 only a single sample at the shoreline of Transect 1 had salinity less than 32‰, while in 2009 Transect 2 was the only sampling location with at least one sample with salinity less than 32‰. Hence, it can be interpreted that the relevant DOH compliance criteria are the regression statistics shown in §11-54-6(d)(1)(ii). Table 5 shows the slopes and upper and lower 95% confidence limits of linear regressions of NO<sub>3</sub><sup>-</sup>, TDN, PO<sub>4</sub><sup>3-</sup>, and TDP as functions of salinity from each of the three ocean transects. Also shown in Table 5 are the “compliance slopes” listed in the West Hawai‘i area-specific water quality standards. As stated in the WQS, “...the absolute value of the upper 95% confidence limit for the calculated sample regression coefficient (i.e., slope) shall not exceed the absolute value listed in the regulations.” When linear regression analyses are performed with data in units of µg/L, the absolute values of confidence limits of the slope of the regression line of NO<sub>3</sub><sup>-</sup> versus salinity exceeded the absolute values of the specific criteria slope (-31.92) on Transects 2 and 3 in 2009 and Transect 1 in 2015. The upper confidence limit of TDN on Transect 2 in 2009 and Transect 1 in 2015 also exceeded the specific criteria slope (Table 5).

The area-specific DOH standards for West Hawai‘i also include three parameters (NH<sub>4</sub><sup>+</sup>, Chl a and turbidity) that are not subject to the conditions of salinity based on the 32‰ boundary. Rather, the specific geometric mean criteria apply to all values of these parameters regardless of salinity. As shown in Appendix 6, Tables 2 and 4, there are many values of NH<sub>4</sub><sup>+</sup> on all three transects within 50 m of the shoreline exceed the geometric mean standard. Similarly, most of the values of turbidity exceed standards. As stated above, with little or no development presently on the Kohala Shoreline property, the offshore conditions may represent essentially the natural setting of the area, although there are legitimate differences of opinion regarding this. The DLNR Division of Aquatic Resources has stated that the turbidity goes beyond that which should be expected as a result of natural surface erosion in these nearshore waters, and that furthermore there are clear effects on the aquatic biota, particularly coral cover. Conversely, as conjectured by MRC, it is possible that the geometric mean values that are presently DOH compliance criteria do not fully consider the natural setting of at least some nearshore areas subject to ephemeral stream flow in West Hawai‘i. This subject is discussed more fully in Section 3.1.4 in the context of aquatic biota.

#### *Impacts and Mitigation Measures: General Considerations*

Given the two input water sources to the nearshore environment – runoff channeled into gulches and groundwater emerging through the basal lens – it is important to eliminate or reduce pollution from both gulches and groundwater, and to evaluate the effect of changes in water quality and quantity when they do occur. When land in a dry, scrubby, sloped area is developed with homes, there are changes in the input dynamics. Sediment input can increase temporarily during construction, if

mitigation is absent or ineffective. Excess sediment input can also occur during occupation of the homes as well, although some landscape and development practices can actually reduce the amount runoff and erosion and thus the sediment transported in gulches. Separately, nutrients from fertilizers, pesticides and other contaminants can infiltrate the soil column and pass through rock into the groundwater. If transported in excessive amounts that exceed the capacity of the soil and rock to remediate them, these contaminants can affect groundwater.

### *Impacts and Mitigation Measures: Surface Waters*

Construction has the potential to produce uncontrolled excess sediment from soil erosion during and after clearing and excavation that may impact natural watercourses, water quality and flooding. Contaminants associated with heavy equipment and other sources during construction can impact surface water and groundwater if not mitigated effectively. In this discussion, mitigation that will be required – either by law, regulation or CC&R codicils that are expected to be mandated when permit approvals are granted – is presented first, to set the stage for the evaluation of impacts.

In order to minimize the potential for sedimentation and erosion of shoreline areas, the contractor shall perform all earthwork and grading in conformance with Chapter 10, Erosion and Sediment Control, Hawai‘i County Code. Grading permits are expected to be required for development of infrastructure (roadways and parking areas), and grading plans will be developed by an engineer and submitted to the County Department of Public Works.

Furthermore, because infrastructure development for the project will disturb more than one acre, a National Pollutant Discharge Elimination System (NPDES) permit will likely be needed before the project infrastructure construction commences. This permit requires the completion of a Storm Water Pollution Prevention Plan (SWPPP). In order to properly manage storm water runoff, the SWPPP will describe the emplacement of a number of best management practices (BMPs) for the project. These BMPs may include, but will not be limited to, the following:

- Minimization of soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or binding substances, as soon as possible after working;
- Minimization of sediment loss by emplacement of structural controls possibly including silt fences, gravel bags, sediment ponds, check dams, and other barriers, in order to retard and prevent the loss of sediment from the site;
- Minimizing disturbance of soil during periods of heavy rain;
- Phasing of large projects in order to disturb a minimum necessary area of soil at a particular time;
- Application of protective covers to soil and material stockpiles;
- Construction and use of a stabilized construction vehicle entrance;
- Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
- Routine maintenance of BMPs by adequately trained personnel; and
- Cleanup of significant leaks or spills and disposal at an approved site, if they occur.

At the points in time when individual lot owners build their homes, there may be additional land clearing that involves areas of an acre or less, which may or may not be subject to NPDES or grading permits. In order to ensure proper mitigation for potential sedimentation, the project will adopt relevant protocols for grading of the lots, similar to those in the *Recommended Construction Best Management Practices (BMPs) for Land Disturbance of Less Than One Acre* that was approved by Board of Directors of the Kohala Ranch Community Association, on August 9, 2007. Specifically, the following are proposed as both CC&Rs applicable to all lots in the project and as conditions of approval of the SMA Use Permit:

(a) Construction Management Techniques

- (1) Limit clearing and grubbing to the minimum necessary for grading and equipment operation.
- (2) Sequence construction to minimize the exposure time of the cleared surface area
- (3) Stage or phase construction for large projects. Stabilize the land surface in one phase before land disturbing activities are initiated in another phase. Stabilization must be accomplished by temporarily or permanently protecting the disturbed soil surface from rainfall impacts and runoff.
- (4) Erosion and sediment control measures must be in place and functional before earth moving operations begin. These measures shall be properly constructed and maintained throughout the construction period.
- (5) All control measures must be checked and repaired as necessary, for example, weekly in dry periods and within twenty-four hours after any rainfall of 0.5 inches or greater within a 24-hour period. During prolonged rainfall, daily checking may be necessary. Maintain records of checks and repairs.
- (6) Maintain records of the duration and estimated volume of storm water discharge(s).
- (7) A specific individual shall be designated to be responsible for erosion and sediment controls on each project site.

(b) Vegetation Controls

- (1) Pre-construction vegetative ground cover shall not be destroyed, removed, or disturbed more than twenty calendar days prior to land disturbance.
- (2) Temporary soil stabilization with appropriate vegetation must be applied on areas that will remain unfinished for more than thirty calendar days.
- (3) Permanent soil stabilization with perennial vegetation or pavement shall be applied as soon as practical after: final grading. Irrigation and maintenance of the perennial vegetation must be provided for thirty calendar days or until the vegetation takes root, whichever is shorter.

(c) Structural Controls

- (1) Storm water flowing toward the construction area must be diverted by using appropriate control measures, as practical.
- (2) Erosion control measures shall be designed according to the size of disturbed or drainage areas to detain runoff and trap sediment.
- (3) Water must be discharged in a manner that the discharge shall not cause or contribute to a violation of State of Hawai'i Water Quality Standards.

The project engineer will also explore the use of “mini-sediment basins”, as successfully implemented in the Kohala Estates subdivision. Rather than excavating one or two large basins, these involve multiple areas that enhance existing topographic basins near intermittent gulches to capture small amounts of runoff that cumulatively offer significant percolation. These professionally engineered but low-key basins are lower in cost and involve less disruption to scenery and vegetation (Susan Fischer, pers. comm.).

In addition to the above requirements related to grading permits, NPDES permits and locally derived BMPs, CC&Rs will require adherence to a set of measures based on Low Impact Design (LID) Guidelines (Hawai‘i CZM Program 2006). While not all design guidelines are appropriate to any given site, one principle that connects all LID practices is sustainability.

“LID is defined as a more sustainable land development pattern than the conventional method currently used in most areas. It incorporates a suite of landscaping and design techniques known as “Better Site Design” that attempt to maintain the natural, pre-development hydrology of a site and the surrounding watershed. An important LID principle is the idea that stormwater is not merely a waste product to be disposed of, but rather that rainwater is a resource. LID also integrates a range of structural best management practices (BMPs) for road design and stormwater and wastewater management systems that minimize environmental impacts (Hawai‘i CZM Program 2006: 1-2).

These guidelines seek to prevent environmental impacts rather than compensate for them; minimize the use of regional conveyance systems; preserve natural areas; reduce impact on watershed hydrology; utilize less complex, non-structural methods to lower cost and maintenance; and create a multifunctional landscape.

LID Guidelines were part of the basis for Best Management Practices specifically designed for the current site by landscape architect Leonard Bisel of B+K Design Group. The measures are consistent with the U.S. Green Building Council (USGBC) requirements and strategies needed to obtain Leadership in Energy and Environmental Design (LEED) certification. They are also consistent with requirements and strategies needed to obtain certification in the Sustainable Sites Initiative (SITES) program, which was developed, in part, by the American Society of Landscape Architects. These measures will act to reduce the quantity of hardscape, increase the infiltration capacity of the open areas on the lot, and reduce erosion and sedimentation. For the current project, the following guidelines will be incorporated in project design as requirements of the CC&Rs. These measures are described and illustrated in detail in Appendix 5 and summarized below.

#### DESIGN CONCEPT #1 - Limit site disturbance:

This design measure has a simple and straightforward rationale: the less area that is disturbed during the development and construction of new home sites, the less potential there will be for increased erosion and sediment loss. The following will be required to be undertaken to ensure limited site disturbance:

1. Clearing and grading of the site will be done in such a way that existing, mature vegetation above and/or below an excavated area is preserved. Vegetated buffers above construction sites aid in the prevention of high-volume sheet flow across cut/fill areas. Vegetated buffers below construction sites help to filter and trap sediment before it can travel to existing waterways.
2. To ensure that significant natural characteristics such as landforms, vegetation, scenic qualities and open space are preserved, a significant portion of each lot will be reserved as "Natural Area." No development will be allowed within the Natural Areas. Prior to planning of the homes and hardscape on each lot, naturally vegetated buffers 10 feet in width on both sides of gulches will be delineated and preserved in a lot landscape plan to be filed in accordance with CC&Rs.
3. As each lot is developed, the homeowner and architect will work with the homeowners' association to identify a proposed Building Envelope. All site improvements will fall within the limits of the proposed Building Envelope. Site improvements include, but are not limited to, built structures, private outdoor spaces, grading, drainage, fencing, and retaining walls. Additionally, certain site improvements, such as utility connections, may fall outside of the Building Envelope. Building Envelopes should comply with all setback criteria and respond to natural features, such as topography and vegetation. Once the Building Envelope has been established, the remainder of the Suggested Building Site Location will become Natural Area.

For areas within the Building Envelope, the following design concepts will be implemented:

DESIGN CONCEPT #2 - Take a less engineered approach to site grading:

Minimizing the amount of disturbed area is an important consideration in terms of reducing erosion. The unique physical characteristics of a site are also important and should be acknowledged and expressed in the site design and grading. Grading methods that strike a balance between the two and are not entirely focused on the efficiency of space are preferred. The following will be required to be considered in the development of each parcel:

1. The grading plan that will be developed by a Civil Engineer in consultation with a Landscape Architect must keep aesthetics in mind and focus on the sense of place. All cut and fill slopes, retaining walls and other site features must be designed to blend into, and reflect the natural characteristic of the site and the surrounding area. Avoid grading that has static, engineered slopes that look unnatural and do not blend in with the surrounding topography. Encourage grading that has natural, undulating slopes that mimic the adjacent landforms and incorporates its natural features.
2. Foundations and exterior spaces should step down with, or be set into, the natural topography wherever practical.
3. Site grading must be adjusted to retain existing vegetation and trees, wherever possible.

### DESIGN CONCEPT #3 - Maximize percolation / Minimize runoff:

Impervious surfaces such as roofs, driveway and parking areas, patios, pool decks and walkways reduce the absorption of rainwater into the ground and increase surface runoff. The following will be considered in the development of each parcel to maximize percolation and minimize runoff:

1. Impervious surfaces will be reduced to the smallest area possible. All other areas will be maintained as landscaped area and covered with planting, porous stone ground cover or mulch. Wherever possible, all existing vegetated areas will be retained.
2. Utilize porous materials for driveways, parking areas, and outdoor spaces where possible. Rainwater from non-porous or semi-porous surfaces will be directed onto landscaped areas. Roof runoff will be captured in gutters and either directed to a cistern and stored for irrigation or directed to a landscaped area with the potential to absorb up to two inches of roof runoff, reducing the volume of site runoff even in moderately large storms.
3. Existing vegetated areas and proposed landscaped areas will reduce the velocity of storm water runoff and prevent erosion. Landscaped areas allow runoff to percolate into the soil, which promotes groundwater recharge, filters sediment and other pollutants, and helps to prevent flooding.
4. Install grassed swales or drainage trenches, as needed, to direct and transmit excess surface flow to detention basins to collect and slow down runoff from impervious surfaces.
5. Proper design and monitoring of landscape irrigation are important considerations in controlling erosion and sedimentation. The following will be considered in the development of each parcel when designing and maintaining an irrigation system, as well as common area irrigation):
  - a) Utilize low-flow/low application rate irrigation heads and drip irrigation that will not apply water faster than it can be absorbed by the soil.
  - b) Separate irrigation valves/zones by plant type (combine plants with similar watering requirements), microclimate (i.e. sunny areas vs. shady areas), and physical site differences (i.e. slope areas vs. flat areas).
  - c) Install a flow sensor which will shut off the irrigation system in the event of a sudden pressure loss due to a broken head, ruptured mainline or lateral line, or defective valve.

### DESIGN CONCEPT #4 – Alternative approaches to slope retention/stabilization:

To the extent possible, site disturbance/grading will be limited in order to minimize erosion and sediment loss. Proposed development will be designed to fit the natural contours, where possible. The use of retaining walls and graded slopes may be required in order to build on hilly terrain. Retaining walls can be effective in controlling erosion because they break-up and slow down the rate of surface flow on a slope. Where retaining walls and graded slopes are utilized, the following must be considered as alternate approaches to slope retention and stabilization in a plan designed by an Architect/Engineer in consultation with a Landscape Architect:

1. Retaining walls will be designed to blend in with the adjacent topography. Curved, organic forms are encouraged rather than straight lines. Where possible, utilize stone that is native to

the area to construct the walls. Break up long lengths of retaining walls with materials such as boulders and portions of dry-stacked boulder walls or consider allowing portions of the existing slope to extend through the wall. Introduce plantings at the top and bottom of walls to create a softer look. Where terraced walls are utilized, incorporate planting between the terraces.

2. Existing vegetation will be required to be retained wherever possible. When existing trees will be saved, the ground surface and flow of water will not be altered within an area that extends out 1-1/2 times the diameter of the drip line of the tree. Appropriate walls should be constructed to maintain existing grades.
3. All exposed slopes should be stabilized to prevent erosion and sedimentation. The following are options to consider instead of (or in addition to) planting; geotextile mats, erosion control blankets, temporary/permanent seeding, reinforced mats, bonded fiber matrices, and stone blankets.
4. Where possible, keep drainage as a natural, sheet surface flow. Runoff will be directed into grassed or vegetated swales, detention basins, landscaped areas, storm drains or other areas located downstream that are not prone to erosion.
5. All areas of exposed soil will be vegetated or covered with a stable layer of mulch as soon as the site grading is completed. All slope areas will be planted with trees, shrubs, and ground covers that are both appropriate for the area and are known to be effective for erosion control. A list of suggested plants for slope retention and stabilization is provided in Appendix 5.

Although home construction on the Kohala Shoreline property, if done poorly, could add slightly to sedimentation, careful development can actually substantially *reduce* the amount of sediment-laden runoff that enters the ocean relative to the no-development condition. This is because the current site is typical of the leeward North Kohala coast, with many bare or poorly vegetated areas subject to overgrazing by goats and the ravages of fire. Without management, the cycle of alien grass proliferation, overgrazing, fire, erosion, and soil depletion will continue indefinitely. The extensive array of measures that will be required as part of development by regulations, laws and CC&R mandated actions will minimize erosion and sedimentation. Although the property is responsible for less than 3 percent of the runoff that flows in deep gulches through the property – with areas upland responsible for 97 percent – it is still possible to make a meaningful reduction. Any reduction is critical. In the opinion of the DLNR Division of Aquatic Resources, repeated high runoff has measurably affected coral cover. The need for reducing sedimentation to maintain and improve the aquatic biota is carried through in Section 3.1.4, below.

#### *Impacts and Mitigation Measures: Groundwater*

Development of any area can bring about changes in groundwater quantity and chemistry. In general, the impacts from a project as small as a six-lot subdivision are very small, and perhaps undetectable through sampling, but the quantity of impact can be modeled. Water is needed for in-home and landscape irrigation uses. For this area of North Kohala, where water systems are private and there is no long-distance transport of domestic water into the area, water supply comes from local wells. Extracting and utilizing this water diverts it from entering the ocean as groundwater. However, much or even most of that water is recirculated back into the ground through wastewater

and that fraction of irrigation water that is not evaporated from the ground or transpired by plants. In dry areas such as leeward Kohala, about 15 percent of the irrigation water returns. The “return flow” can contain various amounts of pollutants including nutrients and chemicals. Keeping these pollutants to a minimum so as not to degrade receiving waters requires effective wastewater treatment and proper irrigation and cultivation practices, as discussed in the design concepts above. The relationship among these factors can be modeled conceptually:

<b>Groundwater flow beneath property post-development =</b> Groundwater flow beneath property pre-development – Water extracted in wells for development + (Irrigation return flow + Wastewater return flow)
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The hydrologic assessment on water resources in Appendix 7, coupled with the investigations by marine biologists for the project previously proposed for the property (Marine Research Consultants 2010, 2015) evaluated the hydrological factors, water chemistry dynamics and marine habitat of the area. The hydrologic assessment specifically addressed the development of 6 homes utilizing potable water for home use and landscaping under two different scenarios. One is a low-use scenario of 750 gallons per day (gpd), which will be encouraged by the CC&Rs that require a reduced water use footprint in conformance with Low Impact Design Guidelines with low-water use fixtures and landscaping limited to xerophytic species. The second is a higher scenario of 1,500 gallons per day, which would be more typical of resort housing with some restrictions on landscaping. In addition to home use, it is assumed that the subdivision entry feature and public parking area will utilize 1,300-1,500 gpd. Table 3 presents and provides the rationale for expected water quantity and chemistry values resulting from development of homes under the two scenarios.

**Table 3. Potential Changes to Groundwater Discharging Along Property Shoreline**

<b>Component of Flow</b>	<b>Flowrate (MGD)</b>	<b>Nitrogen (lbs/day)</b>	<b>Phosphorus (lbs/day)</b>
<b>Pre-Development</b>	<b>0.80</b>	<b>7.7902</b>	<b>0.7127</b>
Groundwater Withdrawal (Kohala Ranch Wells, 750 gpd)	-0.0028	-0.0268	-0.0024
Groundwater Withdrawal (Kohala Ranch Wells, 1,500 gpd)	-0.0052	-0.0512	-0.0046
Percolation of Wastewater from Leach Field	+0.0028	+0.0337	+0.0037
Excess Landscape Irrigation (750 gpd)	+0.0006	+0.0054	+0.0005
Excess Landscape Irrigation (1,500 gpd)	+0.0012	+0.0120	+0.0010
Capture and Disposal of Increase of Rainfall Runoff in Drywells	+0.0014	0.0076	0.0005
<b>Resulting Post-Development</b>			
Calculated Flowrate (750 gpd) (in MGD)	0.8010	7.8101	0.7150
Calculated Flowrate (1,500 gpd) ( in MGD)	+0.7992	7.7923	0.7133
Change Over Pre-Development Condition (750 gpd) (in %)	+ 0.12%	+ 0.26%	+0.32 %
Change Over Pre-Development Condition (1,500 gpd)( in %)	- 0.10%	+0.03%	+0.08%

Source: Appendix 7. Two scenarios of average water use/home are presented: 750 gpd and 1,500 gpd  
 Notes: Of the 0.85 MGD of groundwater flowing beneath the property and discharging at the shoreline, its average salinity is 5.0 PPT and its nitrogen and phosphorus concentrations are the same as in Well 6451-03 (see Table 2). Salinity changes are negligible and thus not listed in table.  
 Nutrient changes from wastewater based on planned advanced wastewater treatment systems.

Evaluations of changes to groundwater flux and composition resulting from the proposed six-lot subdivision indicate that groundwater flow along the half-mile of coastline fronting the property

would essentially stay the same, varying from an increase of 0.12% under the 750 gpd/home scenario to -0.10% under the 1,500 gpd/home scenario. Accompanying the changes in flow rates would be very relatively small increases in nutrient loading of far less than 0.5% under for nitrogen or phosphorus under any scenario.

The calculated potential changes to groundwater discharging along the project's shoreline are so small as to be undetectable relative to natural seasonal variations of these parameters. Furthermore, dilution of groundwater at the shoreline and within the nearshore zone by turbulent mixing will result in essentially no change to groundwater-marine water dynamics. Even if measured concentrations of nutrients are increased by the projected amounts with the development in place, nearshore waters are so well-mixed by ocean waves that there is little likelihood that concentrations will increase beyond the present ranges of conditions.

It is also noteworthy that post-development nutrients in the effluent groundwater would be considerably lower than in naturally occurring groundwater in other areas of West Hawai'i. Elevated nutrient levels at the shoreline as a result of groundwater discharge are natural conditions along the entirety of the West Hawai'i shoreline. This has occurred as long as the island has existed, pre-dating any human activities. In fact, based on the data collected for this project, the North Kohala coastline experiences some of the smallest discharges of groundwater along the entire West Hawai'i coastline owing to the local geologic and hydrologic processes. Areas with substantially higher natural groundwater input that also contain measurable inputs from human activities, such as the South Kohala and North Kona shorelines, contain some of the most well developed coral reef habitats in Hawai'i. It has been well documented that discharge of groundwater at these areas is not a negative factor with respect to reef development, lending support to the conclusion that the miniscule addition of nutrients off the property will have no adverse effect on water quality.

In summary, results of the water chemistry analysis indicate that there does not appear to be any potential for substantial project-related adverse impacts to marine waters off the property. Changes of land use associated with the proposed project should not change water quality of the offshore area to any discernible extent. Through its methodology of sampling well water in the lower areas of Kohala Ranch, this analysis considered the cumulative nutrient effects of the project plus those of this large residential agricultural subdivision situated *mauka* of the Kohala Shoreline property.

It is important to note concerning water quality that water is a public trust resource. This applies to all water resources without exception. It is the duty of agencies to try to maintain waters in their natural state, protect water for use in drinking, maintain water for Native Hawaiian use, and protect reserved water per water code. Applicants who wish to utilize water must show that:

1. There is no harm in fact, or
2. That any potential harm does not preclude a finding that the requested use is nevertheless reasonable and beneficial.

Furthermore, the applicant:

1. Is obligated to demonstrate affirmatively that the proposed use will not affect a protected use;
2. Must demonstrate the absence of a practicable alternative water source; and
3. If the impact is found to be reasonable and beneficial, then in light of the cumulative impact of existing and proposed diversions on trust purposes, must implement reasonable measures to mitigate this impact.

The use of groundwater to sustain homes in this area zoned by the County and State for housing is a reasonable and beneficial use, and the measures the applicant proposes to be required as a condition of permits are both the maximum measures feasible and will effectively protect the water resources from harm.

### 3.1.4 Flora, Fauna and Ecosystems

A terrestrial biological survey was conducted at several times between 2010 and 2018 by Ron Terry, Ph.D., the results of which are presented in Appendix 2 and summarized below. Prior work in the offshore waters off the property documented in Marine Research Consultants (MRC 2010), with additional unpublished survey work done in 2015, evaluated nearshore water chemistry and assessed impacts of altering groundwater quality and chemistry, providing the basis for the analysis in this section.

#### *Existing Terrestrial Biology*

As typical for the region, the property is thickly covered with alien vegetation. Virtually the entire site is dominated by a low forest of scattered *kiawe* (*Prosopis pallida*) with an understory of buffel grass (*Cenchrus ciliaris*). A total of 30 plant species was identified (Table 4). Only four common plants, the roadside herb ‘uhaloa (*Waltheria indica*), the cherished yellow-flowered ‘ilima (*Sida fallax*), the shoreline succulent ‘akulikuli (*Sesuvium portulacastrum*), and the strand vine pa‘ū O Hi‘iaka (*Jacquemontia ovalifolia*), are indigenous to the Hawaiian Islands. All plant species observed in the survey are listed in Table 3 below. No threatened or endangered plant species (USFWS 2019) are present or would be expected on the property. Furthermore, no plant critical habitat is present on the property or within four miles of the property (<https://ecos.fws.gov/ecp/report/table/critical-habitat.html>). The closest plant critical habitat is at above 2,000 feet in elevation in the Kohala Mountains.

#### *Fauna*

The mammalian fauna of the project area is composed mainly of introduced species, including small Indian mongooses (*Herpestes a. auropunctatus*), feral cats (*Felis catus*), roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*). None are of conservation concern and all are deleterious to native flora and fauna.

**Table 4. Plant Species on Property**

Scientific Name	Family	Common Name	Life Form	Status*
<i>Abutilon incanum</i>	Malvaceae	Hoary abutilon	Herb	A
<i>Atriplex semibaccata</i>	Chenopodiaceae	Australian saltbush	Herb	A
<i>Boerhavia coccinea</i>	Nyctaginaceae	Boerhavia	Herb	A
<i>Cenchrus ciliaris</i>	Poaceae	Buffel grass	Grass	A
<i>Cenchrus setaceus</i>	Poaceae	Fountain grass	Grass	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden spurge	Shrub	A
<i>Chenopodium murale</i>	Chenopodiaceae	Goosefoot	Herb	A
<i>Cleome gynandra</i>	Capparaceae	Spider flower	Herb	A
<i>Commelina benghalensis</i>	Commelinaceae	Hairy honohono	Herb	A
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Hedgehog gourd	Vine	A
<i>Desmodium sp.</i>	Fabaceae	Desmodium	Vine	A
<i>Eragrostis amabilis</i>	Poaceae	Lovegrass	Grass	A
<i>Festuca bromoides</i>	Poaceae	Brome fescue	Grass	A
<i>Ficus microcarpa</i>	Moraceae	Chinese banyan	Tree	A
<i>Jacquemontia ovalifolia</i>	Convolvulaceae	Pa‘ū O Hi‘iaka	Vine	I
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Leonotis nepetifolia</i>	Lamiaceae	Lion’s ear	Herb	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Merremia aegyptia</i>	Convolvulaceae	Hairy merremia	Vine	A
<i>Portulaca oleracea</i>	Portulacaceae	Pigweed	Herb	A
<i>Portulaca pilosa</i>	Portulacaceae	Portulaca	Herb	A
<i>Prosopis pallida</i>	Fabaceae	Kiawe	Tree	A
<i>Ricinus communis</i>	Euphorbiaceae	Castor bean	Shrub	A
<i>Sesuvium portulacastrum</i>	Aizoaceae	Akulikuli	Herb	I
<i>Sida fallax</i>	Malvaceae	‘Ilima	Shrub	I
<i>Sida rhombifolia</i>	Malvaceae	Broom weed	Herb	A
<i>Spergula arvensis</i>	Caryophyllaceae	Corn spurry	Herb	A
<i>Verbesina encelioides</i>	Asteraceae	Golden crown beard	Herb	A
<i>Tribulus terrestris</i>	Zygophyllaceae	Puncture vine	Herb	A
<i>Waltheria indica</i>	Sterculiaceae	‘Uhaloa	Herb	I

\* A = alien; I = indigenous; botanical names follow Wagner, Herbst and Sohmer 1990, as updated.

Almost all birds seen on the site were wide-ranging aliens such as common mynas (*Acridotheres tristis*), yellow-billed cardinals (*Paroaria capitata*), saffron finches (*Sicalis flaveola*), gray francolins (*Francolinus pondicerianus*) and zebra doves (*Geopelia striata*). Other than the common shorebird ‘ulili or wandering tattler (*Heteroscelus incanus*) and the Pacific golden-plover or kolea (*Pluvialis fulva*), which were observed right on the shoreline rocks, no birds indigenous to Hawai‘i were identified during the survey.

No critical habitat (<https://ecos.fws.gov/ecp/report/table/critical-habitat.html>) for terrestrial fauna is present in the area, but some endangered species may overfly this and all other areas of the Island of Hawai‘i. The Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian sub-species of Newell’s shearwater (*Puffinus newelli*), and the band-rumped storm-petrel (*Oceanodroma castro*) have been recorded over-flying various areas on the Island of Hawai‘i between late April and the middle of

December each year. The Hawaiian petrel and band-rumped storm-petrel are listed as endangered, and Newell's shearwater as threatened, under both federal and State of Hawai'i endangered species statutes. These seabirds hunt over the ocean during the day and fly to higher elevations at night to roost and nest. The Hawaiian petrel and the band-rumped storm petrel are known to nest at elevations well above 5,000 feet on the Big Island, nowhere near the property. But during its breeding season from April through November, the Newell's shearwater burrows under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, it needs an open downhill flight path through which it can become airborne. Once abundant on all the main Hawaiian Islands, most Newell's shearwaters are today found in the steep terrain between 500 to 2,300 feet on Kaua'i (<https://www.fws.gov/pacificislands/fauna/newellsshearwater.html>).

The primary cause of mortality for all three species in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals. These listed seabirds would not directly utilize the property but could occasionally overfly it.

The only native Hawaiian land mammal, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), may also occur in the area, as it has been observed in almost all parts of the island of Hawai'i. Although the sparse *kiawe*-buffel grass vegetation of the site does not represent essential habitat for this endangered species, bats have been observed in *kiawe* scrub vegetation in other parts of West Hawai'i, and are undoubtedly present at least occasionally.

#### *Impacts and Mitigation Measures to Terrestrial Biology*

In order to frame impacts to terrestrial flora and fauna, it is relevant that the property has been historically used for ranching, has been intensely affected by wildfire and is dominated by introduced plant species. As illustrated in Figure 4, the project will include gradual planting of native plants around homes near the shoreline with the intent to restore native species to enhance the biological environment and human enjoyment of the area. The plants envisioned – including pohuehue (*Ipomoea pes-caprae*), pā'ū-O-Hi'iaka (*Jacquemontia ovalifolia*), 'ilima (*Sida fallax*), ōhelo kai (*Lycium sandwicense*), akulikuli (*Sesuvium portulacastrum*), hinahina (*Heliotropium anomalum*) and kauna'oa (*Cuscuta sandwichiana*) – were selected because they were observed to be thriving on the site and/or in nearby areas without benefit of irrigation. Although low-lying and often grayish green and inconspicuous, with small flowers and fruit, they represent the natural vegetation and have rich cultural associations as well. These plants can be slowly added with gradual effort. Considering the existing environment and planned improvements to the flora, the development will produce almost no impacts to any species of flora and fauna other than the alien species already present. However, several mitigation measures that protect wide-ranging endangered animal species are recommended.

To minimize impacts to the endangered Hawaiian hoary bat, initial infrastructure contract conditions and homeowner construction CC&Rs will prohibit removal or trimming of woody plants

taller than 15 feet from June 1 to September 15 each year. This period is the most vulnerable time in the bat birthing and pup rearing season, and refraining from vegetation removal or trimming is recognized as appropriate by the U.S. Fish and Wildlife Service in recent Endangered Species Act consultations (e.g., see Hawai'i State DHHL 2009).

Outdoor lighting at homes can attract threatened or endangered seabirds, which may become disoriented by the lighting, resulting in downed birds. To avoid the potential downing of these seabirds by interaction with outdoor lighting, no construction or unshielded equipment maintenance lighting will be permitted after dark between the months of April and October. All permanent lighting would be shielded in conformance with Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

### *Existing Marine Biota*

Overall, the biotic composition of the coral reef communities as revealed during intensive investigation of three transects fronting the property conforms to the typical zonation pattern that has been well documented for the West Hawai'i area (Dollar 1983, Dollar and Tribble 1992, MRC 2010). The majority of the shoreline throughout the property is composed of wave-cut vertical basaltic cliffs several meters high that extend below the waterline for an additional several meters, forming the intertidal zone. In several locations that are the shoreline termini of intermittent streams, the shoreline is composed of small beaches covered with boulders and rounded rocks. At these locales, the boulders continue through the nearshore area. The nearshore boulders are essentially devoid of macrobenthos, probably as a result of rolling during periods of large waves breaking on the shoreline.

In areas where boulders do not occur, the reef zone nearest to shore consists of submerged basaltic spurs and outcrops that are colonized primarily by the hemispherical branching coral *Pocillopora meandrina*. This coral has been termed a "pioneering" species in that it is generally the first to settle on newly bared substratum and is often the only coral that has the ability to withstand the physical rigor of water movement within the nearshore zone. It is also of note that unlike many other species of reef building coral, *Pocillopora meandrina* has a "determinate" life history in that it only grows to maximum size or age before colonies die. Hence, natural communities of this species are often composed of a mixture of live colonies and dead skeletal remains.

The other common macroinvertebrates that occupy the nearshore zone are the boring sea urchins *Echinometra matheai* and *Echinostrephus aciculatus*. These urchins are major bioeroders on the rock surfaces and are found in pits that are ground out of the basalt.

Beginning at approximately 35 feet from the shoreline cliffs, the bottom is composed of a basalt platform that extends from depths of about 15 feet to about 30 feet. Off the property, the reef platform is nearly completely covered with growth of living corals. The two species that cover of the platform are helmet-shaped lobed colonies of *Porites lobata* and finely branching mats of *Porites compressa*. Density of *Porites lobata* is highest near the shoreline, with gradually increasing proportions of *P. compressa* in the offshore direction. The solid reef structure of the platform

contains intermittent pockets and channels of coarse white sand. In the 2010 survey (MRC 2010), there was no evidence of any type of damage or environmental impacts (e.g., bleaching, disease) throughout the range of the survey. While species of the genus *Porites* dominated coral cover on the reef platform, several other species were observed in very low density, including *Montipora patula*, *M. capitata* and *Pavona varians*. There were no observations of any stands of macroalgae on the reef platform. Communities of reef fish were also typical of West Hawai‘i, with few observations of large fish that would be categorized as target species for spearfishers.

Subsequent to the re-evaluation of marine community structure in March 2015, a major bleaching event occurred throughout much the world’s tropical oceans in the summer of 2015. Many Hawaiian reefs have been subjected to anomalously warm water resulting in unprecedented bleaching of corals, including the reefs of West Hawai‘i. Fortunately, corals often recover when the temperature stress is removed. Surveys of coral communities statewide are documenting the level of impact to coral communities resulting from the bleaching event, as well as the progress of recovery from this latest event, as indicated in a study by The Nature Conservancy (<https://www.staradvertiser.com/2019/01/23/breaking-news/nature-conservancy-survey-finds-hawaii-island-reefs-under-recovery/> accessed January 2019). Unfortunately, the steady increase in ocean temperature and acidification that is occurring with climate change will likely lead to longer and more intense bleaching episodes in the future, which is of grave concern.

At approximately the 30-foot depth, the gently sloping reef platform terminates at an edge marked by a sharply increasing angle of the bottom. Coral community structure near the shelf break and on the shelf slope is composed primarily of solid interconnected mats of finely branched *Porites compressa*, which is commonly known as finger coral. As with the reef platform, no frondose algae were observed on the reef slope. At a depth of approximately 60 feet, the reef slope and mats of finger coral terminate in a sand plain with corals growing on isolated rocks and rock rubble.

The overall coral community composition off the project site can be characterized as a near-climax successional stage of Hawaiian reef development. Living coral of two species virtually covered the entire hard bottom on the reef platform and slope, eliminating competition for space for other coral species or other forms of bottom cover. The near complete cover indicates that the area is well protected from natural stresses, particularly the storm waves that are the major determinate of community structure on reefs in Hawai‘i.

Coastal waters and beaches of the Kona and Kohala coasts are well-documented feeding areas for endangered green sea turtles (*Chelonia mydas*). Also seen occasionally are endangered Hawaiian hawksbill turtles (*Eretmochelys imbricata*) and Hawaiian monk seals (*Monachus schauinslandi*). The waters surrounding the entire Big Island are critical habitat for the monk seal.

### *The Impact of Sediment*

One of the transects in the marine studies that is 2,000 feet south of the property, adjacent to a gulch, had high runoff in 2009 and 2010 (MRC 2010) and again in 2015 (MRC, unpublished data). Inspection here provided an opportunity to review the response of the marine environment to extreme sediment events. A scenario that likely occurs in this area is that intermittent heavy rainfall

results in discharge of sediment-laden water at the shoreline. This sediment settles out in the nearshore region and may be of a magnitude to smother corals situated on the rocky bottom. Following the storm event, normal wave action flushes the sediment from the area, re-exposing the boulder surfaces. If corals previously inhabiting the rocks are smothered and killed, the remaining skeletons may be bioeroded from the rock surface or removed by wave impacts. Following the removal of sediment, rock surfaces are suitable for settlement of new colonies, which is the stage observed during the present survey. Growth of these new recruits continues until another episode of sediment input occurs. Hence, if there is a relatively small interval between incidents of sediment input, the nearshore zone may remain essentially devoid of mature coral colonies. However, if there is a period between episodes of sediment input that is long relative to the growth cycle of corals, the new recruiting corals may develop into larger “mature” colonies. Within this scenario is the compounding effect of stress from wave energy. Once colonies reach a certain size, impacts from extreme wave forces may limit development. In any event, it is evident that coral community structure is dynamic in nature, and dependent on the magnitude of natural stresses, and the interaction between these stresses.

Comments from the DLNR-Division of Aquatic Resources (DAR) of August 2, 2015, in response to the Draft EA for the original Kohala Shoreline Project (Kohala Shoreline LLC 2015) indicated a different assessment of the health of the aquatic biota in this area. DAR stated that:

The proposed project site is one of the areas where extensive sedimentation onto to the nearshore reef has negatively impacted the adjacent coral reef community. This was first documented in October 2006. One of the most heavily impacted reef areas was directly shoreward of Keawewai Gulch which runs right through the subject property. Sediment impacts were noted down to at least 70 feet. The Keawewai impacted site was subsequently revisited five additional times with accumulation of sediment and dead corals noted as recently as August 2010, the most recent site visit.

Given the above observations it is quite perplexing as to why the March 2010 Assessment of Marine Water Chemistry and Marine Biotic Communities by Marine Research Consultants, Inc. failed to report any accumulated sediments or impacted corals in their report which was done five months prior to the last DAR site visit (August 2010). Indeed, they note that “Effects to reef structure from substantial sediment input are not evident throughout the area fronting the Kohala Shoreline LLC property.” This is also minored in the DEA itself which states “Overall, the water off the project site is very clear and clean, with no apparent human-induced pollution problems.” However, the consultant found that on transects within 50 m of the shoreline most of the values of turbidity exceed DOH water quality standards. Such turbidity is also reflected in a 2015 Goggle [sic] Earth image of the shoreline area which apparently shows suspended sediments in the near shore waters.

DAR has two long-term coral reef monitoring sites in the vicinity of the project site at Waiaka’ilio Bay. One is almost directly offshore of the northern boundary of the proposed project while the other (Kamilo) is one half mile to the north. At both of these sites the percentage of live coral cover on the reef has substantially and significantly declined over the past 16 years. At Waiaka’ilio, coral cover has decreased 11.3% while at Kamilo it has

decreased 14.6%. These findings point out the continued stress the coral reef in these areas is facing and the need to be highly proactive in any activities that may further stress these communities.

Given these very real concerns, the project needs to ensure that Best Management Practices are strictly followed, if not exceeded, in all areas of site development and construction. Special attention should be focused on not further exacerbating erosional issues with Keawewai Gulch and partnering with Kohala Ranch to ensure upland land use practices do not impact water quality and nearshore marine communities.

These concerns should be framed in the context of trends that DAR has been closely monitoring over the last 15 years. A recent assessment summarized this as follows:

Ecosystem indicators compiled for coral reef fishes have shown an overall trend towards a community of smaller, more abundant fishes. From 2003 to 2014, mean fish length, an indicator of adult reef fish size structure, has shown a decreasing trend in both the North and South regions of West Hawai‘i.... Similarly, total fish biomass, an indicator of the entire fish community size, declined by ~20% in the North over the same time frame while in the South, no overall net change was observed. Herbivorous fishes, which are important for coral reef ecosystem resilience, have also declined in biomass across West Hawai‘i over the past 12 years....Redlip Parrotfish.... a targeted herbivorous fish, is currently (2014) at a level of biomass that is considerably lower compared to the maximum biomass observed in 2007 and 2004 for the North and South regions, respectively. In contrast to the observed declines in the overall size structure of reef fishes in West Hawaii, total fish abundance has shown an increasing trend over the same time period, while juvenile yellow tang, which comprise ~85% of the total aquarium fish catch, increased approximately three- to four-fold and are presently at the highest density levels since monitoring began in 1999.

Ecosystem indicators related to benthic reef community integrity indicate a shift in West Hawai‘i towards lowered reef accretion and reduced structural complexity. Hard coral cover, an indicator of reef topographic complexity, habitat structure, and reef accretion, decreased from an average of 44% to 31% cover in the North from 2003 to 2014, a decline of roughly one-third in just 12 years (PIFSC 2016: i-ii).

The causes for this decline are complex and interwoven:

The population of Hawai‘i Island has increased by 320% in the last 56 years, increasing pressures on the marine environment such as coastal development, habitat degradation, fishing pressure, and nutrient pollution. Human wastewater, for example, is principally disposed via on-site waste disposal systems in West Hawai‘i. Cesspools – where effluent receives no treatment prior to being released into the environment – comprise 85% of all on-site waste disposal systems in the region. Cesspools leech excess pollution and nutrients into groundwater that flows to the ocean, threatening human health and degrading marine ecosystem integrity. The total number of on-site waste disposal systems in West Hawai‘i nearly doubled from 1995 to 2010 (PIFSC 2016: i).

Because these comments and research are from an agency charged with assessing and protecting the aquatic environment in Hawai‘i, Kohala Shoreline requested additional survey and analysis to ascertain the reasons for the differences in assessment of the health of the aquatic biota between DAR and MRC. MRC was asked to inspect of the offshore area again in 2015. Their survey indicated no significant changes from 2009 and 2010 and revealed the same processes of episodic sediment input. Coral recruitment and growth had continued. MRC concluded that the offshore reef remained relatively unaffected in any permanent way by sediment input at the shoreline.

The fundamental difference between the two assessments is that DAR’s position stresses that the order of magnitude of sediment input from the gulches of North Kohala is a recent and largely anthropogenic condition to which the local coral and other biota have not been able to adapt. This opinion is based on a series of marine surveys that clearly show high levels of sedimentation, trash and organic debris littering the ocean, coupled with field visits to sites in the drainage basin that revealed highly inadequate sediment control measures associated with some development and land use. This is particularly important because it is combined with other causes of coral reef decline. MRC’s contention is that while periodic sedimentation events do affect nearshore areas, and some events are exacerbated (or even wholly caused) by human action, which induces locally substantial but temporary damage, sedimentation events are basically normal processes that shape marine communities. In this particular environment, the communities are resilient enough to recover from most sedimentation events. The gulches of the Kohala Mountains, which long precede human presence on the island, are the result of steady erosion, the sediment products of which have been deposited in the shoreline area for millennia. The gulches that pass through the property were carved out over geologic time by flood events that carry sediment laden water. The marine environment is adapted to such long-term periodic stress from sedimentation events, but human contributions should nonetheless be minimized.

The differences between these perspectives is interesting and important, but all parties involved are likely in agreement concerning several points:

1. In the big picture in North Kohala, the main culprit responsible for excessive sedimentation is overgrazing by cattle and feral ungulates on typically dry lands. When combined with the twin and interrelated scourges of wildfire and fire-adapted alien grasses, **sediment discharge to the ocean following periodic severe rainfall events can be substantial**. Inadequate sediment control measures during development and urban land uses that are inexcusable and often illegal add to this problem.
2. **The vast majority of the sediment in gulches on the Kohala Shoreline property originates in the 97% plus of the gulch drainage basins that are *mauka* of Akoni Pule Highway**. Only the last few hundred yards of these seven-mile long gulches pass through the property itself, which is currently in an entirely natural condition, albeit affected by feral goats, alien grasses and periodic wildfires.
3. Regardless of the adaptability of the coral communities offshore to sedimentation, **there is a need to avoid any additional sedimentation from the proposed subdivision**, and, in fact, to reduce it from existing levels to the greatest level feasible. Whatever the degree of the resilience of the coral ecosystem, home development should not be allowed to test it.

4. **Climate change, particularly warmer and more acidic ocean waters that lead to coral bleaching, is the greatest threat to the coral ecosystem.** All development needs to utilize design and technologies that help stem global warming.

#### *Impacts and Mitigation Measures to Marine Biota*

The health of the marine community is directly tied to water quality. For this among other reasons, reason, the 6-lot subdivision project currently reduced the number of homes from previous proposals over the years, which had between 9 and 50 homes. Even more importantly, the project features a requirement for advanced treatment unit septic systems that can minimize nutrients. As a result, the predicted changes in water quality constituents detailed above in Section 3.1.3 are negligible (less than a half percent) and within the natural variability of the groundwater-marine water mixing regime. In fact, the groundwater in this area will continue to have nutrient concentrations far below typical natural concentrations in West Hawai'i.

Notably, the subsidies of nutrients are small in comparison to other documented situations in West Hawai'i where anthropogenic inputs have been quantified. For example, leaching of golf course nutrients resulted in an increase over natural flux of about 116% N and 22% P to a semi-enclosed embayment (Keauhou Bay). While these increases are orders of magnitude greater than predicted at the property, there was no measurable nutrient uptake within Keauhou Bay, and no alteration of biotic composition (Dollar and Atkinson 1992). Similarly, nutrients subsidies resulted in increased N and P flux to anchialine ponds at Waikoloa of about 229% and 400%, respectively. Even with such high nutrient subsidies to ponds that reflect substantial nutrient subsidies to groundwater, offshore sites at Waikoloa downgradient from these ponds on wave-exposed coastlines showed no input over natural sources (Dollar and Atkinson 1992). As the wave-exposed shorelines at Waikoloa are probably less turbulent than off the property, it can be expected that the small changes in groundwater nutrient concentrations will likewise have no effect to the marine environment.

In addition to consideration of the effects from nutrient additions, it is also important to consider the potential effect of sedimentation that may occur as a result of construction activities. The property is presently comprised of extensive areas of soil and rock, with relatively little vegetative groundcover, especially during droughts. As discussed extensively above in Section 3.1.3, Best Management Practices in association with grading and NPDES permits and additional BMPS based on local BMP practices as well as Low Impact Design Guidelines adapted specifically to the site will be required by CC&Rs. This will limit the area of excavation at any one time, control sediment onsite, and require dust control measures. During home occupation, a host of permanent practices will be required that will drastically reduce the potential for sedimentation relative to existing conditions and unregulated site development. To summarize the discussion earlier in this section, these will include gulch buffers; strict building envelopes outside of which are reserved "Natural Areas"; blending of all cut and fill slopes into the natural topography; reduction of impervious surfaces to the smallest area possible; and alternate approaches to slope retention and stabilization, utilizing curved, organic forms and stone that is native to the area. Together, these will provide an ongoing check on sediment that flows into the ocean. Although development activities on the Kohala Shoreline property, if done poorly, can add slightly to these sedimentation problems, careful

development can actually substantially reduce the amount of sediment that enters the ocean relative to the no-development condition.

All of these considerations indicate that the proposed 6-lot project will not have any significant negative, or likely even measurable, effect on marine biota in the coastal ocean offshore of the property. Projected changes in groundwater are negligible and remain well within the wide variation in nutrient concentrations of West Hawai‘i. This coupled with the strong mixing characteristics of the nearshore environment indicates that changes to the marine environment from added nutrients from the homes will likely be undetectable, with no measurable change from the present conditions. When combined with the features of the project that have the potential to substantially reduce property-related sedimentation currently affecting the reefs, development of the project should have no adverse effect on marine communities.

### 3.1.5 Air Quality, Noise, and Scenic Resources

#### *Environmental Setting*

Over the last thirty years, air pollution in West Hawai‘i has mainly come from volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) from Kilauea. Vog has persistently blanketed North and South Kona, at least until the cessation (perhaps temporary) of volcanic activity on Kilauea in August 2018. However, air quality in Kohala has been generally good, with the most noticeable degradation occurring when occasional southerly winds would carry vog into the area.

Noise on the property is low to moderate and is derived principally from roadway noise from the adjacent Akoni Pule Highway, as well as activities on developed land *mauka* of the highway.

Waiaka‘ilio Bay, on the northern end of the property (see Figures 1-3), along with the entire coastal viewplane from Akoni Pule Highway, is listed in the Hawai‘i County General Plan as a place of natural beauty. The roughly eight-mile stretch along Akoni Pule Highway between Mahukona in the north and the 3,500-acre plus, upscale rural residential subdivision Kohala Ranch in the south, is mostly undeveloped shoreline, with highly scenic expansive vistas both *mauka* and *makai*. Hawai‘i State Senate Concurrent Resolution (SCR) No. 179, H.D. 1, adopted in 1988, urged the retention of view and open space *makai* of Kawaihae-Mahukona-Hawi Road from Kawaihae to Upolu Point. In 2001, SCR 146 summarized the long history of public sentiment to maintain viewplanes *makai* of Akoni Pule Highway as expressed in legislative resolutions, petitions, and plans. SCR 146 urged the State and County of Hawai‘i “to work collaboratively with the community and residents of Kohala to develop and implement a plan to protect the open nature of the Kohala coast, preserve its valuable historic sites, and provide greater awareness and appreciation of the history and cultural significance of the area for residents and visitors alike.” Concern with the viewplanes was subsequently evinced in the Hawai‘i County General Plan and the North Kohala Community Development Plan (North Kohala CDP). The County has acquired 238 acres of shorefront property at Ka‘iholena North and Pāo‘o, located approximately five miles north of the property. These properties, which contain over 4,000 feet of shoreline, were identified in the North Kohala CDP as important areas for protection for recreational, historical and cultural reasons.

The North Kohala CDP identifies the Kohala Shoreline property on the North Kohala Environmental & Cultural Concept Map (p. 25) as within or near both the “High Concentration of Cultural Sites” coastal area and the “Existing Upscale Development Area.” The property and its undeveloped coastline lie directly *makai* of the developed area of Kohala Ranch and adjacent to the Kohala Kai agricultural subdivision. Additionally, the property is within the State Land Use Urban District and is currently zoned by the County as Single-Family Residential (RS-15).

### *Impacts and Mitigation Measures*

Construction of the project will involve excavation, grading, compressors, vehicle and equipment engine operation, and construction of new infrastructure. These activities have the potential to generate noise exceeding 95 decibels at times, impacting nearby sensitive noise receptors on the margins of the development. Whenever construction noise is expected to exceed the DOH’s “maximum permissible” property-line noise levels, contractors will be required to consult with DOH per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. DOH would then review the proposed activity, location, equipment, project purpose and timetable in order to decide whether a permit is necessary and what conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers, will be necessary. The contractor would consult with DOH to determine whether permit restrictions would consist of construction being limited to daylight hours.

On a permanent basis, future legal uses of the properties for single-family residences will also generate noise consistent with expectations and allowable limits in areas zoned for these uses, which is thus not considered an adverse impact.

SMA 379 required the following:

- Condition 5 required that above ground structures would be set back a minimum of 50 feet from the *mauka* property line along Akoni Pule Highway to meet visual impacts concerns.
- Condition 6 required a preliminary site plan that would create *mauka-makai* view corridors from Akoni Pule Highway would be submitted in conjunction with the subdivision plans and approved by the Planning Department.

Condition I of Rezoning Ordinance No. 97-02 required that all electrical and communication lines within the subject property would be placed underground.

Although the proposed six-lot subdivision is far smaller and less impactful than the project for which these conditions were approved, somewhat similar conditions are expected to be imposed as part of the new Special Management Area Use Permit and Rezoning Ordinance for the project.

Project design will meet or exceed these conditions. The owner proposes to have all homes set back from Akoni Pule Highway by a minimum of 150 feet, and 100 feet from the shoreline, *mauka* of the *ala loa*/jeep road, with a maximum height of 25 feet as measured according to Chapter 25 of the Hawai‘i County Code. CC&Rs will require a color scheme featuring earth-tone colors to harmonize

with the existing landscape tones. As discussed in Section 3.1.4, the project will include gradual planting of native plants near the shoreline in order to enhance the biological environment and human enjoyment of the public access area. All electrical and communication lines within the property will be placed underground.

Conceptual computer-generated simulations of the future appearance of the area after development have been prepared. Figures 9a and 9b, respectively, provide views from the vantages of a driver on Akoni Pule Highway and a low-flying aircraft just offshore. The point at Waiaka‘ilio Bay, listed in the General Plan as an example of natural beauty, will remain visible from the highway, albeit with a mid-ground that might include a developed structure, depending on where on the highway it was viewed from. Although the six homes that would eventually be built will be visible, their visual impact potential has been minimized, and they will not appear out of character given the rural residential and agricultural lots being developed in the area surrounding the project, and the urban appearance of coastal developments just to the south and in Kawaihae. The project will maintain the view corridors and scenic resources of this coastal area, including *mauka-makai* and lateral views.

### **3.1.6 Hazardous Materials, Toxic Substances and Hazardous Conditions**

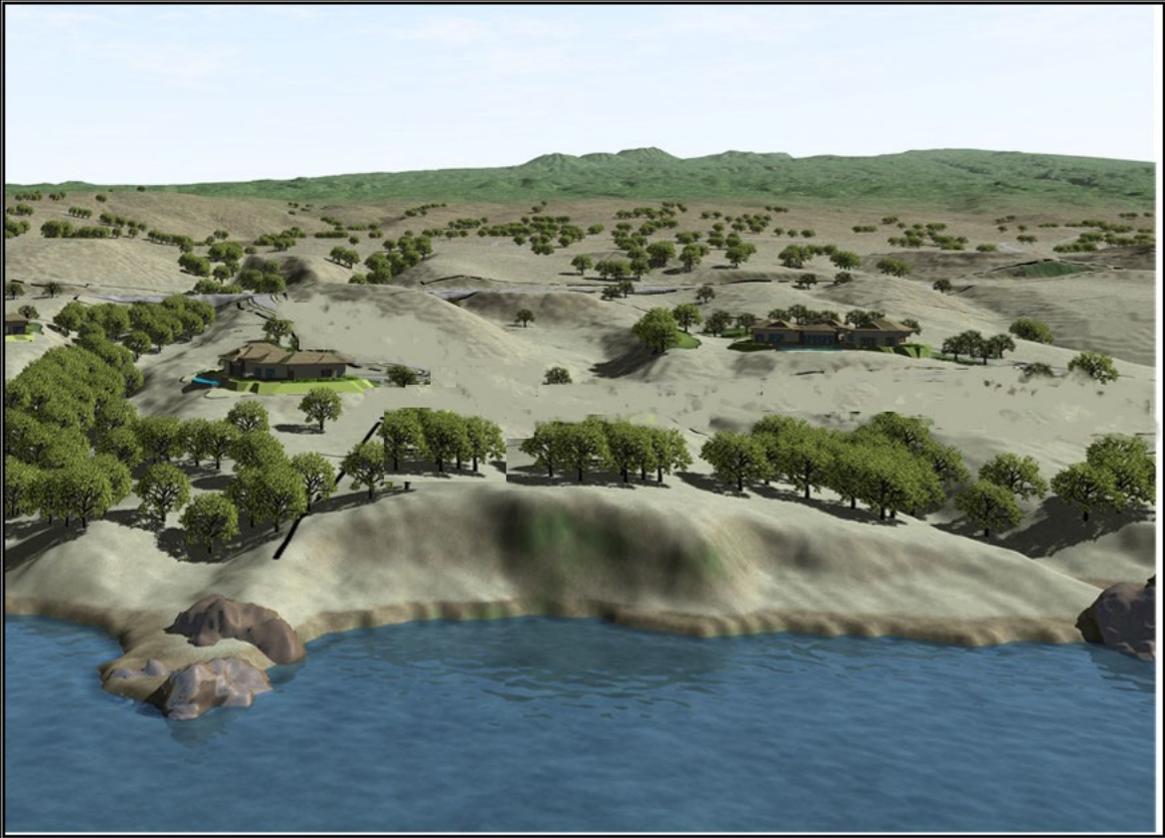
#### *Environmental Setting, Impacts and Mitigation Measures*

No Phase I Environmental Site Assessment was performed for the site, as there was no information on the presence of hazardous materials or toxic substances on the property. No conditions or activities that would lead to such site contamination are known to be present or are expected to be present on the property. The property does not contain quarries, former explosives sites, or other hazardous conditions. The property is vacant and does not appear to have undergone any active land use in modern times. Although the property has been grazed, no farming has been conducted in modern times, and there is no known use that would have involved pesticides or industrial uses. An abandoned vehicle and litter from Akoni Pule Highway are present, but the history of the site and its surroundings as understood by the owner does not suggest the presence of hazardous materials or toxic substances. State databases did not indicate any Underground Storage Tanks (USTs), Leaking Underground Storage Tanks (LUSTs), or records of incidents or releases on the site or in surrounding properties (<https://eha-cloud.doh.hawaii.gov/iheer/#!/viewer>). Although it is unlikely that any potentially hazardous, toxic or radioactive waste would be found on the project site, reasonable precautions would be undertaken by contractors in the context of the project construction Best Management Practices for the appropriate response and remediation should any such hazardous, toxic, or radioactive material be encountered during construction of the project.

**Figure 9a Simulated View from Road**



**Figure 9b Simulated View from Ocean**



## 3.2 Socioeconomic and Cultural

### 3.2.1 Socioeconomic Characteristics

#### *Existing Environment*

The proposed action would most directly affect the portions of rural North Kohala along Akoni Pule Highway and to a lesser extent the town of Kawaihae. Table 5 provides information on the socioeconomic characteristics of North Kohala, along with those of Hawai'i County as a whole for comparison, from the 2010 U.S. Census of Population.

#### *Impacts*

The development of a 6-lot subdivision with lots that would all eventually contain residences would lead to only a minor increase in population. Based on the North Kohala average household size and vacancy rates, an increase of about 16 residents would occur, although some of the homes are expected to be occupied part-time by off-island residents. This would lead to minor shifts in demographic characteristics, unemployment rates, and demands on public services (see Section 3.3, below). Importantly, the population increase is consistent with the expectations of single-family zoning and low-density urban LUPAG designation.

#### *Mitigation Measures*

Rezoning Ordinance No. 97-02 required the following:

- Condition D. Restrictive covenants in the deeds of all proposed residential lots within the subject property shall prohibit the construction of a second dwelling unit on each lot. A copy of the proposed covenants to be recorded with the Bureau of Conveyances shall be submitted with the plans for subdivision to the Planning Director for review and approval. A copy of the approved covenant(s) shall be recited in an instrument executed by the applicant and the County and recorded with the Bureau of Conveyances in conjunction with the issuance of Final Subdivision Approval.
- Condition L. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall secure the concurrence of the Office of Housing and Community Development that the applicant's affordable housing requirements, if any have been mutually agreed to prior to Final Subdivision Approval.

Although the proposed six-lot subdivision is far smaller and less impactful than the project for which these conditions were approved, somewhat similar conditions are expected to be imposed as part of the ordinance that would grant the change of zone to RA-5a.

**Table 5. Selected Socioeconomic Characteristics**

<b>CHARACTERISTIC</b>	<b>Hawai'i Island</b>	<b>North Kohala</b>
Total Population	187,044	6,579
Percent White	33.0%	19.5%
Percent Asian	17.1%	17.1%
Percent Hawaiian or Pacific Islander	12.5%	12.5%
Percent Two or More Races	28.9%	48.7%
Median Age (Years)	40.7	38.2
Percent Under 18 Years	22.5%	18.0%
Percent 65 Years and Over	15.4%	16.2%
Percent Households with Children	25.5%	29.0%
Average Household Size	2.83	3.34
Percent Housing Vacant	22.0%	20.8%
Percent Over 16 Years in Labor Force	61.2%	62.1%
Median Household Income	\$51,520	\$58,673
Percent Below Poverty Level	18.3%	18.1%
Percent 25 years and older with High School Degree	91.0%	93.3%
Percent with Disability	13.5%	12.6%
Percent Foreign Born	12.7%	8.06%

Source: U.S. Census Bureau American Fact Finder: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

### **3.2.2 Coastal Recreation**

Site reconnaissance indicates that the property is lightly used by fishermen, shellfish gatherers, and hikers. Figure 11 of Appendix 3, the Cultural Impact Assessment for the Kohala Shoreline, LLC project, reproduces a portion of Register Map No. 2786 (dated 1917) indicating the presence of a lateral coastal trail projecting into the current project area. This trail is also shown on the 1935 edition of the Tax Map (Figure 16 of Appendix 3). As discussed in Section 3.2.4, this trail, which for many decades has been heavily altered for use as a jeep road, has been called the *ala loa* and has been assessed as a historic property subject to preservation in place.

*Mauka-makai* vehicular access is currently available on the State parcel adjacent to and north of the property. *Mauka-makai* and lateral shoreline pedestrian public access is available on the Kohala Kai

Subdivision, the private property immediately adjacent to and south of the Kohala Shoreline property. There are a few lateral spurs of vehicular accesses onto the property, but there is no continuous lateral vehicular access across the property. On the property itself, a six-foot wide lateral public access easement along the shoreline is shown on the Land Court Map for the property.

Although focused broadly on a long stretch of the coastline of the island of Hawai‘i, the planned development of the Ala Kahakai National Historical Trail (NHT) is also an important potential recreational resource for Kohala. Established in 2000 for the preservation, protection and interpretation of traditional Native Hawaiian culture and natural resources, the Ala Kahakai NHT is a 175-mile trail corridor acknowledged for its cultural and historical significance. The National Park Service (NPS) prepared an EIS and a Comprehensive Management Plan (U.S. Department of the Interior 2008), which provided some of the information in this EA.

The Ala Kahakai NHT traverses hundreds of ancient Hawaiian settlement sites through more than 200 *ahupua‘a* currently owned by private interests and governmental bodies. Cultural resources along the Ala Kahakai include several important *heiau*, royal centers, *kahua* (house site foundations), *loko ‘ia* (fishponds) *ko ‘a* (fishing shrines), *ki ‘i pōhaku* (petroglyphs), *holua* (stone slides), and *wahi pana* (sacred places). Natural resources include anchialine ponds, *pali* (cliffs), nearshore reefs, estuarine ecosystems, coastal vegetation, migratory birds, native sea turtle habitat, and several threatened and endangered species of plants and animals.

The EIS for the Ala Kahakai NHT considered No Action (A), Single Trail (B), and Ahupua‘a Trail System (C) alternatives. Alternative C, the preferred alternative, is based on the traditional Hawaiian trail system in which multiple trail alignments within the *ahupua‘a* (mountain to sea land division) are integral to land use and stewardship. Under the action proposed by NPS, a continuous trail parallel and adjacent to the shoreline would be protected with the consent and cooperation of the affected landowners; however, on public lands and where landowners wish it, the Ala Kahakai NHT could include inland portions of the *ala loa* or other historic trails that run lateral to the shoreline. The shoreline *ala loa* and Ala Kahakai alignment would be connected by *mauka-makai* (mountain to sea) trails equivalent or similar to those that would have traditionally been part of the *ahupua‘a* system. During the 15-year planning period for the trail planning effort, the priority zone from Kawaihae south through Pu‘uhonua o Hōnaunau National Park to Ho‘okena (outside and to the south of the property) would be the focus for developing a continuous publicly accessible trail, but trail administration and management would protect and preserve trail sections outside of that zone as feasible. Through an agreement, the State of Hawai‘i could convey to the NPS a less-than-fee management interest in trail segments that are State-owned under the Highways Act of 1892 within the Ala Kahakai NHT corridor. The NPS would then be responsible for managing these segments and federal law would fully apply. However, in cooperation with the NPS, local communities of the *ahupua‘a* would be encouraged to take responsibility for trail management using the traditional Hawaiian principles of land management and stewardship. The Ala Kahakai Trail Association would be expected to be robust enough to play a major part in trail management, promotion, and funding.

Maps contained with the EIS for Alternative C are general; however, they clearly indicate a possible lateral trail passing through the property. Although the scale of the map is so small that the exact

alignments of these potential trails cannot be specified with precision, discussion with officials from the NPS as well as community members indicates that the *ala loa*, which is essentially located on the existing lateral jeep trail, would be the favored location for the Ala Kahakai. As such, for the purpose of this document, it is assumed that the alignment of the Ala Kahakai will be along the *ala loa*. The owner proposes that *mauka-makai* access to both the existing 6-foot wide lateral public access easement along the shoreline and the future Ala Kahakai be from a proposed 4-stall public access parking lot near the northern end of the property, as shown in Figure 3. Lateral and *mauka-makai* public access currently exists on both the northern, State-owned property and on the southern, private property, both of which will connect to the property's lateral public access easement and the future Ala Kahakai.

The history of the *ala loa* trail on the property has been well documented. Hawai'i Land Court records confirm that the historical alignment of the *ala loa* within the property is owned in fee simple by the owner. During the proceedings for Land Court Application No. 1036 in the 1930s, the Territory of Hawai'i originally claimed ownership of the five (5)-foot wide "Mahukona-Kawaihae Beach Trail," also known as the *ala loa* trail, located within the property. As documented in a Stipulation filed on April 27, 1938, the Territory of Hawai'i agreed to waive and withdraw its claims to the historical alignment of the *ala loa* trail within the property and other adjacent lands, in consideration of the agreement by the owner's predecessor-in-interest to convey certain roadway parcels in Waika, North Kohala, Hawai'i to the Territory of Hawai'i.

Subsequently, the Land Court entered a Decision on May 9, 1938, confirming that title to the historical alignment of the *ala loa* trail segment running through the property was owned in fee simple by the owners of the surrounding lands. Therefore, the historical alignment of the *ala loa* trail within the property is not a State-owned trail. On November 20, 2014, the State DLNR Na Ala Hele Trail & Access System Abstractor confirmed that the 1930s Land Court proceedings covering the property and adjacent lands resulted in a finding that "the Territory of Hawaii subsequently waived and withdrew its claim to all trails with the subject land."

### *Impacts and Mitigation Measures*

As shown in the Site Plan in Figure 3, the owner proposes to provide *mauka-makai* and lateral pedestrian public access through the property. Use of the shoreline area of the property for fishing, gathering and hiking would not be affected by the proposed development, as these activities can occur within the area of the existing coastal public access easement, and, when accepted as a public access easement by the County Council, along the proposed Ala Kahakai/ *ala loa* public access easement. The outdoor activities and public access experience will be accommodated by the wide setback from the shoreline – extending all the way from the shoreline through the *ala loa* – that would prohibit development within the setback area. The owner will work with representatives from the federal Ala Kahakai NHT, the State's Na Ala Hele Trail & Access program, and the North Kohala Community Access Group to have the Ala Kahakai Trail constructed, presumably on the existing *ala loa*/jeep road, with appropriate adjustments to provide buffers for burial sites that the jeep road currently intrudes upon. *ala loa* alignment provides ample area for construction, maintenance and use of the Ala Kahakai. This trail alignment, expected to be 10 feet in width in

conformance with both the design standards of the Ala Kahakai and Chapter 34 of the Hawai‘i County Code, will insure continued public access to and utilization of shoreline resources.

Pedestrian access to this shoreline area at the property would be available from properties to the north or south using the lateral pedestrian shoreline trail, or by walking to the shoreline from the public parking area that would be built on the northern end of the property. The proposed four-stall parking area (the same number of stalls required under SMA 379 for the 50-lot residential project) would be accessed from Akoni Pule Highway and the southern road access (see Figure 3). The parking area, which would be open from a half-hour before sunrise to a half-hour after sunset, would access a new 800-foot long, 10-foot wide *mauka-makai* pedestrian trail. No direct vehicular access to the shoreline would be allowed, either by residents or the general public.

The establishment and maintenance of trail amenities as part of the Ala Kahakai on the property will facilitate coastal access and the continued use of the shoreline for recreational purposes, providing a net benefit to hiking use on the Ala Kahakai NHT and fishing and gathering on the shoreline. The current 6-foot wide trail easement on the shoreline is inadequate for shoreline access, as much of it is steep and eroded. The applicant will seek to dedicate an easement on each lot *makai* of the *ala loa*/jeep road for the entire length of the property for public access, creating, in essence, a 50 to 250-foot wide “trail.” It is expected that most hikers will utilize the *ala loa* /jeep road to traverse the property (and/or the Ala Kahakai, when constructed by government agencies), while fishermen may prefer to utilize the path directly along the shoreline.

Discussion of construction of the Ala Kahakai NHT, including inventory and assessment of resources and possible side trails to coastal recreation locations or lookouts, is beyond the scope of this EA. These issues will be addressed during planning of the trail by the NPS and the State’s Na Ala Hele program. However, one aspect that does require analysis is the side-effect of increased public access on wildfire potential, as discussed in Section 3.1.1. If DLNR plans to intensify use of its property to the north in association with the Ala Kahakai NHT (or any other recreational amenity), it is recommended that the agency install signs warning of the possibility of fire, and also that it consider firebreaks. This recommendation is extended to any plans to encourage public use of trails along the North Kohala coastline; wildfire is a significant issue faced by the Ala Kahakai NHT. According to the EIS for the project, the NPS will prepare a fire management plan in coordination with appropriate State and County agencies. The plan will account for sensitive cultural resources and incorporate guidelines that assist fire personnel in the choice of procedures, tools, and equipment used in fire suppression and post-fire rehabilitation to help protect resources and land even during fire emergencies.

SMA Permit 379 required the following:

- Condition 7: A *mauka-makai* road access of sufficient width to accommodate vehicle access 24 hours a day for drop off and pick up shall be provided along with the minimum 10-foot wide lateral public access walkway along the shoreline. The type of improvements and specific location of the walkway shall be determined at the time of subdivision approval review. Further, a minimum of four on-site public parking stalls to serve the walkway shall be provided and clearly identified. A shoreline setback variance shall be secured for any

improvements to the public access which will be within the 40-foot shoreline setback area. Construction of the public walkway and parking stalls shall be completed prior to issuance of any building permit for any structures.

- Condition 8 (also Condition O of change of zone Ordinance No. 97-02): The applicant shall develop and submit a comprehensive public access plan for the subject property for review and approval to the Planning Director, in consultation with the Department of Land and Natural Resources (Na Ala Hele Trails Program), in conjunction with Final Subdivision Approval. The public access plan shall provide for *mauka-makai* and lateral shoreline pedestrian accessways, public parking stalls for users of the shoreline area, signage and restrictions on use (if any). Such public access improvements shall be completed prior to Final Subdivision Approval for any portion of the subject property.

Although the project is far less and dense and impactful than the project for which these conditions were imposed, somewhat similar conditions requiring a public access plan and a parking lot at the northern entrance to the development are expected to be imposed as part of the new Special Management Area Use Permit and the rezoning ordinance that would grant the change of zone to RA-5a. The owner will request that the parking lot hours be from a half-hour before sunrise to a half-hour after sunset.

Throughout the history of the previous projects, some members of the public have requested vehicular access to the shoreline or parking lots closer to the shoreline; combining the public access with the Kohala Kai access to the south to get a wider access that could potentially “switchback” and achieve a lower grade; and 24-hour access. While support for the Ala Kahakai has been almost universal, some have been concerned that portions of the *ala loa* were too sensitive to be used.

Public access plans on any property planned for development must balance the needs of the public for reasonable access to and along the shoreline with interests of the landowner. The proposed access plan at Kohala Shoreline – with a parking lot and trail to allow users to park within the property and walk about 250 yards to the shoreline – would appear to be reasonable and typical of coastal developments in the region, which do not allow vehicles to park on the shoreline and instead require walking an access route that is open during daylight and dusk hours. Most of the major public accesses in North and South Kohala require walks of 200 to 400 yards. This includes Hapuna Beach State Park (280-455 yards), the Mauna Kea Beach Hotel (400-520 yards), Kohala Waterfront (270-290 yards), Kohala Kai (480 yards), and Lapakahi State Park (275 yards). The proposed plan would improve public access, which is a beneficial impact.

### **3.2.3 Cultural Resources**

An archaeological inventory survey (AIS) report and cultural impact assessment (CIA) report for the proposed action were performed by ASM Affiliates, Inc. The CIA is included in this EA as Appendix 3, and the AIS is included as Appendix 4. In the interest of readability, the summary below, which also is derived from other sources, has eliminated most scholarly references; readers interested in sources may consult the appendices.

## *Cultural and Historical Background*

The property is located in the *ahupua'a* of Kahuā 1<sup>st</sup> (Kahuāli'ili'i) in the district of North Kohala. The concept of the *ahupua'a* was established in Hawai'i during the 15<sup>th</sup> century, adding a new component to what was already a well-stratified society. *Ahupua'a* were usually wedge or pie-shaped, encompassing all of the eco-zones from the mountains to the sea and extending several hundred yards beyond the shoreline, assuring a diverse subsistence resource base. This land unit became the equivalent of a local community, with its own social, economic and political identity.

*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* (often translated as king).

According to the model developed by Kirch (1985) and later revised in terms of initial settlement date (Kirch 2011), the Settlement or Colonization period of Hawai'i was around A.D. 1000, with colonists possibly from the southern Marquesas Islands. Early Hawaiian farmers developed new subsistence strategies during this period, adapting familiar patterns and traditional tools for use in their new environment. Order was kept through adherence to their ancient and ingrained philosophy of life and through the principle of genealogical seniority. According to Fornander (1969), Hawaiians brought from their homeland a variety of Polynesian customs including the major gods of Kane, Ku and Lono; the *kapu* system of law and order; *pu'uhonua* or places of refuge or asylum; the *'aumakua* concept of a family or ancestral spirit and the concept of *mana*, or spiritual power.

The Development Period, which lasted from A.D. 1100-1350, brought changes that included an evolution of traditional tools as well as some distinctly Hawaiian inventions. The evolution of the adze was an example of the former, while the latter included the two-piece fishhook and the octopus-lure breadloaf sinker. Another new article was the *lei niho palaoa*, an item worn by those of high rank which represented a trend toward greater status differentiation.

The Expansion Period from A.D. 1350 to 1650 saw an increase in social stratification and major socioeconomic changes. It also was a time of expansive settling, with the development of the most favorable windward areas as well as more marginal areas on the island's leeward side. This was the time of the greatest population growth as large irrigated field systems were developed and expanded into more arid areas. *Loko* or fishpond aquaculture also flourished during this period.

The second major migration to Hawai'i also occurred during the Expansion Period, with the settlers for this expansion coming from Tahiti in the Society Islands.

An increase in war marked the Proto-Historic Period (A.D. 1650-1795), both locally and between islands. Some of that warfare involved Kohala and the Kawaihae area. Shortly before this period, around 1600, the Maui chief Kamalalawalu sent spies to areas that included Kawaihae to gauge their population and how many warriors it would take to conquer the areas. According to one account:

The spies sent by Kama-lala-walu went to Hawaii and landed at Kawaihae in the evening. Ka-uhi-o-ka-lani ran about that same evening and returned before the canoes were dismantled and placed in the house. The keepers of the gods at Mailekini were servants of Kama, and so they concealed the canoes of the spies...[Kamakau 1992:56].

However, during the spies' visit to Kohala, which according to Kamakau was a "thickly-populated land," they found many empty houses because most of the men were in upland areas taking part in sports competitions. Kamalalawalu's forces first defeated the residents they found in the northern part of Kohala but when they arrived at Kawaihae they again found empty houses because their residents were attending services at Mailekini Heiau in Waimea. The grassy plains of Waimea soon became the setting for a battle between the Maui warriors and the forces of chiefs from Kohala, Waimea, Kona, Puna and Ka'ū. The combined Hawai'i Island forces slew Kamalalawalu and many of his chiefs and warriors, with the remainder making their way back to Maui.

North Kohala is also known as the birthplace of Kamehameha I, who was born in the *ahupua'a* of Kokoiki. It has been said that when he was born, an army was assembling on the leeward Kohala coast, preparing for an attack on Maui, and his birth occurred on a night filled with rain, thunder and lightning. Maui chief Kekaulike was involved at that time in a battle with Alapa'i of Kona. During the conflict, Kekaulike's men cut down trees in Kona and, according to Kamakau, all of the coconut trees in Kawaihae. According to Kamakau, he also "slaughtered the country people of Kohala" before seizing their possessions and returning to Maui, where he soon became ill and surrendered his power to Kamehamehanui.

This period was one of continual war and strife. Ke'eumoku set up a fort at Pololu and Honokane where he was attacked by Kalaniopu'u, and then relocated to Maui. Kalaniopu'u also conquered East Maui, defeating Kamehamehanui, who was Kekaulike's successor and also Kalaniopu'u's wife's brother. Kalaniopu'u appointed one of his chiefs, Puna, to be governor of Hana and Kipahulu. When Kamehamehanui died of illness in 1766, he was succeeded as Maui's king by Kahekili. At about that time, Ke'eumoku took Kamehamehanui's widow, Namahana, who was Kamehamehanui's cousin, as his wife. Their daughter, Ka'ahumanu, who would eventually become the favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki in 1768.

In 1775, Kalaniopu'u and his forces from Hana overran the neighboring Kaupo district and raided Moloka'i, Lana'i, Kaho'olawe and parts of West Maui. Kamehameha's efforts at the battle of Kalaeoka'ilio near Kaupo earned him recognition as a great warrior and the name of Pai'ea (meaning hard-shelled crab) from Maui chiefs and warriors. Ka'ahumanu and her parents left Maui for Hawai'i Island during the battles between Kalaniopu'u and Kahekili.

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu, Maui. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'ūpulehu at

the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called “Lopaka”, all of which were turned over to Kamehameha (Kamakau 1992).

Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kaua‘i. It wasn’t until 1810, when Kaumuali‘i of Kaua‘i gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler,

Kawaihae, located three miles south of the property, eventually became one of the royal centers of the island at which Kamehameha resided, and one where he could make use of trade with foreign ships to acquire guns and ammunition. It was also the site of Pu‘ukohola Heiau, dedicated to the war god Kuka‘ilimoku, which Kamehameha built on the advice of a soothsayer. Subjects came from across Kamehameha’s lands by the thousands to help him build the heiau. When it was completed in 1791, Kamehameha sent for Keoua, ruler of Ka‘ū, who was then killed and placed within the heiau, thus cementing Kamehameha’s rule over Hawai‘i Island.

When in Kawaihae, Kamehameha stayed at Pelekane, located below Pu‘ukohola. After his death in 1819, the royal residence consisted of multiple houses now occupied by his successor, Liholiho, also known as Kamehameha II. The missionary William Ellis observed 100 houses at Kawaihae in 1823, although it was unlikely that the area’s dry climate supported enough agriculture to sustain the court and its entourage as well as the commoners living there. The *Journal of a Trading Voyage Around the World* by an I. Iselin gave the following account of the Kawaihae area ca. 1806:

This bay of Toeigh is very open; an extensive reef runs near it nearly level with the water, and altogether it is no inviting place to anchor at. The country around it looks like a hilly barren desert; nothing grows within ten miles of it, except a few cocoanut trees, of which a fine grove stands near the beach. The inhabitants and huts are thinly scattered along the shore, far less numerous than about [Kealakekua], and seem more indigent, indeed, having to go so far for their subsistence, they are not seldom in want of the supports of life.

Kawaihae was described by Handy and Handy as surrounded by an arid countryside:

The terrain immediately around [Kawaihae] is dry and barren but formerly much dry taro was grown beyond in the lower forest zone, which formerly extended from the Kohala Mountains much farther seaward over what is now open pasture land. Wet taro was grown also in small pockets of land wherever streams, even intermittent ones, flowed down from the mountains in the wet seasons.

Ellis said the coast north of Kawaihae was similarly dry:

The coast was barren; the rock volcanic. The inhabitants were all fishermen. Mr. Thurston was informed, that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than those of the sea-shore.

The historian John Papa I‘i noted that fishermen traded their wares for poi at Kawaihae:

Soon the fishing canoes from Kawaihae, the Kana lands, and Ooma, drew close to the ship to trade for the pa‘i‘ai (hard poi) carried on board, and shortly a great quantity of aku lay silvery-hued on the deck. The fishes were cut into pieces and mashed; and all those aboard fell to and ate, the women by themselves.

According to Ellis, salt was another product of the Kawaihae area:

The natives of this district manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity.

During this 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 *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 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.

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.

The Protestant missionaries who arrived from Boston in 1820 soon were rewarded with land and government positions, as many of the *ali‘i* were eager to assimilate Western-style dress and culture. But at the same time, the continuing sandalwood trade was becoming a heavier burden on commoners, as Ellis noted:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. ... Before daylight on the 22<sup>nd</sup>, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts.

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 and commercial sugarcane, which was more lucrative but carried a heavy environmental price.

The remainder of the 19<sup>th</sup> century saw significant changes in Kawaihae as the practice of trade led many to abandon traditional lifestyles. The result was a loss of population and resources, leaving one observer to describe the town as a “small dreary village” entirely lacking foliage except for “a few sickly cocoa-nut trees.”

Evidence of the earliest permanent settlement in Kohala was obtained from Koai‘e, where a coastal settlement was believed to have existed as early as 1300. Inhabitants subsisted primarily on marine resources likely supplemented by small-scale agriculture. Rosendahl (1972) proposed that early settlers of the area focused on fishing and other ocean-related activities during the summer and farming at upland sites during the winter.

As early as the 1830s, missionaries were noting population changes in Kohala, as deaths were outpacing births. An 1835 census showed the combined population of Kahuā 1<sup>st</sup> and 2<sup>nd</sup> to be 265. But only 11 years later, during the Māhele, there was only a single person making a *kuleana* claim (small awards to commoners) in Kahuānui.

The Mahele ‘Aina that took place in 1848 placed 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.

The leeward North Kohala coast south of Mo‘okini Heiau has few known *heiau*; only three paved structures with large rock fill at Kukuipahu fit the descriptions. However, additional work and closer scrutiny of stone platforms on crests of rises, that are sometimes associated with walled precincts, could reveal more *heiau* along the coastal settlements. The narrow band of habitation settlements along the coast are separated from a broader upland band of agricultural walls and habitations by a barren zone with relatively few archaeological sites. Within individual *ahupua‘a*, trails that pass through the barren zone would have connected coastal settlements with upland fields. The width of the barren zone is inversely related to the abundance of rainfall; in the wetter north near ‘Upolu Point it is about half a mile wide, and it widens to three miles in the drier south at Kahuā. Surveys that have covered the uplands away from the coastline date back to the late 1960s when the University of Hawai‘i field schools mapped Lapakahi Ahupua‘a north of Ka‘iholena Ahupua‘a, using aerial photographs and surveying instruments. Vast portions of Kahuā 1<sup>st</sup> and 2<sup>nd</sup> inland of the highway were surveyed by Hammatt and Borthwick (1986, 1987, 1990). During these upland surveys, which covered land up to the 3,000-foot elevation, archaeologists found trail markers, scattered agricultural terraces, temporary habitation shelters, and rock walls. The remains most probably relate to the upland agricultural fields mentioned in various oral and written histories.

The *ahupua'a* of Kahuāli'ili'i (also known as Kahuā 1<sup>st</sup>) where the property is located was awarded to Lot Kapuāiwa (Kamehameha V). However, hearings held by the Boundary Commission of the Kingdom of Hawai'i to determine the boundaries of Kahuāli'ili'i were not held until 1873, the year following Lot Kapuāiwa's death, and the *ahupua'a* apparently became part of the estate of his father, M. Kekūanāo'a. The boundaries were not officially established until 1903, by which time the *ahupua'a* had been acquired by James Woods. There were no *kuleana* awarded in what is now the property.

Woods started Pu'u Hue Ranch in the early 1870s. Upon his death the ranching operations were taken over by his son, Frank Woods. By the 1920s, Woods was leasing much of the Kahuā lands to former O'ahu residents Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr. By 1928, von Holt and Richards had purchased the lands they formerly leased, and they began combining them with land from the Waika Ahupua'a to the south. Through purchases and leases, they eventually accumulated nearly 30,000 acres which became known as Kahuā Ranch. Von Holt died in 1953, and control of the ranch eventually passed to Herbert "Monty" Richards, Jr. In the 1980s, the ranch was divided between the two families, with the Richards operating Kahuā Ranch and the von Holts controlling the southern portion that formed Ponoholo Ranch. Kahuā Ranch sold the land that now makes up the property.

Because of its arid nature, the Kawaihae area was not highly populated until visits by trade and whaling ships made the bay a frequent port of call. There were no regularly flowing streams to support agriculture, which instead took place far inland.

The economy of Kawaihae received a boost from the introduction of cattle ranching. Cattle from Waimea were brought to Kawaihae via a road built in 1830 and held in pens for the trip to O'ahu on cattle boats. The trade in hides and meat also helped turn Kawaihae into a major port. The *Pacific Commercial Advertiser* reported up to 50 whaling ships making a port call in Kawaihae in 1857. An 1883 map showed Kawaihae with a lighthouse, wool shed, native store, jail, boat house, church and other buildings that were likely houses. Twenty years later, a plant had been built to manufacture soap from cattle tallow.

Kawaihae continued to host harbor activities, and in 1959 a new deep-draft harbor was built by the federal government. However, deposits from dredging of the shallow reef buried Kawaihae Village, its salt pans, the Kauhuhue Heiau and the majority of the coastal Land Commission awards up to 13 feet deep. Additional development in 1969 and 1970 further transformed the area into an industrial park.

### *Cultural Studies in Project Area*

Maria E. Ka'imipono Orr (2003) prepared a cultural impact assessment for a proposed radio communication tower and facility to be placed on Pu'u Waiakanonula in the *mauka* portion of Kahuāli'ili'i. Her study included a detailed culture-historical background for the *ahupua'a*. She also conducted interviews with Sherri Hannum, Genevieve Leina'ala Hoopai, Bernard Hoopai, Bernelle Hoopai, Harold Glenn Kailiawa, Hannah Springer, and Harry Martens (Pono) von Holt II. Orr (2003) concluded that no cultural properties or practices would be affected by the project, but

cautioned that “for over a hundred years, native Hawaiians have lived in a culturally repressed state. It has been only within the last thirty years, due to evolved awareness, that native Hawaiians have been aggressively trying to reclaim their *wahi pana* (sacred and/or legendary places).”

Kepā Maly prepared a detailed culture-historical background for Ka‘iholena Ahupua‘a (Maly 2000) that included information relative to the general region known as *Kohala Waho* or Outer Kohala, of which the property is a part. Maly’s (2000) extensive culture-historical information suggests that the archaeological resources present on the property are best understood within the context of the larger cultural landscape of *Kohala Waho*; a landscape with a long history, rich in cultural traditions. One could conclude from this that the significance of any one resource is enhanced by the presence of other resources, and together form a cohesive landscape that should be treated and managed in its totality.

In 2006, Rechtman Consulting prepared a cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua‘a* adjoining the property to the south (Rechtman 2006). That property and the Kohala Shoreline property share a common history and were subject to similar land uses dating back to the Precontact settlement of the area. As part of the study, William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. Rechtman (2006) concluded that if the archaeological sites were treated in accordance with State Historic Preservation Division (SHPD) approved treatment plans, and access to and along the shoreline was in no way inhibited, there would be no cultural impacts.

In 2004, Rechtman Consulting prepared a cultural impact assessment (Rechtman 2004) for a small coastal parcel within Pāo‘o Ahupua‘a, some six miles north of the current project area. Interviewees for that study included Arthur Mahi, Isabella Mahi Medeiros, and Valerie Luhiau Ako. Collectively, the primary concerns of these individuals (all with cultural ties to the study *ahupua‘a*) revolved around the protection of the archaeological resources and the maintenance of access to the shoreline. The relevance of this study for the Kohala Shoreline project is not so much the specifics of Pāo‘o Ahupua‘a, but rather the general concept that the land needs to be cared for in appropriate ways; the concept of *mālama ‘āina*. This Pāo‘o project required a Conservation District Use Permit, the proceedings for which included oral and written testimony. Most of that testimony revolved around specific resources located on the Pāo‘o parcel, but there was other testimony of a more general nature that had broader implications that should be considered when assessing cultural impacts along this portion of the Kohala coastline.

These included the concepts of *malama ‘āina*, as well as cultural trauma and cultural disintegration fostering multigenerational psychopathologies. Several of those who testified suggested that home construction in currently undeveloped portions of coastal Kohala would be inconsistent with the traditional cultural practice of caring for the land (*mālama ‘āina*), although no basis for this assertion was cited. It should be noted that the property was utilized by generations of Hawaiians as a place of habitation, as evidenced by the numerous structural remains of residential complexes across the property. Testimony presented by Kamana‘opono Crabbe, Ph.D. and Dr. David Liu in relation to Pāo‘o with respect to cultural disintegration and cultural trauma distinguished traditional Hawaiian use of land and modern Western use of land. There are those who assert that all land in

Hawai‘i is a cultural resource and that virtually all modern development (as opposed to traditional uses) has a severe and unmitigable cultural impact.

Section 3.2.4 discusses archaeological resources in detail. While various Precontact and Historic-era archaeological sites not considered significant for preservation by SHPD are present, such features are relatively common in the area and they do not appear to have cultural value aside from their value for interpreting historic patterns. However, there are features that have greater historic value requiring preservation, including burials and several other sites associated with habitation. Beyond their scientific-historic value, they also have cultural value.

### *Consultation*

When assessing potential cultural impacts to resources, practices, and beliefs, input gathered from community members with genealogical ties and/or long-standing residency relationships to the study 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.

Extensive consultation with Native Hawaiian agencies, individuals and organizations occurred throughout the research for the withdrawn 2015 Draft EA (Kohala Shoreline LLC 2015), a process that continued in 2018 for the preparation of this EA. The Office of Hawaiian Affairs in Honolulu and West Hawai‘i, a local Hawaiian Home Lands group, and the Hawaiian Civic Club were consulted by letter on January 10, 2010, to determine whether they had any information concerning whether cultural resources or practices might nevertheless be present. Response letters did not indicate any specific resources or practices of concern.

After a hiatus in the earlier project, consultation resumed in 2014. As part of the CIA, author Robert Rechtman, Ph.D., and project representatives met with the North Kohala Community Access Group (with whom project representatives had also met in 2010). Although this group’s membership is multicultural, they represent many of the Native Hawaiian community’s concerns with respect to access rights, and they were a forum to disseminate information about the project within the Native Hawaiian community and to invite comments on potential resources and impacts related to the property. The South Kohala Community Development Plan Action Committee and the Department of Hawaiian Home Lands Kailapa Community Association were also contacted. As a result of these contacts and communications, a field visit was set up with the intention of viewing the property and discussing any potential cultural impacts. On November 15, 2014, and January 31, 2015, Dr. Rechtman met on-site with several members of the North Kohala Community Access Group, the South Kohala Community Development Plan Action Committee, and residents of the Kailapa Homesteads.

According to Dr. Rechtman’s account of the first meeting, one attendee claimed ownership of the property and advised that none of the group had permission to enter the property. In the interest of avoiding conflict, the group decided not to visit the property. To date, there has been no legal action filed in court by any party to assert ownership to, or any interest in the property. Also present at the aborted meeting was Kaena Peterson, who is *kama‘āina* to the area, a resident of Kailapa, and

President of the South Kohala Hawaiian Civic Club. Kaena was contacted the following day and she requested Dr. Rechtman to meet with her and the Vice President of the South Kohala Hawaiian Civic Club to share information about the project and hear their concerns. On November 23, 2014, Dr. Rechtman met with Kaena Peterson and Lei Kihoi of the South Kohala Hawaiian Civic Club at the Kailapa residence of Kaena Peterson. Their concerns related to the protection of trails, other traditional sites and burial sites, as well as perpetuation of access to the property for traditional and customary practices. With respect to the former, they wanted all burial sites properly treated and for traditional trail routes to remain open for unrestricted pedestrian access. With respect to the perpetuation of traditional and customary practices they wanted to make sure that traditional coastal activities were not impacted, and that Native Hawaiian individuals and organized groups such as *hula halau* had unrestricted access to the trails and shoreline. Both Kaena and Lei stressed the importance of maintaining the traditional access routes that exist on the landscape.

During the second field trip conducted with members of the North Kohala Community Access Group and residents of the Kailapa Homestead in January 2015, much of the discussion revolved around trails and access. Present during this visit was Jojo Tanimoto, a *kupuna* of Native Hawaiian ancestry. She shared recollections of traveling the project area coastline for shoreline fishing activities with her father when she was a child. Jojo also talked about a shoreline pond in the general area that William Akau told her was culturally significant, but she was unsure of its exact location. Also present during this visit was Diane Kāneali‘i and Parish Canon of the Kailapa Homestead. Mr. Canon, a younger generation Native Hawaiian and current president of the Kailapa Community Association, expressed an interest in having community members take an active role in the preservation of cultural sites and resources within the development area.

At this point, the former Draft EA was published in the July 8, 2015 edition of *The Environmental Notice*. As stated previously, the project team received many comments on the Draft EA with concerns including density, lot configuration, public access, historic sites, cultural practices, drainage and water quality. The owner carefully considered the comments and decided not to implement the project as proposed and instead completely redesigned it to respond to these concerns. The former Draft EA was formally withdrawn, and the current project was developed, with a much lower density and all building sites moved completely *mauka* of the *ala loa*, away from the shoreline. As explained in detail the next section, many more archaeological sites that were formerly slated for data recovery will now be formally preserved.

Given the substantial changes, the cultural impact assessment team conducted additional consultation. This consisted of phone calls, emails and letters, and also public notices soliciting consultation for the burial sites that were published in the July 2018 issue of *Ka Wai Ola o OHA*, on June 16, July 1, July 4, 2018 in both the *Honolulu Star Advertiser* and *West Hawai‘i Today* newspapers. The following individuals and organizations were specifically coordinated with.

Kailapa Community Association. Diane Maka‘ala Kāneali‘i was contacted via email (on November 2 and 26, and December 8 and 10, 2018) in her capacity as Executive Director of the Kailapa Community Association. The new six-lot subdivision plan was shared with her and a request was made to make a presentation at a community association meeting. An

arrangement was then made to facilitate an early February 2019 on-site meeting with representatives of the Kailapa Community Association and other community members. On February 2, 2019, Robert B. Rechtman, Ph.D. conducted a walking tour of the proposed subdivision area with Diane Maka'ala Kāneali'i and Cynthia Sharp. Cynthia is also a board member of the Kailapa Community Association. Both Diane and Cynthia expressed pleasure that the extreme coastal portion of the property will be preserved but indicated that the best approach would be to preserve the whole property through a land purchase perhaps using County Public Access, Open Space and Natural Resources Preservation Commission (PONC) funds. Short of this happening, both were encouraged by the overall limited space available for future development. Diane indicated that she would work with the owner to help establish a community stewardship program that could participate in the preservation of the cultural landscape, conduct coastal clean-up, and help restore and protect archaeological resources. The owner has stated that it is committed to continued consultation with this and any other Kohala cultural community groups with respect to the long-term protection and care of the project area's cultural landscape, and the Kailapa Community Association will be further consulted with respect to the archaeological preservation plan.

Hawai'i Island Burial Council (HIBC). Dr. Rechtman appeared before the HIBC on November 5, 2018 to conduct preliminary consultation with respect to the five burial sites within the development area, and he related to the Council members that there were no responses to the public notices. The existing treatment plan (PHRI 2000) for four of those sites was discussed and it was explained that a fifth site had been discovered as a result of the updated AIS (Rechtman and Clark 2010). It was also explained that the existing HIBC-approved 20-foot buffers for the sites would be increased to 30 feet in the new Burial Treatment Plan (BTP). Council members were pleased with the increased buffer size and were interested in ensuring that appropriate access to the burial sites would be allowed. Provisions for such access will be included in the forthcoming BTP.

Kaena Peterson. Kaena Peterson lives in the Kailapa (Honokoa) Community and serves as the President of the South Kohala Hawaiian Civic Club. She was consulted during the earlier iteration of the project. Kaena was contacted again via email (on October 30 and December 8, 2018). The new six-lot subdivision plan was shared with her and a request was made to make a presentation at a Civic Club meeting. Scheduling could not accommodate such a presentation, however, in a phone conversation (on December 11) Kaena shared that she was happy to see all development activity moved to the *mauka* side of the *ala loa*. She also strongly urged the owner to keep the current six-lot plan and not change it later to higher density and make sure that future homeowners would not encroach on the trails, which to her are at the heart of cultural practice. Kaena related that the uniqueness of living on an island comes with a *kuleana* toward fellow residents, something she believes was a part of traditional Hawaiian culture.

Ala Kahakai National Historical Trail. Further brief consultation was conducted with Rick Gmirkin of the National Park Service's Ala Kahakai National Historical Trail Program. The new six-lot subdivision plan was shared via email and a brief phone conversation (on December 10, 2018) was conducted. Rick expressed approval that there will be no breaches

of the *ala loa* and that the public access to the *ala loa* will follow along an existing traditional *mauka/makai* trail alignment. He was also encouraged that the new subdivision configuration supported the preservation of more of the archaeological landscape, as this helps provide the context for the Ala Kahakai. The owner will continue to consult with the Ala Kahakai National Historical Trail Program to fine-tune the public alignment of the Ala Kahakai in order to include features of the trail important for public use and enjoyment, as well as exclude certain significant features (e.g., burial sites) from public interaction.

Office of Hawaiian Affairs (OHA). Shane Nelson of OHA's West Hawai'i office was contacted via email (on September 12 and October 30, 2018) and a phone conversation was arranged for November 5, 2018. The reduced-lot development plan was shared with Shane and he expressed his pleasure that the proposed development would have less of an impact on the cultural landscape and the archaeological sites contained therein. Shane requested continued consultation with OHA when the burial treatment and archaeological preservation plans become available.

North Kohala Community Access Group. On January 9, 2019, Dr. Rechtman accompanied the project planner and environmental scientist to a regularly scheduled meeting of the NKCAG. The purpose was primarily to explain in detail the significant changes in project design and to take input concerning public access.

#### *Impacts and Mitigation Measures: Cultural Resources and Practices*

The Constitution of the State of Hawai'i clearly states the duty of the State and its agencies 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." 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 ruled that, "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). The duty of agencies when granting land use permits to identify valued natural, cultural and historical resources, assess impacts to them and devise feasible actions to reasonably protect native Hawaiian rights was established by the Hawai'i Supreme Court in the case of Ka Pa'akai O Ka 'Aina vs. the Hawai'i State Land Use Commission (94 Hawai'i 31, 7 P.3d 106, 2000).

To assist in consideration of cultural resources and their impacts during the EA/EIS process, the Hawai'i State Office of Environmental Quality Control (OEQC) developed the *Guidelines for Assessing Cultural Impacts* (<http://health.hawaii.gov/oeqc/>). The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-

related, recreational, and religious and spiritual customs. A cultural impact assessment must evaluate 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.

As part of the effort to identify valued natural, cultural and historical resources, the physical resources of the Kohala Shoreline property, such as plants and water features, were assessed. In general, it was observed that no culturally important native vegetation, springs, groves of native trees, caves or *pu'u*, all of which may have cultural significance, are present on the property. The vegetation of almost the entire property, and all areas potentially affected by construction, is heavily disturbed, alien kiawe forest with buffel grass, as discussed in Section 3.1.4, above. Of critical importance, however, is the value of the shoreline and its resources, and the related issue of access. These need to be maintained in as pristine a condition as possible for the sustenance, both physical and cultural, that they provide. In addition to natural resources that are important in cultural practice, the property supports burials and archaeological features that have cultural significance. Potential impacts to these cultural resources and associated practices can be largely avoided or at least greatly reduced by appropriate mitigation. The strategies for implementing this are discussed below.

Mitigation for Cultural Impacts to Burials and Archaeological Sites. To avoid potential impacts to the cultural value of burial sites present on the property, a burial treatment plan will be prepared in compliance with HAR §13-300. To avoid potential adverse impacts to the cultural value of the preservation sites, and to enhance the preservation, interpretive and cultural values of these sites, an archaeological preservation plan will be prepared. As explained in more detail in the next section, 11 archaeological sites will be reassigned a preservation treatment, increasing the number of preservation sites from sixteen to 27. Both plans will be implemented prior to the commencement of any ground-disturbing activities. Throughout this process, native Hawaiian individuals and organizations will continue to be consulted in order to ensure that implementation actions are appropriate. These actions must also be implemented prior to any ground-disturbing activities. To mitigate the potential impacts to the cultural value of the other archaeological sites on the property, a data recovery plan will be prepared and implemented in compliance with laws and regulations governing historic sites in the State of Hawai'i.

Mitigation for Cultural Impacts to Shoreline Access, Resources and Gathering. The shoreline area of the property is a valued natural/cultural resource because, among other attributes, it provides access to marine resources and practices. Within the local community these lands are known to have been privately held for over 100 years, with access to the shoreline for traditional cultural practices that has never been prohibited but may have been more difficult because of a lack of parking and improved trails. Based on extensive community consultation, the project has been modified over the decades to a plan that now proposes no development from the shoreline to the *ala loa*/jeep road, a distance that varies from 40 to 300 feet (generally over 125 feet), partly in order to protect these practices. Also, in the spirit of *mālama 'āina*, current development plans call for a down-zoning from the current zoning of Single-Family Residential 15,000-square foot minimum lot size to Residential and Agricultural 5-acre minimum lot size. The plan would locate building sites

away from the shoreline, with low densities and buffers that can preserve a significant portion of the archaeological and cultural landscape.

Improved and clearly marked access with the support of the owner will promote continuing and expanded traditional use of the shoreline. In a general sense, access to and use of the shoreline area of the property for recreational, subsistence, transportation, and spiritual purposes can be considered an ancient, as well as ongoing practice, and it is thus a valued cultural resource. The primary concern raised by one consulted party in a previous assessment (William Akau) was that of maintaining lateral pedestrian access for fishing, transportation, and recreation. He has long been an advocate for the perpetuation of Hawaiian rights of access to, and use of, the traditional system of trails. As discussed in Section 3.2.2, above, old maps indicate that the land was crossed by a coastal trail or *ala loa*, parts of which eventually became the coastal jeep road. The extensive trail amenities proposed for the project discussed in Section 3.2.2, which include a pedestrian lateral shoreline trail, a *mauka/makai* pedestrian trail, and a public parking area, will facilitate coastal access and the continued use of the shoreline for recreational, subsistence, transportation, and spiritual purposes, thus alleviating any potential impacts related to shoreline access and cultural use. Steps like these that help promote access to the shoreline help mitigate the potential detrimental psychosocial effects mentioned above (and discussed in more detail in Appendix 3) with respect to cultural disintegration and cultural trauma.

Although the shoreline vegetation does not currently include the quality and quantity of botanical resources that would be important for native gathering, leeward areas such as the property formerly supported a number of culturally important littoral (near-shoreline) plants. Accordingly, the area *makai* of the *ala loa*/jeep road is planned for gradual planting with native shoreline plants that could have cultural value, both simply by their restored presence and also as gathering resources. With the expected decrease in erosion, fire frequency and goat grazing, along with at least a minimal degree of care, these plants can become re-established and set an example for restoring traditionally important plants in the State and County public land properties to the north.

In summary, the implementation of the above described measures relative to the identified archaeological sites, public access, cultural resources, and cultural practices and beliefs will help to minimize impacts to such resources, practices, or beliefs by the proposed development of the property. The pedestrian public access easements (which will be dedicated to the County of Hawai'i) will allow the perpetuation of access to cultural resources for traditional and customary practices. The native plants planned for reintroduction in the area *makai* of the *ala loa*/jeep road as part of the owner's landscape concept can be utilized for native gathering. In addition, continued coordination on the part of the owner and future residents with members of the local Native Hawaiian community is encouraged. Allowing these knowledgeable and committed residents to participate in the preservation of resources within the development area and maintain an on-going dialog with the current and future lot owners would serve both cultural resources and community harmony.

### 3.2.4 Archaeological Resources

An archaeological inventory survey report addressing all archaeological sites on the property was performed by ASM Affiliates. The report was finalized in January 2016 and approved by the State Historic Preservation Division in February 2016. The AIS is an update on an earlier survey prepared for a different project plan by Graves and Franklin in 1998. Because the previous AIS was predicated on the construction of only one residence on the property and had incompletely recorded certain sites, an updated survey was required. The 2016 survey is included in Appendix 4, which begins with the February 8, 2016 letter approving the AIS, and a December 8, 2018 letter to the SHPD with revised treatment recommendations based on a reduced development footprint, which will allow preservation rather than data recovery for certain sites.

At least eight archaeological studies of the property have been conducted since 1985, when M. Allen carried out a pair of limited archaeological reconnaissance surveys. Others include a data recovery plan for one archaeological site (Rosendahl 1994), an archaeological inventory survey (Graves and Franklin 1998), and data recovery excavations (O’Hare and Goodfellow 1999). Burial and site preservation plans were also prepared (PHRI 2000), followed by additional testing of burial features in 2005. Other archaeological studies performed in the area of the property include three conducted in 1964 (Soehren), and 1968 (Bonk).

Beginning in 2010, initial fieldwork for the current archaeological inventory survey by Rechtman Consulting (the predecessor to ASM Affiliates, Inc.), was conducted, followed by additional survey, subsurface testing at selected features, and further review of historic maps. The work identified all of the 39 archaeological sites previously recorded and refined the site descriptions for five of those sites. The latter included a corrected location and characterization of Feature D at Site 2496, a previously unrecorded rock shelter feature at Site 4013, a previously unrecorded rough terrace feature at Site 161331, an unrecorded northern extension of Site 16147, and an unrecorded marine shell scatter at Site 16151. Additionally, a portion of the previously undocumented Site 29271 – the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the property. The 40 archaeological sites are mapped in Figure 10 and summarized in Table 6.

#### *Impacts and Mitigation Measures*

As a result of the current AIS, the original significance evaluation made by Graves and Franklin in 1998 and adopted in the subsequent DLNR-SHPD determination (DOC NO.: 9805PM21) has been recommended for modification for five of the previously recorded sites. Four of these (Sites 4000, 4010, 16132, and 16138) were not considered to be significant in the original study; however, all these sites are part of a relatively intact archaeological landscape that documents evolving land use from Precontact times to the late Historic Period. As such, all four of these sites are now considered to be significant under Criterion D for their information content. Further, Site 2496 was originally



**Table 5. Archaeological Sites**

SIHP Site No.	Site Type	Age	Significance	Recommended Treatment
2496	Habitation/Burial	P	D, E*	Preservation/Burial Preservation
2498	Habitation/Ceremonial	P	C, D, E	Preservation
2499	Habitation	P/H	C, D	Preservation
4000	Wall	P/H	D**	Preservation
4002	Rock Mound	P	D	Data Recovery
4003	Habitation	P/H	D	Data Recovery
4004	Burial	P/H	D, E	Burial Preservation
4005	Habitation	P/H	C, D	Preservation
4010	Animal Enclosure	H	D**	Preservation
4011	Habitation	P/H	D	Preservation
4012	Habitation	P/H	D	Preservation
4013	Habitation/Burial	P/H	D, E	Data Recovery/ Burial Preservation
4015	Habitation	P	D	Data Recovery Completed
15261	Trail	P/H	D, E	No Further Work
16131	Habitation	P/H	D	Preservation
16132	Wall	H	D**	No Further Work
16133	Well/Reservoir	H	D	Preservation
16134	Enclosure	H	D	Preservation
16135	Wall	P	D	Data Recovery
16136	Habitation	P	D	No Further Work
16137	Rock Mound	P	D	Data Recovery
16138	Platform and Cairn	P	D**	Preservation
16139	Habitation	P	D	Preservation
16140	Habitation	P	D	Preservation
16141	Habitation	P	D	Preservation
16142	Habitation	P	D	Preservation
16143	Habitation	P	D	Preservation
16144	Habitation	P	D	Preservation
16145	Habitation	P	D	Preservation
16146	Habitation	P	D	Preservation
16147	Habitation	P	D	Preservation
16148	Habitation/Burial	P	D, E	Burial Preservation
16149	Habitation	P	D	Preservation
16150	Habitation	P	D	Data Recovery
16151	Habitation	P	D	Preservation
16162	Burial	P	D, E	Burial Preservation
16163	Habitation	P	D	Preservation
16164	Habitation	P	D	Data Recovery
16167	Agricultural Terrace	P/H	D	Preservation
29271	Trail	P/H	D,E	Preservation***

**Age:** P – Precontact; H – Historic. **Significance Criteria:** **A** - Associated with events that have made an important contribution to the broad patterns of our history; **B** - Associated with the lives of persons important in our past; **C** - Embody the distinctive characteristics of a type, period or method of construction; represent the work of a master; or possess high artistic value; **D** - Have yielded, or be likely to yield, information important for research on prehistory or history; **E** - Have an important value to the native Hawaiian people or to another ethnic group of the state due to

associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts, these associations being important to the group's history and cultural identity. \* Criterion E added because a burial was found at this site during the current study. \*\* These sites are considered significant under Criterion D in the current study; they were determined to not be significant in the earlier inventory. \*\*\* In conformance with standard treatments for linear features such as trails, roads and certain walls, the preservation plan for the trail will accommodate breaches for the *mauka-makai* public access trail.

determined to be significant solely under Criterion D; however, as this site is now known to contain a burial, it should also be considered significant under Criterion E. When the 2015 nine-lot subdivision was proposed, site treatments were reconsidered and plans were made to revise existing data recovery, preservation and burial treatment plans. With the reduction of the proposal to six lots, with no development *makai* of the *ala loa*/jeep road, recommended treatments have been further revised, and future data recovery, preservation and burial treatment plans will be further updated.

The four previously identified burial sites (Sites 4004, 4013, 16148, and 16162) shall continue to be preserved. In conformance with the recommendation of the latest archaeological inventory survey, the burial treatment plan (PHRI 2000a) will be updated to reflect the proposed change in land use and the newly identified burial site (Site 2496 Feature D). The 2000 burial plan had noted that any subsequent change in the project's components could require that the applicant return to the Hawai'i Island Burial Council for review of proposed preservation measures.

The 2016 AIS recommended data recovery for 16 sites, plus portions of two additional sites (2496 and 4013) that contain preserved burial features. All those sites were previously approved for data recovery based on the Graves and Franklin survey with the exception of Sites 4010 and 16138, which were earlier approved for no further work. It is believed that these two sites still retain information that could be recovered and aid in developing a specific chronology of land-use history for the project area. As noted in Table 6 above, eleven archaeological sites (SIHP Sites 2496, 4010, 4012, 16138, 16140, 16141, 16143, 16144, 16146, 16151, and 16167) that have been previously approved for data recovery by DLNR-SHPD will be reassigned a preservation treatment, reducing the total number of sites that will be subject to data recovery from eighteen to seven and increasing the number of preservation sites from sixteen to twenty-seven. Pursuant to HAR 13-278, a plan addressing the data recovery of the seven sites will be prepared and submitted to DLNR-SHPD for review and approval.

Preservation is now recommended for 27 sites, all but one of which (Site 4000) was approved for data recovery based on the original inventory survey. A new preservation plan that addresses these 27 sites will be prepared and submitted to DLNR-SHPD for review and compliance.

SHPD approved the AIS for the project per letter of February 6, 2016 (see Appendix 4). The project archaeologist wrote SHPD on December 8, 2018, with revised treatment recommendations based on a reduced development footprint, which will allow preservation rather than data recovery for certain sites (see Appendix 4). In addition to development and implementation of data recovery, preservation and burial treatment plans, the project has involved continuing consultation with native Hawaiian individuals and organizations, as discussed in the previous section. Continued consultation with the Office of Hawaiian Affairs will occur with respect to all archaeological sites determined significant under Criterion e.

SMA 379 and Rezoning Ordinance No. 97-02 required the following:

- SMA Condition 10 and Rezoning Ordinance Condition M: A Data Recovery Plan and Preservation Plan shall be prepared for the review and approval by the Planning Director in consultation with the Department of Land and Natural Resources-Historic Preservation Division (DLNR-HPD). Proposed mitigation treatment (preservation in place or Disinterment-reinterment) for burial sites must be approved by the Historic Preservation Division's Hawai'i Island Burial Council before detailed mitigation plans are finalized for these sites. A copy of the approved Final Data Recovery Plan and Preservation Plan shall be submitted to the Planning Director for its files prior to submitting plans for subdivision review and prior to any approval for any land alteration permits.
- SMA Condition 11 and Rezoning Ordinance Condition N: Should any remains of historic sites, such as rock walls, terraces, platforms, marine shell concentrations or human burials, be encountered, work in the immediate area shall cease and the Department of Land and Natural Resources-Historic Preservation Division (SHPD) shall be immediately notified. Subsequent work shall proceed upon an archaeological clearance from the SHPD when it finds that sufficient mitigative measures have been taken.

Similar conditions are expected to be imposed as part of the new Special Management Area Use Permit and the Rezoning Ordinance that would grant change of zone to RA-5a, which can help mitigate any impacts to archaeological and cultural resources of the property. It should be noted that extensive consultation has occurred, and is slated to continue to occur, throughout this project's development.

### **3.3 Infrastructure**

#### **3.3.1 Utilities, Energy, Public Facilities and Public Services**

##### *Existing Utilities, Impacts and Mitigation Measures*

Electrical power would be supplied to the project area by Hawai'i Electric Light, a privately-owned utility company regulated by the State Public Utilities Commission, via its island-wide distribution network. In the project area the network utilizes overhead lines in a utility easement that runs parallel to and approximately 2,000 feet east (*mauka*) of Akoni Pule Highway. Telephone service is available from Hawaiian Telcom, also located in the utility easement. Underground connections to those utilities will be established for the project, similar to those utilized in the Kohala Ranch and Kohala Estates subdivisions located to the east and southeast.

Water will be provided to the project under an agreement with the Kohala Ranch Water Company through a 12-inch water line along Akoni Pule Highway fronting the site. Storage in the Kohala Ranch Water system is provided by an existing 500,000-gallon storage reservoir located approximately 1,400 feet east of the property. This tank is sufficient to meet domestic and fire protection requirements for the project. Six-inch water lines will be installed at two locations along Akoni Pule Highway to provide water for the project's homes and fire hydrants. The capacity of the

private system is adequate to accommodate the additional demand to serve the project's six lots, which is expected to be a maximum of 1,000 gallons per day. CC&Rs will require that the homes feature low-water fixtures and use roof-runoff for irrigation, as well as low-water-use landscaping, which is also in keeping with the natural vegetation of this part of Kohala.

No municipal wastewater treatment service is available in Kohala. Homes will utilize individual wastewater treatment systems meeting with the requirements of the State Department of Health at Chapter 11-62, "Wastewater Systems." All six residences would use systems such as the Cyclic Biological Treatment (CBT) system evaluated in Babcock et al (2006), per LID Guidelines on wastewater treatment (Hawai'i CZM Program 2006: 4-9). The removal rates of the CBT system would be 85 percent for TN and 75 percent for TP. Effluent from the CBT system would be disposed of in leach fields. Upon passage through the leach fields, the effluent would travel downward through unsaturated lava flows and then travel with the basal groundwater to discharge along the property's shoreline. Removal of TN and TP during passage through the leach field and unsaturated lavas are conservatively assumed to be 70 and 90 percent, respectively. The system will be managed through the homeowners' association by one of the professional wastewater companies that operate in the West Hawai'i area.

The proposed addition of dwellings on the 6 lots is a relatively minor action in the context of existing utility systems, and it would not have any adverse impact on existing public or private utilities. The design of the homes will incorporate features to minimize water use.

#### *Existing Public Services and Facilities*

Fire, police and emergency medical services are available at a full-time fire station and a police station in Kapa'au located approximately 16 miles to the north. There is also a volunteer fire station located at Kohala Ranch approximately two miles to the east. County medivac helicopter service is available seven miles south of the property on Queen Ka'ahumanu Highway at the South Kohala Fire Station, which also contains a police sub-station. Acute medical care service is available at Kohala Hospital in Kapa'au, and also at North Hawai'i Community Hospital in Waimea, approximately 14 miles away.

Solid waste from the development will be hauled by residents and/or collected and hauled by commercial disposal operators to the County's West Hawai'i Sanitary Landfill in Pu'uanahulu, which has several decades of capacity.

Public schools in the area include Kohala Elementary School and Kohala Intermediate & High School, both of which are in Kapa'au. There are also elementary and middle schools located in both Waimea and Waikoloa. Two private K to 12 school, Hawai'i Preparatory Academy and Parker School, are located in Waimea. Several State and County beach parks are located within 18 miles of the property, including Spencer County Beach Park, Hapuna Beach State Park, Lapakahi State Park, Mahukona County Park, Kapa'a County Beach Park, Kamehameha County Park and Keokea County Beach Park. Additional recreational and open space land was acquired by the County *makai* of Akoni Pule Highway at Ka'iholena and Pāo'o; there are currently no facilities there. Pu'ukohola

Heiau, a federal historical site, is located near Kawaihae. Public boat ramps are located at Mahukona, Kawaihae Harbor and Puako.

*Impacts and Mitigation Measures to Public Facilities and Services*

The project may have an effect on public services and facilities through minor additional demand for fire, police, and emergency services, solid waste services, schools and recreational facilities. Taxes and a system of required fair share contributions will mitigate these impacts. Rezoning Ordinance No. 97-02 required the following:

- Rezoning Ordinance Condition P. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the subject property with respect to parks and recreation, fire, police, solid waste disposal facilities, and roads.
- Rezoning Ordinance Condition E. In conjunction with Final Subdivision approval, the applicant shall construct the necessary distribution pipeline, service laterals, and fire hydrants, meeting with the requirements of the Department of Water Supply. No building permit for any of the residential structures shall be issued until units of water are available and committed to the subject property, as represented in the applicant's agreement with the Kohala Ranch Water Company (formerly Kohala Joint Venture).
- Rezoning Ordinance Condition K. The applicant, its successors or assigns shall prepare a Solid Waste Management Plan prior to securing Final Subdivision Approval for the proposed development within the subject property meeting with the approval of the Department of Public Works. A copy of the approved Plan shall be submitted to the Planning Director.

Although the current project is far smaller and less impactful to public services and utilities than the project for which these conditions were imposed, similar conditions are expected to be imposed as part of the new Rezoning Ordinance that would grant change of zone to RA-5a.

It should be noted that high value rural residential/resort-residential homes in the County of Hawai'i tend to provide a significant net benefit in terms of public services and facilities. A 2003 economic study of resort-residential housing (Decision Analysts Hawai'i, Inc. 2003) in West Hawai'i determined that on balance it provides substantial economic benefits to the Big Island. Construction and occupant expenditures are important for employment and economic growth, and the support services required by those occupying the homes and condominiums cost far less to the County and State than the large amount of property taxes they pay. Revenues are high and steady because of the large numbers of very high value units, the low percentage of homeowners who qualify for homeowner exemptions, and the high property tax rate for properties that are not occupied by homeowners. Government costs are low because developers fund most or all of the infrastructure and amenity construction costs, and often much of the operating costs. Also, low occupancy rates mean lower demand for County services, and as most residents are well-off, they require little if any government assistance. According to the report:

“Thus, property-tax revenues from resort-residential projects exceed support expenditures by \$20.8 million per year for existing projects (\$22.2 million – \$1.4

million) and \$25 million per year for planned projects (\$26.7 million – \$1.7 million). In effect, resort-residential projects provide substantial tax revenues to subsidize support services to other Big Island residents and visitors” (Ibid: 6).

In summary, considering fair-share contributions and real property and other tax contributions, the six-lot Kohala Shoreline, LLC development would more than compensate for extra costs of public services and would also enable agencies to improve and expand their services.

### 3.3.2 Roadways and Traffic

#### Introduction

Pursuant to Section 25-2-46 (Concurrency Requirements), Hawai‘i County Zoning Code, a traffic impact analysis report (TIAR) is required with the application for any zoning amendment which can generate 50 or more peak hour trips. The proposed six-lot subdivision project thus was analyzed to determine the number of peak hour trips.

The trip generation methodology used is based upon applications developed by the Institute of Transportation Engineers (ITE) and published in “Trip Generation”, 8th Edition, 2011. Trip generations have been developed for a variety of land uses (or facility types) which correlate trips with dwelling units, area, population, vehicle ownership and intensity of use. Each facility type has a catalog Classification number for identification purposes. In this case, Classification 210, Single-family Detached, was used. For any given classification, repeated field studies by the ITE measuring actual trips generated by different land uses has calculated a generator factor for peak hour trips. This factor is multiplied by the number of units in a land use (in this case, single-family residences). This is further divided into trips that are entering or exiting the development, a split that differs by time of day. As shown in Table 7, a six-lot subdivision generates a total of less than 12 peak hour trips; furthermore, in this case, they are split (>5 and >7) between two separate access points. It should be further noted that to obtain conservative estimates of potential traffic, no adjustments were made to reflect the impact of less than full-time residents, which could be the case in the study area. In any case, as the project would generate far less than 50 peak hour trips, no TIAR is necessary.

**Table 7. Project Peak Hour Trip Generation**

Time	Number of Lots Using Access	Generator Factor	Trips Entering		Trips Exiting		Total Trips #
			%	#	%	#	
Akoni Pule Highway & South Access point							
AM	2	0.77	26%	<1	74%	<2	<3
PM	2	1.02	64%	~1	26%	<1	<2
Akoni Pule Highway & Kohala Ranch Road							
AM	4	0.77	26%	<1	74%	<2	<3
PM	4	1.02	64%	<3	26%	1	<4

The project clearly has no potential to generate substantial traffic at peak hour or any other time. Nevertheless, impacts to roadways and access are considered.

### *Existing and Proposed Facilities*

The project's two short internal roadways are confined to the portion of the property immediately adjacent to the highway (see Figure 3). They will be designed and constructed as two private residential streets with minimum 50-foot rights-of-way, which could be slightly widened to account for slope, occupied by two 10-foot wide paved lanes with grassed or aggregate shoulders on which parking will not be allowed, to preclude wildfire ignition. The north roadway will be about 350 feet long and will provide access to four driveways and the public parking lot. The south access point will be an approximately 100-foot long stub that will provide access to two driveways. Per LID Guidelines, they will include dry swales to assist with stormwater flow reduction (Hawai'i CZM Program 2006).

Akoni Pule Highway (State Highway 270) is the major north-south highway in the vicinity of the property, conducting traffic between Hawi and Kawaihae and beyond. Other access to North Kohala is available on the Kohala Mountain Road, located approximately five miles to the east (a private road for Kohala Ranch residents only connects the Kohala Mountain Road and Akoni Pule Highway). The Akoni Pule Highway, which is under the jurisdiction of the State of Hawai'i, has one lane in each direction and a posted speed limit of 55 miles per hour in this area.

The highway has a south-bound turn lane and acceleration and deceleration lanes at the intersection with Kohala Ranch Road. Several intersections are present within a mile of Kohala Ranch Road (see Figure 1b). There are no improved intersections within a mile to the north of the property, although there are unimproved and unpermitted accesses to various 4WD roads on the State property *makai*. The nearest existing access to the south is the first Kohala Kai Subdivision entrance, 2,140 feet south of Kohala Ranch Road, which is a three-legged intersection extending north, south and west; then Ala Kahua Road, which extends north, south and east, at 2,800 feet south of Kohala Ranch Road; then the second and third Kohala Kai Subdivision roads, 3,500 feet and 4,400 feet south of Kohala Ranch Road, which also features three-legged intersections extending north, south and west; and finally the Hokulele Road/Lela Nai'a at Kohala Waterfront Subdivision, a four-legged intersection located 5,000 feet south of Kohala Ranch Road. At a minimum of 500 feet apart, these intersections are widely spaced. No new intersections are planned or would likely be permitted, given State Highways policies.

### *Impacts and Mitigation Measures*

As stated above and shown in Figure 3, access and egress for the six-lot subdivision will be from two new access points along the *makai* side of Akoni Pule Highway. Due to the low background traffic in this area, both intersections are proposed to be unsignalized. Given the low total number of peak hour trips generated by the project, no adverse effects to local or regional traffic are expected.

The north access point will be the west leg of the existing intersection of the highway with Kohala Ranch Road; it will provide access and egress to four lots. Existing conditions at the Kohala Ranch Road intersection are as follows: a southbound through lane, a northbound through lane, northbound right lane, a westbound lane and a westbound right/out lane. There is a refuge pocket for the westbound left turn lane on Akoni Pule Highway. There is adequate area to make a lane for a

northbound left refuge pocket and for a southbound right deceleration lane. The south access point will also be located along the west side of the highway, approximately 1,300 feet south of Kohala Ranch Road (and the north access point ); it will provide access to two lots. The proposed intersection improvements to Akoni Pule Highway at the south access point would be determined in consultation with the Hawai‘i State Department of Transportation, Highways Division (DOT). Improvements to both intersections would require design review by and approval from the DOT, which will also deal with the issue of utility easements in the highway right-of-way.

Rezoning Ordinance No. 97-02 required the following related to roads and traffic:

- Rezoning Ordinance Condition F. Access to the subject property from Akoni Pule Highway and any improvements within the Akoni Pule Highway shall be constructed prior to Final Subdivision Approval meeting with the requirements and approval of the State Department of Transportation.
- Rezoning Ordinance Condition G. Roadway connections to the adjoining parcel of the subject property’s southeastern boundary shall be provided meeting with the approval of the Department of Public Works and shall be delineated on the final subdivision plat map for the subject property.
- Rezoning Ordinance Condition H. All interior roadways within the subject property shall be constructed meeting with the requirements of Chapter 23 of the Subdivision Code and with the approval of the Department of Public Works.

Although the current project is far smaller and less impactful to traffic than the project for which these conditions were imposed, similar conditions are expected to be imposed as part of any new Rezoning Ordinance that would grant change of zone to RA-5a, however, the project may require approval of a variance or planned unit development permit to address road standards, lot sizes and other design variances. The only mitigation required would be restriping of Akoni Pule Highway at the north access point to convert the existing refuge pocket into a northbound left turn lane.

### **3.4 Secondary and Cumulative Impacts**

Somewhat distinct from the direct effects that construction and occupation of a housing project can have on the environment are secondary impacts. These can include impacts from residents traveling to different parts of the island for work or recreation and inducing impacts in environmentally sensitive areas. Another potential secondary impact is economic; although generally positive, increased economic activity resulting from the expenditures of new residents can draw in workers who add to the existing demand for affordable housing. In the case of the subject project, its modest scale in relation to the existing population of the island indicates that any such adverse secondary impacts would be negligible.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. It is therefore appropriate to frame the setting in the context of ongoing and future developments. The North Kohala District is primarily residential in nature, with some ongoing agricultural activities including ranching. Some commercial activities occur in its two primary towns, Hawi and Kapa‘au. This area

supported some of the earliest wind farms in Hawai‘i and is being explored for biomass and green farming. Between these towns and the property in the very south of North Kohala lies an area of undeveloped shoreline, with expansive vistas both *mauka* and *makai*. Over the decades, several subdivisions have been proposed that would alter the character of some areas of shoreline, prompting calls by citizens to acquire open space, which have been answered by the County with several property acquisitions, as discussed in Section 3.1.5. Although on the fringe of this undeveloped area, the Kohala Shoreline property itself is adjacent to several upscale agricultural and residential subdivisions, including the more than 3,500-acre Kohala Ranch, which is continuing to be developed with homes. The property is near the border of South Kohala and approximately three miles north of Kawaihae Harbor, one of only two deep-draft harbors on Hawai‘i Island and the only one located on its western or leeward side. A small-boat harbor, which the State has expanded, is also located there. Also located in Kawaihae is the State Department of Hawaiian Home Lands’ 10,152-acre Kawaihae Tract which, while currently mostly used for grazing, will eventually be developed with commercial, residential, agricultural and community use components. The town of Kawaihae itself has a small residential population and several small commercial centers. Aside from the residential and industrial uses at the Department of Hawaiian Home Lands projects to the south of the property, no major projects are known to be proposed for development in the area.

The proposed six-lot subdivision project will have minor impacts for almost all categories of resources. It should be noted that the proposed change of zone limits future potential density from the 50 lots approved under SMA 379 down to six lots. Cumulative effects are potentially of concern for the following resources:

- **Traffic:** Considered cumulatively, there is a negligible effect on Average Daily Traffic on Akoni Pule Highway and all other major roads, but a slightly more substantial effect with the interaction of left turns at the main entrance of Kohala Ranch. This is mitigable by the proposed project intersection improvements, which includes a northbound to westbound left-turn pocket and a southbound deceleration lane.
- **Visual Resources:** The project will contribute to the slow transformation of the views of undeveloped coastal areas that is occurring in North Kohala. The effect is not severe in this part of North Kohala because of the extensive developed area that lies directly *mauka*, as well as the presence of other similarly developed coastal properties to the south. This is further mitigated by the proposed project design that locates house pads away from both the highway and the shoreline, retains most of the existing kiawe tree landscape, and restricts homes to 25 feet in height in a development concept significantly less dense than allowed by existing zoning. Furthermore, the prevalence of essentially undevelopable State properties adjacent to the north, combined with the continuing acquisition by the County of private properties *makai* of the highway, will cumulatively build the inventory of perpetually undeveloped shoreline in North Kohala. This will maintain the health of this scenic resource.
- **Water Quality:** The project may minimally add to input of nutrients and other pollutants (while likely slightly reducing sedimentation) but changes of land use associated with the project should not contribute along with other actions to a decrease in water quality.

A cumulative beneficial impact is the provision of a corridor, along with a landowner encouraged to be cooperative under expected SMA and Change of Zone conditions, for the establishment of the

Ala Kahakai Trail across the property. As discussed in Section 3.2.2, this trail system is meant to traverse the entire west coast of the island. A trail segment on the property would provide a key link. The benefit of this section of the trail would accumulate with similar benefits for nearby properties, helping create a coherent trail that is greater than the sum of its parts.

### **3.5 Required Permits and Approvals**

The following permits and approvals would be required:

- County of Hawai‘i, Department of Public Works, Engineering Division: Grading Permit.
- County of Hawai‘i, Planning Department, Variance and/or Planned Unit Development Permit and Subdivision Approval.
- County of Hawai‘i, Leeward Planning Commission: Special Management Area Use Permit and Change of Zone Recommendation.
- County of Hawai‘i, County Council: Change of Zone Approval.
- State Department of Transportation: Approval for Work within State Roadway Right-of-Way.
- State of Hawai‘i, Department of Health: Underground Injection Control (UIC) permits. National Pollutant Discharge Elimination System (NPDES) permit.

### **3.6 Consistency with Government Plans and Policies**

#### **3.6.1 Hawai‘i State Plan**

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. The proposed project would promote these goals by adding housing and a location for an important coastal recreational trail for the North Kohala district, thereby enhancing quality-of-life and community and social well-being.

#### **3.6.2 Hawai‘i State Land Use Law**

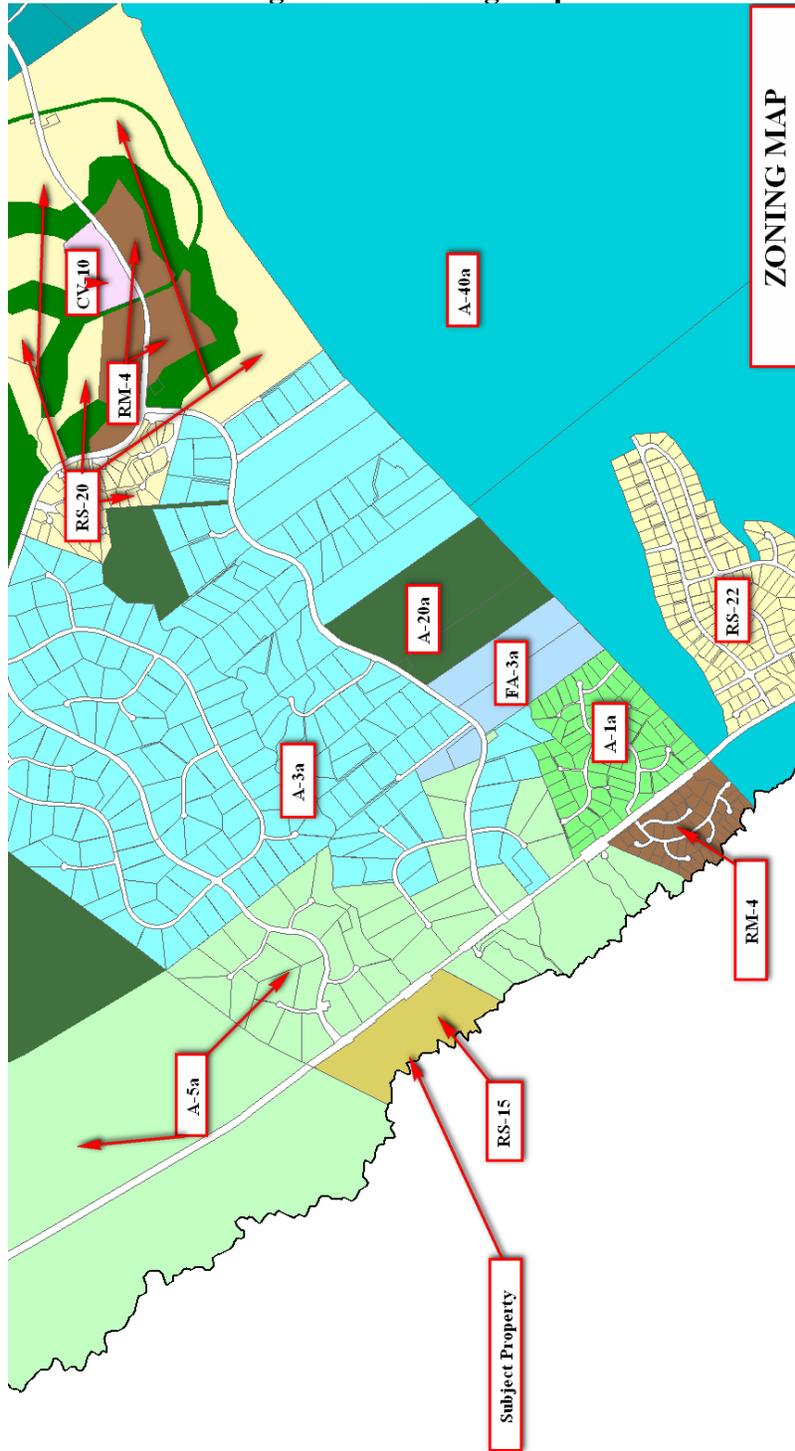
All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. The property is in the State Land Use Urban District. The proposed use is consistent with intended uses for this land use district.

Figure 11 depicts the high-level land use designations for three types: State Land Use District, County General Plan Land Use Pattern Allocation Guide Map (LUPAG), and County Zoning Districts. Only the high-level categories are designated with letter codes on the map: U for Urban, A for Agricultural, C for Conservation, O for Open and R for Rural. Although the meanings of these terms across designation types are not identical, the purpose of the map is to show the extent of urban versus other types in the region.

**Figure 11 Regional Land Use Designations**



Figure 12 Zoning Map



### 3.6.3 Hawai‘i County Zoning and General Plan

*Hawai‘i County Zoning.* The entire property (Figure 12) carries a zoning designation of RS-15 (single-family residential, with a minimum lot size of 15,000 square feet). The proposed action would reduce the allowed density to an average of one home per six acres.

The *Hawai‘i County General Plan Land Use Pattern Allocation Guide (LUPAG)*. The LUPAG map component of the *General Plan* is a graphic representation of the Plan’s goals, policies, and standards as well as of the physical relationship between land uses. It also establishes the basic urban and non-urban form for areas within the planned public and cultural facilities, public utilities and safety features, and transportation corridors. The property is classified as Low Density Urban, Extensive Agriculture, and Open in the LUPAG (Figure 13). Most of the property is designated Low Density Urban, with a small portion designated Extensive Agriculture, and a strip of Open along the shore. The proposed six-lot subdivision would be consistent with the Low Density Urban designation, which allows “residential, with ancillary community and public uses, and neighborhood and convenience-type commercial uses; overall residential density may be up to six units per acre.” The shoreline area would remain undeveloped and dedicated to public access and consistent with Open under the proposed site plan (see Figure 3).

The *General Plan* for the County of Hawai‘i is a policy 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 (Hawai‘i County Planning Department). The *General Plan* itself 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. Analysis for the EA confirms that it generally satisfies the following Goal and Policies, and Courses of Action of particular chapters of the *General Plan*:

#### ECONOMIC GOALS

Provide residents with opportunities to improve their quality of life through economic development that enhances the County’s natural and social environments.

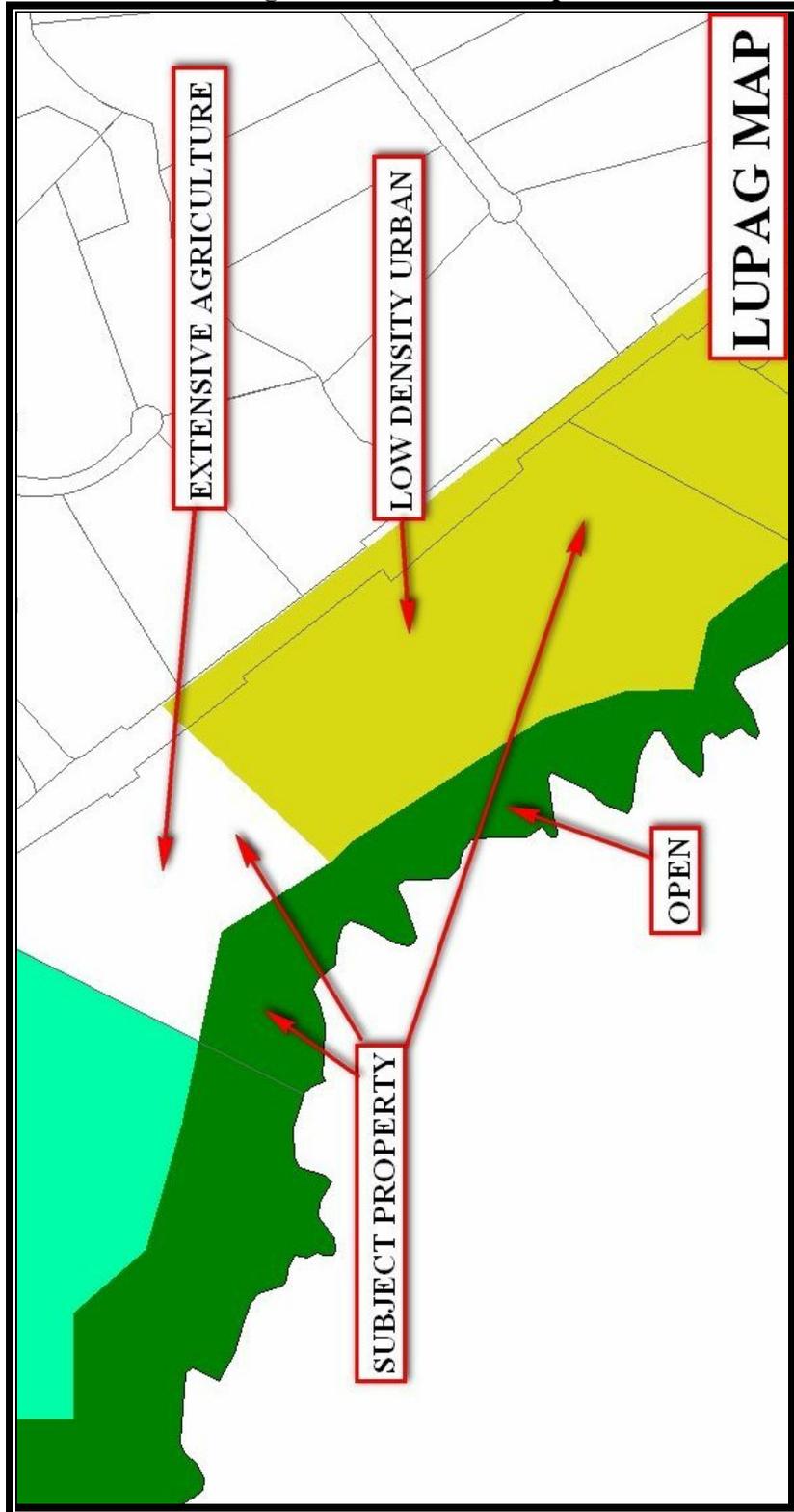
Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.

Strive for diversity and stability in the economic system.

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 action is in balance with the natural, cultural and social environment of the County, and it will create temporary construction jobs for local residents and indirectly benefit the economy through construction industry purchases from local suppliers. A multiplier effect takes place when these employees spend their income for food,

Figure 13 LUPAG Map



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.

#### ENVIRONMENTAL QUALITY GOALS

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.

Maintain and, if feasible, improve the existing environmental quality of the island.

#### ENVIRONMENTAL QUALITY POLICIES

Take positive action to further maintain the quality of the environment.

#### ENVIRONMENTAL QUALITY STANDARDS

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.

Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.

*Discussion:* The proposed action, which occurs in an area designated by zoning for urban development, would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The project will obtain permits and follow the conditions designed to reduce or eliminate pollution and environmental degradation.

#### HISTORIC SITES GOALS

Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.

Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

#### HISTORIC SITES POLICIES

Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.

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 indications that the land under consideration has historical significance.

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

*Discussion:* Archaeological resources have been properly assessed through an inventory survey approved by SHPD. Certain sites will be subject to data recovery and preservation, and plans will be developed and approved by SHPD. Appropriate access to significant historic sites will occur through burial treatment plans, preservation plans, and trails.

#### FLOOD CONTROL AND DRAINAGE GOALS

Conserve scenic and natural resources.

Protect human life.

Prevent damage to man-made improvements.

Control pollution.

Prevent damage from inundation.

Reduce surface water and sediment runoff

#### FLOOD CONTROL AND DRAINAGE POLICIES

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.

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

#### FLOOD CONTROL AND DRAINAGE STANDARDS

Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.

Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).

Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control" of the Hawaii County Code.

Applicable standards and regulations of the Natural Resources Conservation Service and the Soil and Water Conservation Districts.

*Discussion:* Most of the property lies within Zone X, areas of minimal flood hazard. No home development will occur within the VE zone adjacent to the coast or within gulches. All standards regarding drainage, flooding and sedimentation will be adhered to and project design will be reviewed by and subject to permits from the Hawai'i County Department of Public Works and the Hawai'i State Department of Health.

## NATURAL BEAUTY GOALS

Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.

Protect scenic vistas and view planes from becoming obstructed.

Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

## NATURAL BEAUTY POLICIES

Increase public pedestrian access opportunities to scenic places and vistas.

Protect the views of areas endowed with natural beauty by carefully considering the effects of proposed construction during all land use reviews.

Do not allow incompatible construction in areas of natural beauty.

*Discussion:* The site plan for the project, which will be reviewed and approved by the Planning Department, maintains *mauka-makai* view corridors and has all structures set back a minimum of 150 feet from Akoni Pule Highway and 100 feet from the shoreline, *mauka* of the *ala loa*/jeep road. All electrical and communication lines within the property will be placed underground. The Waiaka'ilio Bay area is named in the 2005 General Plan as a place of natural beauty and was also so listed in the 1989 General Plan. The subsequent granting of the RS-15 zoning and SMA Permit indicates that the proposed urban land use for the property was considered compatible with this natural beauty designation. As discussed in Section 3.1.4, the point at Waiaka'ilio Bay will continue to be visible from the highway, albeit with a mid-ground that includes some developed structures. CC&Rs will restrict homes to a height of 25 feet as measured according to Chapter 25, Hawai'i County Zoning Code and will require a color scheme featuring earth-tone colors to minimize visual impacts, as generally shown in the visual simulations. Although the homes will be visible, their visual impact has been minimized, and they will not appear out of character given the large residential-agricultural development directly adjacent to the property, and the urban appearance of coastal developments just to the south and in Kawaihae.

## NATURAL RESOURCES AND SHORELINES GOALS

Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.

Provide opportunities for the public to fulfill recreational, economic, and educational needs without despoiling or endangering natural resources.

Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.

Ensure that alterations to existing landforms and vegetation, except crops, 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 earthquake.

## NATURAL RESOURCES AND SHORELINES POLICIES

The County of Hawaii should require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.

Encourage the use of native plants for screening and landscaping.

*Discussion:* The proposed action would locate all homes a minimum of 100 feet from the shoreline and a minimum of 40 feet above sea level. Impacts to existing natural landforms and vegetation will be mitigated through permit-regulated Best Management Practices in conformance with Low Impact Design guidelines to avoid any impacts related to flooding, landslides, sedimentation or other similar impacts.

## LAND USE GOALS

Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.

## LAND USE POLICIES

Allocate appropriate requested zoning in accordance with the existing or projected needs of neighborhood, community, region and County.

## LAND USE, OPEN SPACE GOALS

Provide and protect open space for the social, environmental, and economic well-being of the County of Hawaii and its residents.

Protect designated natural areas.

## LAND USE, OPEN SPACE POLICIES

Open space shall reflect and be in keeping with the goals, policies, and standards set forth in the other elements of the General Plan.

*Discussion:* The proposed residential project on an urban-designated parcel would be in keeping with County and State land use plans and does not detract from important open space.

### 3.6.5 Chapter 205A and Special Management Area

*Special Management Area.* The property is situated within the County's Special Management Area (SMA) and an SMA Use Permit will be applied for before the Hawai'i County Leeward Planning Commission. The criteria for review of development within the Special Management Area are stated in HRS, Chapter 205a-26(2) (Special Management Area guidelines) and Rule 9-11(E) in the Planning Commission Rules. Planning Commission Rule 9-11(E) states that the Authority may permit the proposed development only upon finding that:

1. The development will not have any substantial adverse environmental or ecological effect except as such adverse effect is minimized to the extent practicable and is clearly outweighed by public health, safety, or compelling public interest;
2. The development is consistent with the objectives and policies and the Special Management Area guidelines as provided by Chapter 205A, HRS; and
3. The development is consistent with the General Plan, Zoning Code and other applicable ordinances.
4. The development will, to the extent feasible, reasonably protect native Hawaiian rights if they are found to exist, including specific factual findings regarding:
  - a. The identity and scope of valued cultural, historical or natural resources in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;
  - b. The extent to which those resources, including traditional and customary native Hawaiian rights, will be affected or impaired by the proposed action; and
  - c. The feasible action, if any, to be taken by the Authority to reasonably protect any valued cultural, historical or natural resources, including any existing traditional and customary native Hawaiian rights.

Based on the resources and impacts described in previous sections, the project is consistent with the above criteria, a subject which will be evaluated and discussed in detail as part of the SMA application.

There is a potential that some houses in the Project could be larger than 7,500 square feet in size. Per Hawai'i County SMA Rules, any proposal for a house greater than 7,500 feet must undertake an SMA Major Use Permit with the Planning Commission.

### 3.6.5 North Kohala Community Development Plan

The North Kohala Community Development Plan encompasses the judicial district of North Kohala 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 General Plan now requires that a Community Development Plan shall be adopted by the County Council as an “ordinance,” giving the CDP the force of law. This contrasts with plans created over past years, adopted by “resolution” that served only as guidelines or reference documents to decision-makers. In November 2008, the North Kohala CDP was adopted by the County Council. The version referenced in this Environmental Assessment is at:  
<http://www.hcrc.info/community-planning/community-development-plans/north-kohala>.

The purposes of the North Kohala CDP are to:

- Articulate North Kohala’s residents’ Vision and Values for their Community
- Identify North Kohala’s residents’ Priority Issues to be addressed by the CDP
- Develop Strategies and Action Programs to address those Priority Issues

The CDP, with a theme of “Keep Kohala, Kohala,” describes the district as a “Cultural and Historical Preservation Community” and emphasizes that all development decisions “shall be required to assess and disclose their potential impact on cultural sites and resources within the district and shall be in keeping with the heritage and culture of North Kohala.”

The overall goal of the North Kohala CDP is:

“To manage the future growth of the district in a manner that is consistent with the Kohala lifestyle and ideals of being a rural community with a strong cultural heritage, an agricultural base, and a small town feel.”

That overall goal is expressed through four Priority Issues, each with its own Goal. The Kohala Shoreline, LLC project is compatible with Priority Issue 1 and its Goal - Growth Management. Under the CDP growth is to be directed “to areas within and near existing town centers in order to preserve the district’s open space and cultural resources; and to promote agriculture.”

The area proposed for the project is bounded on the *mauka* side by similar rural-residential and agricultural-residential developments, which are also present in many areas *makai* of the highway from the subject property towards the south. This is also in keeping with CDP Section 3.3, which calls for upscale developments to be limited to areas where they are already located, as depicted in the CDP’s “North Kohala Environmental & Cultural Concept Map” located on Page 25. The property is located within or immediately adjacent to the area depicted as “Existing Upscale Development” on this map.

Another relevant consideration from the North Kohala CDP is the protection of viewplanes and places of natural beauty.

“Strategy 1.9: Establish a View Plane Protection Program to identify and protect areas of significant beauty along the Kohala Mountain Road and Akoni-Pule Highway corridor.”

The project will have all homes set back 150 feet from Akoni Pule Highway and 100 feet from the shoreline, *mauka* of the *ala loa*/jeep road. Buildings will be limited to 25 feet in height as measured under the Zoning Code and restricted to earth-tone color schemes to minimize visual impacts. The natural kiawe tree landscape will be largely preserved. These factors will protect view plans.

The development of Kohala Shoreline, LLC will help implement Strategy 2.5, which aims to “Encourage and increase cooperation and coordination between the community and private land owners regarding public access to coastal and mauka lands.” The proposed shoreline access and parking area and lateral shoreline trail will help maintain and improve public access to coastal lands.

The North Kohala Community Development Plan Strategy 2.6 identified vehicular access on an existing jeep road over the subject property, TMK 5-9-001:008, to Waiaka‘ilio Bay as part of the coastline trail and drivable *mauka-makai* access element.

The owner understands the desire for vehicular access across his property as part of this element, but it has foregone any such access for even itself and future buyers out of respect for input provided during community and native Hawaiian consultation, which strongly opposed crossing the *ala loa* with driveways. No development of any kind is to be allowed *makai* of the *ala loa*/jeep road under the plan proposed by the owner. It should be noted that this is one of the steepest parts of the property and would require extensive cut and fill to develop a road dedicable to the County of Hawai‘i. A parking lot with these impacts near the shoreline would be incompatible with the low-impact nature of the subdivision and unlike shoreline access for all other developments in the area, which for access provide a parking lot coupled with a trail of several hundred yards to the ocean, and sunrise to sunset access.

#### **PART 4: DETERMINATION**

The owner and future applicant for the change of zone and Special Management Area Use Permit, Kohala Shoreline, LLC, expects that the Hawai‘i County Planning Department 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.

## **PART 5: FINDINGS AND REASONS**

Chapter 11-200-12, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

*1. The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.*

No valuable natural or cultural resources would be committed or lost. Archaeological sites are being protected through preservation plans, and there will be a wide setback zone from the shoreline to protect and promote public enjoyment of shoreline resources. The property and surrounding areas support residential and open space uses that will not be affected by the proposed action.

*2. The proposed project will not curtail the range of beneficial uses of the environment.*

The principal beneficial use of the area is for shoreline recreation, which will not be curtailed in any way – and in fact will be substantially enhanced through provision of a corridor for the Ala Kahakai trail and a wide easement area for public shoreline enjoyment.

*3. The proposed project will not conflict with the State's long-term environmental policies.*

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 proposed action provides housing in an area identified in the General Plan for such uses, fulfilling needed County and State goals while avoiding significant impacts to the environment. It is thus consistent with all elements of the State’s long-term environmental policies.

*4. The proposed project will not substantially affect the economic or social welfare of the community or State.*

The project will not adversely affect the social welfare of the community and will contribute to the economy and to shoreline access.

*5. The proposed project does not substantially affect public health in any detrimental way.*

No effects to public health are anticipated. Water quality will be protected, and likely enhanced, through adherence to Best Management Practices that will be specified as part of NPDES and Grading permits.

*6. The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.*

Only modest secondary effects are expected to result from the rural residential project. Because of the nature of the project, real property and other tax contributions would more than compensate for extra costs of public services and would also enable agencies to improve and expand their services.

*7. The proposed project will not involve a substantial degradation of environmental quality.*

The proposed action is taking place in a general area already impacted in the past or currently by onsite ranching, fire and goat grazing, and by nearby construction and rural residential activities. The project would be regulated by permits to avoid environmental degradation and thus would not contribute to environmental degradation.

*8. The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.*

Traffic impacts from the six lots will have a negligible impact on cumulative traffic operations. The project will contribute to the transformation of views of undeveloped coastal areas occurring in North Kohala, but the effect is not severe because of the remaining extensive stretch of undeveloped coastal areas to the north, as well as the presence directly *mauka* and south of already developed areas. The project may minimally add to input of nutrients and other pollutants (while likely slightly reducing sedimentation) but changes of land use associated with the project should not change water quality of the offshore area to any discernible extent.

*9. The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.*

The property supports overwhelmingly alien vegetation. With standard mitigation on timing of vegetation removal to protect Hawaiian hoary bats, impacts to rare, threatened or endangered species of flora or fauna will not occur.

*10. The proposed project will not detrimentally affect air or water quality or ambient noise levels.*

Due to the character of the proposed action, no non-negligible adverse effects on these resources would occur.

*11. The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive areas such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.*

Although the proposed action is located in an area with seismic and shoreline hazard, the entire Island of Hawai'i shares this risk, and the proposed action is not imprudent to construct. All home development will be set well back from the shoreline at elevations of 40 feet or higher to account for potential sea level rise. Culverts within the subdivision are being planned as oversized to accommodate the 100-year, rather than the required 50-year storm, in order to account for future potential increases in runoff.

Uncertainties regarding regional circulation make it possible that climate change may lead to drier rather than wetter conditions, increasing wildfire risk. If this occurs, the substantial precautions to prevent and adapt to wildfire risk discussed in Section 3.1.1 will mitigate additional potential risk.

*12. The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.*

The project has been designed through restrictions in density, grading, tree removal, home height and home position to minimize impacts on protected scenic viewplanes, including views from Akoni Pule Highway of the coast. The project will contribute to the transformation of views of undeveloped coastal areas occurring in North Kohala, but the effect is not severe because of the remaining extensive stretch of undeveloped coastal areas to the north, as well as the presence directly *mauka* and south of already developed areas.

*13. The project will not require substantial energy consumption.*

Although the project's infrastructure and dwelling unit construction will require energy, the development's electrical requirements are within HELCO's capacity and no major adverse effects to energy consumption would be expected. There is no feasible way to provide housing without energy consumption. The project design will include photovoltaic solar, energy efficient lighting fixtures, low water use fixtures, and low water use landscaping, all of which reduce energy use.

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 1a**

#### **Comments in Response to Early Consultation**

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**From:** Fujio, Mary <Mary.Fujio@hawaiicounty.gov>  
**Sent:** Monday, November 26, 2018 9:16 AM  
**To:** rterry@hawaii.rr.com  
**Subject:** Early Consultation on EA for TMK 5-9-001-008 (Kohala Shoreline LLC)

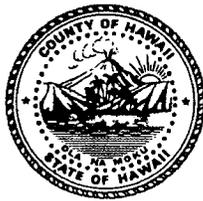
Good morning, Mr. Terry –

The Department of Environmental Management, County of Hawai'i, has received your 11/10/18 letter soliciting comments on the proposed development. DEM has no comments.

Thank you.

Mary E. Fujio  
Private Secretary to William Kucharski, Director  
and Diane Noda, Deputy Director  
Department of Environmental Management  
County of Hawai'i  
345 Kekūanāo'a Street, Suite 41  
Hilo, Hawai'i 96720  
Telephone: (808) 961-8099

**Harry Kim**  
*Mayor*



**Paul K. Ferreira**  
*Police Chief*

**Kenneth Bugado, Jr.**  
*Deputy Police Chief*

## **County of Hawai'i**

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

November 23, 2018

Mr. Ron Terry  
Geometrician Associates, LLC  
P.O. Box 396  
Hilo, Hawai'i 96720

**SUBJECT: EARLY CONSULTATION ON ENVIRONMENTAL ASSESSMENT FOR A SIX-LOT  
RESIDENTIAL AGRICULTURAL SUBDIVISION, TMK 5-9-001:008, NORTH KOHALA,  
ISLAND OF HAWAII**

Dear Mr. Terry:

Staff has reviewed the above-referenced letter and has no comments at this time. It is not necessary to send a separate copy of the EA to the Hawai'i Police Department.

Should you have any questions, please contact Captain Jeremie Evangelista, Commander of the North Kohala District, at 808-889-6540.

Sincerely,

PAUL K. FERREIRA  
POLICE CHIEF

  
JAMES B. O'CONNOR  
ASSISTANT CHIEF  
AREA II OPERATIONS

JCE/jaj  
18HQ0287

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

December 14, 2018

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

via email: [rterry@hawaii.rr.com](mailto:rterry@hawaii.rr.com)

Dear Mr. Terry:

SUBJECT: Early Consultation on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision on behalf of **Kohala Shoreline LLC** located at North Kohala, Island of Hawaii; TMK: (3) 5-9-001:008

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) Division of Forestry & Wildlife, (c) Commission on Water Resource Management, and (d) Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to call Darlene Nakamura at (808) 587-0417. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji  
Land Administrator

Enclosures  
cc: Central Files

DAVID Y. IGE  
GOVERNOR OF HAWAII



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



**STATE OF HAWAII**  
**DEPARTMENT OF LAND AND NATURAL RESOURCES**  
**LAND DIVISION**

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

November 21, 2018

**MEMORANDUM**

~~TO:~~  
**FROM**

**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:~~  
**FROM:**

Russell Y. Tsuji, Land Administrator

~~SUBJECT:~~  
**SUBJECT:**

Early Consultation on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision

**LOCATION:**

North Kohala, Island of Hawaii; TMK: (3) 5-9-001:008

**APPLICANT:**

Geometrician Associates, LLC on behalf of **Kohala Shoreline LLC**

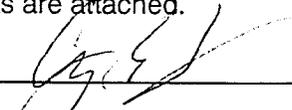
RECEIVED 12/11/18 ENGINEERING

Transmitted for your review and comment is information on the above-referenced subject matter. We would appreciate your comments by **December 12, 2018**.

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. Thank you.

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

Signed:

  
\_\_\_\_\_

Print Name:

Cary S. Chang, Chief Engineer  
\_\_\_\_\_

Date:

12/11/18  
\_\_\_\_\_

Attachments

cc: Central Files

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

**LD/Russell Y. Tsuji**

**Ref: Early Consultation on Environmental Assessment for a Six-Lot Residential  
Agricultural Subdivision, North Kohala, Island of Hawaii;  
TMK: (3) 5-9-001:008**

**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:

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

Signed:   
CARTY S. CHANG, CHIEF ENGINEER

Date: 12/11/10

19303

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

November 21, 2018

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 on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision

LOCATION:

North Kohala, Island of Hawaii; TMK: (3) 5-9-001:008

APPLICANT:

Geometrician Associates, LLC on behalf of **Kohala Shoreline LLC**

Transmitted for your review and comment is information on the above-referenced subject matter. We would appreciate your comments by **December 12, 2018**.

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. Thank you.

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

Signed:

\_\_\_\_\_

Print Name:

**DAVID G. SMITH, Administrator**

Date:

\_\_\_\_\_

Attachments

cc: Central Files



**NA ALA HELE**  
Hawaii Trail & Access System

November 20, 2014

Ref: H14:04 Kohala Shoreline

TO: Clement Chang, Trails Specialist

FROM: D. Moana Rowland, Abstractor *DMR*

SUBJECT: Inquiry from Shawn Yamada of Carlsmith Ball regarding State-owned Trails through Tax Map Key 5-9-1-8

Documents disclose in the 1930's the Territory of Hawaii did claim ownership of a trail known then as the "Mahukona-Kawaihae Beach Trail", which ran laterally through the property. However, in consideration for the landowner's conveyance of other mauka lands for roadway purposes, the Territory of Hawaii subsequently waived and withdrew its claim to all trails within the subject land.

Beginning in 1976, the successors in interest to the original owner in the 1930's would re-subdivide and consolidate the subject land with adjoining parcels resulting in Land Court Consolidation 129.

By 1993, Tom Gentry owns the subject parcel and submits to the County of Hawaii Planning Department a Shoreline Management Area Minor Permit No. 93-19. The County requires Gentry to provide a Pedestrian Shoreline Access.

A map and metes and bounds description is prepared by Patrick Cummins, Surveyor, that delineates a Shoreline setback line for coastal public access intended to be six (6) feet from and parallel to the highwater mark.

In 1994, Gentry files a Petition for Erosion, Redesignation of Lot with Erosion and Designation of Shoreline Setback Line for Coastal Public Access. Upon approval by the State Land Surveyor, Land Court Order No. 118635 is filed and Map 5 Consolidation 129 is accepted which shows the location of the coastal public access route.

Kohala LLC acquired title to the subject parcel in 1999 with the coastal public access route cited as an encumbrance on the land.

This coastal public access is not under the jurisdiction of the Department of Land and Natural Resources.

**Nakamura, Darlene K**

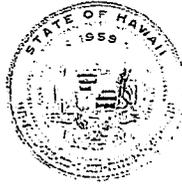
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**From:** Rowland, Moana  
**Sent:** Wednesday, November 28, 2018 11:05 AM  
**To:** Nakamura, Darlene K  
**Subject:** Kohala Shoreline LLC 5-9-1-8  
**Attachments:** Kohala Shoreline LLC EA Consultation.PDF

Aloha,  
Attached you will find a memo dated November 2014 that will serve as our comments on this matter.  
Mahalo,  
Moana

Doris Moana Rowland  
Department of Land and Natural Resources  
Division of Forestry and Wildlife  
Na Ala Hele Trails and Access Program  
1151 Punchbowl Street Room 325  
Honolulu, Hawaii 96813  
Office: 808-587-0057  
Mobile: 808-426-6967  
Fax: 808-587-0160

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

November 21, 2018

MEMORANDUM

RECEIVED  
COMMISSION ON WATER  
RESOURCE MANAGEMENT  
2018 NOV 21 AM 11:44

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

FR:

to

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision

LOCATION:

North Kohala, Island of Hawaii; TMK: (3) 5-9-001:008

APPLICANT:

Geometrician Associates, LLC on behalf of **Kohala Shoreline LLC**

Transmitted for your review and comment is information on the above-referenced subject matter. We would appreciate your comments by **December 12, 2018**.

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. Thank you.

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

Signed: /s/ Jeffrey T. Pearson, P.E.

Print Name: Deputy Director

Date: December 3, 2018

Attachments  
cc: Central Files

FILE ID:	RFD.4211.8
DOC ID:	20632

DAVID Y. IGE  
GOVERNOR OF HAWAII



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

SUZANNE D. CASE  
CHAIRPERSON

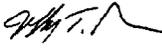
BRUCE S. ANDERSON, PH.D.  
WILLIAM D. BALFOUR, JR.  
KAMANA BEAMER, PH.D.  
MICHAEL G. BUCK  
NEIL J. HANNAHS  
PAUL J. MEYER

JEFFREY T. PEARSON, P.E.  
DEPUTY DIRECTOR

December 3, 2018

REF: RFD.4211.8

TO: Mr. Russell Tsuji, Administrator  
Land Division

FROM: Jeffrey T. Pearson, P.E., Deputy Director   
Commission on Water Resource Management

SUBJECT: Early Consultation on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision

FILE NO.: RFD.4211.8  
TMK NO.: (3) 5-9-001:008

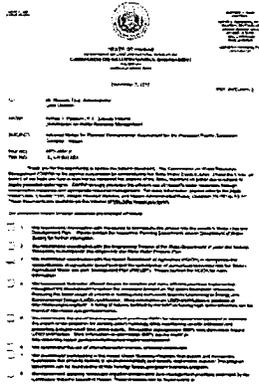
Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all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

Our comments related to water resources are checked off below.

1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.
2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.
3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.
4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at <http://www.usgbc.org/leed>. A listing of fixtures certified by the EAP as having high water efficiency can be found at <http://www.epa.gov/watersense>.
5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at <http://planning.hawaii.gov/czm/initiatives/low-impact-development/>
6. We recommend the use of alternative water sources, wherever practicable.
7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at <http://energy.hawaii.gov/green-business-program>.
8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at [http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH\\_Irrigation\\_Conservation\\_BMPs.pdf](http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf).

- 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.
- 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.
- 11. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.
- 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.
- 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.
- 14. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.
- 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.
- 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.
- 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.
- 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.
  
- OTHER: The Draft Environmental Assessment should discuss the projected water demands for the project, both potable and non-potable, and provide the calculations used to estimate demands. The Draft Environmental Assessment should identify the proposed water source(s) to support the project, and include a discussion of the potential impacts on water resources and other public trust uses of water, and describe any proposed mitigation measures. Water conservation and efficiency measures to be implemented should also be discussed

If you have any questions, please contact Lenore Ohye of the Commission staff at 587-0216.



Doc Reviews (5) RFD.4981.8  
Pacific Spaceport; RFD.4983.3  
Ala Wai Canal Bridge  
Alternatives Analysis;  
RFD.4984.5 Pulama Lanai Miki  
Basin 200-Acre Industrial Area;  
RFD.4211.8 Six-Lot Residential  
Agricultural Subdivision;  
RFD.4985.5 Hoku-ao 201H  
Housing Proj

Adobe Sign Document History

12/03/2018

Created:	12/03/2018
By:	Kathy Yoda (kathy.s.yoda@hawaii.gov)
Status:	Signed
Transaction ID:	CBJCHBCAABAAwX4bNg3niLiGD4my2xLdYY6POjppDd7d

"Doc Reviews (5) RFD.4981.8 Pacific Spaceport; RFD.4983.3 Ala Wai Canal Bridge Alternatives Analysis; RFD.4984.5 Pulama Lanai Miki Basin 200-Acre Industrial Area; RFD.4211.8 Six-Lot Residential Agricultural Subdivision; RFD.4985.5 Hoku-ao 201H Housing Proj" History

 Document created by Kathy Yoda (kathy.s.yoda@hawaii.gov)  
12/03/2018 - 10:29:31 AM HST- IP address: 132.160.239.30

 Document emailed to Jeffrey Pearson (jeff.pearson@hawaii.gov) for signature  
12/03/2018 - 10:39:30 AM HST

 Document viewed by Jeffrey Pearson (jeff.pearson@hawaii.gov)  
12/03/2018 - 8:23:12 PM HST- IP address: 174.239.9.207

 Document e-signed by Jeffrey Pearson (jeff.pearson@hawaii.gov)

Signature Date: 12/03/2018 - 8:27:32 PM HST - Time Source: server- IP address: 174.239.9.207

 Signed document emailed to all eligible parties.

12/03/2018 - 8:27:32 PM HST

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

2018 NOV 23 P 12:24

RECEIVED  
LAND DIVISION  
HONO. HAWAII

November 21, 2018

MEMORANDUM

FROM:  
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

TO:

FROM: Russell Y. Tsuji, Land Administrator

SUBJECT: Early Consultation on Environmental Assessment for a Six-Lot Residential Agricultural Subdivision

LOCATION: North Kohala, Island of Hawaii; TMK: (3) 5-9-001:008

APPLICANT: Geometrician Associates, LLC on behalf of **Kohala Shoreline LLC**

Transmitted for your review and comment is information on the above-referenced subject matter. We would appreciate your comments by **December 12, 2018**.

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. Thank you.

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

Signed: 

Print Name: GORDON C. HEIT

Date: 12/3/18

Attachments  
cc: Central Files

> Begin forwarded message:

>

>> From: toni withington <sundownertoni@yahoo.com>

>> Date: November 12, 2018 at 9:20:14 AM HST

>> To: rterry@hawaii.rr.com

>> Subject: Re: Early consultation for new 6-lot Kohala Shoreline project

>>

>> Thanks for the notification, Ron. Yes, I and others would like to be consulted as the project progresses. A couple of questions:

>>

>> Would you be able to share the information about lot locations, public access parking and maunamakai access before we comment?

>> Could we send our willingness to be consulted in the project to you via email, or do you need a letter?

>> Will you be interviewing other stakeholders in the land as part of the cultural impacts section of the EA?

>>

>> I am very pleased that the owner is receptive to the comments made about the previous project and looking forward to a win for both him and the community as well as the public.

>>

>> My vet husband and I are also celebrating today the sacrifices made for our freedoms.

>> Aloha, toni

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 2 Biological Report**

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***Terrestrial Flora and Fauna Survey***  
***Kohala Shoreline LLC Property TMK: (3rd) 5-9-001:008***  
***Kahuali‘ili‘i, North Kohala District,***  
***Hawai‘i Island, State of Hawai‘i***

**By Ron Terry, Ph.D.**  
**Geometrician Associates, LLC**  
**Prepared for Kohala Shoreline, LLC**  
**January 2019**

Kohala Shoreline proposes to develop a 6-lot subdivision on Akoni Pule Highway (State Route 270) on a 37.88-acre parcel located approximately three miles north of Kawaihae Harbor. The lots would be approximately five acres.

Field surveys of terrestrial biological resources were conducted by Ron Terry, Ph.D., at various times in February 2010, March 2015, and December 2018, the combined results of which are presented below.

*Vegetation and Flora*

In February 2010, after a long dry period, the property was systematically walked in zigzagging transects perpendicular to the shoreline, spaced approximately 50 meters apart, with special attention to gulches, ridges, and outcrops. In addition, the entire shoreline area was walked. On follow-up visits, which were conducted to observe the property after periods of rainfall, surveys took place on the shoreline, the trails, the gulches, and selected other areas.

As is typical of the region, the property was thickly covered with alien vegetation. Virtually the entire site is dominated by a low forest of scattered *kiawe* (*Prosopis pallida*) with an understory of buffel grass (*Cenchrus ciliaris*), with relatively little cover by other plants. In gulches, runoff that creates soil moisture and collects seeds creates an environment where the flora is expanded by more species of weeds.

A total of 30 plant species were identified. Only four of them, the common roadside herb ‘uhaloa (*Waltheria indica*), the common but cherished yellow-flowered *ilima* (*Sida fallax*), the common shoreline succulent ‘akulikuli (*Sesuvium portulacastrum*) and the strand vine *pa‘ū O Hi‘iaka* (*Jacquemontia ovalifolia*), are indigenous to the Hawaiian Islands. The other 26 species are non-native. All plant species observed during the survey are listed in Table 1 below. No threatened or endangered plant species (USFWS 2019) are present or would be expected on the property. Furthermore, no plant critical habitat is

**Table 1**  
**Plant Species on Project Site**

Scientific Name	Family	Common Name	Life Form	Status*
<i>Abutilon incanum</i>	Malvaceae	Hoary abutilon	Herb	A
<i>Atriplex semibaccata</i>	Chenopodiaceae	Australian saltbush	Herb	A
<i>Boerhavia coccinea</i>	Nyctaginaceae	Boerhavia	Herb	A
<i>Cenchrus ciliaris</i>	Poaceae	Buffel grass	Grass	A
<i>Cenchrus setaceus</i>	Poaceae	Fountain grass	Grass	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden spurge	Shrub	A
<i>Chenopodium murale</i>	Chenopodiaceae	Goosefoot	Herb	A
<i>Cleome gynandra</i>	Capparaceae	Spider flower	Herb	A
<i>Commelina benghalensis</i>	Commelinaceae	Hairy honohono	Herb	A
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Hedgehog gourd	Vine	A
<i>Desmodium sp.</i>	Fabaceae	Desmodium	Vine	A
<i>Eragrostis amabilis</i>	Poaceae	Lovegrass	Grass	A
<i>Festuca bromoides</i>	Poaceae	Brome fescue	Grass	A
<i>Ficus microcarpa</i>	Moraceae	Chinese banyan	Tree	A
<i>Jacquemontia ovalifolia</i>	Convolvulaceae	Pa'ū O Hi'iaka	Vine	I
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Leonotis nepetifolia</i>	Lamiaceae	Lion's ear	Herb	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Merremia aegyptia</i>	Convolvulaceae	Hairy merremia	Vine	A
<i>Portulaca oleracea</i>	Portulacaceae	Pigweed	Herb	A
<i>Portulaca pilosa</i>	Portulacaceae	Portulaca	Herb	A
<i>Prosopis pallida</i>	Fabaceae	Kiawe	Tree	A
<i>Ricinus communis</i>	Euphorbiaceae	Castor bean	Shrub	A
<i>Sesuvium portulacastrum</i>	Aizoaceae	'Akulikuli	Herb	I
<i>Sida fallax</i>	Malvaceae	'Ilima	Shrub	I
<i>Sida rhombifolia</i>	Malvaceae	Broom weed	Herb	A
<i>Spergula arvensis</i>	Caryophyllaceae	Corn spurry	Herb	A
<i>Verbesina encelioides</i>	Asteraceae	Golden crown beard	Herb	A
<i>Tribulus terrestris</i>	Zygophyllaceae	Puncture vine	Herb	A
<i>Waltheria indica</i>	Sterculiaceae	'Uhaloa	Herb	I

\* A = alien; I = indigenous; botanical names follow Wagner, Herbst and Sohmer 1990.

present on the property or within four miles of the property (<https://ecos.fws.gov/ecp/report/table/critical-habitat.html>). The closest plant critical habitat is at above 2,000 feet in elevation in the Kohala Mountains.

### *Fauna*

No mammals were seen on the site, but studies of nearby areas indicate that the mammalian fauna of this part of Kohala is composed of mainly introduced species, including possibly small Indian mongooses (*Herpestes a. auropunctatus*), feral cats (*Felis catus*) roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*). None are of conservation concern and all are deleterious to native flora and fauna.

The only native Hawaiian land mammal, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), may also be present in the area, as it is present in many areas on the island of Hawai'i. Observation took place in daylight, and therefore the lack of bat observations does not signify an actual absence of bats. Although the sparse *kiawe*-buffel grass vegetation of the site would not be expected to represent essential habitat for this endangered species, they have been observed in *kiawe* scrub vegetation in other parts of Kona.

Almost all birds seen on the site were wide-ranging aliens such as common mynas (*Acridotheres tristis*), yellow-billed cardinals (*Paroaria capitata*), saffron finches (*Sicalis flaveola*), gray francolins (*Francolinus pondicerianus*) and zebra doves (*Geopelia striata*). Other than the common shorebird 'ulili or wandering tattler (*Heteroscelus incanus*), which was observed right on the shoreline rocks, no birds indigenous to Hawai'i were identified during the survey.

No critical habitat (<https://ecos.fws.gov/ecp/report/table/critical-habitat.html>) for terrestrial fauna is present in the area, but some endangered species may overfly this and all other areas of the Island of Hawai'i. The Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian sub-species of Newell's shearwater (*Puffinus newelli*), and the band-rumped storm-petrel (*Oceanodroma castro*) have been recorded over-flying various areas on the Island of Hawai'i between late April and the middle of December each year. The Hawaiian petrel and band-rumped storm-petrel are listed as endangered, and Newell's shearwater as threatened, under both federal and State of Hawai'i endangered species statutes. These seabirds hunt over the ocean during the day and fly to higher elevations at night to roost and nest. The Hawaiian petrel and the band-rumped storm petrel are known to nest at elevations well above 5,000 feet on the Big Island, nowhere near the property. But during its breeding season from April through November, the Newell's shearwater burrows under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, it needs an open downhill flight path through which it can become airborne. Once abundant on all the main Hawaiian Islands, most Newell's shearwaters are today found in the steep terrain between 500 to 2,300 feet on Kaua'i (<https://www.fws.gov/pacificislands/fauna/newellsshearwater.html>).

The primary cause of mortality for all three species in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals. These listed seabirds would not directly utilize the property but could occasionally overfly it.

The only native Hawaiian land mammal, the Hawaiian hoary bat (*Lasiurus cinereus semotus*), may also occur in the area, as it has been observed in almost all parts of the island of Hawai'i. Although the sparse *kiawe*-buffel grass vegetation of the site does not represent essential habitat for this endangered species, bats have been observed in *kiawe*

scrub vegetation in other parts of West Hawai‘i, and are undoubtedly present at least occasionally.

### *Impacts and Mitigation Measures*

In order to frame impacts to terrestrial flora and fauna, it is relevant that the property has been historically used for ranching, has been intensely affected by wildfire and is dominated by introduced plant species. The project will include gradual planting of native plants around homes near the shoreline with the intent to restore native species to enhance the biological environment and human enjoyment of the area. The plants envisioned – including pohuehue (*Ipomoea pes-caprae*), pā‘ū-O-Hi‘iaka (*Jacquemontia ovalifolia*), ‘ilima (*Sida fallax*), ōhelo kai (*Lycium sandwicense*), akulikuli (*Sesuvium portulacastrum*), hinahina (*Heliotropium anomalum*), kauna‘oa (*Cuscuta sandwichiana*)) – were selected because they were observed to be thriving on the site and/or in nearby areas without benefit of irrigation. Although low-lying and often grayish green and inconspicuous, with small flowers and fruit, they represent the natural vegetation and have rich cultural associations as well. These plants can be slowly added with gradual effort. Considering the existing environment and planned improvements to the flora, the development will produce almost no impacts to any species of flora and fauna other than the alien species already present. However, several mitigation measures that protect wide-ranging endangered animal species are recommended.

To minimize impacts to the endangered Hawaiian hoary bat, it is recommended that initial infrastructure contract conditions and homeowner construction CC&Rs prohibit removal or trimming of woody plants taller than 15 feet from June 1 to September 15 each year. This period is the most vulnerable time in the bat birthing and pup rearing season, and refraining from vegetation removal or trimming is recognized as appropriate by the U.S. Fish and Wildlife Service in recent Endangered Species Act consultations (e.g., see Hawai‘i State DHHL 2009).

Outdoor lighting at homes can attract threatened or endangered seabirds – the Hawaiian petrel the Hawaiian sub-species of Newell’s shearwater, and the band-rumped storm-petrel – which may become disoriented by the lighting, resulting in downed birds. To avoid the potential downing of these seabirds by interaction with outdoor lighting, no construction or unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All permanent lighting should be shielded in conformance with Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

### **REFERENCES**

- Gagne, W., and L. Cuddihy. 1990. “Vegetation,” pp. 45-114 in W.L. Wagner, D.R. Herbst, and S.H. Sohmer, eds., *Manual of the Flowering Plants of Hawai‘i*. 2 vols. Honolulu: University of Hawai‘i Press.

- Banko, W. E. 1980. "Population Histories – Species Accounts Seabirds: Newell's Shearwater ('A'o)." Cooperative National Park Resources Studies Unit, University of Hawai'i at Manoa, Department of Botany, Technical Report #5A.
- Day, R. H., B. Cooper, and T. C. Telfer. 2003. *Decline of Townsend's (Newell's) Shearwaters (Puffinus auricularis newelli) on Kauai, Hawaii*. *The Auk* 120: 669-679.
- University of Hawai'i at Hilo, Dept. of Geography. 1998. *Atlas of Hawai'i*. 3rd ed. Honolulu: University of Hawai'i Press.
- U.S. Fish and Wildlife Service (USFWS). 2019. *USFWS Threatened and Endangered Species System (TESS)*. Washington: GPO. <https://ecos.fws.gov/ecp/species-reports>
- Wolfe, E.W., and J. Morris. 1996. *Geologic Map of the Island of Hawai'i*. USGS Misc Investigations Series Map i-2524-A. Washington, D.C.: U.S. Geological Survey.

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 3**

#### **Cultural Impact Assessment**

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# Cultural Impact Assessment for the Proposed Development of TMK: (3) 5-9-01:008

Kahuāliʻiliʻi Ahupuaʻa  
North Kohala District  
Island of Hawaiʻi



*Prepared By:*

Robert B. Rechtman, Ph.D.

*Prepared For:*

Kohala Shoreline, LLC  
C/O Greg Mooers  
GRM Enterprises, LLC  
P.O. Box 1101  
Kamuela, HI 96743

December 2018



Archaeology • History • Ethnography • Architectural History

Office: (808) 969-6066 • Fax: (808) 443-0065



# Cultural Impact Assessment for the Proposed Development of TMK: (3) 5-9-01:008

Kahuāli‘ili‘i Ahupua‘a  
North Kohala District  
Island of Hawai‘i



## CHAPTERS

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# 1. INTRODUCTION

At the request of Kohala Shoreline, LLC, ASM Affiliates, Inc. has prepared this Cultural Impact Assessment (CIA) associated with the proposed subdivision and development of TMK: (3) 5-9-01:008 (Figure 1). The project area is within the State Urban District, on land zoned by the County of Hawai'i as RS-15 (single-family residential with minimum lots of 15,000 square feet) in the *ahupua'a* of Kahuāli'ili'i, North Kohala District, Hawai'i Island (Figure 2). Early archaeological work on the subject property included studies by Soehren (1964) and Bonk (1968). Soehren (1964) recorded two small rock cairns, a rock platform, and two open-ended enclosures with associated marine shell and coral within the *ahupua'a* of Kahuā 1 and 2. Bonk (1968) recorded 24 stone features within Kahuā 1. The concentration of Bonk's features that were recorded on the northern side of the current project area was later designated SIHP 4156 during the 1972 Statewide Inventory as the Waiakailio Bay Complex. These studies were of a regional nature and included archaeological survey of large tracts of land of which the study area was only a small part.

Starting in 1983 Paul H. Rosendahl, Ph.D., Inc (PHRI) began a series of archaeological studies that focused on the current project area and adjoining land to the south (Allen 1985a, 1985b; Corbin 2000, 2003, 2004; Graves and Franklin 1998; Kubo and Rosendahl 2003; O'Hare and Goodfellow 1999; PHRI 2000, 2005; Rosendahl 1994). The resultant reports include reconnaissance surveys, an inventory survey, mitigation (preservation and data recovery) plans, and burial treatment plans. More recent work conducted by Rechtman Consulting, LLC and ASM Affiliates, Inc. as follow-up to those studies includes an archaeological data recovery project (Loubser and Rechtman 2007) in coastal Kahuānui, preservation planning (Rechtman 2014) for coastal sites in Waikā, and Kahuānui, and an archaeological inventory survey update for the current study area (Rechtman and Clark 2010). This latter study contains a map that shows the locations of the archaeological sites recorded within the current project area (Figure 3), and contains recommendations for the preparation of additional data recovery, preservation, and burial treatment plans.

Four additional studies are relevant for the current investigation. Maria Ka'imipono Orr completed a cultural impact assessment for a *mauka* portion of Kahuāli'ili'i Ahupua'a associated with a communication tower facility (Orr 2003). Her study contains detailed historical information for both of the Kahuā *ahupua'a*. Kepā Maly prepared a detailed culture-historical background for Kaiholena Ahupua'a (Maly 2000) that included information relative to the general region known as *Kohala waho* or Outer Kohala, of which the current project area is a part. And, the current author prepared two cultural impact assessments, one for the land immediately adjacent to the current project area (Rechtman 2006), and another for a coastal parcel in nearby Pāo'o Ahupua'a (Rechtman 2004). Oral interviews conducted during the former study contain information applicable to the current study area, and information presented during a contested case hearing associated with the latter study is also reviewed in the current study. The information contained in these earlier studies, combined with additional research specific to Kahuāli'ili'i, Ahupua'a, and additional consultation with members of both the North and South Kohala communities form the basis for the interpretations and evaluation presented in the current study.

An earlier version of the current report was prepared for an earlier iteration of the current proposed development, which was for a nine-lot subdivision. Information gathered during the earlier study helped inform the decision to reduce the proposed subdivision density to six lots and move all potential development activity to the *mauka* side of the *ala loa*, for which additional consultation was conducted.

This report was prepared in support of an environmental assessment in compliance with HRS Chapter 343, and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai'i, on November 19, 1997.

Below is a description of the general project area and the proposed development activities. This is followed by a detailed background section providing setting and context (cultural, historical, and regional) to facilitate a more complete understanding of the potential significance of the cultural landscape and the historic and cultural properties within that landscape. Next, the consultation process is described, which is followed by a discussion of potential cultural impacts and the appropriate actions and strategies that mitigate any potential impacts.

1. Introduction



Figure 1. Project area location map.

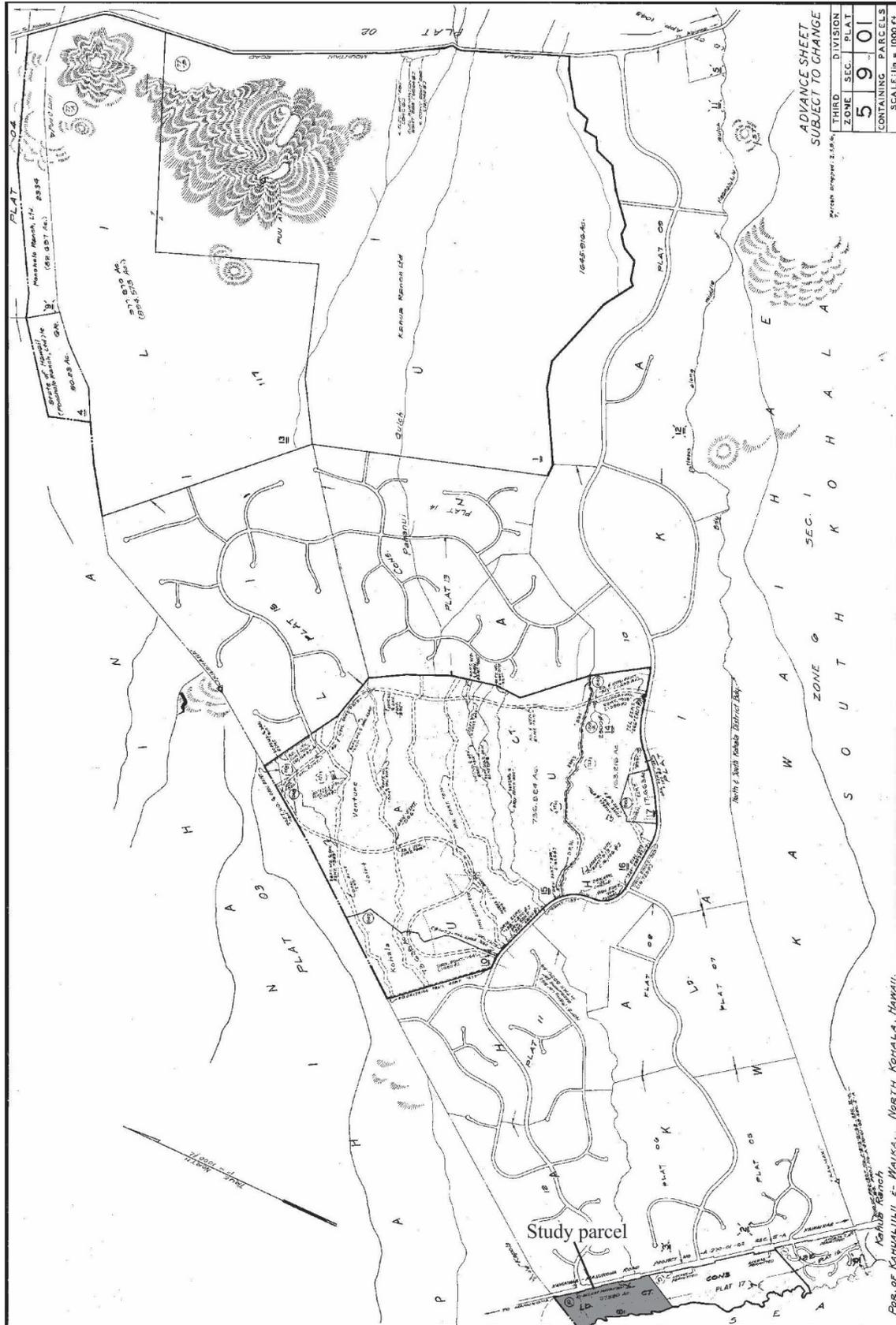


Figure 2. Project area location.

1. Introduction

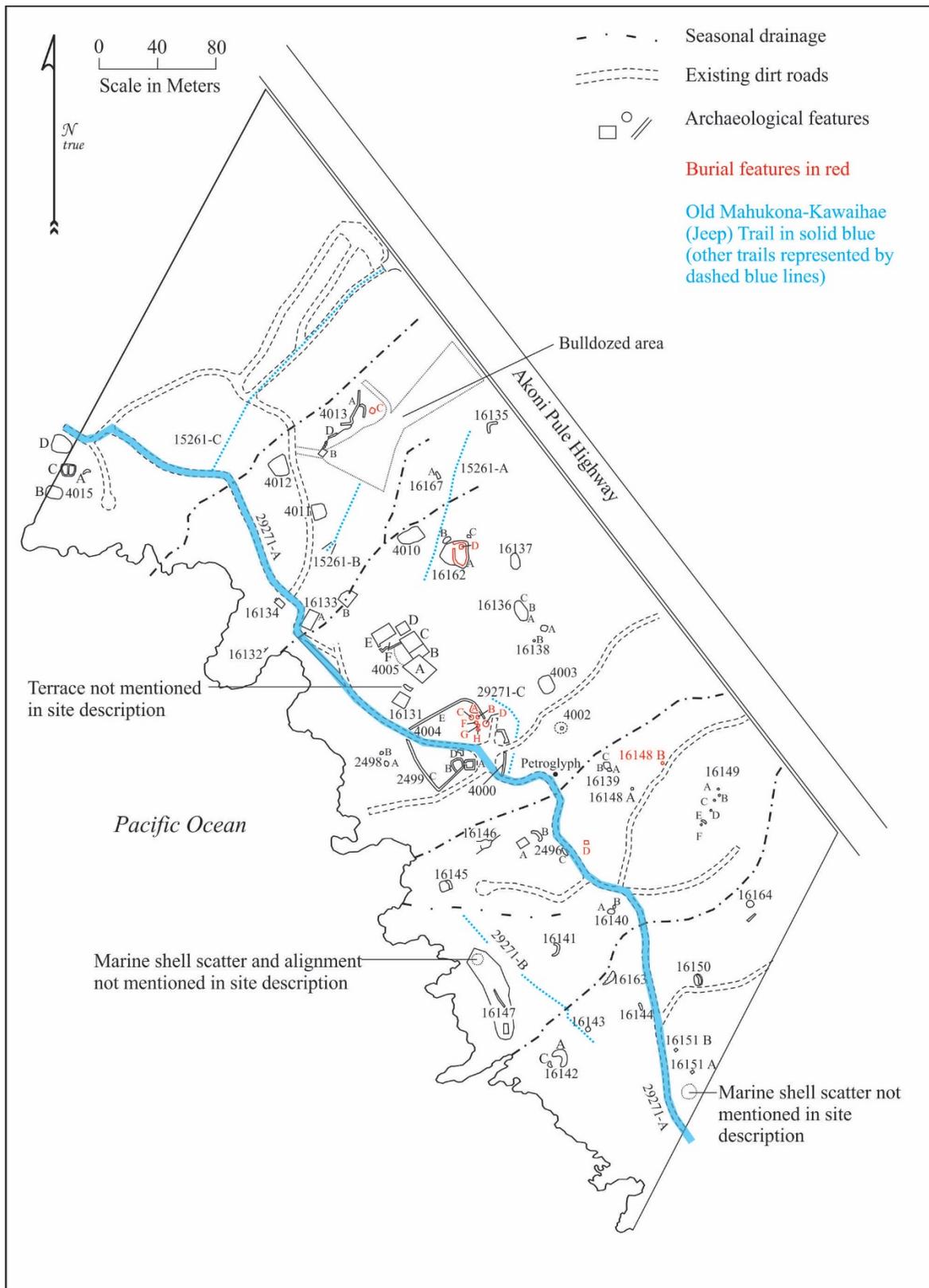


Figure 3. Archaeological sites recorded within the current project area.

## 2. PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The project area occupies 37.8 acres along the North Kohala coast, bounded by the ocean to the west and Akoni-Pule Highway (Hwy 270) to the east (see Figure 2). To the north the project area is bounded by undeveloped state land, and to the south by a partially developed privately-owned subdivision (see Figure 2). Elevation within the project area ranges from sea level to about 160 feet above sea level and the surface geology consists of basaltic lava flows from Kohala volcano dating from at least 120,000 years ago (Wolfe and Morris 1996). Soil within the study area is classified as Kawaihae very rocky very fine sandy loam. The sloping terrain is dissected in a few locations by steeply incised drainage channels (Figure 4) and the vegetation is almost exclusively low grasses and *kiawe* (Figure 5). The typical shoreline in this area is rocky (Figure 6) with a few small coral, rock, and sand beach areas (Figure 7). Waiakailio Bay (Figure 8), at the northern end of the property, is the least rocky and most sheltered area along this portion of the coast, and it offers the easiest ocean access.

The proposed development plan (Figure 9) includes the establishment of a six-lot subdivision. The property is currently zoned for single-family residential with minimum lots of 15,000 square feet (RS-15), which could allow for the development of over 100 units. Upon reviewing the project site and development options, the property owner determined that a less dense development would be more appropriate, and is proposing a change of zone to Residential Agricultural 3-acres (RA-3a), which would decrease potential density and lessen impacts to archaeological resources. Road access would be from two locations along Akoni-Pule Highway. The project would be provided with water, electrical, and telephone service from existing lines located within a utility easement above Akoni-Pule Highway. The house sites would be located a minimum of 150 feet below the highway and covenants, conditions and restrictions (CC&Rs) would limit homes to a single story and require color schemes that minimize visual impacts. Landscaping would be installed along the subdivision's two internal roadways and also on the residential lots, subject to CC&Rs. The project includes public shoreline access and associated parking and will preserve a coastal buffer that would extend from the current Jeep road/*ala loa* (SIHP Site 29271-A) to the shoreline.



Figure 4. Keawewai Gulch drainage.



Figure 5. Typical vegetation cover across the study parcel.

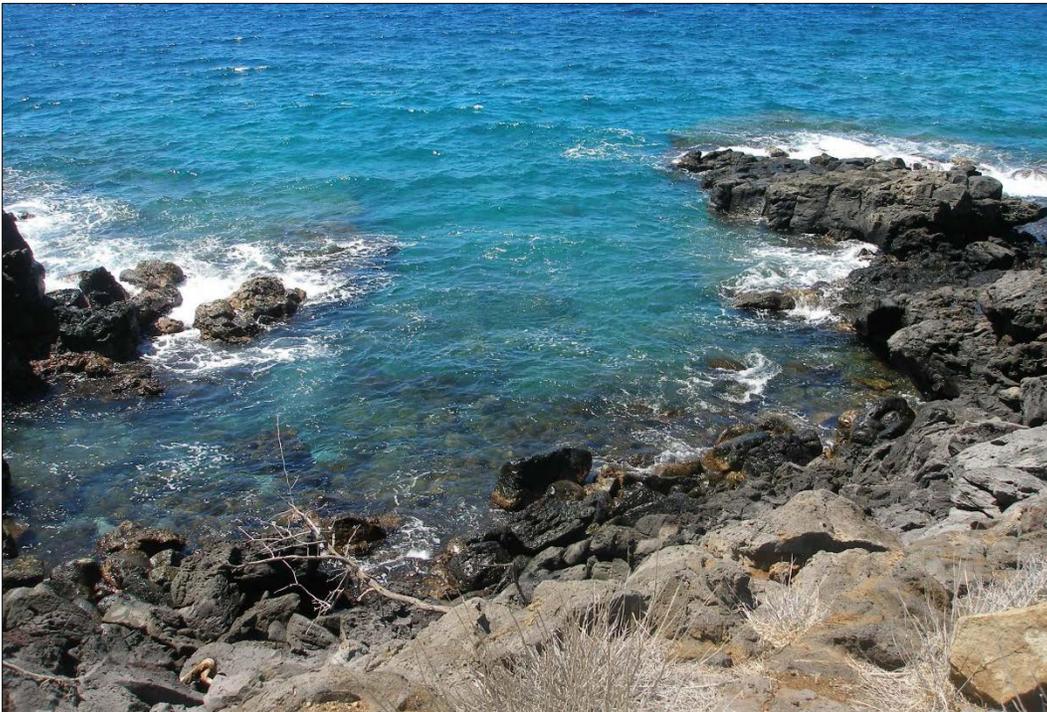


Figure 6. Typical rocky shoreline along the study parcel.



Figure 7. Typical rocky beach area.



Figure 8. Waiakailio Bay.



### 3. CULTURE-HISTORICAL CONTEXT

#### A GENERALIZED MODEL OF HAWAIIAN PREHISTORY

The generalized cultural sequence that follows is based on Kirch's (1985) model, and amended to include recent revisions offered by Kirch (2011). The conventional wisdom has been that first inhabitants of Hawai'i Island probably arrived by at least A.D. 300, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). However, there is no archaeological evidence for occupation of Hawai'i Island (or perhaps anywhere in Hawai'i) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) has convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, and the Expansion Period to A.D. 1350 to 1650.

The initial settlement in Hawai'i is believed to have occurred from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the '*aumakua* concept; various epiphenomenal beliefs; and the concept of *mana*.

The Development Period brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawai'i produced quality basalt for adze production. Mauna Kea on the island of Hawai'i was a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are '*ulu maika* stones and '*lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. Early dates from leeward Kohala (Kapa'anui) were reported by Dunn and Rosendahl (1989); these sites are believed to have been temporary campsites (Wulzen et al. 1995). The greatest population growth occurred during the Expansion Period. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dryland areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985).

It was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands. According to Kamakau (1976) the *kahuna* Pa'ao settled in the islands during the 13<sup>th</sup> century. Pa'ao was the keeper of the god Ku'ka'ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pa'ao escaped Lonopele's wrath by fleeing in a canoe. Kamakau (1991:100–102) told the following story in 1866:

Puna on Hawai'i Island was the first land reached by Pa'ao, and here in Puna he built his first *heiau* for his god Aha'ula and named it Aha'ula [Waha'ula]. It was a *luakini*. From Puna, Pa'ao went on to land in Kohala, at Pu'uepa. He built a *heiau* there called Mo'okini, a *luakini*. It is thought that Pa'ao came to Hawai'i in the time of the *ali'i* La'au because Pili ruled as *mo'i* after La'au. You will see Pili there in the line of succession, the *mo'o kū'auhau*, of Hanala'anui. It was said that Hawai'i Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawai'i Island had been without a chief for a long time, and the chiefs of Hawai'i were *ali'i maka'āinana* or just commoners. There were seventeen generations during which Hawai'i Island was without chiefs—some eight hundred years.

There are several versions of this story that are discussed by Beckwith (1976), including the version where Mo'okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pa'ao are said to be deposited in a burial cave in Kohala in Pu'uwepa [possibly Pu'uepa?] (Kamakau 1964:41).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986).

The *ali'i* and the *maka'āinana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hau 1974). The *ahupua'a* was further divided into smaller sections such as the *'ili*, *mo'o'aina*, *pauku'aina*, *kihapai*, *koele*, *hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. Sometime between A.D. 1736 and 1758, Kamehameha I was born in the *ahupua'a* of Kokoiki, North Kohala near the Mo'okini Heiau [there is some controversy about his birth year, see Kamakau 1992:66–68]. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley's comet [this is also controversial] (Kamakau 1992). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

This period was one of continual conquest by the reigning *ali'i*. Ke'eumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

## HISTORY AFTER CONTACT

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

In 1779 King of the Cook expedition explored the North Kohala country and reported:

As far as the eye could reach, seemed fruitful and well inhabited. [Three and four miles inland, plantations of taro and potatoes and *wauke*] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canes planted close on each side, make the most beautiful fences that can be conceived. [The exploring party stopped six or seven miles from the sea.] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood

behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations . . . as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted. (Handy and Handy 1972:528)

Around A.D. 1780 Kalani'opu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawaii continued until A.D. 1795 (Kuykendall and Day 1976; Handy and Handy 1972).

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'ūpulehu at the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called "Lopaka", all of which were turned over to Kamehameha (Kamakau 1992). Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kaua'i gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, Hawai'i saw the beginnings of a market system economy (Kent 1983). This marked the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of *'ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs saw a change:

The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*'ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali'i, and in most of the histories of ancient rulers. Free

eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstated the eating *kapu* but others appear to have thought otherwise. Liholiho's cousin, Kekuaokalani, caretaker of the war god Kū'kā'ilimoku, revolted, but by December of 1819 the revolution was quelled. With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the 'aumakua worship, to continue (Oliver 1961; Kamakau 1992).

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaii. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopt their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali'i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). On a stopover in the Kohala district Ellis wrote:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Kuykendall and Day 1976:42, 43; Ellis 1963:397)

The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry. The windward portions of North Kohala became a center of sugarcane production, although sugarcane cultivation in Kohala had its origins in prehistory.

Pukui (1983) cites two proverbs that reference both Kohala and sugarcane. She provides an explanation and notes that Hawaiian proverbs have layers of meaning that are best left to the imagination of the reader:

*He pa'a kō kea no Kohala, e kole ai ka waha ke 'ai*  
A resistant white sugar cane of Kohala that injures the mouth when eaten.

Pukui explains this proverb as follows:

A person that one does not tamper with. This was the retort of Pupukea, a Hawai‘i chief, when the Maui chief Makakuikalani made fun of his small stature. It was later used in praise of the warriors of Kohala, who were known for valor (1983:95).

*I ‘ike ‘ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.*

One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui interprets this proverb as follows:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983:127).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1972:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children’s teeth by chewing on it (Handy and Handy 1972:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odoratissimus*) were not abundant (Malo 1903). Sugarcane was also used in relation to taro and sweet potato. Handy and Handy (1972:186) explain:

In wet-taro farming, cane was planted along the embankments separating the flooded terraces and flats. In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown.

Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. The Chinese on Lāna‘i are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976).

Kohala became a land in transition and eventually a major force in the sugar industry with the arrival of American missionary Elias Bond (KTF 1975). In her comprehensive study of North Kohala, Tomonari-Tuggle relates this transition:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district’s history. In those years a new religion, a new land tenure system, and a changing economy altered the lifestyles and world view of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed. (Tomonari-Tuggle 1988:I-23)

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988:I-39)

In 1860 Rev. Bond engaged Samuel N. Castle in founding the Kohala Sugar Company on lands owned by Bond and his neighbor Dr. James Wight. The first crop was harvested in January 1865 (KTF 1975). Kohala’s transition was a reflection of what was happening elsewhere in Hawai‘i as the sugar industry grew. The industry brought in tens of thousands of laborers from Asia, Europe, the Americas, Oceania, and Africa to work on the many plantations and mills that were being established on all major islands (Oliver 1961). This influx not only radically changed the culture, but also drastically altered agricultural lands and destroyed traditional architectural features in the process. The drier leeward portions of Kohala were not suited for cane cultivation and thus became vast pasturelands for grazing cattle.

## A GENERALIZED SETTLEMENT MODEL FOR *KOHALA WAHO*

The following summary of settlement patterns for the leeward coast of North Kohala follows earlier regional models (Rosendahl 1972; Griffin et al. 1971; Tomonari-Tuggle 1988) and takes into account observations and information contained in traveler, missionary, and Kingdom records (Maly 2000).

Evidence for early occupation of Kohala has been collected from Kapa'anui. Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 460 (Site 12444). This early date may be related to the establishment of small, short-term camps to exploit seasonal, coastal resources. Data recovered from Mahukona suggest initial occupation there by A.D. 1280 (Burgett and Rosendahl 1993:36). The earliest date range for permanent settlement in Kohala (A.D. 1300) was obtained from Koai'e, a coastal settlement where subsistence primarily derived from marine resources. According to Tomonari-Tuggle (1988:13), these resources were probably supplemented by small-scale agriculture.

The period from A.D. 1300–1500 was characterized by population growth and expanded efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and there is evidence that suggests that there were substantial changes to the political system as well. Within Kohala, the Great Wall complex at Koai'e is organized with platforms in the complex apart from contemporaneous features. Griffin et al. (1971) interpret this as symbolizing class stratification. By AD 1600, there is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that this unification resulted in a partial abandonment of portions of leeward Hawai'i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980).

By the time of contact, numerous coastal villages and extensive dryland agricultural systems were in place in North Kohala. The *ahupua'a* system of social organization was also firmly established by this time, with defined land units extending from the mountains to the sea. The *ahupua'a* were controlled by local chiefs, and were integrated at the district level. Districts were ruled by paramount chiefs through a system of taxation and redistribution. Social stratification was defined by a class separation between the ruling *ali'i* (chiefs) at one end, and the *maka'ainana* (commoners) at the other. Kamehameha I eventually united the Island of Hawai'i, and ultimately all of the Hawaiian Islands, and freely participated in the European-introduced market economy.

The earliest detailed written descriptions of the region are contained in the Journal of William Ellis (1963), an English Missionary who traveled through the area in 1823. Two of his journal entries are of particular relevance: a visit to the villages of Owawarua [Awalua] (just south of Kukuipahu) and Hihiu (Māhukona), and an account of the coast between Towaihae [Kawaihae] and Māhukona related to him by one of his companions: Lorrin Thurston.

About three p.m. we reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fisherman. Here we tried to collect a congregation, but only three women and two small children remained in the place, the rest having gone to Waimea to fetch sandalwood for Karaiomoku. From Owawarua we passed on to Hihiu, where we had an opportunity to speak to a small party of natives.

In these villages we saw numbers of canoes and many large fishing nets, which are generally made with a native kind of flax, very strong and durable . . . In taking fish out of the sea, they commonly make use of a net, of which they have many kinds, some very large, others mere hand-nets; they occasionally employ the hook and line, but never use the spear or dart which is a favourite weapon with the southern islanders.

Quantities of fish were spread out in the sun to dry, in several places, and the inhabitants of the northern shores seem better supplied with this article than those of any other part of the island. . . .

Being considerably fatigued, and unable to find any fresh water in the village, we procured a canoe to take us to Towaihae, from which we were distant about 20 miles. Though we had numbered, in our journey today, 600 houses, we had not seen a thing like four hundred people, almost the whole population being employed in the mountains cutting sandalwood. It was about seven o'clock in the evening when we sailed from Hihii, in a single canoe. (Ellis 1963:285-286)

On the 23d Mr. Thurston left Towaihae, and walked along the shore towards the north point [‘Upolu]. About noon he reached the small village, called Kipi [North of Kahuāli‘ili‘i], where he preached to the people; and as there was only one village between Kipi and the place where I had preached on Wednesday evening [Hihii/Māhukona], he retraced his steps to Towaihae. He preached at another four villages on his return [perhaps at settlements within or adjacent to the current project area], where the congregations, though not numerous, were attentive . . . The coast was barren; the rocks volcanic; the men were all employed in fishing; and Mr. Thurston was informed that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than on the shore. In the evening he reached Towaihae. (Ellis 1963:288)

Ellis (1963), whose colleague Thurston traveled through the project area in 1823, not only noted a barren coastline, but also limited cultivation around settlements. Early travelers' accounts indicate that managed stands of trees normally occurred near settlements; these included coconut, *lauhala* (*Pandanus* sp.), *loulu* (*Prichardia* sp.), *milo* (*Thespesia populnea*), and *kou* (*Cordia subcordata*). Hawaiians in general cultivated a number of tropical root, tuber, and tree crops, the most important being taro (*kalo*, *Colocasia esculanta*) and sweet potato (*‘uala*, *Ipomoea batatas*). Planting, tending, and harvesting crops was typically men's work, although women weeded and maintained dry land fields (Kirch 1997:2).

Dry taro was grown in the lower forest zone farther up the slopes of Kohala Mountain (Handy and Handy 1972:531). According to Handy and Handy this forest used to extend further *makai* over what is now open pasture. Wet taro was grown in small pockets wherever even intermittent streams flowed (ibid.). However, sweet potato was probably the main source of carbohydrates for people who lived in the dry *kula* lands (ibid. 532). According to Maly (1999), mounds were mulched with sugarcane refuse, known as *Pu‘u-‘aina-ko*; and this is recorded as a regional name for the fields that once occurred within the general vicinity of the project area. Taken together, orally transmitted accounts and documented eyewitness accounts seem to suggest that the project area was far more luxuriant than what is currently the case.

In 1825 Thurston told Ellis (1963:408) that people living in the wooded and upslope part of the Kohala coast interior “were far more numerous than those of the sea-shore.” It is conceivably the people from this area that Menzies (1920:56) observed in 1793 as carrying timber from the uplands to the coast. That people laboring in the uplands were the same as those fishing along the coast, however, is attested by Ellis's 1823 observation of “inhabitants of the northern shores...being employed in the mountains cutting sandalwood” (Ellis 1963:409). Apart from cultivating fields and using inland resources, Ellis (1963:408) observed that inhabitants of the settlements in the project area fished extensively in the nearby ocean. This is substantiated by Varigny's (1981:73) observation in the 1850s that within leeward Kohala “are rich in fishing grounds...the seas was covered with small native canoes, shaped from hollowed logs and balanced by a cross-beam, or outrigger, and nearly all equipped with triangular sails.” In Hawai‘i it was the ocean that yielded the greatest variety and abundance of protein. Hawaiian fishermen used varied techniques and tools to obtain food from inshore reefs to deeper benthic waters, including bone and shell fishhooks, spears, traps, nets, and weirs. Women gathered mollusks, sea urchins, and seaweed from rocky headlands and bays (Kirch 1997:3).

In addition to being accomplished extractors of food from the ocean, Polynesians brought domestic pigs, dogs, and fowl with them to Hawai‘i and raised a substantial number of these animals for food. Within the vicinity of the project area, much of the produce and pigs seem to have been raised in the uplands and brought down to the shore. Furthermore, it is in the uplands that commoners mostly labored, while aristocrats tended to live along the shoreline. The use of *mauka/makai* trails facilitated transhumance between the different ecological areas. Old Hawaiian tales also bear witness to this spatial link between coast and interior and the social relationship between aristocrat and laborer. It is to some of these traditional stories that the discussion now turns, dealing specifically with those that mention natural features in the vicinity of the project area by name. Many of the place names are no longer used, but their meanings indicate particular uses or features of the named locations or their direct or metaphorical associations with historical personages (Maly 2000:53).

### 3. Culture-Historical Background

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According to Maly (2000:28), traditional Hawaiians see all things and people within their environment as being interrelated; those from the coastal lowlands were linked to those from the interior uplands. The *ahupua'a* as a land unit was the thread that bound these things and people together. An *ahupua'a* was typically under the control of an appointed *konohiki*, or chief-landlord of lower rank. This person answered to an *ali'i-ai-ahupua'a*, or chief who controlled the *ahupua'a* resources. The *ali'i-ai-ahupua'a* in turn answered to an *ali'i ai moku*, or chief who claimed the produce from the entire district that combines a number of *ahupua'a*. Produce from the *ahupua'a* accordingly not only supported the laborers, or *maka'āinana*, but also supported the royals, or *ali'i*. The ideology that accompanied the social relations of production between these two classes and its representation of the environment are aptly recalled in various traditional Hawaiian tales.

Native Hawaiians succinctly compare the Kohala peninsula with a built structure. According to the Hawaiian language newspaper *Ka Hoku o Hawai'i* (1917) (as quoted by Maly 1999), two prominent volcanic cinder cones on Kohala Mountain are referred to as “the ridge pole” of the area, “which bear the winds, rain and sun of this famous land on their back.” Traditions reputedly dating back to the 1600s described the leeward coast of Kohala as “containing many houses” (Kamakau 1961:56) “with men to every point of the land.” (Pukui 1983:1973). What we see here then is conceivably a portrayal of the Kohala landscape as one massive house containing many people. That this structure is animated by the strong winds can be seen in the poetic allusion of the paired cinder cones as being “two traveling hills...which follows behind one like a lover.” In another account the “two traveling hills” on Kohala Mountain act “like a sweetheart nestled fondly in the bosom of love . . .” (Maly 2000:38). In a third story these two traveling hills are said to “mystify men.” (Maly 2000:40). Accounts such as these strongly suggest that certain landscape features were anthropomorphized; not only was the environment intricately linked to human affairs and actions, at times the environment behaved in a human fashion.

According to Pukui et al. (1974) the name *Kahuā* means “the jealous one.” Interestingly, *Kahuā* is also called *koai'e*, a native hard wood (*Acacia koaia*) similar to *koa* that is associated in a traditional chant with a commoner who was in close pursuit of his aristocratic girlfriend (Colum 1937). All-in-all, indigenous tales seem to intricately link landscape features and legendary personages within the general project area. Closer scrutiny of such tales, some of which could have great antiquity, may throw light on former ideological conceptions, social divisions, and how these affected the general use of the environment and its resources.

The term *kahuā* is mentioned in a legend that supposedly dates back to the thirteenth-century joint reign of two Kohala paramount chiefs known as *Hikapoloa* and *Kapa'au-iki-a-Kalana* (Maly 1999). In this legend *kahuā* is the name given to comparatively open and level locales where people gathered for competitive sports, not unlike the flat pebble beaches at the mouths of *Keanahalululu* and *Keawewai* gulches. In the legend, *Keanahalululu* is the name of a male commoner who tended the sugarcane of a local female chief known as *Keawe*. *Keanahalululu* also refers to the roaring sound that wind makes when blowing through a cave or narrow gulch. In the legend it is *Keanahalululu* who accompanies royal visitors from a neighboring area to his female chief *Keawe*, very much like the virtually ever-present wind that greets travelers through the district of Kohala. To the south of the current project area is *Keanahalululu* Gulch, and *Keawewai* Gulch is within the project area. The term *Ke-awe-wai* in fact means narrow watercourse, or the water of the female chief *Keawe* (Maly 1999).

The pairing of *Keanahalululu* and *Keawewai* Gulches on the natural landscape is perhaps echoed by the pairing of legendary personages with the same names in the following ways: male and female, commoner and aristocrat, wind and water. These related sets of oppositions also seem to be expressed in another legend where a commoner male named *Hiku* follows an aristocratic female known as *Kawelu* below the water of the ocean from his farming abode in the Kohala uplands. This brings to mind the *mumuku* wind that sweep down the slopes of Kohala Mountain into the sea immediately below, which forces the surface of the water to boil and seemingly open up in places. Moreover, the commoners *Keanahalululu* and *Hiku* were not allowed to consume certain foods reserved for the aristocrats *Keawe* and *Kawelu*. Though resentful of this prohibition the male commoners nonetheless came to the aid of their female rulers when they were in jeopardy. Perhaps this shows that the opposition between commoner and aristocrat is reminiscent of the opposition between persistent winds (i.e., constant labor) versus fluctuating rains (i.e., change of rulers and/or their power). Like the ultimate interdependence between wind and rain, traditional Hawaiians conceivably used this observable natural relationship as an apt metaphor for an idealized interdependence between socioeconomic classes; commoners supplied aristocrats with food but in the end relied on aristocratic mediation with the spirit world and maintenance of intra- and inter-regional affairs (e.g., Kirch 1997:6-7).

As early as the 1830s, missionaries in Kohala noting that “deaths are more numerous than births; [h]ence the population is decreasing” (Doyle 1953:72), began compiling census records by *ahupua‘a*. In an 1835 census, Kahuā (combined) is listed as having a resident population of 256 (Schmidt 1973:27), documenting a sizeable population. Traditional and historical accounts indicate that the residents of the *ahupua‘a* in *Kohala waho* lived both along the coast in fishing villages and in the uplands near the agricultural systems. It is interesting that within Kahuā there were 256 residents recorded in 1835, and that eleven years later in 1846 there was only one claimant for a *kuleana* in Kahuānui during the *Māhele*; the claim was not awarded having been contested by Kekūānāo‘a.

Traditional land use patterns saw a rapid shift after the *Māhele* in 1848. By the mid-19th century, leeward settlement shifted to the windward side of North Kohala as the leeward, agriculturally marginal, areas were abandoned in favor of more productive and wetter sugarcane lands. In addition, native populations were decimated by disease and a depressed birth rate. According to Tomonari-Tuggle (1988:37), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. Settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. At this point most communities were centered on sugar mills and became part of the plantation social hierarchy. Much of the coastal land in leeward North Kohala was used as cattle pasture. Walled complexes became the dominant residential structure for those remaining leeward settlements as families enclosed their holdings to protect them from feral cattle and to clearly define their *kuleana* boundaries.

### **Kahuāli‘ili‘i Ahupua‘a**

Kahuāli‘ili‘i Ahupua‘a is one of the three southernmost *ahupua‘a* of the North Kohala District (only Kahuānui Ahupua‘a and Waikā Ahupua‘a, along the North Kohala/South Kohala boundary, are further south; see Figure 2). During the *Māhele* of 1848 all three of these *ahupua‘a* were awarded to *ali‘i*. Kahuāli‘ili‘i was awarded to Lot Kapuāiwa (Kamehameha V) as LCAw. 7715:5, Kahuānui was awarded to Victoria Kamamalu (Lot’s Sister and last Kahina-Nui of Hawai‘i) as LCAw. 7713:4, and Waikā was awarded to Gina Lahilahi (daughter of John Young) as LCAw. 8020-B:2. Pahinahina Ahupua‘a, bordering Kahuāli‘ili‘i Ahupua‘a to the north, was retained as Government Land. There were no *kuleana* awarded within Kahuāli‘ili‘i Ahupua‘a during the *Māhele* of 1848.

By 1857 Kahuāli‘ili‘i had been leased by Lot Kapuāiwa to G. W. Macey, who also leased Waikā Ahupua‘a from Victoria Kamamalu in 1859 (Graves and Frankilin 1998). An 1859 map of Kahuāli‘ili‘i prepared by S. C. Wiltse (Figure 10) shows a “Road to Macy [sic] and Vida’s Ranch” that extends from the coast within the current project area (labeled “Waiakailio Landing”) inland towards Kahuānui and Waikā *ahupua‘a*, suggesting that Macey had leased the lands for ranching purposes, and that Waiakailio Bay was the landing for the ranch. Later Boundary Commission testimony (in 1873; see below) indicates that the houses belonging to Macey and Vida were located near the Kahuānui/Waikā boundary close to the Government Road, well *mauka* of the current project area. Ownership of Kahuāli‘ili‘i and Waikā, which would eventually become part of Kahuā Ranch, changed hands several times during the second half of the nineteenth century. In the 1890s these lands sold (along with other lands) to John Maguire, who managed Huehue Ranch in Kona. In about 1895 Mr. Maguire sold a half interest in the Kahuā lands to James Frank Woods, who then assumed management of the property and later purchased the half interest that John Maguire still held (Henke 1929).

In 1862, to certify the boundaries of the *ahupua‘a* awarded during the *Māhele*, the Kingdom of Hawai‘i established the Boundary Commission. The primary informants for the boundary descriptions were elder native residents. Their testimony provides a wealth of information concerning the locations of place names and landmarks. Some of the witnesses also inform about the functions of certain areas on the landscape (e.g., resting places, residential areas, agricultural plots, fishing grounds, boundary markers). This information is very useful when interpreting archaeological features as elements of a cultural landscape. Many of the locations referenced in the boundary testimony are depicted on a map of the lands of Waikā and Kahuāli‘ili‘i prepared by A. B. Lobenstein in 1903, the year when the boundaries of those *ahupua‘a* were officially set (Hawai‘i Registered Map No. 2231; Figure 11). The 1903 map also shows the route of the *ala loa* (coastal trail) between Kawaihae and Mahukona across the current project area.

3. Culture-Historical Background

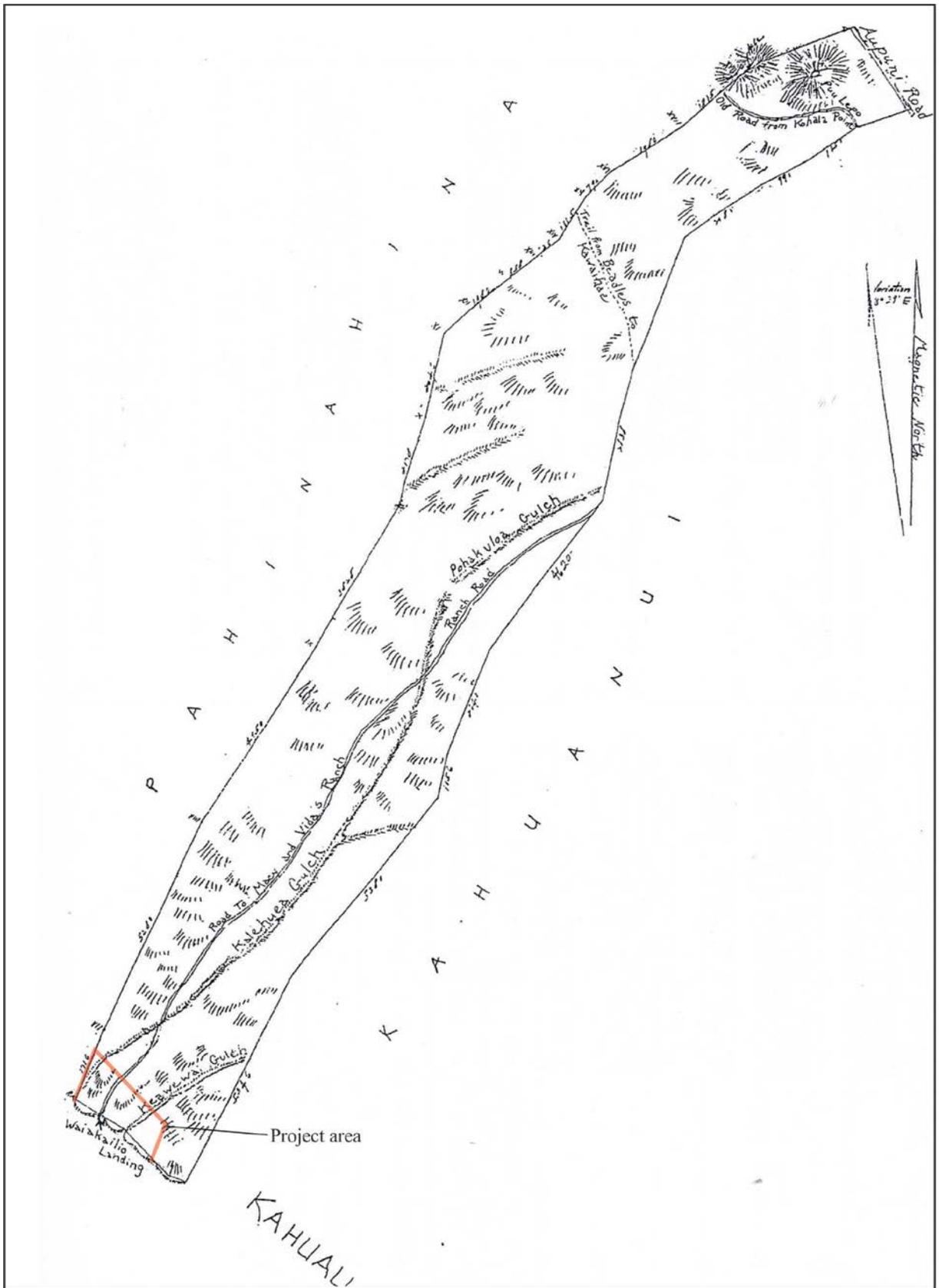


Figure 10. 1859 map of Kahuāliʻiliʻi prepared by S. C. Wiltse showing the current project area.

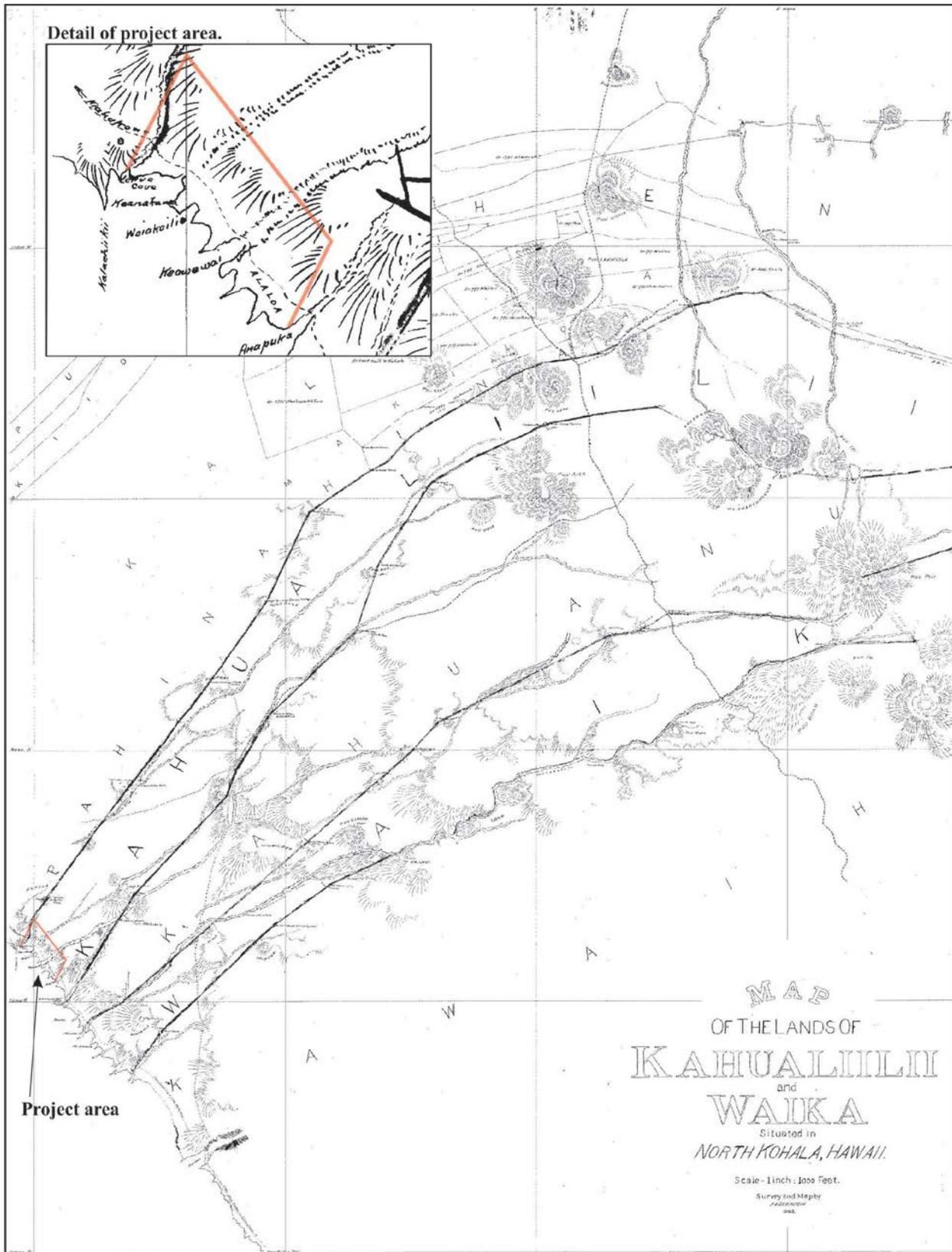


Figure 11. Hawai'i Registered Map No. 2231 (prepared by A. B. Lobenstein in 1903) showing the current project area.

Hearings for establishing the boundaries of Kahuāli‘ili‘i (also known as Kahuā 1<sup>st</sup>) began in November of 1873, roughly one year after Lot Kapuāiwa died; apparently the *ahupua‘a* became part of his father’s (M. Kekūānāo‘a) estate. The boundaries were not officially set until December of 1903, by which time the land in question had been acquired by James Woods. The 1873 boundary testimony reads as follows:

Kaili, kane, sworn, I was born in Kohala at the time of the great famine, now live in Kokio; know the boundaries of Kahualilii. Kiha, my Father and Pohina, my Uncle, showed them to me. I do not know all the boundaries between Kahuanui and Kahualilii. Bounded on the north side at shore by the land of Pahinahina, commencing at a cave called Lehua, the boundary runs makai to a point at the sea shore called Kananakauwa; thence it runs mauka to a pile of rocks at Lehua; thence mauka to an ahu named Panipani; thence mauka to another pile of stones and thence to a place, called Kilohana where there is a pile of stones that Kahuhu and I built when Wiltse was surveying. Kilohana is an old resting place; thence mauka to Ahuaele; an ahua with a pile of stones on it; thence mauka to Pahukinikini, [page 139] a small ahua with a pile of rocks on it; thence to Puuolani hill, this is along the land of Pahinahina; that was sold to Makuaole and is now owned by Kanehaloa of Puuehuehue; thence to Lolelole, the mauka corner of land sold; thence mauka to Ahaloa, an old kauhale at the mauka corner of Pahinahina; thence along Makeloa (belonging to Kamehameha & Estate); thence the boundary runs mauka to Kalolo, a water hole in a gulch, thence across the gulch and mauka along the land of Kalala; thence mauka to Puukoa; a hill of Koa, at the mauka corner of Kanehalo’s land; thence along Kailikea, a land mauka of Puukoa (Wiltse, in surveying, cut off a corner of Kalala, and ran the line to Holeipalaoa gulch); there is a rock there on the mauka side of the gulch marked KK; thence it is bounded by Kehena to Kilohana on Honokane pali (Note See Certificate of boundaries of Kehena); Thence along Honokane pali towards Waimea, to the Waimea side of Puuwau hill, the boundary being some distance this way of the kauhale; Bounded at shore by a small gulch called Haaho, a rock marked K is at this place; thence up the gulch to an ahua; thence up to where Keawewai gulch crosses Haolo gulch; thence the boundary runs up the north side of the gulch; thence to a place called Kapakamakahonu; thence to Pohakuloa, a large rock in the gulch; thence to an ahua; thence to Kawaihae Government road; thence to Puuala; thence to Niupaa, a bullock pen, the boundary passing through the center of the pen. Thence it crosses the Government road to the wire fence some distance to the north of Upida’s [Vida’s?] old house; thence to Puumanu; thence to the south side of Ahumoa; thence on the north side of Waiakananaula, a water place; thence to Puuiki and from thence to Honokane pali.

Boundary Commission hearings for Kahuānui Ahupua‘a (also known as Kahuā 2<sup>nd</sup>), which shares a boundary with Kahuāli‘ili‘i Ahupua‘a also began in November of 1873, but the boundaries were not set until June of 1905. The petitioner and owner of the land was James W. Austin, who had acquired the land from Victoria Kamamalu and M. Kekūānāo‘a in 1862 (Graves and Franklin 1998). By the time the boundaries were set in 1905 Austin had died and the lands had passed on to the Austin Estate. The 1873 boundary testimony for Kahuānui reads as follows:

Kekua, kane, sworn, I was born at the time of Aepapa and have always lived at Kahua until lately. Kahuanui is bounded on the Kona side by Waika. Commencing at the mouth of a gulch the boundary between the Ahupuaa and Kuponon begins at a landing place called Kaiopae; thence mauka along the Kuponon to Ahukuli, a pile of stones; thence mauka to Puueoka, a heiau; thence to along stone named Pohakuloa; thence to Kamakaiwi, a resting place; thence to Kapio; thence to Ahumoa, the boundary running through the hills; thence to Puuiki; thence to Kanoa, where fire used to be; Thence to Kahawaikukae, to pali of Kahawaiki; thence to Kahawaiholopapa; thence to Ainamakanui at the head of Honokane Gulch.

The kuponon Kahawainui, Kukui runs up here. Waika ends at Pahoakala, a place where they used to gather mamaki. This is as far as I [page 145] know the boundaries on this side. I have heard that the land runs down to Mahiki in Hamakua. When Lyons surveyed Waika he cut across the kuponon of Kahua and included them in Waika. Know a place called Ahuanaha. The real boundary is from Oneloa to Kapai, a pile of stones by the road; thence to Kamamukaa, where the gulch is the boundary between Waika and Kahua. The boundary crosses the gulch to the Kohala side at Ahuanaha; thence it runs to Ahuakapaakea; thence mauka to Kalehua; thence up the gulch to Moalau (The pile of stones is way on the Kohala side of the gulch, but the boundary is at the gulch). Thence past Macy’s (G.W. Macy’s) old house and mauka to Hookeke; thence to kahawai Palapalai; thence mauka to the pali of Kaloloulaula on Pili; thence to Kapohoakala; thence along to Kahaliaina, a place below

Puupala, where Kawaihae joins Kahua. From Kahaliaina the boundary runs along the foot of the pali to just above Puuwau on Kahuanui. Puuwau is a hill a short distance back from Pili; thence to Hinamakanui, a cabbage garden on the brow of Honokane pali. The boundary at shore between Kahuanui and Kahualiili is a rock in the middle of the sea called Kahuapopolo. (Note: Kaauwai, kane puts the boundary a few rods on the Kohala side of this rock.)

Thence to Waiakanalopaia, a pool of water at the end of the gulch, thence to Pohakupalalaha, a wall below the road to Kawaihae, now called Kamakahonu; thence to Waiklio gulch; thence the boundary runs to a stone called Pohakulao; thence mauka across Pohakulao gulch to Puanau, a resting place; thence to Puuala; thence Kipawale, a resting place at the Government road; thence to a hill called Ahuamanu; thence to Waiakapiai; thence to Ahumoa, part of which is on Kahua and part on another land. This is all I know of the boundaries.

Frank Woods continued to ranch the Kahuā lands throughout the first half of the twentieth century. The 1913 U.S.G.S. Kawaihae quadrangle shows some of the ranch's infrastructure, including a trail labeled "Beach Trail" that leads to the coast within the current project area (Figure 12). This trail alignment appears to be similar to the road alignment (to Macy and Vida's Ranch) that is shown on the 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (see Figure 10). By the 1920s, Woods was leasing much of the area to Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr., who had both come to Hawai'i from O'ahu to pursue cattle ranching. By the late 1920s to early 1930s, von Holt and Richards had purchased the lands they were leasing from Woods as well as Kahuānui from the Austin heirs, thus consolidating the Kahuā *ahupua'a* with Waikā Ahupua'a into what has become known as Kahuā Ranch (Langlas 1994). A map of Kahuāli'ili'i, Kahuānui, and Waikā *ahupua'a* filed on July 15, 1931 with Land Court Application 1043 (Figure 13) shows some additional ranching infrastructure within these *ahupua'a* including a fence line that extends to the coast within the current project area and a trail, labeled "Ancient Trail", that follows the southern edge of the fence to the coast where it meets the *ala loa*. Both of the trail alignments depicted on the 1931 map are different than the alignments depicted on older maps. The *ala loa*, which is also labeled as the "Mahukona-Kawaihae Trail", is shown further inland at the southern end of the current project area than it is on the 1903 map (see Figure 11). Also, the *mauka/makai* trail is located further north than the road shown on the 1859 map (see Figure 10) and the trail shown on the 1913 U.S.G.S. map (see Figure 12), suggesting that both of these trails had been realigned by 1931. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus the current project area remained in the ownership of Kahuā Ranch with no encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII. Subsequent to WWII, Kahuā Ranch maintained the roadway across their lands for ranching, transportation, and recreational uses.

According to Langlas (1994), the partners, Richards and von Holt, eventually expanded Kahuā Ranch through leases and purchases of private land to almost 30,000 acres. Orr (2003:46) describes that although Herbert, Sr. served on the board of Kahuā Ranch, Atherton Richards (Herbert's brother) was von Holt's "the real partner." In 1953 von Holt died and Herbert, Jr. (better known as Monty) returned to Hawai'i after finishing school on the mainland; gradually Monty took over as manager of the Ranch (OCA 2000). The 1956 U.S.G.S. Kawaihae quadrangle shows some of the Kahuā Ranch lands and infrastructure (Figure 14), including a fence line and "Beach Trail" extending to the coast within the current project area. A windmill (recorded as part of Site 16133) is shown adjacent to the fence line at the coast within the current project area. Both the fence line and trail are different alignments than are shown on the 1931 Land Court Application 1043 map (see Figure 12). A trail is also shown extending parallel to the coast through the project area on the 1956 map (following an alignment similar to that of the Mahukona-Kawaihae Trail shown on the 1931 map). In 1973, when construction of the current Akoni-Pule Highway was completed, most if not all of the vehicular traffic between Mahukona and Kawaihae shifting away from the coastal Jeep road to the newly constructed highway. By 1982, the coastal trail is no longer shown on the

### 3. Culture-Historical Background

U.S.G.S. Kawaihae quadrangle. The Richards and von Holt families jointly operated Kahuā Ranch until the 1980s at which point it was legally split into two entities. The current project area was severed from the ranch and sold around this time. Today, the Richards family operates Kahuā Ranch and the von Holt family operates Ponoholo Ranch.

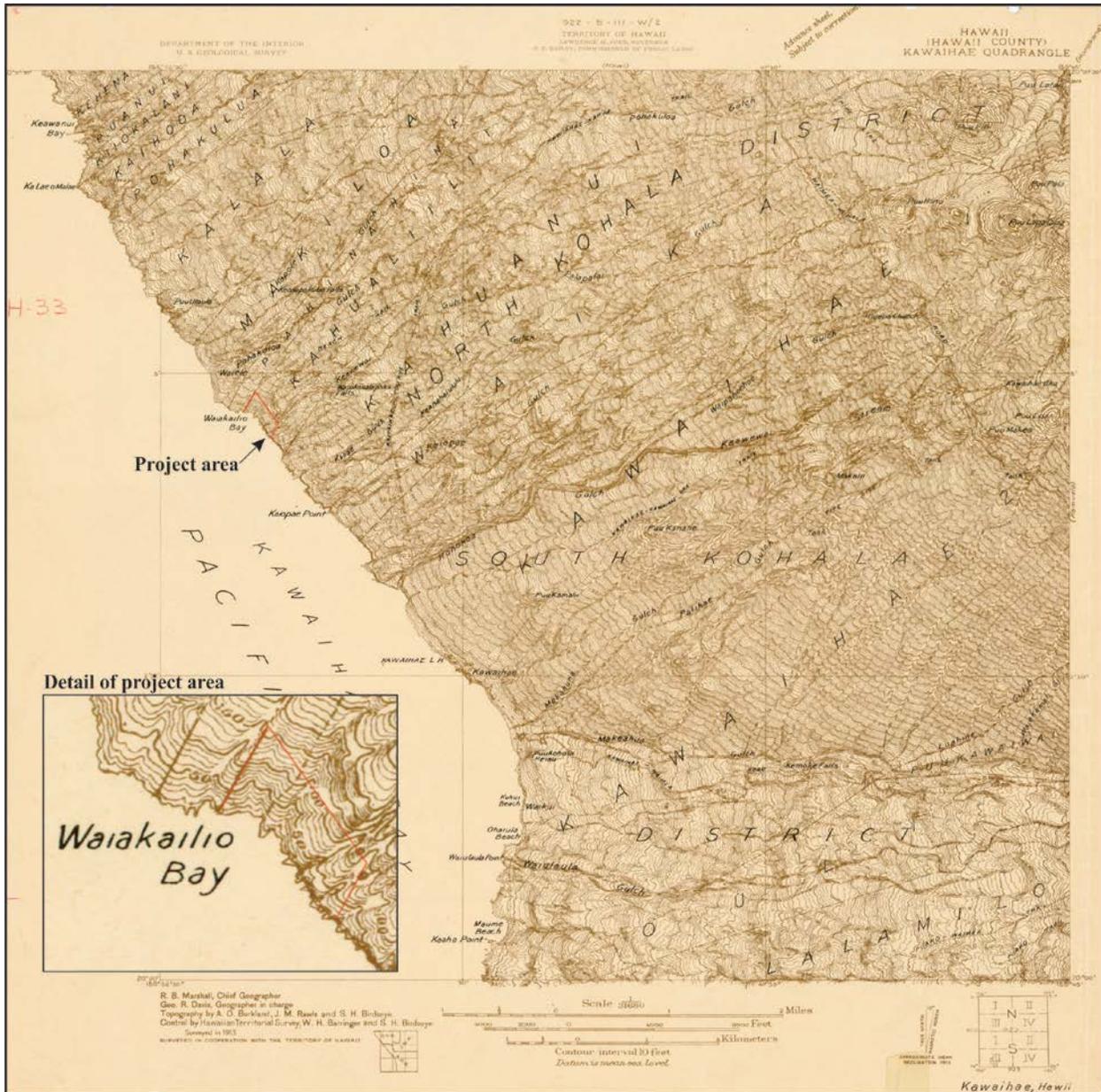


Figure 12. 1913 U.S.G.S. Kawaihae quadrangle showing the current project area.

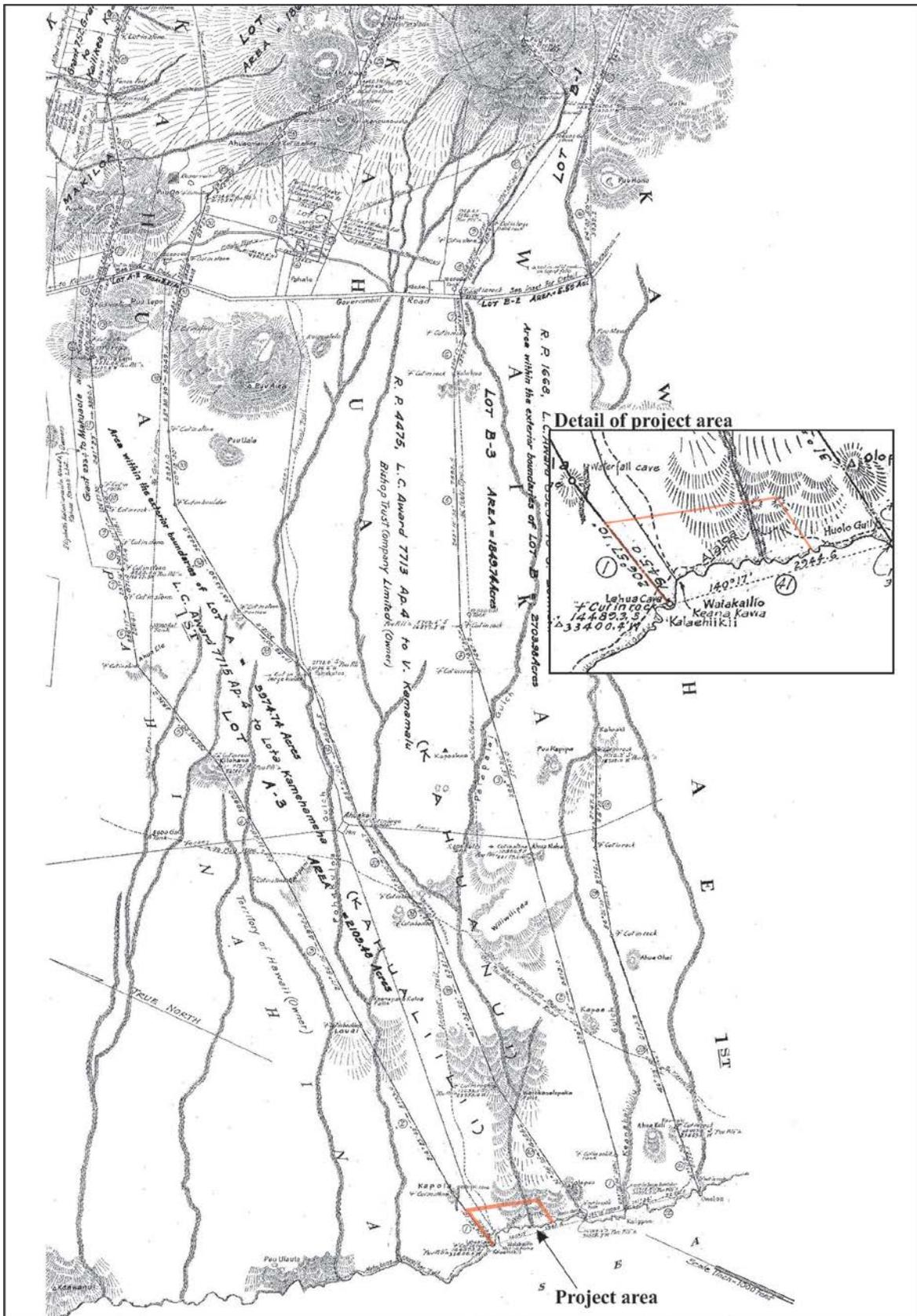


Figure 13. Portion of the 1931 Land Court Application map 1043 showing the current project area.

3. Culture-Historical Background



Figure 14. 1956 U.S.G.S. Kawaihae quadrangle showing the current project area.

## 4. DISCUSSION OF PRIOR CULTURAL STUDIES

Maria E. Ka'imipono Orr (2003) prepared a cultural impact assessment for a then proposed radio communication tower and facility to be placed on Pu'u Waiakanonula (perhaps the *pu'u* referred to as Waiakananula in the above-cited boundary testimony) in the *mauka* portion of Kahuāli'ili'i. Her study included a detailed culture-historical background for the *ahupua'a*, as well as a specific history of land use from Precontact times to the historic and modern use of the area by Kahuā Ranch. She also conducted oral interviews with Sherri Hannum, Genevieve Leina'ala Hoopai, Bernard Hoopai, Bernelle Hoopai, Harold Glenn Kailiawa, Hannah Springer, and Harry Martens (Pono) von Holt II. Orr (2003) concluded that no cultural properties or practices would be affected by the project, but cautioned that "for over a hundred years, native Hawaiians have lived in a culturally repressed state. It has been only within the last thirty years, due to evolved awareness, that native Hawaiians have been aggressively trying to reclaim their *wahi pana* (sacred and/or legendary places)."

As previously stated, Kepā Maly prepared a detailed culture-historical background for Kaiholena Ahupua'a (Maly 2000) that included information relative to the general region known as *Kohala waho* or Outer Kohala, of which the current project area is a part. Maly's (2000) extensive culture-historical information suggests that the archaeological resources present in the current study area are best understood within the context of the larger cultural landscape of *Kohala Waho*; a landscape with a long history, rich in cultural traditions. One could conclude from this that the significance of any one resource is enhanced by the presence of other resources, and together form a cohesive landscape that should be treated and managed in its totality.

In 2006, the present author prepared a cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua'a* adjoining the current study area to the south (Rechtman 2006). That study area and the current study area share a common history, and were subject to similar land use dating back to the Precontact settlement of the area. As part of the study, William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. Rechtman (2006) concluded that as long as the archaeological sites were treated in accordance with DLNR-SHPD approved treatment plans; and that access to and along the shoreline was in no way inhibited; then there would be no cultural impacts.

In 2004, the present author prepared a cultural impact assessment (Rechtman 2004) for a small coastal parcel within Pāo'o Ahupua'a, some six mile north of the current project area. Interviewees for that study included Arthur Mahi, Isabella Mahi Medeiros, and Valerie Luhiau Ako. Collectively, these individuals' (all with cultural ties to the study *ahupua'a*) primary concerns revolved around the protection of the archaeological resources and the maintenance of access to the shoreline. The relevance of this study for the current study is not so much the specifics of Pāo'o Ahupua'a, but rather the general concept that the land needs to be cared for in appropriate ways; the concept of *mālama 'āina*. This Pāo'o project required a Conservation District Use Permit, and resulted in a contested case hearing. The testimony presented in both written and oral form as part of the contested case hearing process is also reviewed here as several perspectives were offered that should be considered when assessing cultural impacts along this portion of the Kohala coastline.

The contested case for the Pāo'o project took place in 2008, and resulted in the landowners withdrawing their Conservation District Use Application. While much of the cultural testimony revolved around specific resources located on the Pāo'o parcel, there was other testimony of a more general nature that had broader implications. These included the concepts of *mālama 'āina*, cultural trauma, and cultural disintegration fostering multigenerational psychopathologies. Several of those who testified suggested that the development of the currently undeveloped portions of coastal Kohala would be inconsistent with the traditional cultural practice of caring for the land (*mālama 'āina*), although no basis for this assertion was cited. It should be noted that the land within the current study area was "developed" for use by generations of Hawaiians as a place of habitation as evidenced by the numerous structural remains of residential complexes across the property. It is perhaps the testimony presented by Kamana'opono Crabbe, Ph.D. and Dr. David Liu with respect to cultural disintegration and cultural trauma that may account for the distinction made between traditional Hawaiian use of land and modern Western use of land.

In his testimony Dr. Liu contended that:

. . . the theory of cultural trauma posits that . . . certain historical events experienced by a group continue to be experienced by that group, even decades or perhaps centuries after the initial event:

the events or processes are a “traumatic loss of identity or meaning, a tear in the social fabric.” These experiences transform communities, oftentimes in negative aspects.

There are both biological and psychological bases for the transmittal of the traumas. Biologically, trauma is transmitted through the formation of emotional memory, involving both the autonomic and higher level nervous systems. Psychologically, cultural trauma is transmitted through struggles for meaning and interpretation, which are expressed through means such as stories and songs.

The experience of cultural trauma is as a group, but its expression is on an individual basis. Such expression of individual knowing of trauma may take forms ranging from non-adherence to medication to self-destructive behaviors, such as substance abuse or overeating. Hawaiians may subconsciously choose to resist dominant models of “health” through behaviors which are ultimately self-destructive.

Hawaiians have experienced and continue to experience cultural trauma, from the coming of Captain Cook, through massive depopulation and alienation from the land to invasion, occupation, annexation and continuing depredation of the islands. Infrastructure, from the economic to political, social and spiritual saw significant degradation and destruction, processes which continue today. Perhaps one of the most fundamental institutions which continues to be eroded by the current political economy is that of the connection of Hawaiians to land, through the genealogy of Papahānaumoku, Wākea, Ho‘ohōkūikalani, and Hāloa, which leads to the Hawaiian. Because of these connections and the sacred nature of the land . . . Hawaiians have a kuleana, or duty to mālama, or take care of the ‘āina. To fail in this duty, to allow desecration or destruction, is to invite retribution from the Akua (God, or gods) or ‘aumākua (family gods).

Kamana‘opono Crabbe, Ph.D. added that proposed modern development on or nearby traditional sites:

. . . would be considered sacra religious and conflict with traditional-cultural norms. . . Consistent with theories of cultural loss and/or disintegration as well as psychosocial models of pathological illness, the discontinuance of specific cultural practices has multiple implications. The struggle to perpetuate cultural lifestyles is challenged constantly on a daily basis due to acculturation or the dynamic cultural exchange . . . between two or more distinct cultural-ethnic groups. This psychosocial process occurs on many levels typically affecting the non-dominant group within the larger dominant society, which in this case is Native Hawaiians. The long-term outcome of acculturation leads to the progressive social or cultural disintegration [of] infrastructures . . . as well as ongoing deterioration in a particular society.

If the above contentions are taken as valid, and all land within Hawai‘i is to be considered a valued resource, then there is potentially a direct conflict between Western private property rights (which were established under the Hawaiian Kingdom during the reign of Kamehameha III) and traditional Hawaiian cultural values. It is then perhaps the role of the state’s regulatory agencies to take such factors into account when making land use decisions that might have unexpected long-term psychological effects on a particular cultural group within our modern-day multicultural society.

## 5. SUMMARY OF CONSULTATION

As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present author's further contention that the oral interviews should also be used to augment the process of assessing the significance of any traditional cultural properties that may be identified. It is the researcher's responsibility, therefore, to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

As part of the current study the author met with the North Kohala Community Access Group. Although this group's membership is multicultural, they represent many of the Native Hawaiian community's concerns with respect to access rights, and they were a forum to present the project and to help get the word out to folks within the Native Hawaiian community who may have comments and concerns about the project. The South Kohala Community Development Planning Group was also contacted to help get the word out to potential interested parties, and the Department of Hawaiian Home Lands Kailapa Community Association was also contacted. As a result of these contacts and communications, a field visit was set up with the intention of viewing the property and discussing any potential cultural impacts. On November 15, 2014, Robert Rechtman, Ph.D. met on-site with several members of the North Kohala Community Access Group, the South Kohala Community Development Planning Group, and residents of the Kailapa Homesteads. Among others (e.g., Diane Kanealii, Jojo Tanimoto, Toni Withington), present at the site visit were Kelvin Kaho'opi'i and his wife Anna. Kelvin immediately explained that he believed that he owned the property, not the current landowner, and that he [Kelvin] would consider it to be trespassing if the assembled group were to leave the highway where we had met and go onto the property. He further suggested that there would be "serious consequences" if we violated this order. It was explained to him that the landowner (and the project consultants) felt comfortable in the ownership rights and that if he had a legitimate complaint he should file legal papers. He then showed some sort of Hawaiian Kingdom title document and explained that it is incumbent on the person claiming to be landowner to show him Royal Patent documents to prove ownership (see discussion of chain of property ownership above). We agreed to disagree on this issue, and none of the assembled people felt comfortable continuing with the planned site visit, and so further field consultation did not occur.

Present at this aborted meeting was Kaena Peterson, who is *kama'āina* to the area, a resident of Kailapa, and President of the South Kohala Hawaiian Civic Club. Kaena was contacted the following day and she asked me to meet with her and the Vice President of the South Kohala Hawaiian Civic Club to share information about the project and hear their concerns. On Sunday November 23, 2014, Robert Rechtman, Ph.D. met with Kaena Peterson and Lei Kihoi of the South Kohala Hawaiian Civic Club at the Kailapa residence of Kaena Peterson. Their concerns were related to both the protection of trails along with other traditional sites and burial sites, and the perpetuation of access to the property for traditional and customary practices as protected under state statutes. With respect to the former, they wanted to make sure that all burial sites are properly treated and that the traditional trail routes remain open for unrestricted pedestrian access. With respect to the perpetuation of traditional and customary practices they wanted to make sure that traditional coastal activities were not impacted and that Native Hawaiian individuals and organized groups such as *hula halau* had unrestricted access to the trails and shoreline. Both Kaena and Lei stressed the importance of maintaining the traditional access routes that exist on the landscape.

A second, this time successful, field visit was conducted on January 31, 2015 with members of the North Kohala Community Access Group and residents of the South Kohala Department of Hawaiian Home Lands Kailapa community. Much of the discussion during this visit revolved around trails and access. Present during this visit was JoJo Tanimoto, a *kupuna* of Native Hawaiian ancestry. She shared recollections of traveling the project area coastline with her father when she was a child for shoreline fishing activities. Jojo also talked about a shoreline pond in the general area that William Akau related to her was culturally significant, but was unsure of its exact location. Also present during this visit was Diane Kanealii and Parish Canon of the Kailapa community. Mr. Canon, a younger generation Native Hawaiian and current president of the Kailapa Community Association expressed an interest in having community members take an active role in the preservation of cultural sites and resources within the development area.

No other individuals have come forward with any specific information about significant cultural resources or traditional and customary practices that have occurred or are still taking place on the current study property.

Information obtained from three prior interviews is also directly relevant to the current study area. As part of the cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua‘a* adjoining the current study area to the south (Rechtman 2006), William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. That study area and the current study area share a common history, and were subject to similar land use dating back to the Precontact settlement of the area. The interview questions asked during that study and the responses given apply equally to the current study area. The interviews were informal unrecorded phone conversations and the consultants were asked specific questions concerning their personal knowledge of the general project area and the former Kahuā Ranch lands.

William Akau was a life-long resident of Kawaihae with genealogical ties to the area dating back to at least 1791. As a child in the 1930s, William Akau walked the coastal trails, fished the near shore and gardened sweet potatoes in the then *‘auwai* watered lands near Pu‘u Koholā. He was asked if he knew of any specific cultural sites or practices that have taken place or are ongoing within the general project area. He knew of nothing specific, but did relate that the area was and is used for shoreline fishing. When asked about his concerns for development of the area, he was strong in his reply that the traditional trail systems be protected and kept open for pedestrian access. He related that in the 1980s it was he who entered into a lawsuit with the Mauna Kea Hotel to stop their blocking of the coastal trails. William Akau prevailed in his lawsuit, and access rights to the trails along the Kawaihae and ‘Ōuli shoreline were protected.

Monty Richards, born at Kahuā Ranch in 1929, is a descendant of both the Reverend William Richards who arrived in Hawai‘i in 1823, and Amos Starr Cooke who arrived in Hawai‘i in 1837. Monty’s father moved from O‘ahu to Hawai‘i in the 1920, and along with his brother Atherton and Ronald von Holt established Kahuā Ranch. Monty was asked if he knew of any specific cultural sites within former coastal ranch lands. He indicated that there are many archaeological sites recorded and that the late Henry Auwae showed him a place in Kahuānui (to the south of the current study area) that he called a turtle shrine.

Pono von Holt, born in 1938, is the third child of Ronald von Holt and Dorothy Erdman. Pono was named after his paternal grandfather (Harry Martens von Holt), who was called Hale Ponohele by Hawaiians. Hale’s father (Pono’s great grandfather) arrived in Hawai‘i from Hamburg, Germany in 1851. Pono also described Henry Auwae showing him a *honu* shrine located near the mouth of the Kai‘ōpae drainage. When asked about past ranching activities on the coastal lands, he explained that the entire area had been grazed by cattle for many years.

While it is abundantly clear from the archaeological and historical records that the property was used during Precontact and early historic times for the entire range of traditional Hawaiian cultural activities and practices (residential, burial, ceremonial, subsistence production and procurement, etc.); none of the consultants had knowledge of any specific traditional cultural practices currently being exercised on the property; although William Akau suggested (and the present author observed) that the shoreline is actively being accessed for fishing, and both Monty and Pono concurred that such activities are and have commonly been practiced along the Kahuā shoreline. Also, during earlier Pāo‘o consultations, Arthur Mahi and Valerie Luhiau Ako discussed the general practice of *mālama ‘āina*, and many within the Hawaiian community, along with the Office of Hawaiian Affairs, recognize such caretakership of the land as an ongoing cultural practice with traditional roots.

### **ADDITIONAL CONSULTATION**

As mentioned in the introduction, the first version of the current CIA study was prepared for an earlier iteration of the current proposed project. Given the newly proposed reduction in lot density (from nine lots to six lots) and the commitment that nothing will be constructed *makai* of the *ala loa*, additional consultation was sought relative to not only the density reduction, but also the future treatment of historic properties within the proposed development area that were previously evaluated a significant due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts (HRS Chapter 6E evaluation Criterion e). Eight such sites were identified in the updated AIS (Rechtman and Clark 2010), the five burial sites (SIHP Sites 2496, 4004, 4013, 16148, and 16162), the two trail sites (SIHP Sites 15261 and 29271), and one site (SIHP Site 2498) that has been characterized as consisting of one habitation feature and one shrine feature (Graves and Franklin 1998); all of these sites will be preserved.

The following individuals and organizations were contacted and/or re-contacted for additional consultation, and Public Notices soliciting consultation for the burial sites were published in the July 2018 issue of *Ka Wai Ola o OHA*, on June 16, July 1, July 4, 2018 in both the *Honolulu Star Advertiser* and *West Hawai‘i Today* newspapers.

### **Kailapa Community Association**

Diane Maka‘ala Kāneali‘i was contacted via email (on November 2 and 26, and December 8 and 10, 2018) in her capacity as Executive Director of the Kailapa Community Association. The new six-lot subdivision plan was shared with her and a request was made to make a presentation at a community association meeting. On February 2, 2019, Robert B. Rechtman, Ph.D. conducted a walking tour of the proposed subdivision area with Diane Maka‘ala Kāneali‘i and Cynthia Sharp. Cynthia is also a board member of the Kailapa Community Association. Both Diane and Cynthia expressed pleasure that the extreme coastal portion of the property will be preserved, but indicated that the best approach would be to preserve the whole property through a land purchase perhaps using County Public Access, Open Space and Natural Resources Preservation Commission (PONC) funds. Short of this happening, both were encouraged by the overall limited space available for future development. Diane indicated that she would work with the landowner to help establish a community stewardship program that could participate in the preservation of the cultural landscape, conduct coastal clean-up, and help restore and protect archaeological resources. The landowner is committed to continued consultation with this and any other Kohala cultural community groups with respect to the long term protection and care of the project area’s cultural landscape, and the Kailapa Community Association will be further consulted with respect to the archaeological preservation plan.

### **Hawai‘i Island Burial Council (HIBC)**

Robert B. Rechtman, Ph.D. appeared before the HIBC on November 5, 2018 to conduct preliminary consultation with respect to the five burial sites within the development area, and related to the Council members that there were no responses to the public notices. The existing treatment plan (PHRI 2000) for four of those sites was discussed and it was explained that a fifth site had been discovered as a result of the updated AIS (Rechtman and Clark 2010). It was also explained that the existing HIBC-approved 20 foot buffers for the sites would be increased to 30 feet in the new Burial Treatment Plan (BTP). Council members were pleased with the increased buffer size, and were interested in ensuring that appropriate access to the burial sites would be allowed. Provisions for such access will be included in the forthcoming BTP.

### **Kaena Peterson**

Kaena Peterson lives in the Kailapa (Honokoa) Community and serves as the President of the South Kohala Hawaiian Civic Club. She was consulted during the earlier iteration of the project. Kaena was contacted via email (on October 30 and December 8 2018). The new six-lot subdivision plan was shared with her and a request was made to make a presentation at a Civic Club meeting. Scheduling could not accommodate such a presentation, however, in a phone conversation (on December 11) Kaena shared that she was happy to see all development activity moved to the *mauka* side of the *ala loa*. She also strongly urged the developer to keep the current six-lot plan (not to change it later to higher density) and make sure that future homeowners would not encroach on the trails, which to her are at the heart of cultural practice. Kaena related that the uniqueness of living on an island comes with a *kuleana* toward fellow residents, something she believes was a part of traditional Hawaiian culture

### **Ala Kahakai National Historical Trail**

Further brief consultation was conducted with Rick Gmirkin of the National Park Service’s Ala Kahakai National Historical Trail Program. The new six-lot subdivision plan was shared via email and a brief phone conversation (on December 10, 2018) was conducted. Rick expressed his pleasure that there will be no breaches of the *ala loa* and that the public access to the *ala loa* will follow along an existing traditional *mauka/makai* trail alignment. He was also encouraged that the new subdivision configuration supported the preservation of more of the archaeological landscape, as this helps provide the context for the Ala Kahakai. The landowner will continue to consult with the Ala Kahakai National Historical Trail Program to fine tune the public alignment of Ala Kahakai to include important aspect of the trail as well as exclude other significant features (i.e., burial sites) from public interaction.

### **Office of Hawaiian Affairs (OHA)**

Shane Nelson of OHA’s West Hawai‘i office was contacted via email (on September 12 and October 30, 2018) and a phone conversation was organized on November 5, 2018. The reduced-lot development plan was shared with Shane and he expressed his pleasure that the proposed development would have less of an impact on the cultural landscape and the archaeological sites contained therein. Shane requested continued consultation with OHA when the burial treatment and archaeological preservation plans become available.

## 6. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are nature features of the landscape and historic sites, including traditional cultural properties. A working definition of traditional cultural property is:

“Traditional cultural property” means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community’s history and contribute to maintaining the ethnic community’s cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. “Traditional” as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. “Cultural” refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term “Property” defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of “Property” wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion D at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion E. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa‘akai O Ka‘āina v Land Use Commission* court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent

to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of the archaeological studies conducted within the project area forty archaeological sites were identified (see Figure 3). These include five sites with burials (SIHP Sites 2496, 4004, 4013, 16148 and 16132) evaluated as significant under Criteria d and e, two multi-feature trail sites (SIHP Site 15261 and Site 29271) also evaluated as significant under Criteria d and e, one habitation/ceremonial sites evaluated as significant under Criteria c, d, and e, two habitation sites (SIHP Sites 2499 and 4005) evaluated as significant under Criteria c and d, and thirty additional archaeological sites (SIHP Sites 4000, 4002, 4003, 4010, 4011, 4012, 4015, 16131, 16132, 16133, 16134, 16135, 16136, 16137, 16138, 16139, 16140, 16141, 16142, 16143, 16144, 16145, 16146, 16147, 16149, 16150, 16151, 16163, 16164 and 16167) evaluated as significant under Criterion d.

Thirty-seven of these archaeological sites are considered to be valued cultural resources and retain the potential to be impacted by the current development proposal. DLNR-SHPD is the state agency that has been empowered to make determinations with respect to impacts to archaeological sites and to assure that appropriate measures are implemented to mitigate any potential impacts. To mitigate potential impacts to the burial sites identified within the current project area, a revised burial treatment plan should be prepared in compliance with HAR 13§13-300 and implemented prior to the commencement of any ground-disturbing activities. To mitigate the potential impacts to the non-burial archaeological sites identified within the project area, archaeological preservation and data recovery plans should be prepared in compliance with HAR13§13-277 and HAR 13§13-278, respectively, and implemented prior to any ground-disturbing activities.

As a result of the consultation and given the reduction in the number of lots from nine to six, eleven archaeological sites (SIHP Sites 2496, 4010, 4012, 16138, 16140, 16141, 16143, 16144, 16146, 16151, and 16167) that have been previously approved for data recovery by DLNR-SHPD will be reassigned a preservation treatment, reducing the total number of sites that will be subject to data recovery from eighteen to seven and increasing the number of preservation sites from sixteen to twenty-seven.

With respect to the land (as a valued natural/cultural resource) within the current project area and the current proposed Kohala Shoreline LLC development, conditions exist that may mediate the potential detrimental psychosocial effects postulated by Kamana'opono Crabbe, Ph.D. and Dr. David Liu with respect to cultural disintegration and cultural trauma. The fact is that within the local community these lands are known to have been private lands for over 100 years, and that access to the shoreline for traditional cultural practices has never been prohibited, a situation that will continue under the current proposed development. Further, in the spirit of *mālama 'āina*, the current development plans call for a down zoning from the current approved Single-Family Residential 15,000 square foot lot size to Agricultural Residential 3 acre lot size, and a planned unit development that locates building sites away from the immediate shoreline and in such a way as to preserve a significant portion of the archaeological landscape; and although seemingly not currently practiced within the study area, ongoing *mālama 'āina* could and should be resurrected for the current project area. In this vein, Lei Kihoi suggested that if a community association is established to maintain the preserved cultural sites on the property, that a member(s) of the local Hawaiian community with ties to the land be retained for this task. Parish Canon also expressed a desire to have members of the local Native Hawaiian community be encouraged to participate in the preservation of resources within the development area, and to maintain an on-going dialog with the developer and the individual landowners. In this way the traditional concept of *mālama 'āina* could be perpetuated.

Other potential cultural impacts that may result from the proposed project specifically relate to coastal access and use. In a general sense access to and use of the entire shoreline within the study area for recreational, subsistence, transportation, and spiritual purposes can be considered an ancient as well as ongoing practice; thus the shoreline itself could be considered a valued cultural resource and would be significant under Criterion E. The primary concern raised by William Akau was that of maintaining long-shore pedestrian access for fishing, transportation, and recreation. He was a longtime advocate for the perpetuation of Hawaiian rights of access to, and use of, the traditional system of trails. These same concerns for maintaining traditional and customary access rights were raised by Kaena Peterson and Lei Kihoi during more recent consultation. Figure 15 is a portion of Land Court Application 1043 Map 1 (dated 1931) indicating the presence of a coastal trail within the current project area. This trail is also shown on the 1935 edition of the Tax Map (Figure 16) and based on an overlay with current maps it appears as though this trail eventually became the coastal Jeep road, which was recorded in the most recent archaeological study (Rechtman 2014) as Site 29271.

Along much of the Kohala coast, this Jeep road followed the course of an existing *ala loa* that had been in use for centuries. The *ala loa* is depicted on several historical maps dating back at least to 1903; however, its location was perhaps most accurately recorded on the detailed survey map prepared in 1931 (see Figure 15) to accompany a set of land court applications (L.C.App. 1036 and 1043) that contain information relevant to the current project area. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus within the current project area there are no state-owned (public) trail encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII.

However, within the current study property, in 1994 the then landowner recorded a map within the Land Court system that specified a shoreline setback for coastal public access in the area between the highwater mark and six feet inland of the "highwater mark as is from time to time established" (Figure 17); re-establishing a public access easement on the property. This access corridor in conjunction with an access alignment coincident with Site 29271 will continue to provide lateral access across the property. Additionally, there will be a public access parking lot within the property and a *mauka/makai* pedestrian trail leading to the lateral access corridors and shoreline (see Figure 9). The establishment and maintenance of these trail easements will facilitate coastal access and the continued use of the shoreline for recreational, subsistence, transportation, and spiritual purposes; thus alleviating any potential impacts related to shoreline access and related cultural use. Additionally, there will be no development activities permitted *makai* of the *ala loa*, which will help to limit any visual impacts on the coastal cultural landscape.

Implementation of the above described measures relative to the identified archaeological and cultural resources, and cultural practices and beliefs will help to ensure that no such resources, practices, or beliefs will be adversely affected by the proposed subdivision and subsequent development of the subject property

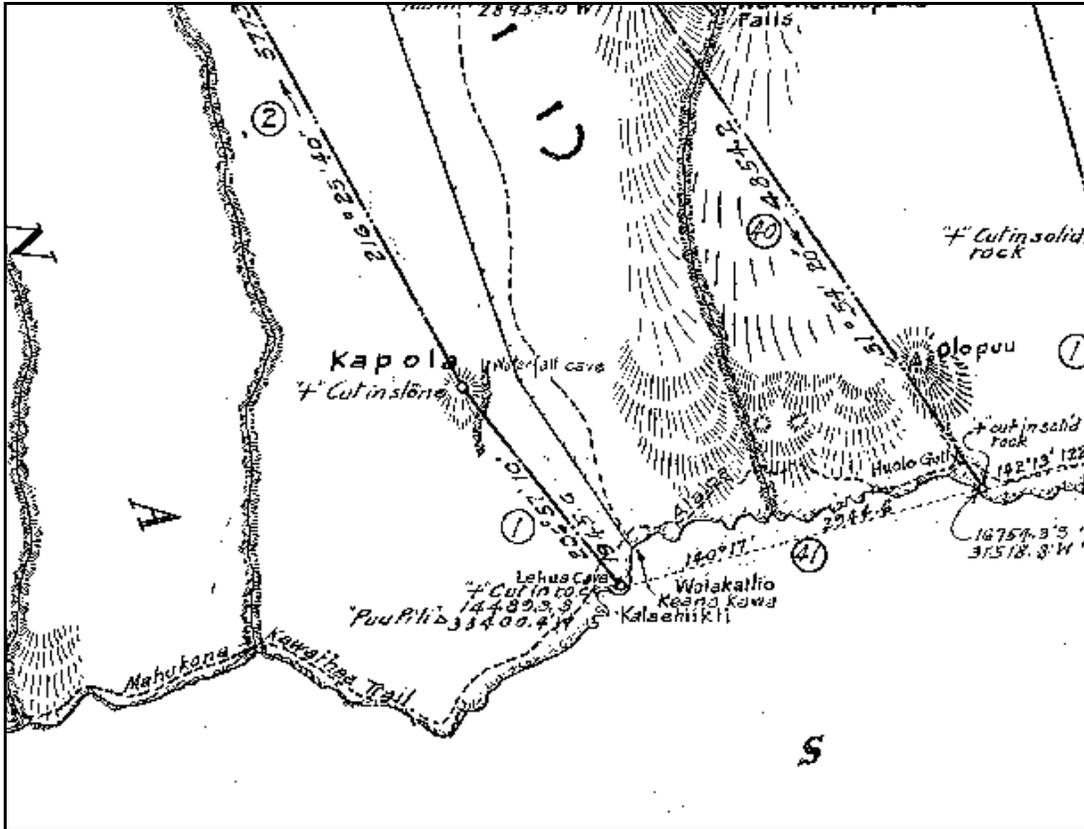


Figure 15. Portion of Land Court Application 1043 Map 1 (dated 1931).

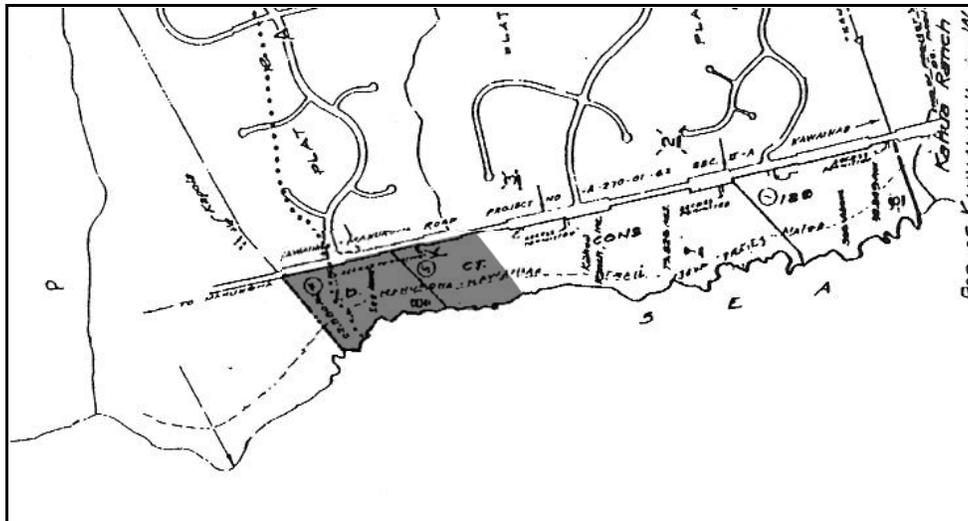


Figure 16. Portion of 1935 Tax Map showing coastal "Hawaiian trail," current project area shaded.

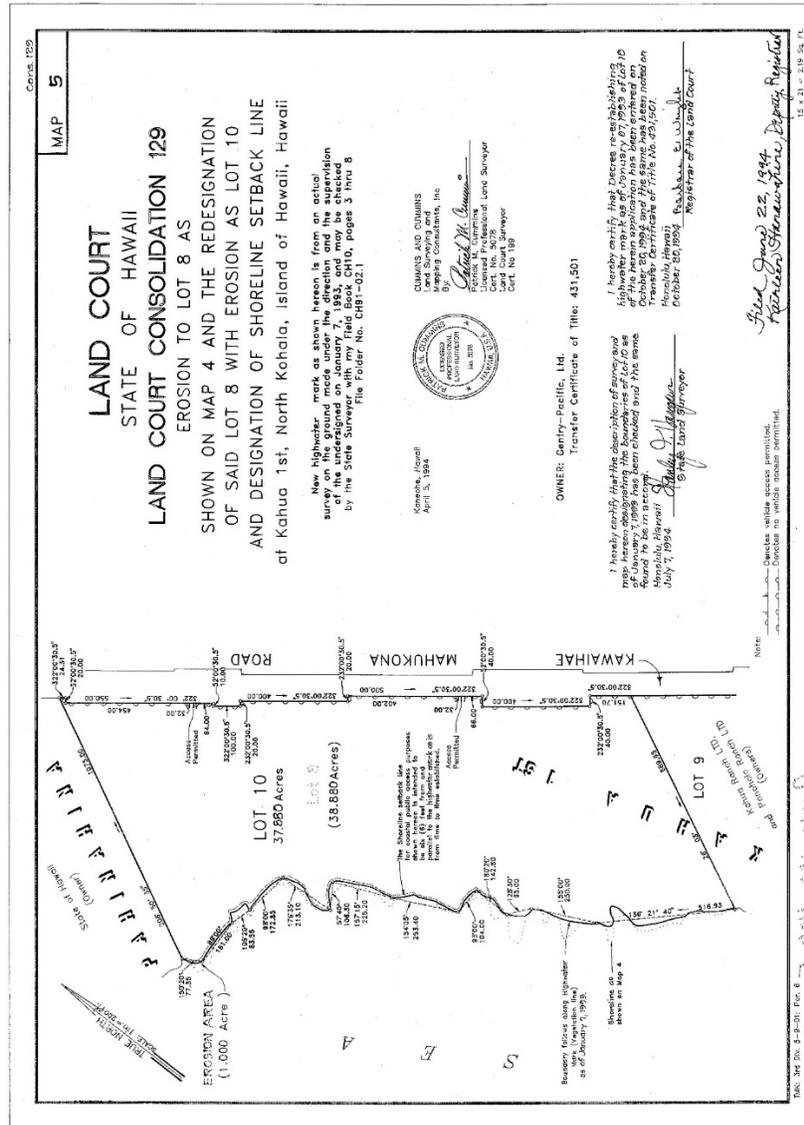


Figure 17. 1994 map showing the establishment of a coastal public access along the shoreline.

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 4**

#### **Archaeological Inventory Survey and Related Correspondence**

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DAVID Y. IGE  
GOVERNOR OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

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

KEKO KALUHIWA  
FIRST DEPUTY

JEFFREY T. PEARSON  
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

February 8, 2016

Dr. Robert B. Rechtman  
507A E. Lanikaula St.  
Hilo, HI 96720

Log No. 2015.02305  
Doc. No. 1602KM15  
Archaeology

Dear Dr. Rechtman,

**SUBJECT: Chapter 6E-42 Historic Preservation Review –  
Supplemental Archaeological Inventory Survey of 37.8 acres  
Kahuā 1<sup>st</sup> Ahupua‘a, North Kohala District, Island of Hawai‘i  
TMK: (3) 5-9-001:008**

Thank you for the opportunity to review the revised draft report titled *Supplemental Archaeological Inventory Survey of TMK: (3) 5-9-001:008, Kahuā 1<sup>st</sup> Ahupua‘a, North Kohala District, Island of Hawai‘i* (Rechtman, January 2016). We received the initial draft on December 31, 2014 for which SHPD requested revisions on January 19, 2016 (Log No. 2014.05803, Doc. No. 1601KM18). We received the revised draft via email on January 20, 2016 (Log No. 2015.02305).

This supplemental archaeological inventory survey (AIS) was prepared by ASM Affiliates, Inc. (ASM) at the request of Gregory R. Mooers of Mooers Enterprises LLC, on the behalf of Kohala Shoreline, LLC. The supplemental AIS project area totals 37.8 acres, comprising the entirety of TMK: (3) 5-9-001:008. The landowner proposes to develop a 9 lot subdivision for a single-residence gated community. The development would involve rezoning from Residential (RS) to Residential Agricultural (RA) to afford each lot 3 acres. The proposed project would involve construction of single-residence dwellings on each lot, two internal roadways, and public shoreline access and associated parking lot. Residential units would utilize existing water, electrical, and telecommunication lines.

Review of our records indicate an archaeological inventory survey was conducted for the subject parcel and adjacent Parcel 007. The AIS documented a total of 68 historic properties, including 55 previously identified and 13 newly identified sites. Eight sites were recommended for no further work while 17 sites were recommended for preservation in place, and 43 sites were recommended for archaeological data recovery. The AIS (Graves and Franklin 1998) was accepted by the SHPD on June 8, 1998 (Log No. 21268, Doc. No. 9805PM21). Several mitigation documents including a burial treatment plan (Rosendahl, April 2000), a phased mitigation plan (Kubo and Rosendahl 2001; Log No. 2003.1295, Doc. No. 0307PM22), site preservation plan (Rosendahl August 2000; Log No. 26597, Doc. No. 0011PM14), and archaeological data recovery report (O’Hare and Goodfellow 1999; Log No. 25962, Doc. No. 0008RC05) were prepared over the course of several years between 1999 and 2005. Additional information for sites was also collected during additional inventory survey (Corbin 2003; Log No. 2006.1566, Doc. No. 0605JT43) and documentation of possible burial sites (PHRI 2005; Log No. 2003.1290, Doc. No. 0307PM20).

The current Supplemental AIS (Rechtman 2016) was prepared in support of the previous AIS (Graves and Franklin 1998) to provide the following: (1) Assessment of current site conditions; (2) Relocation of previously identified sites and identification and documentation of any newly located sites and features; and (3) Revised mitigation recommendations. A total of 40 historic properties were documented; 39 previously identified sites were relocated and further documented, and a single, newly identified site was recorded (Site 29271). Pursuant to Hawaii Administrative Rules (HAR) §13-284-6, the Supplemental AIS evaluated all of the 40 sites as significant with 30 sites significant under Criterion “d” (information potential) only; 7 sites as significant under Criteria “d” and “e”

(significance to particular group); 2 sites as significant under Criteria “c” (method of construction, craftsmanship) and “d” (information); and one site as significant under Criteria “c”, “d”, and “e”. In addition to significance evaluations, the Supplemental AIS updated proposed site mitigation recommendations as follows: archaeological data recovery only for 16 sites; preservation only for 16 sites; data recovery and burial preservation for 2 sites; burial preservation only for 3 sites; and no further work for 3 sites (Table 1). The project effect determination is “Effect, with agreed upon mitigation commitments.” The SHPD concurs with the site significance assessments and recommended mitigation measures.

Table 1. Overview 40 historic properties identified within project area

Site	Type/Function	Significance	Previous Mitigation Recommendations	Current Mitigation Recommendations**
2496	Habitation and burial	“d” and “e”	Preservation	<b>Data recovery</b> and burial preservation
2498	Habitation and ceremonial	“c”, “d”, and “e”	Preservation	Preservation
2499	Habitation	“c” and “d”	Preservation	Preservation
4000	Wall	“d”	No further work	<b>Preservation</b>
4002	Rock mound	“d”	Preservation	<b>Data recovery</b>
4003	Habitation	“d”	Preservation	<b>Data recovery</b>
4004	Burial	“d” and “e”	Burial preservation	Burial preservation
4005	Habitation	“c” and “d”	Preservation	Preservation
4010	Animal enclosure	“d”	No further work	<b>Data recovery</b>
4011	Habitation	“d”	Preservation	Preservation
4012		“d”	Preservation	<b>Data recovery</b>
4013	Habitation and burial	“d” and “e”	Burial preservation	<b>Data recovery</b> and burial preservation
4015	Habitation	“d”	Data recovery (completed)	No further work
15261	Trail	“d” and “e”	No further work	<b>Preservation</b>
16131	Habitation	“d”	Preservation	Preservation
16132	Wall	“d”	No further work	No further work
16133	Well/reservoir	“d”	Preservation	Preservation
16134	Enclosure	“d”	Preservation	Preservation
16135	Wall	“d”	Preservation	<b>Data recovery</b>
16136	Habitation	“d”	No further work	No further work
16137	Rock mound	“d”	Preservation	<b>Data recovery</b>
16138	Platform and cairn	“d”	No further work	<b>Data recovery</b>
16139	Habitation	“d”	Preservation	Preservation
16140	Habitation	“d”	Preservation	<b>Data recovery</b>
16141	Habitation	“d”	Preservation	<b>Data recovery</b>
16142	Habitation	“d”	Preservation	Preservation
16143	Habitation	“d”	Preservation	<b>Data recovery</b>
16144	Habitation	“d”	Preservation	<b>Data recovery</b>
16145	Habitation	“d”	Preservation	Preservation
16146	Habitation	“d”	Preservation	<b>Data recovery</b>
16147	Habitation	“d”	Preservation	Preservation
16148	Habitation and burial	“d” and “e”	Burial preservation	Burial preservation
16149	Habitation	“d”	Preservation	Preservation
16150	Habitation	“d”	Preservation	<b>Data recovery</b>
16151	Habitation	“d”	Preservation	<b>Data recovery</b>
16162	Burial	“d” and “e”	Burial preservation	Burial preservation
16163	Habitation	“d”	Preservation	Preservation
16164	Habitation	“d”	Preservation	<b>Data recovery</b>
16167	Agricultural terrace	“d”	Preservation	<b>Data recovery</b>
29271	Trail	“d” and “e”	Not documented previously	Preservation

\*\*Mitigation underlined and in bold differs from previous recommendations

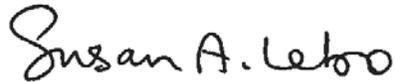
Mr. Rechtman  
February 8, 2016  
Page 3

The revisions address the issues and concerns raised in our earlier correspondence (January 19, 2016, Log No. 2014.05803, Doc. No. 1601KM18; January 20, 2016, Robert Rechtman email correspondence). The report provides adequate discussion of the project, physical environment, cultural and historical background, previous archaeological studies, methods and field findings, and meets the requirements specified in HAR §13-276-5. **It is accepted by SHPD.** Please send one hardcopy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.

As stipulated in HAR §13-284-7(e), when the SHPD comments that the project determination is “Effect, with agreed upon mitigation commitments,” then detailed mitigation plans shall be developed for SHPD review and acceptance. The agreed-upon mitigation measures for the proposed development project are archaeological preservation, data recovery work, and burial preservation. As described above, a number of mitigation documents have been submitted based on the treatment recommendations of the previous archaeological investigations. However, pursuant to HAR §13-284-8, these mitigation documents need to be revised, as appropriate, to correlated with the revised recommendations provided by the current Supplemental AIS report (Rechtman January 2016). The SHPD looks forward to receiving for review and acceptance a revised data recovery plan that meets the requirements of HAR §13-278-3, a revised preservation plan that meets the requirements of HAR §13-277, and appropriate burial treatment plan(s) that meet the requirements of HAR §13-300-33.

Please contact Kimi Matsushima at (808) 692-8027 or at [Kimi.R.Matsushima@hawaii.gov](mailto:Kimi.R.Matsushima@hawaii.gov) if you have any questions or concerns regarding this letter.

Aloha,

A handwritten signature in black ink that reads "Susan A. Lebo". The signature is written in a cursive, flowing style.

Susan A. Lebo, PhD  
Archaeology Branch Chief



December 8, 2018

Sean Naleimaile  
Hawai'i Island Archaeologist  
DLNR-SHPD  
40 Pookela Street  
Hilo, HI 96720

Dear Sean:

I am writing on behalf of my client, Kohala Shoreline, LLC, to request revisions to the accepted treatments of eleven archaeological sites that were described in a Supplemental AIS report for TMK: (3) 5-9-001:008 in Kahuā Ahupua'a, North Kohala District, Island of Hawai'i. That report was accepted in 2016 (Log No. 2015.02305; Doc. No. 1602KM15). Since acceptance that development plans for the property changed from a 9-lot subdivision to a 6-lot subdivision, which has resulted in the ability to preserve more of the archaeological landscape. As such the attached table contains the proposed revisions. In all cases we are requested a change from Data Recovery to Preservation. Once approved we will be poised to prepare the Data Recovery and Preservation Plans.

Thank you for your consideration,

A handwritten signature in black ink, appearing to read "Robert B. Rechtman".

Robert B. Rechtman, Ph.D.  
Principal Archaeologist  
Attach/Table

**Proposed Treatment Revisions**

<i>SIHP No.</i>	<i>Current Approved Treatment</i>	<i>Proposed Revised Treatments</i>
2496	Data Recovery/Burial Preservation	Preservation/Burial Preservation
2498	Preservation	
2499	Preservation	
4000	Preservation	
4002	Data Recovery	
4003	Data Recovery	
4004	Burial Preservation	
4005	Preservation	
4010	Data Recovery	Preservation
4011	Preservation	
4012	Data Recovery	Preservation
4013	Data Recovery/Burial Preservation	
4015	No Further Work	
15261	Preservation	
16131	Preservation	
16132	No Further Work	
16133	Preservation	
16134	Preservation	
16135	Data Recovery	
16136	No Further Work	
16137	Data Recovery	
16138	Data Recovery	Preservation
16139	Preservation	
16140	Data Recovery	Preservation
16141	Data Recovery	Preservation
16142	Preservation	
16143	Data Recovery	Preservation
16144	Data Recovery	Preservation
16145	Preservation	
16146	Data Recovery	Preservation
16147	Preservation	
16148	Burial Preservation	
16149	Preservation	
16150	Data Recovery	
16151	Data Recovery	Preservation
16162	Burial Preservation	
16163	Preservation	
16164	Data Recovery	
16167	Data Recovery	Preservation
29271	Preservation	

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# Supplemental Archaeological Inventory Survey of TMK: (3) 5-9-001:008

Kahuā 1<sup>st</sup> Ahupua'a  
North Kohala District  
Island of Hawai'i

FINAL VERSION



*Prepared By:*

Robert B. Rechtman, Ph.D.

*Prepared For:*

Kohala Shoreline, LLC  
c/o: Mooers Enterprises  
P.O. Box 1101  
Kamuela, HI 96743

November 2014  
(Revised January 2016)

ASM Project Number 22500.00



Archaeology • History • Ethnography • Architectural History

Office: (808) 969-6066 • Fax: (808) 443-0065



# Supplemental Archaeological Inventory Survey Update of TMK: (3) 5-9-001:008

Kahuā 1<sup>st</sup> Ahupua‘a  
North Kohala District  
Island of Hawai‘i





## EXECUTIVE SUMMARY

At the request of Gregory R. Mooers of Mooers Enterprises LLC, on behalf of his client Kohala Shoreline, LLC, ASM Affiliates, Inc. (ASM) has conducted this supplemental archaeological inventory survey (AIS) updating and expanding on an earlier DLNR-SHPD accepted AIS of an approximately 37.8 acre project area in Kahuā 1<sup>st</sup> Ahupua‘a, North Kohala District, Island of Hawai‘i (TMK: 3-5-9-001:008). The earlier archaeological inventory survey report contained site treatments based on the then planned subdivision development of the parcel. Subsequent archaeological work on the property included the preparation of a data recovery plan for one site (Rosendahl 1994) and the data recovery of that site (O’Hare and Goodfellow 1999), additional burial testing at three sites (PHRI 2005) and the preparation of a burial treatment plan (PHRI 2000a), along with the preparation of an archaeological sites preservation plan (PHRI 2000b). These follow-up studies were conducted with the understanding that the development of the subject parcel would be limited to one single-family residence occupying the extreme western end of the parcel, and that the remaining bulk of the parcel would be left in its natural state. Thus the site treatment recommendations accepted in the earlier AIS report were reconsidered and revised such that the treatment of all of the sites previously approved for data recovery was changed to preservation. The current proposed development plan for the parcel is no longer restricted to the construction of one single-family residence, but rather includes the creation of a nine lot subdivision. This new proposed land use necessitates revising the site treatments once again, bringing them into greater conformance with what was accepted in the original AIS. The purpose of the current supplemental AIS is to assess current site conditions and identify any previously unrecorded sites and features, and to provide new site treatment recommendations appropriate for the newly proposed nine lot subdivision development plan as well as to provide a map showing accurate site locations. To that end, ASM completed a supplemental AIS of the study area, identified and replotted the previously recorded sites, and documented additional features that had not been previously recorded.

The supplemental AIS of the current project area was conducted on December 1–3, 2009 by J. David Nelson, B.A., Christopher S. Hand, B.A., Johnny R. Dudoit, B.A., and Ashton K. Dircks Ah Sam, B.A. under the direction of Robert B. Rechtman, Ph.D. Additional survey and subsurface testing at selected features was conducted on February 23 and 24, 2010 by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and by J. David Nelson, B.A. A search for remnants of the trails shown on the various Historic maps reviewed for this study was undertaken by Robert B. Rechtman, Ph.D., and Matthew R. Clark, B.A. on August 22, 2013 and on July 16, 2014. During the intensive pedestrian survey of the study area, the entire parcel was subject to north/south transects with fieldworkers spaced at 10-meter intervals. All thirty-nine of the previously recorded sites were identified, and while the earlier plotting of site locations was not wholly accurate, in all but six cases, the site descriptions were adequate. Additionally, a portion of a previously unrecognized site – Site 29271, the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the project area. Of these seven site omissions in the previous inventory survey (Graves and Franklin 1998), four were deemed sufficiently significant to warrant further inventory survey investigation (Site 2496 Feature D, Site 4013 newly identified rock shelter, Site 15261 additional trail branches, and the Site 29271 Mahukona-Kawaihae Trail section); the other three omissions are relatively minor and can be adequately addressed during subsequent data recovery and preservation work. The current fieldwork revealed the presence of a burial at Site 2496 Feature D and an additional habitation feature at Site 4013 (Feature D).

Given the current development proposal (a nine lot subdivision) for the study property (see Figures 8 and 10), site treatments are reconsidered and the existing preservation and burial treatment plans require revision. Table 4 shows the prior approved treatments and the proposed treatment recommendations. As can be seen in this table, the proposed treatment for several of the sites reverts back to that as was approved in the earlier AIS. The revised treatments were based on a very limited land use (one single-family residence) of the 37.8 acre parcel, and the current proposed treatments take into consideration the current proposed development plan. No further work continues to be the proposed treatment for two sites (Sites 16132 and 16136); both of these were substantially documented during either the original AIS (Graves and Franklin 1998) or the subsequent burial testing (PHRI 2005). Data recovery has already been completed for Site 4015 (O’Hare and Goodfellow 1999), thus no further work is recommended for this site. Two of the sites (Sites 4010 and 16138) that were earlier approved for no further work are now recommended for data recovery prior to their destruction; and one site (Site 4000) that was approved for no further work is now recommended for preservation as it appears to be a part of the Site 4004 burial complex.

The four previously identified burial sites (Sites 4004, 4013, 16148, and 16162) shall continue to be preserved, however the burial treatment plan (PHRI 2000a) should be updated to reflect the proposed change in land use and the newly identified burial site (Site 2496 Feature D) added to the plan. As stated in the burial treatment plan:

While it is the intent of the owner to develop only the western portion of the project area, and to leave the larger eastern portion in its present undeveloped condition, it is recognized that the possibility of changes in intended property use by the current or any subsequent owner may arise in the future. Therefore, any proposed future changes in land use for the eastern portion of the property will require the owner to return to the HIBC for possible reconsideration of the adequacy of the long-term preservation measures for the burial sites as proposed in this BTP. (PHRI 2000a:15)

Data recovery is now recommended for sixteen sites (4002, 4003, 4010, 4012, 16135, 16137, 16138, 16140, 16141, 16143, 16144, 16146, 16150, 16151, 16164, 16167) plus portions of two additional sites (Sites 2496 and 4013) that also contain preserved burial features. All of these sites were accepted for data recovery in the prior AIS (Graves and Franklin 1998) with the exception of Sites 4010 and 16138, which were accepted for no further work. It is believed that these two sites still retain information that could be recovered and aid in developing a specific chronology of the project area land use history. Pursuant to HAR 13§13-278, a plan addressing the data recovery of these eighteen sites should be prepared and submitted to DLNR-SHPD for review and acceptance.

Preservation is now recommended for sixteen sites (2498, 2499, 4000, 4005, 4011, 15261, 16131, 16133, 16134, 16139, 16142, 16145, 16147, 16149, 16163 and 29271) two of which (Sites 4000 and 15261) were approved for no further work as a result of the original AIS (Graves and Franklin 1998) and another (Site 29271), which was not identified at that time. A new preservation plan that addresses these sixteen sites should be prepared and submitted to DLNR-SHPD for review and acceptance in compliance with HAR 13§13-277.

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## 1. INTRODUCTION

At the request of Gregory R. Mooers of Mooers Enterprises LLC, on behalf of his client Kohala Shoreline, LLC, ASM Affiliates, Inc. (ASM) has conducted this supplemental archaeological inventory survey (AIS) updating and expanding on an earlier DLNR-SHPD accepted AIS (Graves and Franklin 1998) of an approximately 37.8 acre project area in Kahuā 1<sup>st</sup> Ahupua‘a, North Kohala District, Island of Hawai‘i (TMK: (3) 5-9-01:008; Figures 1 and 2). The earlier archaeological inventory survey report contained site treatments based on the then planned subdivision development of the parcel. Subsequent archaeological work for the property included the preparation of a data recovery plan for one site (Rosendahl 1994) and the data recovery of that site (O’Hare and Goodfellow 1999), additional burial testing at three sites (PHRI 2005) and the preparation of a burial treatment plan (PHRI 2000a), along with the preparation of an archaeological sites preservation plan (PHRI 2000b). These follow-up studies were conducted with the understanding that the development of the subject parcel would be limited to one single-family residence occupying the extreme western end of the parcel, and that the remaining bulk of the parcel would be left in its natural state. Thus the site treatments accepted in the earlier AIS report (Graves and Franklin 1998) were reconsidered and revised such that the treatment of all of the sites previously approved for data recovery was changed to preservation.

The current proposed development plan for the parcel is no longer restricted to the construction of one single-family residence, but rather includes the creation of a nine lot subdivision. This new proposed land use necessitates revising the site treatments once again, bringing them into greater conformance with what was approved in the original AIS. The purpose of the current supplemental AIS is to assess current site conditions and identify any previously unrecorded sites and features, and to provide new site treatment recommendations appropriate for the newly proposed nine lot subdivision development plan, as well as to provide a map showing accurate site locations. To that end, ASM completed a supplemental AIS of the study area, identified and re-plotted the previously recorded sites, and documented additional features that had not been previously recorded.

The current report documents the findings of the resurvey of the study area and has been prepared as a companion document to a cultural impact assessment (Rechtman 2014), fulfilling the requirements of the County of Hawai‘i Planning Department and the Department of Land and Natural Resources (DLNR) with respect to permit approvals for land-altering and development activities.

This report begins with a description of the general project area and the proposed development activities. This is followed by a presentation of the archaeological background for the specific study area, as well as a discussion of the culture-historical background for Kahuā Ahupua‘a and the North Kohala region. This comprehensive background information facilitates a more complete understanding of the significance of the resources that exist within the study area. A description of the current conditions of the previously recorded archaeological sites is then presented, followed by a re-evaluation of site significance assessments and proposed new treatment recommendations.



Figure 1. Project area location.



## 2. PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The project area occupies 37.8 acres along the North Kohala coast, bounded by the ocean to the west and Akoni-Pule Highway (Hwy 270) to the east (see Figure 2). The project area is bounded to the north by an undeveloped state-owned parcel and to the south by the recently developed Kohala Kai subdivision (see Figure 2). Elevation within the project area ranges from sea level to about 160 feet above sea level and the surface geology consists of basaltic lava flows from Kohala volcano dating from at least 120,000 years ago (Wolfe and Morris 1996). Soil within the study area is classified as Kawaihae very rocky very fine sandy loam. The sloping terrain is dissected in a few locations by steeply incised drainage channels (Figure 3) and the vegetation is almost exclusively low grasses and *kiawe* (Figure 4). The typical shoreline in this area is rocky (Figure 5) with a few small coral, rock, and sand beach areas (Figure 6). Waiakailio Bay (Figure 7), at the northern end of the property, is the least rocky and most sheltered area along this portion of the coast, and it offers the easiest ocean access.

The proposed development plans (Figure 8) include the establishment of a nine-lot gated subdivision. The property is currently zoned for single-family residential with minimum lots of 15,000 square feet (RS-15). Upon reviewing the project site and development options, the property owner determined that a less dense development would be more appropriate, and is proposing a change of zone to Residential Agricultural 3-acres (RA-3a), which would decrease potential density and lessen impacts to archaeological resources. Road access would be from two locations along Akoni-Pule Highway. The project would be provided with water, electrical, and telephone service from existing lines located within a utility easement above Akoni Pule Highway. The house sites would be located a minimum of 150 feet below the highway and covenants, conditions and restrictions (CC&Rs) would limit homes to a single story and require color schemes that minimize visual impacts. Landscaping would be installed along the subdivision's two internal roadways and also on the residential lots, subject to CC&Rs. The project includes public shoreline access and associated parking and will preserve a coastal buffer through the establishment of a 100-foot no development shoreline setback for all but Lot 1, which would be subject to the normal 40 foot setback.



Figure 3. Keawewai Gulch drainage.



Figure 4. Typical vegetation cover across the study parcel.



Figure 5. Rocky shoreline along the study parcel.



Figure 6. Typical rocky beach area.



Figure 7. Waiakailio Bay.



Figure 8. Proposed development plan.

### 3. ARCHAEOLOGICAL BACKGROUND

In 1964 Soehren surveyed the construction corridor for the Kawaihae to Mahukona Highway, which terminated roughly nine miles (14.5 kilometers) to the north of the project area. During this survey Soehren (1964) recorded two small rock cairns, a rock platform, and two open-ended enclosures with associated marine shell and coral within the *ahupua'a* of Kahuā 1 and 2. In 1968 Bonk surveyed the coastal area from Kawaihae to Kaiholena *ahupua'a*. During this survey Bonk (1968) recorded 24 stone features within Kahuā 1. The concentration of Bonk's features that were recorded on the northern side of the current project area was later designated in the State Inventory of Historic Places (SIHP) as SIHP Site 4156 during the 1972 Statewide Inventory as the Waiakailio Bay Complex. Starting in 1983 Paul H. Rosendahl, Ph.D., Inc (PHRI) began a series of archaeological studies that focused on the current project area and adjoining lands to the south (Allen 1985a, 1985b; Corbin 2004; Graves and Franklin 1998; Kubo and Rosendahl 2003; O'Hare and Goodfellow 1999; PHRI 2000a, 2000b, 2005). The resultant reports include reconnaissance surveys, an inventory survey, mitigation (preservation and data recovery) plans, data recovery reports, and burial treatment plans. The AIS (Graves and Franklin 1998) contains a map that shows the locations of the archaeological sites that were recorded within the current project area (Figure 9), and Table 1 lists the sites and their prior approved treatments.

**Table 1. Sites within the current project area and their prior approved treatments**

SIHP No.	Treatment in Inventory*	Revised Treatment in Preservation Plans**
2496	Data Recovery	Preservation
2498	Data Recovery/Preservation	Preservation
2499	Data Recovery/Preservation	Preservation
4000	No Further Work	No Further Work
4002	Data Recovery	Preservation
4003	Data Recovery	Preservation
4004	Burial Preservation	Burial Preservation
4005	Data Recovery/Preservation	Preservation
4010	No Further Work	No Further Work
4011	Data Recovery	Preservation
4012	Data Recovery	Preservation
4013	Burial Preservation	Burial Preservation
4015	Data Recovery Completed	Data Recovery Completed
15261	No Further Work	No Further Work
16131	Data Recovery	Preservation
16132	No Further Work	No Further Work
16133	Data Recovery	Preservation
16134	Data Recovery	Preservation
16135	Data Recovery	Preservation
16136	Further Data Collection	No Further Work
16137	Data Recovery	Preservation
16138	No Further Work	No Further Work
16139	Data Recovery	Preservation
16140	Data Recovery	Preservation
16141	Data Recovery	Preservation
16142	Data Recovery	Preservation
16143	Data Recovery	Preservation
16144	Data Recovery	Preservation
16145	Data Recovery	Preservation
16146	Data Recovery	Preservation
16147	Data Recovery	Preservation
16148	Further Data Collection	Burial Preservation
16149	Data Recovery	Preservation
16150	Data Recovery	Preservation
16151	Data Recovery	Preservation
16162	Further Data Collection	Burial Preservation
16163	Data Recovery	Preservation
16164	Data Recovery	Preservation
16167	Data Recovery	Preservation

\*Derived from Graves and Franklin (1998); \*\* PHRI (2000b); PHRI (2005).

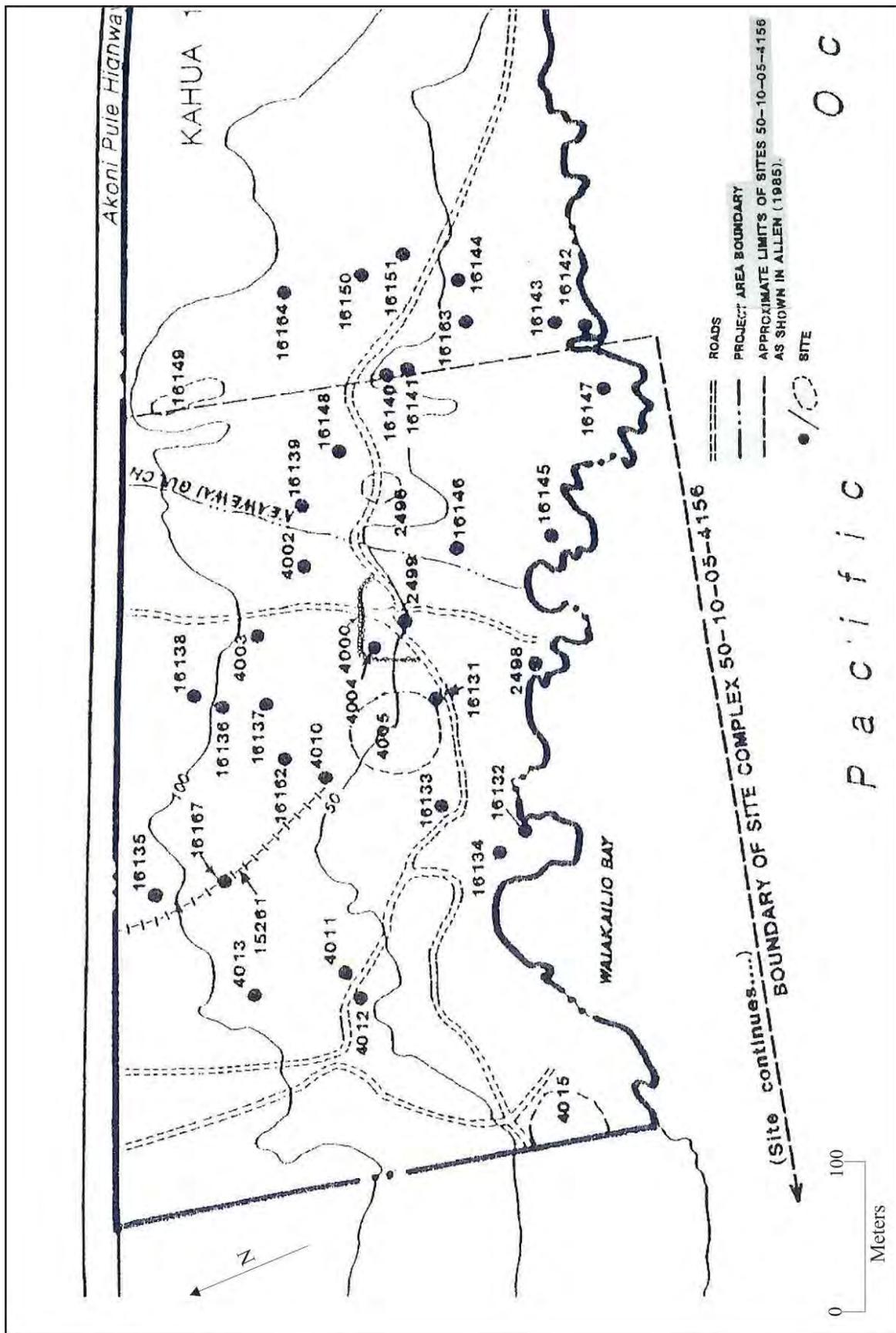


Figure 9. Portion of Graves and Franklin (1998) map of the study area showing archaeological sites.

### 3. Archaeological Background

Within the western portion of the current study parcel, data recovery investigations at SIHP Site 4015 (Figure 10) focused on four enclosure features (O'Hare and Goodfellow 1999). Fishing gear and grinding tools were recovered, as well as radiocarbon assays of charcoal from each of the four features. Based on the food remains, architecture, and radiocarbon results, Site 4015 could have been a habitation site associated with the collection of near-shore and offshore marine resources, possibly dating back to A.D. 1370. Judging from the presence of sub-wall deposits, an even earlier occupation could have been present at Site 4015.

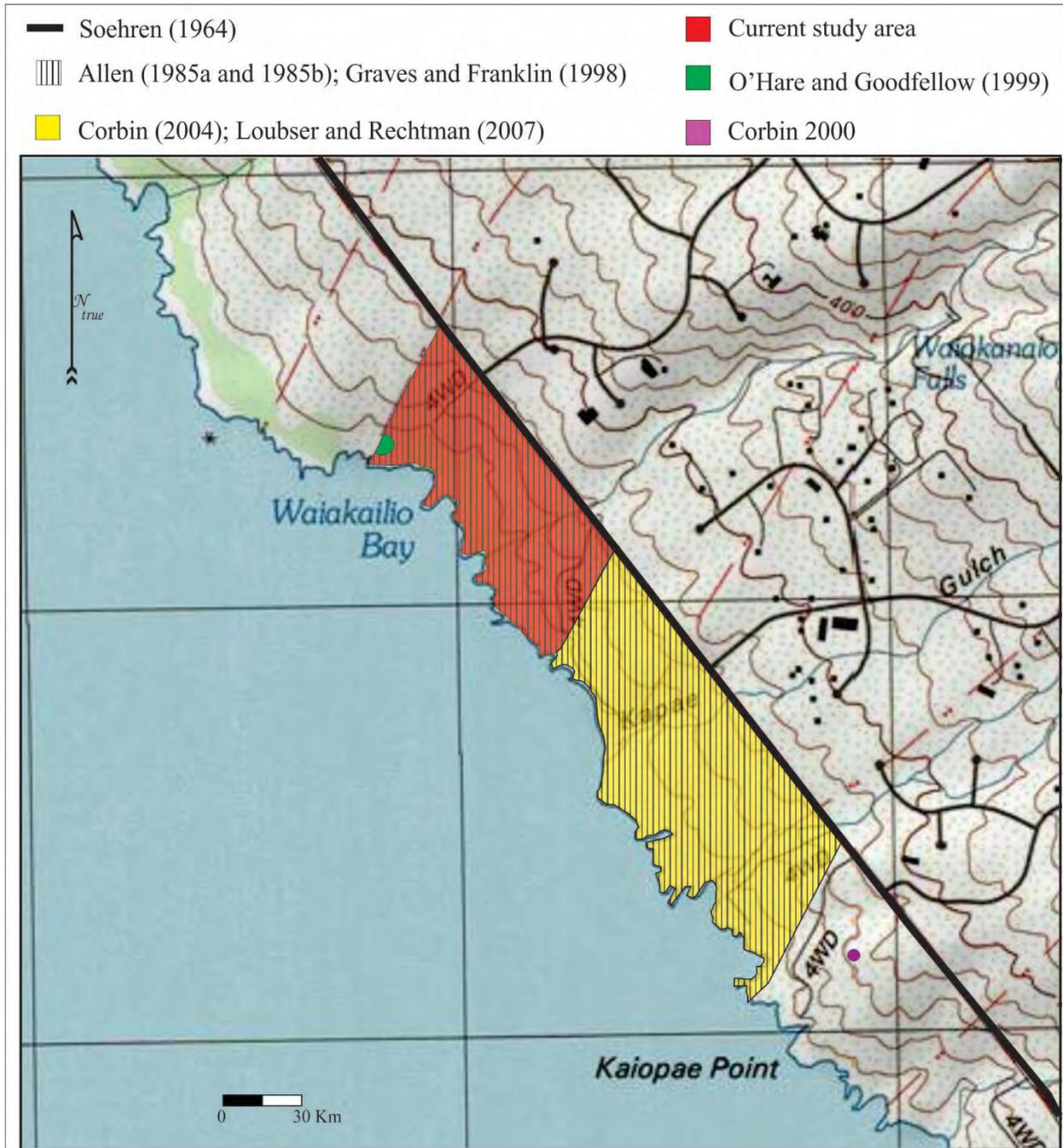


Figure 10. Locations of previous archaeological investigations in the vicinity of the current study area.

Additional recent archaeological work near the project area includes an extensive data recovery investigation along the coastal portions of Kahuā 2 and Waikā *ahupua'a* (Loubser and Rechtman 2007), and a data recovery investigation of Site 16170 in coastal Waikā (Corbin 2000; see Figure 10). The Loubser and Rechtman (2007) study was conducted at seven sites (SIHP Sites 2492, 16177, 16122, 2494, 16129, 2485, and 16154) within the state designated site complex (SIHP Site 4157) known as the Kahuā 2 Complex. This study recovered a wealth of information pertaining to resource collection, settlement distribution, feature function, and site chronology. The oldest radiocarbon date (A.D. 1270–1420) from the site complex came from a sub-wall context and is roughly contemporaneous with the early date from the nearby Waiakailio Bay Complex (O'Hare and Goodfellow 1999). Loubser and Rechtman (2007) also documented the temporal development of the Kahuā 2 village area showing where it may have started, how it subsequently expanded, and finally contracted; and demonstrated that the habitation area most likely constituted a nucleated settlement of several households with co-residential domestic groups. Discrete households were identified using a *kauhale* settlement model, and male and female activity areas were identified within each *kauhale*.

The Corbin (2000) study focused on a modified outcrop and a platform. The modified outcrop yielded volcanic glass flakes and gastropods, whereas the platform yielded volcanic glass flakes, sea urchin spine abraders, and a hearth. The hearth feature, exposed at the bottom of the platform, yielded three charcoal samples radiocarbon dated to between A.D. 1435 and 1635. The upper layers within the platform dated to after A.D. 1665. Based on the results, Corbin suggested that the platform at Site 16170 represented a temporary habitation site that was occupied to procure gastropods and possibly to manufacture urchin spine abraders.

A settlement model for leeward coastal North Kohala can be derived from the previous archaeological work referenced above. Settlement complexes are more-or-less evenly spaced along the leeward coastline of North Kohala, with a subsistence focus on marine resources, although the ostensible absence of perishable products from cultivation has most likely skewed the archaeological record. Site complexes seem to concentrate around small bays and cobble beaches where canoes could land along the otherwise cliff-lined coast. A focal point of most settlement complexes is a *halau*, or canoe shed, located above and behind the beach that affords the best opportunity for launching or landing. A canoe shed is typically long, narrow, and open on the *makai* side. Inland and on either side of the canoe shed are habitation and storage sites of various kinds. Tomonari-Tuggle (1988) notes that within site complexes it is possible to distinguish concentrations of habitation structures and associated features that could represent the areas once occupied by family units. Each family unit contained one or more living structure, an animal pen or two, outdoor working areas, and burial mounds. Typical features within a habitation area, or *kauhale*, include the following: structures with massive walls that resemble long “cupboards,” multiple unit longhouses with an opening on one end, houses with enclosing platforms, house complexes enclosed by walls, rectangular houses with open ends, a variety of C- and U-shaped structures, and burial mounds and small platforms on the periphery. According to available evidence there are few known *heiau* on the leeward North Kohala coast; only three paved structures with large rock fill at Kukuipahu fit the descriptions (Smith et al. 1973). Additional work and closer scrutiny of stone platforms on crests of rises, that are sometimes associated with walled precincts, could reveal more *heiau* along the coastal settlements, however (e.g., Soehren 1969).

The narrow band of habitation settlements along the coast are separated from a broader upland band of agricultural walls and habitations by a barren zone with relatively few archaeological sites. Within individual *ahupua'a*, trails that pass through the barren zone would have connected coastal settlements with upland fields (Apple 1965). The width of the barren zone is inversely related to the abundance of rainfall; in the wetter north near 'Upolu Point it is one kilometer wide and widens to five kilometers at Kahuā in the drier south. Surveys that have covered the uplands away from the coastline date back to the late 1960s when the University of Hawai'i field schools mapped Lapakahi *ahupua'a* north of Kaiholena *ahupua'a*, using aerial photographs and surveying instruments (Newman 1970). Vast portions of Kahuā 1 and 2 inland of the highway were surveyed by Hammatt and Borthwick (1986, 1987, 1990). During these upland surveys, that covered land up to the 3,000-foot contour above sea level, archaeologists found trail markers, scattered agricultural terraces, temporary habitation shelters, and rock walls. The remains most probably relate to the upland agricultural fields mentioned in various oral and written histories. On the basis of surveys and excavations, Rosendahl (1994) has identified the following sites in the better watered Lapakahi area: residential structures with C-shapes or rectangular plan forms, piled stone walls or earthen embankments demarcating agricultural fields, trails, possible burial piles, water cisterns, rock shelters, and petroglyphs.

Bearing in mind that the inhabited lowland zone along the coast and the inhabited upland zone of the interior were most likely occupied by the same people at different parts of the year, detection of increased and expanded use of any one of the zones should be suggestive of overall increased population size (of course, if none of the zones show signs of decline or abandonment). Based on 54 radiocarbon assays and evidence for increasing subdivision of stone-walled

### 3. Archaeological Background

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field parcels in the Lapakahi uplands north of the project area, Rosendahl (1994) has suggested that the Kohala upland fields began around A.D. 1400 in the form of shifting cultivation, which intensified to a crop-rotation system with clearly delineated boundaries by A.D. 1600. Based on evidence from the entire Hawaiian Archipelago, Kirch (1985:216–217) has proposed that agricultural development and population growth occurred as three generalized phases: adjustment, expansion, and intensification. When Polynesian colonizers first landed they had to adjust to the unique demands of the less tropical Hawaiian environment. Once this adjustment along the littoral zone had been made, settled populations were able to increasingly utilize upland areas. Greater labor inputs to increase yields eventually meant that even the uplands needed to be terraced and sub-divided for crop rotation. By the time Europeans documented Hawaiian agriculture from the late eighteenth century onwards, the system was a fully fledged intensive one, with populations utilizing even seemingly marginal zones. The practice of mulching and the surprisingly rapid construction of irrigation systems enabled Hawaiian communities to cultivate seemingly marginal hinterlands (Kirch 1985:236). For example, Kamehameha I was able to feed his substantial entourage and standing army at Kawaihae by constructing irrigated fields in the Waimea uplands over a five-year period.

To summarize the archaeologically derived settlement patterns of the Kohala area, the first significant occupation of the area seems to occur around A.D. 1300 near the coast. Based on available evidence, the population appears to have been small and engaged primarily in fishing and some cultivation of crops. Over the next two centuries the uplands too were increasingly cultivated. This period experienced more regular seasonal transhumance between the coast in summer and uplands in winter. Around A.D. 1500 *ahupua'a* were clearly delineated and bound fields in the uplands also became more marked. By A.D. 1700 more-or-less permanent settlements occurred along the coast and in the uplands. The *ahupua'a* system of social organization was firmly established at this time, with defined land units extending from the ocean into the mountains. Local chiefs controlled the *ahupua'a* and these were in turn integrated at the district level. Paramount chiefs ruled over the district within a feudal-like system of taxation and redistribution. Class distinction between ruling *ali'i*, or chiefs, and *maka'āinana*, or commoners, characterized the overall political economy and ideology prior to the *Māhele* in 1848.

## 4. CULTURE-HISTORICAL BACKGROUND

### A GENERALIZED MODEL OF HAWAIIAN PREHISTORY

The generalized cultural sequence that follows is based on Kirch's (1985) model, and amended to include recent revisions offered by Kirch (2011). The conventional wisdom has been that first inhabitants of Hawai'i Island probably arrived by at least A.D. 300, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). However, there is no archaeological evidence for occupation of Hawai'i Island (or perhaps anywhere in Hawai'i) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) has convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, and the Expansion Period to A.D. 1350 to 1650.

The initial settlement in Hawai'i is believed to have occurred from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; various epiphenomenal beliefs; and the concept of *mana*.

The Development Period brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko'i*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawai'i produced quality basalt for adze production. Mauna Kea on the island of Hawai'i was a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *'ulu maika* stones and *lei niho palaoa*. The later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). Early dates from windward Kohala were reported by Cordy (2000); these sites are believed to have been utilized in the early 1200s.

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period.

It was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands. According to Kamakau (1976) the *kahuna* Pā'ao settled in the islands during the 13<sup>th</sup> century. Pā'ao was the keeper of the god Kū'kā'ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pā'ao escaped Lonopele's wrath by fleeing in a canoe. Kamakau (1991:100–102) told the following story in 1866:

Puna on Hawai'i Island was the first land reached by Pa'ao, and here in Puna he built his first *heiau* for his god Aha'ula and named it Aha'ula [Waha'ula]. It was a *luakini*. From Puna, Pa'ao went on to land in Kohala, at Pu'uēpa. He built a *heiau* there called Mo'okini, a *luakini*. It is thought that Pa'ao came to Hawai'i in the time of the *ali'i* La'au because Pili ruled as *mo'i* after La'au. You will see Pili there in the line of succession, the *mo'o kū'auhau*, of Hanala'anui. It was said that Hawai'i Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawai'i Island had been without a chief for a long time, and the chiefs of Hawai'i were *ali'i maka'āinana* or just commoners. There were seventeen generations during which Hawai'i Island was without chiefs—some eight hundred years.

There are several versions of this story that are discussed by Beckwith (1976), including the version where Mo'okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pa'ao are said to be deposited in a burial cave in Kohala in Pu'uēpa [possibly Pu'uēpa?] (Kamakau 1964:41).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social,

economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986).

The *ali'i* and the *maka'ainana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hou 1974). The *ahupua'a* was further divided into smaller sections such as the *'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone, and kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. Sometime between A.D. 1736 and 1758, Kamehameha I was born in the *ahupua'a* of Kokoiki, North Kohala near the Mo'okini Heiau [there is some controversy about his birth year, see Kamakau 1992:66–68]. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley's comet [this is also controversial] (Kamakau 1992). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

This period was one of continual conquest by the reigning *ali'i*. Ke'eaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo District, then launched several more raids on Moloka'i, Lana'i, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

## HISTORY AFTER CONTACT

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

In 1779 King of the Cook expedition explored the North Kohala country and reported:

As far as the eye could reach, seemed fruitful and well inhabited. [Three and four miles inland, plantations of taro and potatoes and *wauke*] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canes planted close on each side, make the most beautiful fences that can be conceived. [The exploring party stopped six or seven miles from the sea.] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations . . . as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted. (Handy and Handy 1972:528)

Around A.D. 1780 Kalaniopu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawai'i continued until A.D. 1795 (Kuykendall and Day 1976; Handy and Handy 1972).

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'ūpulehu at the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called "Lopaka", all of which were turned over to Kamehameha (Kamakau 1992). Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, Hawai'i saw the beginnings of a market system economy (Kent 1983). This marked the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of *'ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs saw a change:

The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*'ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali'i, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992:222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom

from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstated the eating *kapu* but others appear to have thought otherwise. Liholiho's cousin, Kekuaokalani, caretaker of the war god Kū'kā'ilimoku, revolted, but by December of 1819 the revolution was quelled. With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaii. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopt their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali'i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). On a stopover in the Kohala district Ellis wrote:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Kuykendall and Day 1976:42, 43; Ellis 1963:397)

The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry. The windward portions of North Kohala became a center of sugarcane production, although sugarcane cultivation in Kohala had its origins in prehistory.

Pukui (1983) cites two proverbs that reference both Kohala and sugarcane. She provides an explanation and notes that Hawaiian proverbs have layers of meaning that are best left to the imagination of the reader:

*He pa 'a kō kea no Kohala, e kole ai ka waha ke 'ai*

A resistant white sugar cane of Kohala that injures the mouth when eaten.

Pukui explains this proverb as follows:

A person that one does not tamper with. This was the retort of Pupukeya, a Hawai'i chief, when the Maui chief Makakuikalani made fun of his small stature. It was later used in praise of the warriors of Kohala, who were known for valor (1983:95).

*I 'ike 'ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.*

One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui interprets this proverb as follows:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983:127).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1972:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy and Handy 1972:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odoratissimus*) were not abundant (Malo 1951). Sugarcane was also used in relation to taro and sweet potato. Handy and Handy (1972:186) explain:

In wet-taro farming, cane was planted along the embankments separating the flooded terraces and flats. In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown.

Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. The Chinese on Lana'i are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976).

Kohala became a land in transition and eventually a major force in the sugar industry with the arrival of American missionary Elias Bond (KTF 1975). In her comprehensive study of North Kohala, Tomonari-Tuggle relates this transition:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district's history. In those years a new religion, a new land tenure system, and a changing economy altered the lifestyles and world view of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed. (Tomonari-Tuggle 1988:I-23)

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988:I-39)

In 1860 Rev. Bond engaged Samuel N. Castle in founding the Kohala Sugar Company on lands owned by Bond and his neighbor Dr. James Wight. The first crop was harvested in January 1865 (KTF 1975). Kohala's transition was a reflection of what was happening elsewhere in Hawai'i as the sugar industry grew. The industry brought in tens of thousands of laborers from Asia, Europe, the Americas, Oceania, and Africa to work on the many plantations and mills that were being established on all major islands (Oliver 1961). This influx not only radically changed the culture, but also drastically altered agricultural lands and destroyed traditional architectural features in the process. The drier leeward portions of Kohala were not suited for cane cultivation and thus became vast pasturelands for grazing cattle.

## **A GENERALIZED SETTLEMENT MODEL FOR KOHALA WAHO**

The following summary of settlement patterns for the leeward coast of North Kohala follows earlier regional models (Rosendahl 1972; Griffin et al. 1971; Tomonari-Tuggle 1988) and takes into account observations and information contained in traveler, missionary, and Kingdom records (Maly 2000).

Evidence for early occupation of Kohala has been collected from Kapa'anui. Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 460 (Site 12444). This early date may be related to the establishment of small, short-term camps to exploit seasonal, coastal resources (or more likely are the result of an anomalous radiocarbon assay; see Kirch 2011). Data recovered from Mahukona suggest initial occupation there by A.D. 1280 (Burgett and Rosendahl 1993:36). The earliest date range for permanent settlement in Kohala (A.D. 1300) was obtained from Koai'e, a coastal settlement where subsistence primarily derived from marine resources. According to Tomonari-Tuggle (1988:13), these resources were probably supplemented by small-scale agriculture.

The period from A.D. 1300–1500 was characterized by population growth and expanded efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during

the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and there is evidence that suggests that there were substantial changes to the political system as well. Within Kohala, the Great Wall complex at Koai'e is organized with platforms in the complex apart from contemporaneous features. Griffin et al. (1971) interpret this as symbolizing class stratification. By A.D. 1600, there is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that this unification resulted in a partial abandonment of portions of leeward Hawai'i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980).

By the time of contact, numerous coastal villages and extensive dryland agricultural systems were in place in North Kohala. The *ahupua'a* system of social organization was also firmly established by this time, with defined land units extending from the mountains to the sea. The *ahupua'a* were controlled by local chiefs, and were integrated at the district level. Districts were ruled by paramount chiefs through a system of taxation and redistribution. Social stratification was defined by a class separation between the ruling *ali'i* (chiefs) at one end, and the *maka'ainana* (commoners) at the other. Kamehameha I eventually united the Island of Hawai'i, and ultimately all of the Hawaiian Islands, and freely participated in the European-introduced market economy.

The earliest detailed written descriptions of the region are contained in the Journal of William Ellis (1963), an English Missionary who traveled through the area in 1823. Two of his journal entries are of particular relevance: a visit to the villages of Owawarua [Awalua] (just south of Kukuipahu) and Hihui (Māhukona), and an account of the coast between Towaihae [Kawaihae] and Māhukona related to him by one of his companions named Lorrin Thurston.

About three p.m. we reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fisherman. Here we tried to collect a congregation, but only three women and two small children remained in the place, the rest having gone to Waimea to fetch sandalwood for Karaiomoku. From Owawarua we passed on to Hihui, where we had an opportunity to speak to a small party of natives.

In these villages we saw numbers of canoes and many large fishing nets, which are generally made with a native kind of flax, very strong and durable . . . In taking fish out of the sea, they commonly make use of a net, of which they have many kinds, some very large, others mere hand-nets; they occasionally employ the hook and line, but never use the spear or dart which is a favourite weapon with the southern islanders.

Quantities of fish were spread out in the sun to dry, in several places, and the inhabitants of the northern shores seem better supplied with this article than those of any other part of the island. . . . Being considerably fatigued, and unable to find any fresh water in the village, we procured a canoe to take us to Towaihae, from which we were distant about 20 miles. Though we had numbered, in our journey today, 600 houses, we had not seen a thing like four hundred people, almost the whole population being employed in the mountains cutting sandalwood. It was about seven o'clock in the evening when we sailed from Hihui, in a single canoe. (Ellis 1963:285-286)

On the 23d Mr. Thurston left Towaihae, and walked along the shore towards the north point [Upolu]. About noon he reached the small village, called Kipi [North of Kahuāli'ili'i], where he preached to the people; and as there was only one village between Kipi and the place where I had preached on Wednesday evening [Hihui/Māhukona], he retraced his steps to Towaihae. He preached at another four villages on his return [perhaps at settlements within or adjacent to the current project area], where the congregations, though not numerous, were attentive . . . The coast was barren; the rocks volcanic; the men were all employed in fishing; and Mr. Thurston was informed that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than on the shore. In the evening he reached Towaihae. (Ellis 1963:288)

As early as the 1830s, missionaries in Kohala noting that "deaths are more numerous than births; [h]ence the population is decreasing" (Doyle 1953:72) began compiling census records by *ahupua'a*. In an 1835 census, Kahuā (combined) is listed as having a resident population of 256 (Schmidt 1973:27), documenting a sizeable population.

Traditional and historical accounts indicate that the residents of the *ahupua'a* in *Kohala waho* lived both along the coast in fishing villages and in the uplands near the agricultural systems. It is interesting that within Kahuā there were 256 residents recorded in 1835, and that eleven years later in 1846 there was only one claimant for a *kuleana* in Kahuānui during the *Māhele*; the claim was not awarded having been contested by Kekūānāo'a.

Traditional land use patterns saw a rapid shift after the *Māhele* in 1848. By the mid-19th century, leeward settlement shifted to the windward side of North Kohala as the leeward, agriculturally marginal, areas were abandoned in favor of more productive and wetter sugarcane lands. In addition, native populations were decimated by disease and a depressed birth rate. According to Tomonari-Tuggle (1988:37), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. Settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. At this point most communities were centered on sugar mills and became part of the plantation social hierarchy. Much of the coastal land in leeward North Kohala was used as cattle pasture. Walled complexes became the dominant residential structure for those remaining leeward settlements as families enclosed their holdings to protect them from feral cattle and to clearly define their *kuleana* boundaries.

### **Kahuāli'ili'i Ahupua'a**

Kahuāli'ili'i Ahupua'a is one of the three southernmost *ahupua'a* of the North Kohala District (only Kahuānui Ahupua'a and Waikā Ahupua'a, along the North Kohala/South Kohala boundary, are further south; see Figure 2). During the *Māhele* all three of these *ahupua'a* were awarded to *ali'i*. Kahuāli'ili'i was awarded to Lot Kapuāiwa (Kamehameha V) as LCAw. 7715:5, Kahuānui was awarded to Victoria Kamamalu (Lot's Sister and last Kahina-Nui of Hawai'i) as LCAw. 7713:4, and Waikā was awarded to Gina Lahilahi (daughter of John Young) as LCAw. 8020-B:2. Pahinahina Ahupua'a, bordering Kahuāli'ili'i Ahupua'a to the north, was retained as Government Land. There were no *kuleana* awarded within Kahuāli'ili'i Ahupua'a during the *Māhele*.

By 1857 Kahuāli'ili'i had been leased by Lot Kapuāiwa to G. W. Macey, who also leased Waikā Ahupua'a from Victoria Kamamalu in 1859 (Graves and Franklin 1998). An 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (Figure 11) shows a "Road to Macy [sic] and Vida's Ranch" that extends from the coast within the current project area (labeled "Waiakailio Landing") inland towards Kahuānui and Waikā *ahupua'a*, suggesting that Macey had leased the lands for ranching purposes, and that Waiakailio Bay was the landing for the ranch. Later Boundary Commission testimony (in 1873; see below) indicates that the houses belonging to Macey and Vida were located near the Kahuānui/Waikā boundary close to the Government Road, well *mauka* of the current project area. Ownership of Kahuāli'ili'i and Waikā, which would eventually become part of Kahuā Ranch, changed hands several times during the second half of the nineteenth century. In the 1890s these lands were sold (along with other lands) to John Maguire, who managed Huehue Ranch in Kona. In about 1895 Mr. Maguire sold a half interest in the Kahuā lands to James Frank Woods, who then assumed management of the property and later purchased the half interest that John Maguire still held (Henke 1929).

In 1862, to certify the boundaries of the *ahupua'a* awarded during the *Māhele*, the Kingdom of Hawai'i established the Boundary Commission. The primary informants for the boundary descriptions were elder native residents. Their testimony provides a wealth of information concerning the locations of place names and landmarks. Some of the witnesses also inform about the functions of certain areas on the landscape (e.g., resting places, residential areas, agricultural plots, fishing grounds, boundary markers). This information is very useful when interpreting archaeological features as elements of a cultural landscape. Many of the locations referenced in the boundary testimony are depicted on a map of the lands of Waikā and Kahuāli'ili'i prepared by A. B. Lobenstein in 1903, the year when the boundaries of those *ahupua'a* were officially set (Hawai'i Registered Map No. 2231; Figure 12). The 1903 map also shows the route of the *ala loa* (coastal trail) between Kawaihae and Mahukona across the current project area.

4. Culture-Historical Background

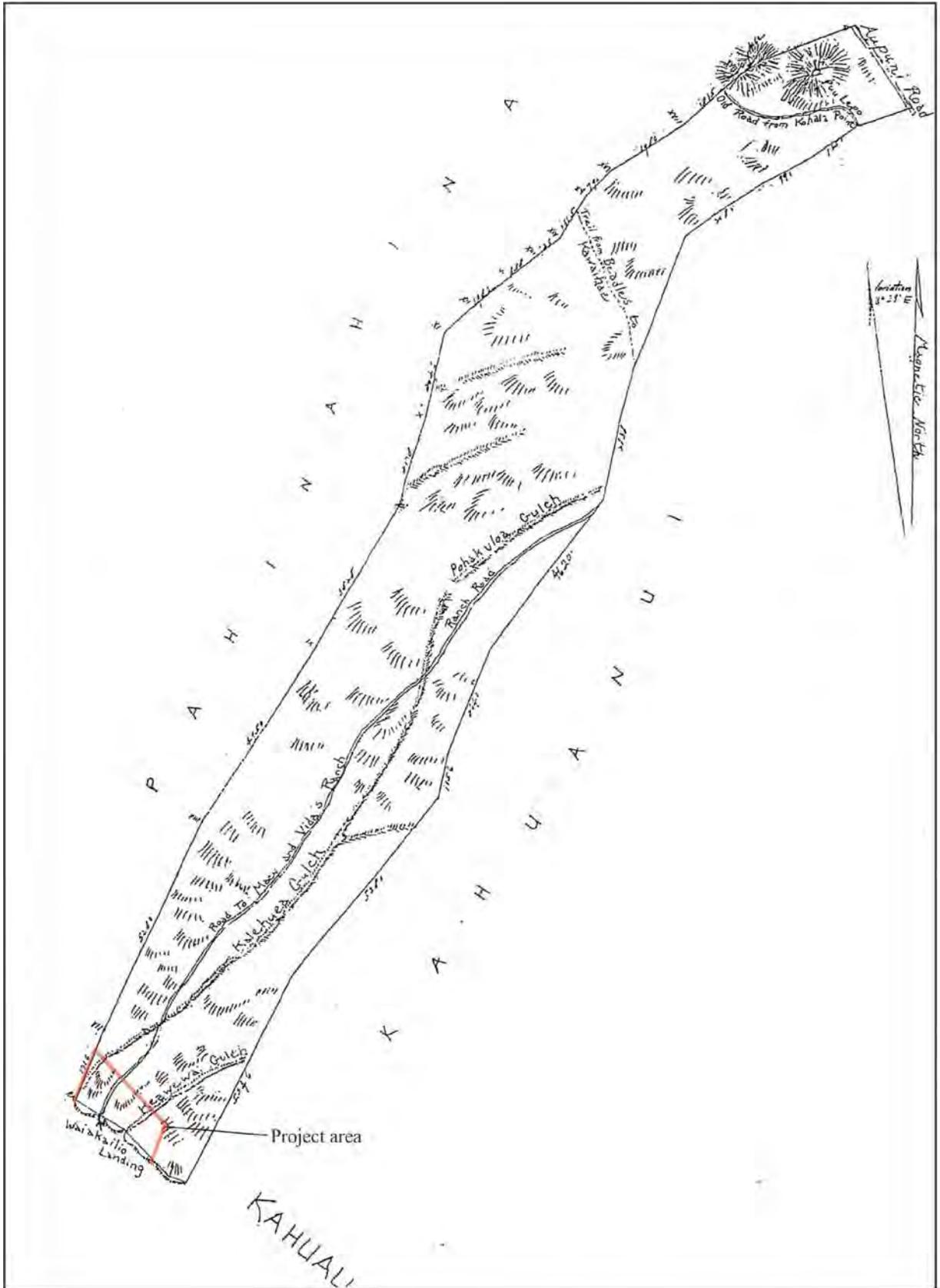


Figure 11. 1859 map of Kahuāli'i prepared by S. C. Wiltse showing the current project area.



Hearings for establishing the boundaries of Kahuāli‘ili‘i (also known as Kahuā 1<sup>st</sup>) began in November of 1873, roughly one year after Lot Kapuāiwa died; apparently the *ahupua‘a* became part of his father’s (M. Kekūānāo‘a) estate. The boundaries were not officially set until December of 1903, by which time the land in question had been acquired by James Woods. The 1873 boundary testimony reads as follows:

Kaili, kane, sworn, I was born in Kohala at the time of the great famine, now live in Kokio; know the boundaries of Kahualiilii. Kiha, my Father and Pohina, my Uncle, showed them to me. I do not know all the boundaries between Kahuanui and Kahualiilii. Bounded on the north side at shore by the land of Pahinahina, commencing at a cave called Lehua, the boundary runs makai to a point at the sea shore called Kananakauwa; thence it runs mauka to a pile of rocks at Lehua; thence mauka to an ahu named Panipani; thence mauka to another pile of stones and thence to a place, called Kilohana where there is a pile of stones that Kahuhu and I built when Wiltse was surveying. Kilohana is an old resting place; thence mauka to Ahuaele; an ahua with a pile of stones on it; thence mauka to Pahukinikini, [page 139] a small ahua with a pile of rocks on it; thence to Puuolani hill, this is along the land of Pahinahina; that was sold to Makuaole and is now owned by Kanehaloa of Puuehuehue; thence to Lolelole, the mauka corner of land sold; thence mauka to Ahaloa, an old kauhale at the mauka corner of Pahinahina; thence along Makeloa (belonging to Kamehameha & Estate); thence the boundary runs mauka to Kalolo, a water hole in a gulch, thence across the gulch and mauka along the land of Kalala; thence mauka to Puukoa; a hill of Koa, at the mauka corner of Kanehalo’s land; thence along Kailikea, a land mauka of Puukoa (Wiltse, in surveying, cut off a corner of Kalala, and ran the line to Holeipalaoa gulch); there is a rock there on the mauka side of the gulch marked KK; thence it is bounded by Kehena to Kilohana on Honokane pali (Note See Certificate of boundaries of Kehena); Thence along Honokane pali towards Waimea, to the Waimea side of Puuwau hill, the boundary being some distance this way of the kauhale; Bounded at shore by a small gulch called Haaho, a rock marked K is at this place; thence up the gulch to an ahua; thence up to where Keawewai gulch crosses Haolo gulch; thence the boundary runs up the north side of the gulch; thence to a place called Kapakamakahonu; thence to Pohakulua, a large rock in the gulch; thence to an ahua; thence to Kawaihae Government road; thence to Puuala; thence to Niupaa, a bullock pen, the boundary passing through the center of the pen. Thence it crosses the Government road to the wire fence some distance to the north of Upida’s [Vida’s?] old house; thence to Puumanu; thence to the south side of Ahumoa; thence on the north side of Waiakananaula, a water place; thence to Puuiki and from thence to Honokane pali.

Boundary Commission hearings for Kahuānuī Ahupua‘a (also known as Kahuā 2<sup>nd</sup>), which shares a boundary with Kahuāli‘ili‘i Ahupua‘a also began in November of 1873, but the boundaries were not set until June of 1905. The petitioner and owner of the land was James W. Austin, who had acquired the land from Victoria Kamamalu and M. Kekūānāo‘a in 1862 (Graves and Franklin 1998). By the time the boundaries were set in 1905 Austin had died and the lands had passed on to the Austin Estate. The 1873 boundary testimony for Kahuānuī reads as follows:

Kekua, kane, sworn, I was born at the time of Aepapa and have always lived at Kahua until lately. Kahuanui is bounded on the Kona side by Waika. Commencing at the mouth of a gulch the boundary between the Ahupuaa and Kuponu begins at a landing place called Kaiopae; thence mauka along the Kuponos to Ahukuli, a pile of stones; thence mauka to Puueoka, a heiau; thence to along stone named Pohakulua; thence to Kamakaiwi, a resting place; thence to Kapio; thence to Ahumoa, the boundary running through the hills; thence to Puuiki; thence to Kanoa, where fire used to be; Thence to Kahawaikukae, to pali of Kahawaiki; thence to Kahawaiholopapa; thence to Ainamakanui at the head of Honokane Gulch.

The kuponu Kahawainui, Kukui runs up here. Waika ends at Pahoakala, a place where they used to gather mamaki. This is as far as I [page 145] know the boundaries on this side. I have heard that the land runs down to Mahiki in Hamakua. When Lyons surveyed Waika he cut across the kuponu of Kahua and included them in Waika. Know a place called Ahuanaha. The real boundary is from Oneloa to Kapai, a pile of stones by the road; thence to Kamamukaa, where the gulch is the boundary between Waika and Kahua. The boundary crosses the gulch to the Kohala side at Ahuanaha; thence it runs to Ahuakapaakea; thence mauka to Kalehua; thence up the gulch to Moalau (The pile of stones is way on the Kohala side of the gulch, but the boundary is at the gulch). Thence past Macy’s (G.W. Macy’s) old house and mauka to Hookeke; thence to kahawai Palapalai; thence mauka to the

pali of Kaloloulaula on Pili; thence to Kapohoakala; thence along to Kahaliaina, a place below Puupala, where Kawaihae joins Kahua. From Kahaliaina the boundary runs along the foot of the pali to just above Puuwau on Kahuanui. Puuwau is a hill a short distance back from Pili; thence to Hinamakanui, a cabbage garden on the brow of Honokane pali. The boundary at shore between Kahuanui and Kahualiilii is a rock in the middle of the sea called Kahuapopolo. (Note: Kaauiwai, kane puts the boundary a few rods on the Kohala side of this rock.)

Thence to Waiakanalopaia, a pool of water at the end of the gulch, thence to Pohakupalalaha, a wall below the road to Kawaihae, now called Kamakahonu; thence to Waikalio gulch; thence the boundary runs to a stone called Pohakuloa; thence mauka across Pohakuloa gulch to Puanau, a resting place; thence to Puuala; thence Kipawale, a resting place at the Government road; thence to a hill called Ahuamanu; thence to Waiakapiai; thence to Ahumoa, part of which is on Kahua and part on another land. This is all I know of the boundaries.

Frank Woods continued to ranch the Kahuā lands throughout the first half of the twentieth century. The 1913 U.S.G.S. Kawaihae quadrangle shows some of the ranch's infrastructure, including a trail labeled "Beach Trail" that leads to the coast within the current project area (Figure 13). This trail alignment appears to be similar to the road alignment (to Macy and Vida's Ranch) that is shown on the 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (see Figure 11). By the 1920s, Woods was leasing much of the area to Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr., who had both come to Hawai'i from O'ahu to pursue cattle ranching. By the late 1920s to early 1930s, von Holt and Richards had purchased the lands they were leasing from Woods as well as Kahuānui from the Austin heirs, thus consolidating the Kahuā *ahupua'a* with Waikā *ahupua'a* into what has become known as Kahuā Ranch (Langlas 1994). A map of Kahuāli'ili'i, Kahuānui, and Waikā *ahupua'a* filed on July 15, 1931 with Land Court Application 1043 (Figure 14) shows some additional ranching infrastructure within these *ahupua'a* including a fence line that extends to the coast within the current project area and a trail, labeled "Ancient Trail", that follows the southern edge of the fence to the coast where it meets the *ala loa*. Both of the trail alignments depicted on the 1931 map are different than the alignments depicted on older maps. The *ala loa*, which is also labeled as the "Mahukona-Kawaihae Trail", is shown further inland at the southern end of the current project area than it is on the 1903 map (see Figure 12). Also, the *mauka/makai* trail is located further north than the road shown on the 1859 map (see Figure 11) and the trail shown on the 1913 U.S.G.S. map (see Figure 13), suggesting that both of these trails had been realigned by 1931. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus the current project area remained in the ownership of Kahuā Ranch with no encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII. Subsequent to WWII, Kahuā Ranch maintained the roadway across their lands for ranching, transportation, and recreational uses.

According to Langlas (1994), the partners, Richards and von Holt, eventually expanded Kahuā Ranch through leases and purchases of private land to almost 30,000 acres. Orr (2003:46) describes that although Herbert, Sr. served on the board of Kahuā Ranch, Atherton Richards (Herbert's brother) was von Holt's "the real partner." In 1953 von Holt died and Herbert, Jr. (better known as Monty) returned to Hawai'i after finishing school on the mainland; gradually Monty took over as manager of the Ranch (OCA 2000). The 1956 U.S.G.S. Kawaihae quadrangle shows some of the Kahuā Ranch lands and infrastructure (Figure 14), including a fence line and "Beach Trail" extending to the coast within the current project area. A windmill (recorded as part of Site 16133) is shown adjacent to the fence line at the coast within the current project area. Both the fence line and trail are different alignments than are shown on the 1931 Land Court Application 1043 map (see Figure 12). A trail is also shown extending parallel to the coast through the project area on the 1956 map (following an alignment similar to that of the Mahukona-Kawaihae Trail shown on the 1931 map). In 1973, when construction of the current Akoni-Pule Highway was completed, most if not all of the vehicular traffic between Mahukona and Kawaihae shifted away from the coastal Jeep road to the newly constructed highway. By 1982, the coastal trail is no longer shown on the U.S.G.S. Kawaihae quadrangle. The Richards and von Holt families jointly operated Kahuā Ranch until the 1980s at which point it was legally split into two entities. The current project area was severed from the ranch and sold around this time. Today, the Richards family operates Kahuā Ranch and the von Holt family operates Ponoholo Ranch.

4. Culture-Historical Background



Figure 13. 1913 U.S.G.S. Kawaihæ quadrangle showing the current project area.



#### 4. Culture-Historical Background



Figure 15. 1956 U.S.G.S. Kawaihāe quadrangle showing the current project area.

## 5. ARCHAEOLOGICAL FIELDWORK

An intensive AIS of the current project area was conducted on December 1–3, 2009 by J. David Nelson, B.A., Christopher S. Hand, B.A., Johnny R. Dudoit, B.A., and Ashton K. Dircks Ah Sam, B.A. under the direction of Robert B. Rechtman, Ph.D. Additional survey and subsurface testing at selected features was conducted on February 23 and 24, 2010 by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and by J. David Nelson, B.A. A search for remnants of the trails shown on the various Historic maps reviewed for this study was undertaken by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and Ashton K. Dircks Ah Sam, B.A. on August 22, 2013.

During the intensive pedestrian survey of the study area, the entire parcel was subject to north/south transects with fieldworkers spaced at 10-meter intervals. When archaeological resources were encountered, they were compared to existing site location maps and descriptions to determine if they had been previously recorded. If they had been recorded during the earlier studies, the sites were examined to see that the earlier site descriptions and temporal associations were consistent with current field observations. Features and sites were examined for indicators of temporal affiliation and then, based on a diverse set of criteria, assigned to one or more of the three generic time periods commonly used to describe sites in Hawaiian archaeology (Precontact, Historic, or Modern). The criteria used to assign features to a particular time period include architectural style, construction materials, location, proximity and similarity to other features, associated cultural material, and the accumulated knowledge of Hawaiian archaeological forms. Several lines of evidence, including the accumulated archaeological data, historical documentary research, the *Māhele* and grant records, and oral historical information, can be used in combination to identify features whose construction, or most recent use, likely dates to the Historic Period. One common indicator of Historic Period utilization of a feature is the presence of Historic Period artifacts. The presence (or absence) of Historic artifacts is often used as a relative dating technique in Hawaiian archaeology. Cordy et al. explain that:

Certain artifact types were introduced after European Contact – A.D. 1778, the arrival of Captain Cook. These include objects made from materials such as metal, glass, ceramics, and chert. Common artifact types made from these materials include metal nails and spikes, barrel hoops, cans, knives, and bullets; glass bottles and window panes; ceramic pipes, plates, bowls, cups and beads; and chert gun flints. A less frequently considered artifact is concrete used as a construction material. The presence of these objects and materials are indicators of post-A.D. 1778 age. Obviously, historic artifacts were not immediately adopted island-wide by A.D. 1778. Trade objects probably were not numerous until after 1790-1800, so the absence of the items could possibly indicate an early historic period age also. (1991:459)

Features that lack Historic Period artifact types and construction styles may still be assigned to the Historic Period based on their associations with, or locations relative to, places or features known through historical documentary research or oral historical information to have been loci of Historic Period use. However, with no specific information indicating that a particular site without Historic Period artifacts or construction techniques (i.e. core-filled wall construction) was occupied post 1778, that site will be assigned a Precontact association. Such an assignment can be revised if appropriate as a result of any subsequent data recovery work.

All thirty-nine of the previously recorded sites were identified, and while the earlier plotting of site locations was not wholly accurate, in all but six cases, the site descriptions were adequate. Additionally, a portion of a previously unrecognized site – Site 29271, the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the project area.

Of these seven omissions from the previous AIS (Graves and Franklin 1998), the following four were deemed potentially significant enough to warrant further AIS investigation: at Site 2496, a burial platform (designated as Feature D) was mislocated and inaccurately characterized as an agricultural mound; at Site 4013 a rock shelter feature (designated as Feature D) was not recorded; and at Site 15261 two additional branches of the trail alignment (designated Features B and C) that are shown on Historic maps were identified. At the four sites where further documentation was deemed warranted various strategies were employed to integrate the newly collected information with the previously documented historic properties. At Sites 2496 and 4013 the new observations had the potential to reveal previously undocumented burials. As such Feature D of Site 2496 was remapped and subject to subsurface testing, and the newly observed rock shelter (Feature D) at Site 4013 was mapped and subject to subsurface testing. At Sites 15261 and 29271 the trail/road alignments were mapped across the property and photographed. Figure 16 shows the re-plotted and previously unrecorded site locations. The results of the supplemental AIS work conducted at Sites 2496, 4013, 15261, and 29271 is presented below. The remaining three omissions are relatively minor and can be adequately addressed during subsequent data recovery and preservation work. At Site 16131 a rough terrace feature

5. Archaeological Fieldwork

was not recorded; at Site 16147 the northern extension of the site was not recorded; and at Site 16151 a marine shell scatter was not recorded.

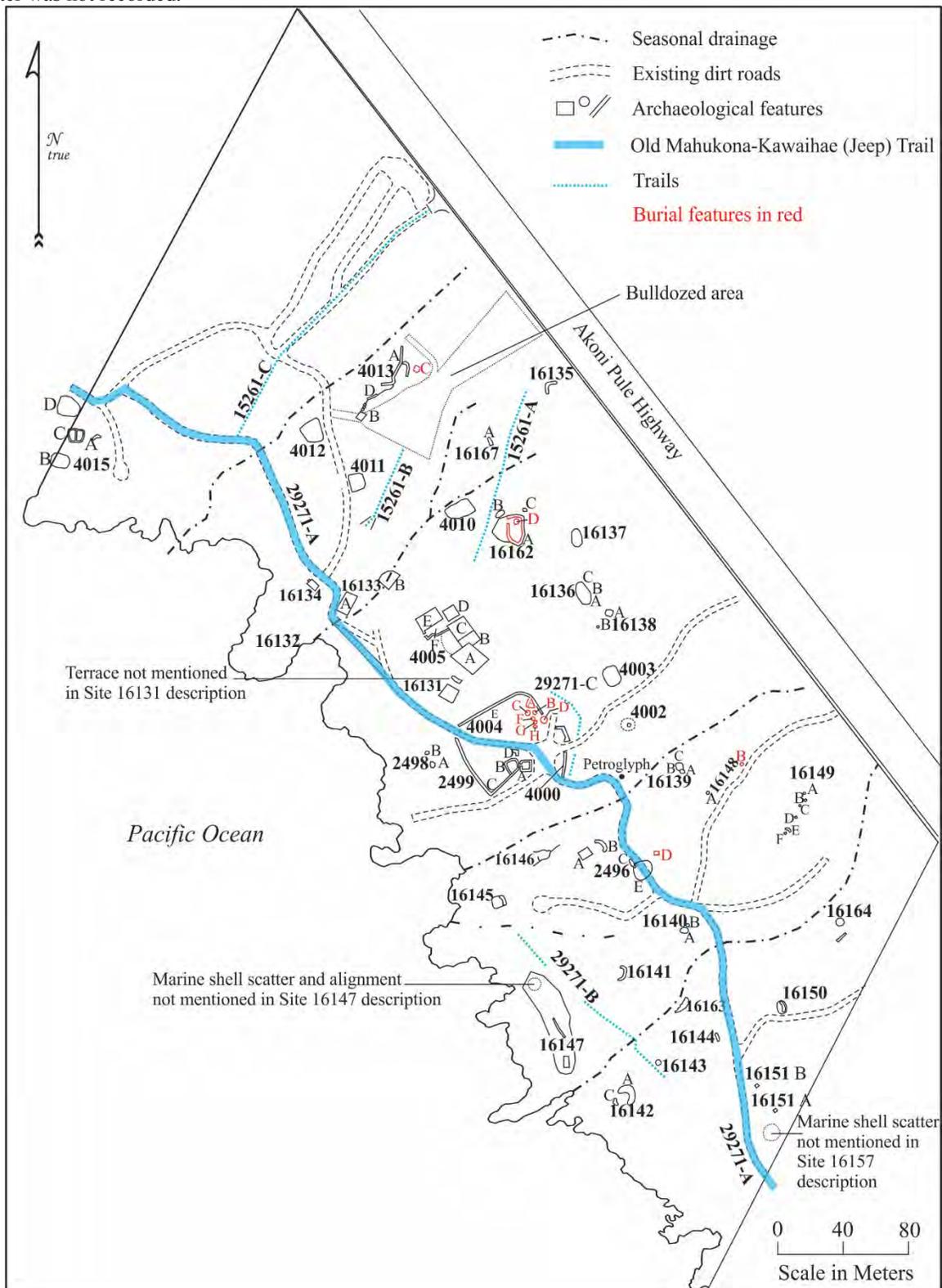


Figure 16. Re-plotted site locations and previously unrecorded features (Site 4013 D; Site 15261 B and C; Site 29271 B).

**SIHP SITE 2496**

Sites 2496 and 2497 were originally recorded by Bonk (1968) as two single-feature sites four meters apart. During the PHRI inventory study (Graves and Franklin 1998), the two sites were combined and three additional features were described as comprising Site 2496 (the Site 2497 designation was dropped). Site 2496 is located entirely within the current project area. As Graves and Franklin (1998:A-20) describe:

This site is on a ridge just east of Keawewai Gulch and it is bisected by the coastal jeep road. This complex consists of Feature A (enclosure), Feature B (C-shape), Feature C (terrace), Feature D (mound), and Feature E (midden deposit) [their map of the site is provided as Figures 17 and 18].

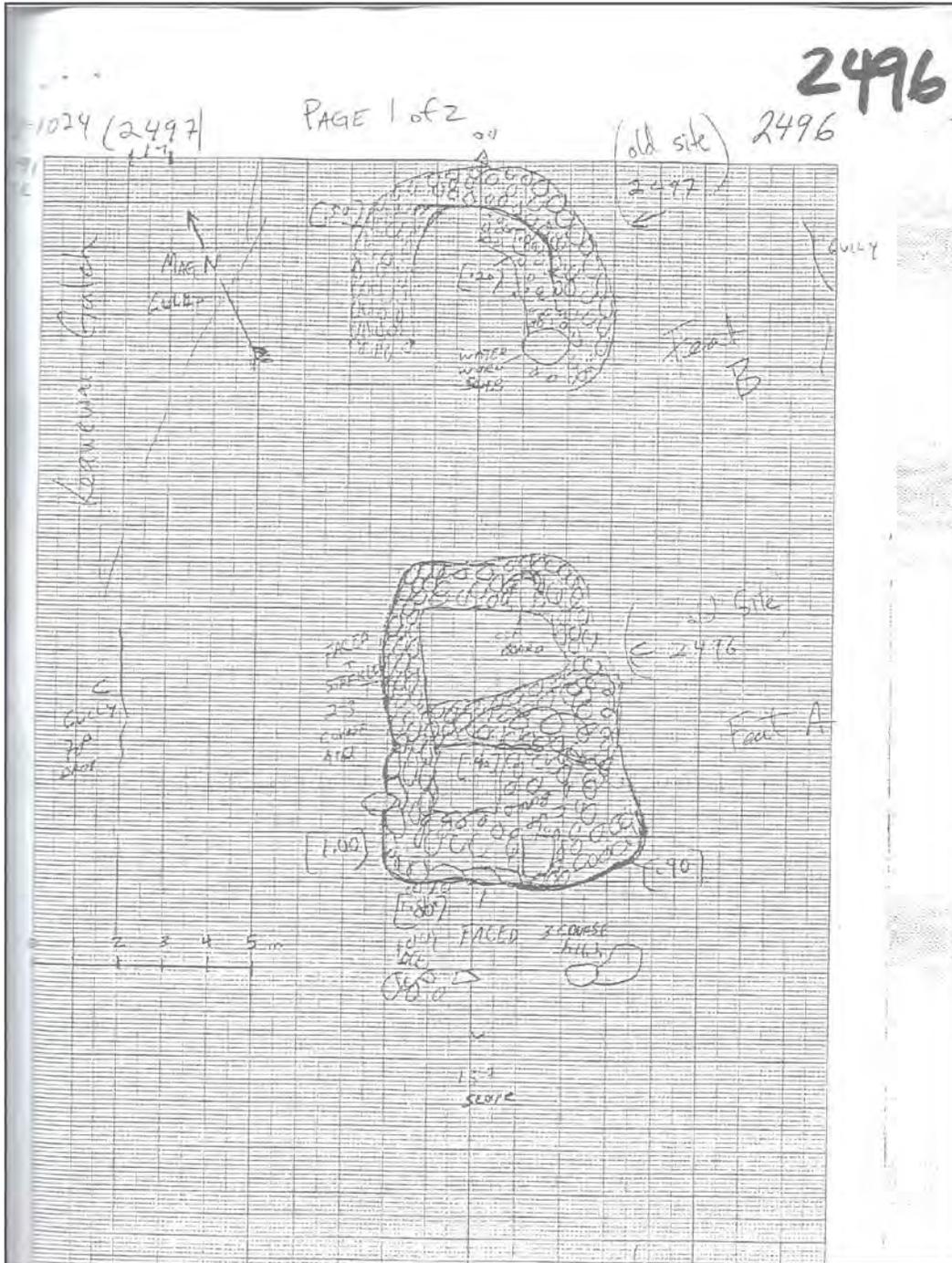


Figure 17. Graves and Franklin (1998) map of Site 2496 page 1 of 2.

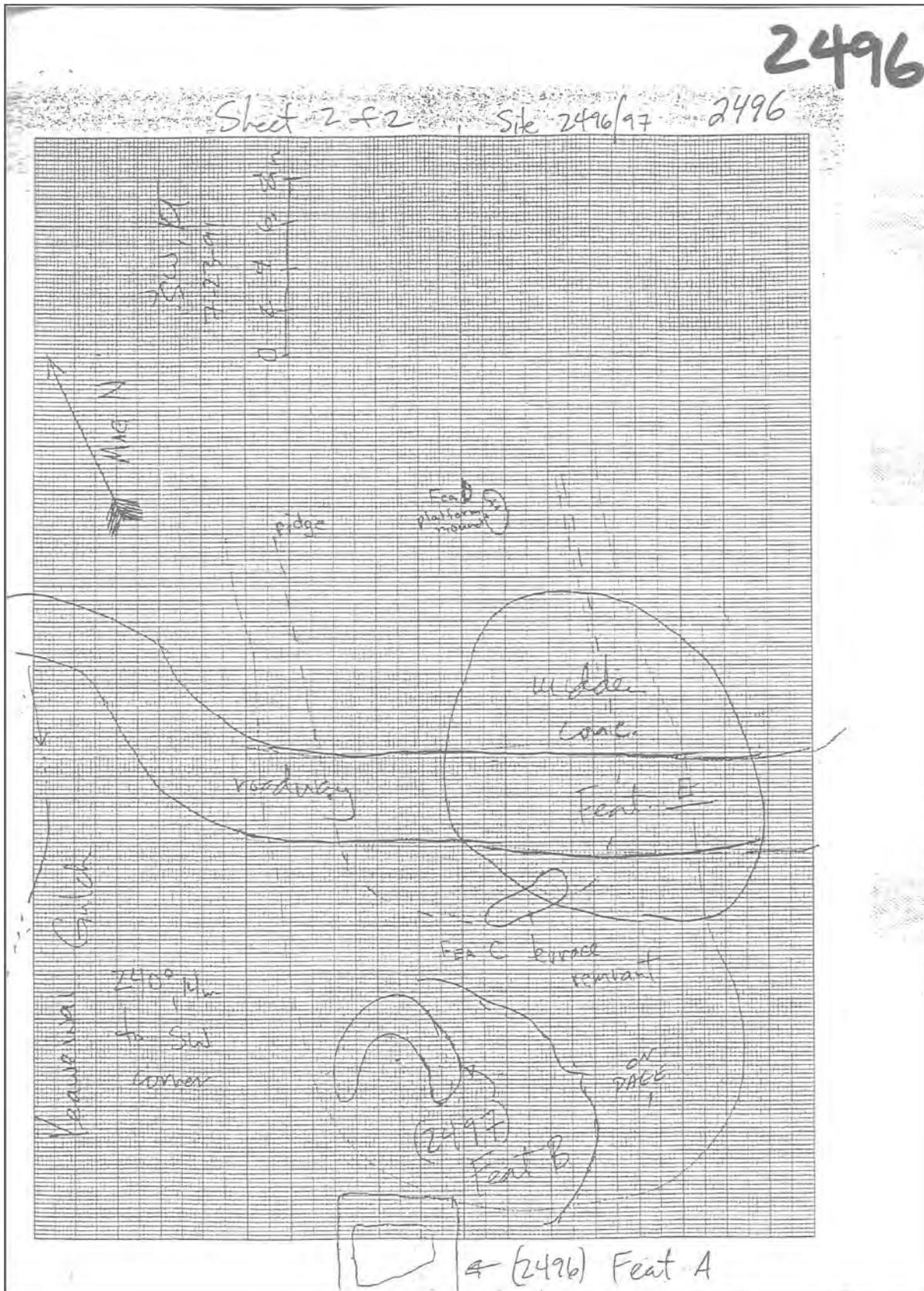


Figure 18. Graves and Franklin (1998) map of Site 2496 page 2 of 2.

## Feature D

Site 2496 Feature D (Figure 19) was further described as “a low flat stone mound [2.3 m by 1.4 m by 0.5 m]. . . constructed of subangular pahoehoe boulders 10-20 cm in diameter . . . roughly stacked 3 courses high. The *platform* is core filled with cobbles c. 0.10 m or less and *decorated with coral.*” (Graves and Franklin 1998:A-20, *italics* added for emphasis). Despite their description, Graves and Franklin (1998) interpreted this feature to have functioned as an agricultural mound.



Figure 19. SIHP Site 2496 Feature D, view to the northwest.

The location of Feature D as shown on Figure 17 is not accurate thus the site was remapped during the current study so as to accurately depict the relationship of Feature D to the rest of the site (Figure 20). Feature D was also individually mapped (Figure 21) and not feeling comfortable with the agricultural functional interpretation, we excavated a test trench (TU-1) bisecting the feature in a north/south direction. Upon removal of the architectural rock layer, an intrusive pit was observed in the underlying soil. Continued excavation within this pit revealed the presence of a capstone below which was the articulated human skeletal remains of one individual. Upon discovery of the remains, DLNR-SHPD was contacted, the test unit was profiled (Figure 22) and refilled, and the platform reconstructed as closely matching the original specification as possible.

As a result of the current study, SIHP Site 2496 Feature D is redescribed as a roughly rectangular platform (see Figure 12) measuring 3 meters by 2 meters with edges stacked 35 to 40 centimeters above the surrounding ground surface (see Figure 15). The platform is constructed of weathered angular basalt cobbles as large as 25 centimeters in diameter with a few waterworn cobbles and coral fragment on its surface. The platform was built over a grave pit containing the remains of a single individual. Given the absence of Historic Period material it is surmised that this feature dates to the Precontact Period.

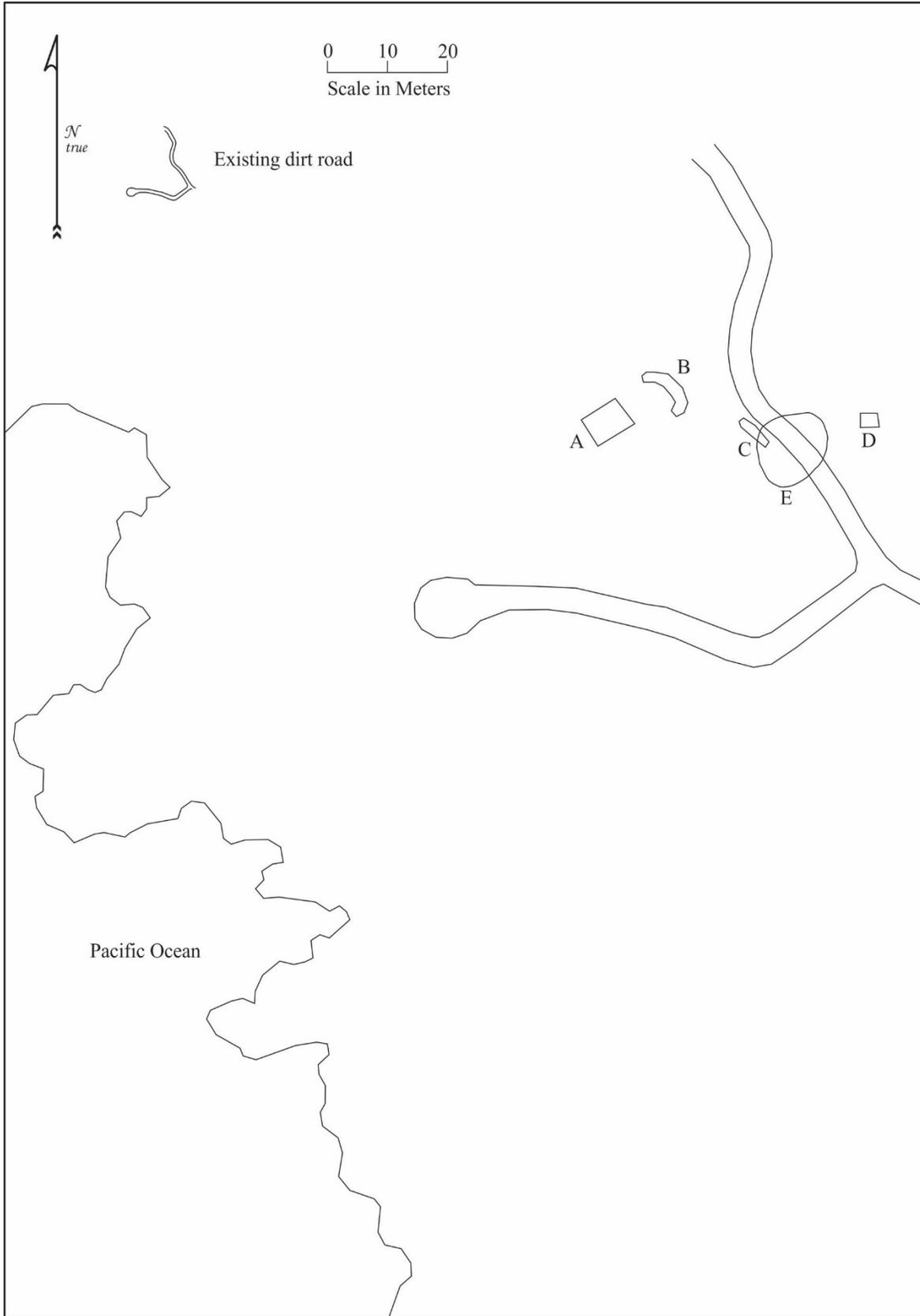


Figure 20. SIHP Site 2496 schematic plan view.

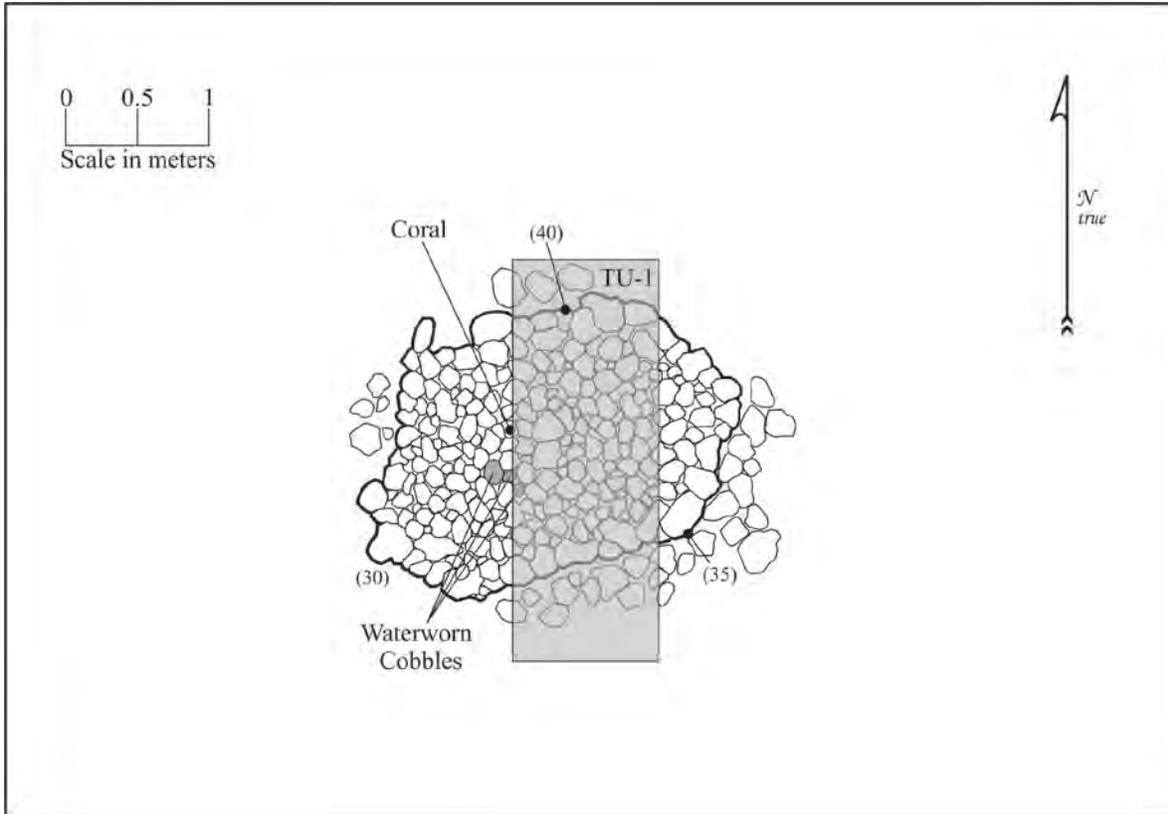


Figure 21. SIHP Site 2496 Feature D plan view.

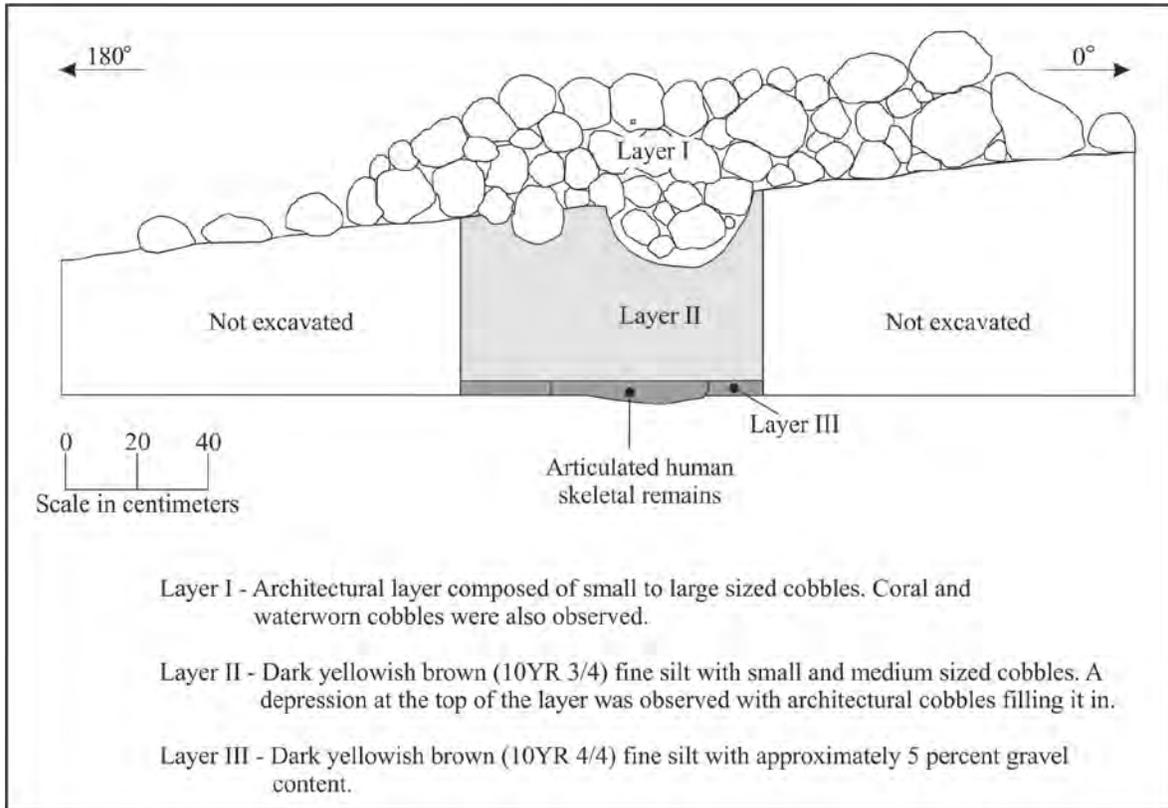


Figure 22. SIHP Site 2496 Feature D TU-1 west wall profile.



## Feature D

The newly identified overhang rock shelter, Site 4013 Feature D, is located along the bedrock exposure that connects Features A and B (see Figure 23). This portion of the bedrock protrudes horizontally for about 1 meter, creating a shelter space that has been enhanced through the placement of numerous medium to large boulders (Figure 24). The floor of the shelter space is relatively level and free of stones. The effective useable interior space is 3 meters by 1 meter with the ceiling height reaching a maximum of 50 centimeters (Figure 25). There was no cultural material observed on the surface of the shelter, and to test the accumulated soil a 50 centimeter by 1.5 meter test unit (TU-2) was excavated at the center of the overhang. TU-2 was excavated in 10 centimeter arbitrary levels until bedrock was reached at a maximum depth of 12 centimeters below the surrounding ground surface (Figure 26). The soil encountered in TU-2 was dark yellowish brown (10YR 3/3) silt. Cultural material recovered from the 1/8 inch screening of the excavated soil included 36.6 grams of marine shell and seven pieces (0.1 gram) of fish bone (Table 2). Based on its barricaded nature and the presence of faunal remains, Feature D is considered to have functioned as either a sleeping or working area.



Figure 24. SIHP Site 4013 Feature D, view to the southeast.

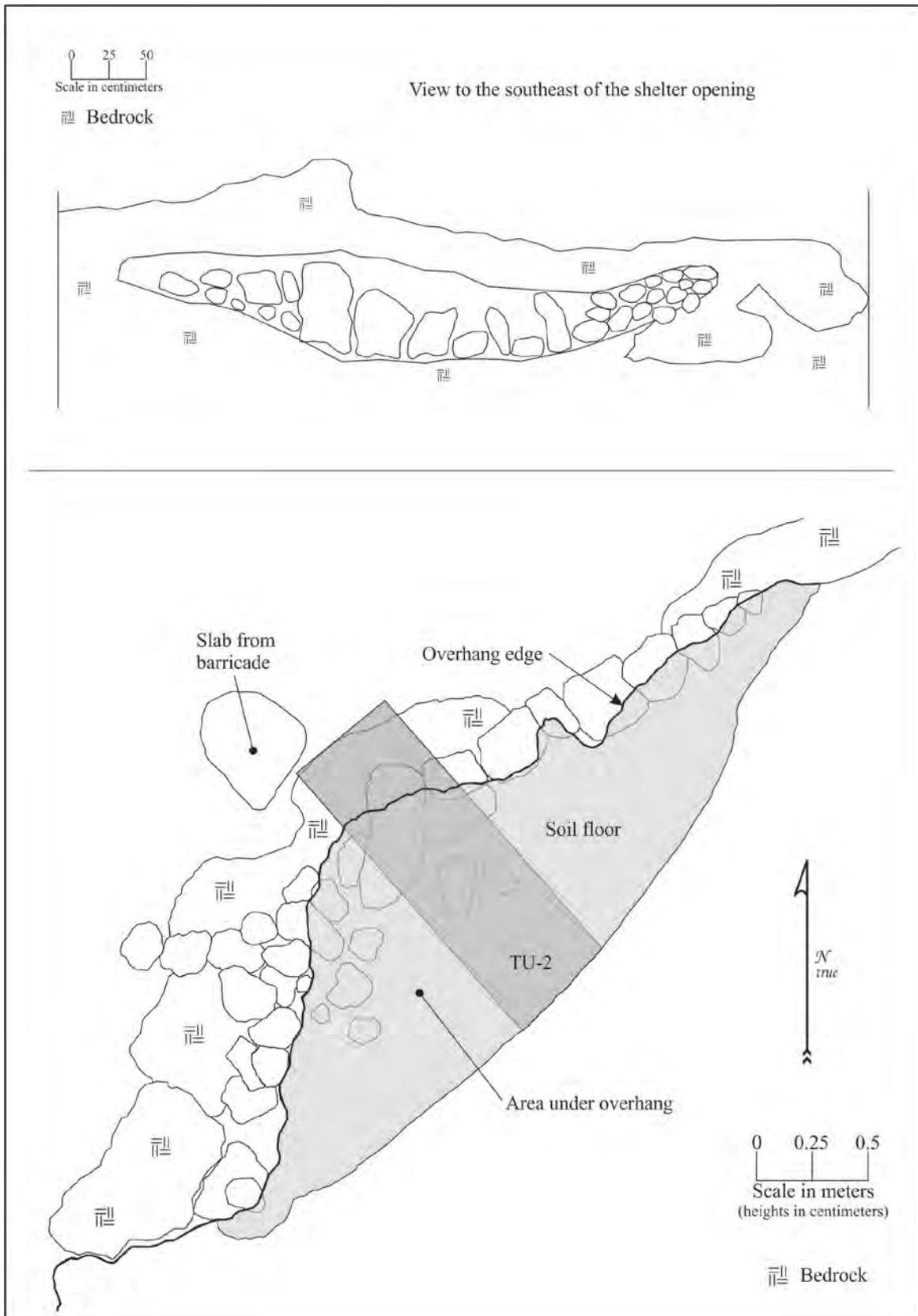


Figure 25. SIHP Site 4013 Feature D plan view and profile.

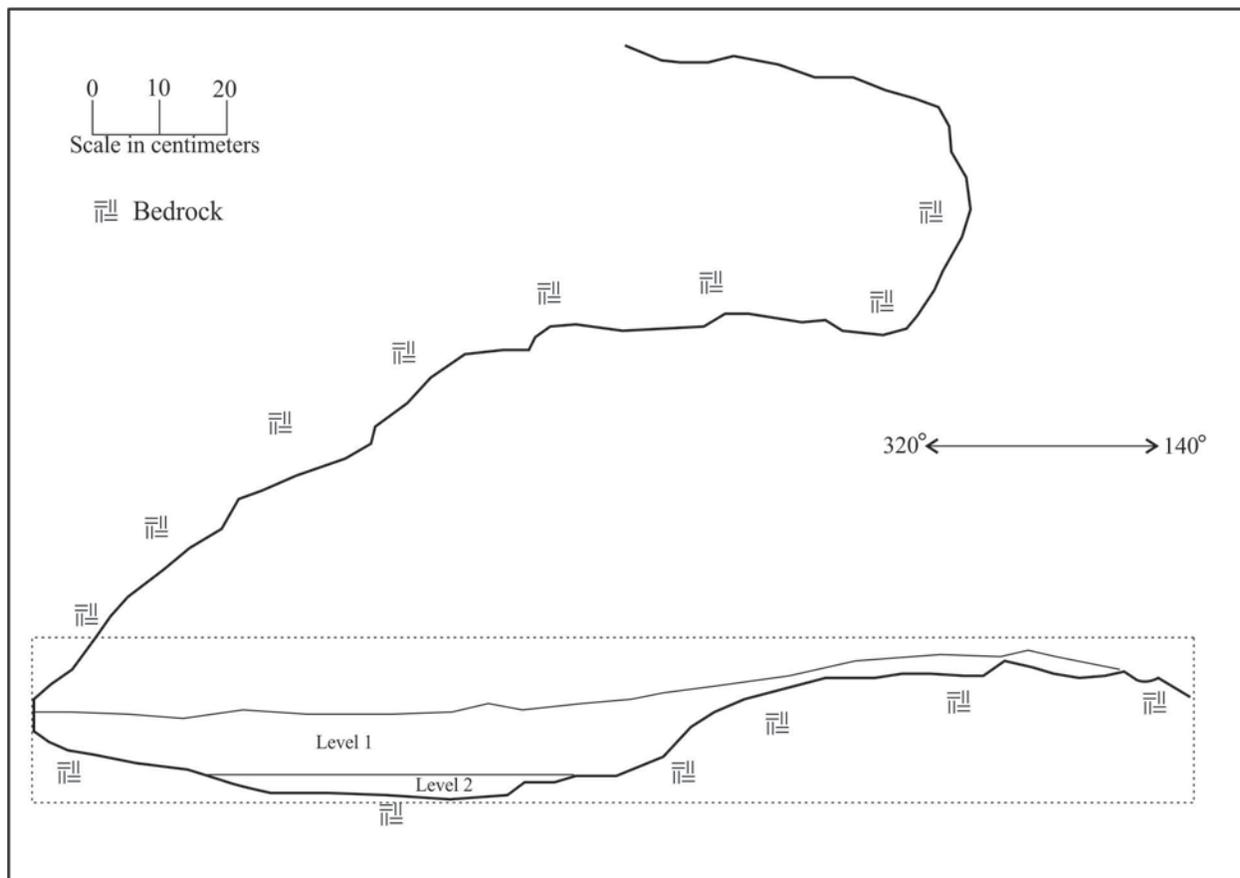


Figure 26. SIHP Site 4013 Feature D TU-2 and overhang western profile.

**Table 2. Items recovered from SIHP Site 4013 Feature D TU-2.**

<i>Acc. #</i>	<i>Level</i>	<i>Material</i>	<i>Type/Species</i>	<i>Count</i>	<i>MNI</i>	<i>Weight (g.)</i>
2	1	Echinoderm	Echinoidea	3	-	1.7
3	1	Marine shell	<i>Nerita</i> sp.	9	8	1.5
4	1	Marine shell	<i>Cellana</i> sp.	2	2	15.9
5	1	Marine shell	<i>Drupa</i> sp.	5	2	1.5
6	1	Marine shell	<i>Cypraea</i> sp.	16	2	14.2
7	1	Fish bone	unidentified	7	1	0.1
8	1	Reptile bone	Gekkonidae	1	1	<0.1
9	1	Rodent bone	<i>Mus</i> sp.	1	1	<0.1
10	1	Marine shell	Mitridae	1	1	0.2
11	1	Marine shell	unidentified	1	1	0.5
12	1	Nut Shell	<i>kukui</i>	4	-	2.7
13	2	Marine shell	<i>Cellana</i> sp.	2	1	0.3
14	2	Marine shell	<i>Nerita</i> sp.	2	2	0.8

## SIHP SITE 15261

Site 15261 was recorded by PHRI (Graves and Franklin 1998) as a discontinuous *mauka/makai* trail segment that begins c. 10 meters south of the Akone-Pule Highway and extends seaward along the eastern side of a shallow gully for c. 150 meters (see Figure 9). The route of the trail is marked mostly by a worn path (0.52-0.68 meters wide), but it also has a short section (2.5 meters long) where small boulders line its northern edge. PHRI notes that destruction along the trail has been caused mostly by erosion, but that it has also been impacted by bulldozing. This roughly 108-meter-long trail segment (Feature A) was relocated and mapped during the current inventory survey fieldwork, as were two additional trail segments that measure roughly 50 meters long and roughly 180 meters long (Features B and C, respectively), located to the north of the first (see Figure 16). All three trail segments are situated entirely within the current project area and do not extend beyond the project area boundaries. A review of Historic cartographic resources for the general project area suggests that all three segments are likely separate branches of the same *mauka/makai* trail alignment. The trail segments may represent subsequent alignments that were created as earlier alignments were abandoned due to deterioration (from erosion) or changing land use and transportation needs during the Historic Period; or they may have seen contemporaneous use (at least by foot or horse) depending on the traveler's coastal destination or starting point. Each of the three segments of Site 15261 identified within the project area exhibits varying levels of deterioration, and each is separated from the next by an intervening gulch, making either scenario possible. Graves and Franklin (1998), in their analysis of site and feature types recorded during the original AIS, interpret Site 15261 (the only trail segment they identified) as the remains of an "ancient trail" shown on a 1935 Tax Map Key (the alignment depicted on that map appears to be the same as the "ancient trail" alignment depicted on the 1931 map submitted with Land Court Application 1043, and was likely copied directly from that older map; see Figure 13). However, an overlay of the "ancient trail" alignment from the 1931 map onto the current project area map indicates that the Site 15261 trail segment recorded by PHRI is actually located well to the south of the trail shown on that map.

Historic maps from 1859, 1913, 1931, and 1956 show various *mauka/makai* trail alignments extending across the current project area (Figure 27). The trails follow two general routes (a pre-1913 route and a post-1931 route) that are both distinct from the route of Site 15261 reported by Graves and Franklin (1998). The 1859 map of Kahuāli'i'i'i prepared by S. C. Wiltse (see Figure 11) shows a Road to Macy and Vida's Ranch that extends from the coast within the current project area at Waiakailio Landing inland to roughly 1,600 feet above sea level before exiting the southern boundary of the *ahupua'a* (Trail 1 in Figure 27). The 1913 U.S.G.S. Kawaihae quadrangle (see Figure 13) shows a similar *mauka/makai* trail alignment (labeled "Beach Trail") extending from the coast within the current project area to roughly 1,100 feet above sea level where it meets the Kawaihae-Puu Hue Trail near the southern *ahupua'a* boundary and the junction with the Kawaihae-Kahua Trail (Trail 8 in Figure 27). As discussed above, the 1931 map submitted with Land Court Application 1043 (see Figure 13) also shows a *mauka/makai* trail (labeled "Ancient Trail") extending inland from the coast within the current project area (Trail 7 in Figure 27). The *makai*-most portion of this trail is depicted to the north of the trail alignments shown on the earlier maps (adjacent to a fence line), but *mauka* of the project area (beginning at an elevation of roughly 150 feet above sea level) the trail appears to follow the same combined routes as the Beach and Kawaihae-Kahua trails that are depicted on the 1913 U.S.G.S. (see Figure 27). The 1956 U.S.G.S. Kawaihae quadrangle shows a *mauka/makai* trail alignment extending inland from the coast within the current project area (labeled "Beach Trail") that is similar to that shown on the 1931 map (Trail 11 in Figure 27). *Mauka* of the project area, however, beginning at an elevation of roughly 150 feet above sea level, the trail turns to the east (eventually becomes a road) and follows a different route than shown on any of the earlier maps to the Kawaihae-Puu Hue Trail before continuing as the Kawaihae-Kahua Trail.

As shown in Figure 27, *mauka* of the current project area, the trail alignments depicted on the Historic maps (with the exception of the Beach Trail shown on the 1956 U.S.G.S. Kawaihae quadrangle) all follow similar, intertwined routes to the Kawaihae-Puu Hue Trail (Trail 6 in Figure 27) where they meet with the Kawaihae-Kahua Trail (Trail 7 in Figure 27) and continue to the Government Road (Trail 4 in Figure 27). It is posited that these trails actually represent shifting alignments of the same *mauka/makai* trail route, and that the branches discovered with the current project area are functionally, if not temporally, related. For this reason the branch of Site 15261 originally recorded by PHRI (the southernmost branch; see description above) has been designated Feature A, the newly recorded branch shown on pre-1913 maps (the middle branch) has been designated Feature B, and the other newly recorded branch shown on post-1931 maps (the northern branch) has been designated Feature C. The newly recorded Features B and C are described below.

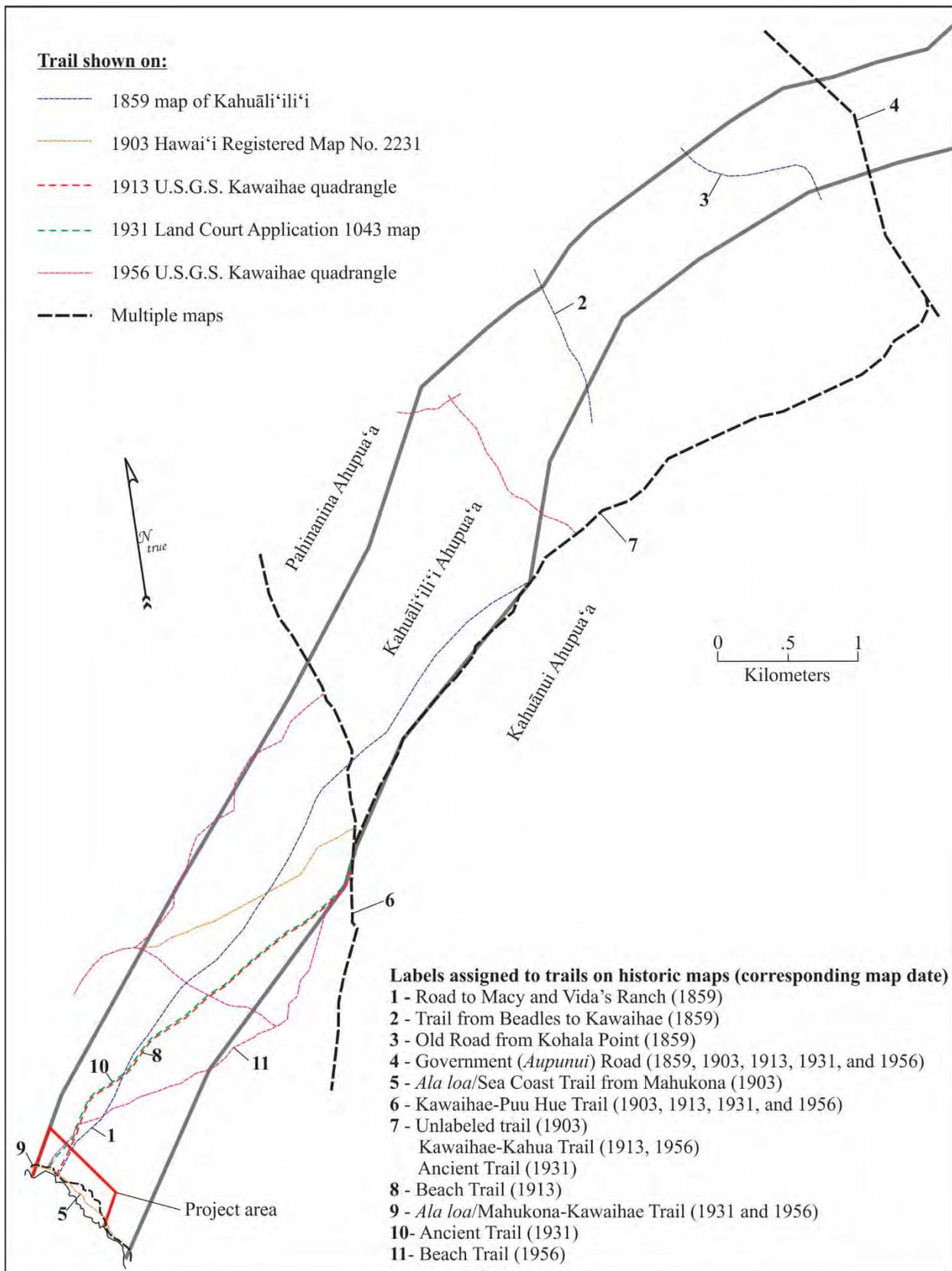


Figure 27. Trail alignments shown on Historic maps in Kahuāli‘ili‘i Ahupua‘a.

### Feature B

Site 15261 Feature B is a trail segment that extends *mauka* from Site 16133 for roughly 50 meters (see Figure 16). The trail begins c. 20 meters south of Site 4011 at a low spot in a bedrock ledge that partially encloses the northern edge of Site 16133. Both edges of the bedrock ledge at this location, for a distance of roughly 10 meters, constricting from more than 5 meters apart at the southwestern end of the gap in the bedrock ledge to roughly 2 meters apart at the northeastern end, have been modified with short sections of stacked cobbles (Figure 28). The discontinuous stacking along the northwestern edge of the low spot is wholly dependent on the bedrock ledge for support (Figure 29), while sections of the stacking along the southeast edge are free standing and on top of the bedrock (Figure 30). The gap between the bedrock edges allows for the easiest *mauka/makai* access at Site 16133, where a well, a windmill (erected in 1931), and a cattle pen are located. Beyond the bedrock low spot Feature B seems to continue in a northeasterly direction for about 40 meters (and perhaps as far as 65 meters). A discontinuous alignment of small boulders on an eroded bedrock slope of loose cobbles and boulders faintly marks this section of Feature B (Figure 31). Beginning at a distance of roughly 65 meters from the southwestern end of Feature B, nearly the entire ground surface between the two gullies that bound the trail route and separate it from Feature A (to the south) and Feature C (to the north), up to the highway alignment, has been disturbed by bulldozing and no further traces of Site 15261 Feature B are discernable. This trail section appears to match the trail alignments shown of the 1859 and 1913 maps (see Figure 27); it is labeled “Road to Macy and Vida’s Ranch” in 1859 and “Beach Trail” in 1913.



Figure 28. SIHP Site 15261 Feature B, view to the northeast.



Figure 29. SIHP Site 15261 Feature B, view to the north.



Figure 30. SIHP Site 15261 Feature B, view to the south.



Figure 31. SIHP Site 15261 Feature B, view to the southwest.

### Feature C

Site 15261 Feature C is a roughly 180-meter-long segment of a *mauka/makai* trail that is depicted on maps prepared in both 1931 and 1956 (see Figure 27). On the 1931 map the trail (labeled “Ancient Trail”) is shown adjacent to a fence line that extends to the coast. An overlay of that map onto the current project area map indicates that portions of the fence line are still extant on the property and that the *mauka* portion of the trail is a 4WD access road that extends southwest from a gate at the highway (Figure 32). Approximately 130 meters from the highway this *mauka/makai* road section turns into a lateral road that once crossed the gullies on either side of Feature C, but has been blocked in both directions. The trail shown at this location on the 1931 map continues in a straight line *makai* of the T-intersection to the coastal alignment of the *Ala loa*/Kawaihae-Mahukona Trail (Site 29271). On the eroded cobble and boulder slope southwest of the road intersection (Figure 33) a possible older segment of Feature C was identified. This section, which has the appearance of an old, overgrown bulldozed road, is roughly 5 meters long by 2.5 meters wide with low cobble berms along either edge (Figure 34). No further sections of Feature C were identified on the loose cobble slope.

### SIHP SITE 29271

Site 29271 is a coastal trail depicted on the 1903 Hawai‘i Reg. Map 2231 as the *Ala loa* and “sea coast trail from Mahukona” (see Figure 13), the 1931 Land Court Application Map 1043 as the Mahukona-Kawaihae Trail (see Figure 15), and the 1956 U.S.G.S. Kawaihae quadrangle as an unnamed trail (see Figure 16) that extended parallel to the coast between Kawaihae to the south and Mahukona to the north. The trail alignment is not shown on U.S.G.S. maps after 1956. The SIHP site designation 29271 was first assigned to this trail by Clark and Rechtman (2010). For the most part this historic property is not discernable in its original state across the current study area and beyond, as it has been superseded by a series of bulldozed Jeep roads constructed between the 1940s and 1970s. Two slightly different routes of the trail are shown on the Historic maps reviewed for this study (see Figure 27). On the 1903 map the trail alignment stays close to the shore, but on the 1931 and 1956 maps the trail turns inland near the southern boundary of the current project area where it crosses Keawewai Gulch. It is likely that the two alignments represent a shift from an earlier coastal walking trail to a later Jeep road.



Figure 32. SIHP Site 15261 Feature C, view to the northeast.



Figure 33. SIHP Site 15261 Feature C, view to the southwest.



Figure 34. SIHP Site 15261 Feature C, view to the southwest.

Graves and Franklin (1998:34) discuss, that in response to comments regarding PHRI’s failure to mention the *Ala loa* or other *mauka/makai* trails identified on maps of the area in earlier drafts of their AIS report, PHRI had conducted a “pedestrian inspection to determine if any portion of a jeep road that crosses the coastal portion of the project area could be identified as the *ala loa* trail.” The inspection included walking the length of the road to search for evidence of constructed causeways or curbing that might still be present, but none was found, and they concluded that “if the road did indeed follow the original path of the trail, all traces of it have been obliterated by long-term use and alteration (Graves and Franklin 1998:34). For the purposes of the current supplemental AIS the *Ala loa*/Mahukona-Kawaihae Trail alignments from the Historic maps were overlaid on the newly prepared project area map to examine their locations relative to the existing Jeep roads on the property. The overlays indicate that the trail alignments shown on the 1931 and 1956 correspond to bulldozed Jeep road alignments across the entire property, but that the alignment depicted on the 1903 map, while it corresponds to Jeep roads for much of its length, is shown *makai* of the bulldozed Jeep road at the southern end of the project area where it crosses Keawewai Gulch. Further pedestrian inspection of the area between and the southern parcel boundary revealed two possible trail remnants, one *makai* of the Jeep road near the southern property boundary, and another *mauka* of the Jeep road near SIHP Site 4000. For descriptive purposes the Jeep road (the later alignment of the *Ala loa*) is discussed below as Feature A of Site 29271, while the remnants of the earlier pedestrian alignments are discussed as Features B and C (see Figure 17). A petroglyph found in Keawewai Gulch near where Features A and B meet is described below with Feature A.

### Feature A

Site 29271 Feature A is the alignment of the *Ala loa*/Mahukona-Kawaihae Trail shown on the 1931 and 1956 maps (see Figure 17). This alignment (Figure 35) consists wholly of bulldozed sections of Jeep road that were likely created between the 1940s and 1970s, superseding the earlier pedestrian trail alignment. Some sections of this alignment are still accessible to 4WD vehicles (Figure 36), but others are overgrown and cannot be driven on (Figure 37). The Jeep road is generally 2.5 to 3.0 meters wide and is badly eroded in some sections, and if intact would extend roughly 680 meters across the entire project area and beyond the project area boundaries to the northwest and southeast. At the northern end of the property the road has been blocked by bulldozed berms at two locations to prevent vehicular access. On the *mauka* side of the road as it crosses Keawewai Gulch there is a single anthropomorphic petroglyph etched into an eroded vertical surface (Figures 38 and 39). This image measures 25 centimeters tall by 13 centimeters wide, and its appearance and nature of execution (etching) it appears to be on the more recent end of the spectrum of such traditional practices.



Figure 35. Aerial view (from Google Earth) showing the locations of SIHP Site 29271 Features A, B, and C.



Figure 36. SIHP Site 29271 Feature A, view to the northwest.



Figure 37. SIHP Site 29271 Feature A, view to the south.



Figure 38. Triangle body anthropomorphic petroglyph etched on exfoliating vertical surface along the route of Site 29271 Feature A in Keawewai Gulch.

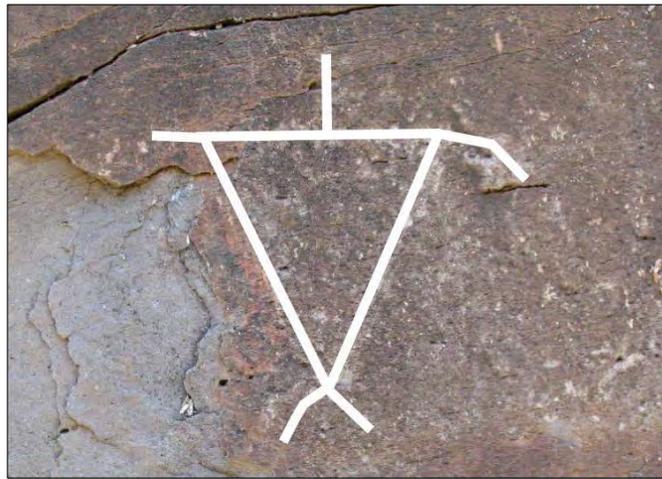


Figure 39. Outline detail of Site 29271 Feature A petroglyph.

### Feature B

Site 29271 Feature B consists of a short, remnant section of the *Ala loa*/Mahukona-Kawaihae Trail that roughly matches its location as shown on the 1903 Hawai'i Reg. Map 2231 (see Figure 13). This faint trail alignment extends for roughly 130 meters in a northwesterly/southeasterly direction, 25 to 50 meters inland of the coast, near the southern boundary of project area (see Figure 17). The trail is discontinuous and very rough, but is marked in a few locations by short alignments of small boulders and cobbles along one edge (Figure 40). The pathway is littered with loose cobbles, but may have been 0.5 to 0.75 meters wide when in use. A 30 meter section of the trail, 25 meters from its northwestern end, has been erased by bulldozing. The projected route of the trail, while it could not be positively identified at Keawewai Gulch, suggests that it crossed that steep sided land form at the only easily accessible location *makai* of the existing Jeep road (Feature A). A section of this trail is observable crossing a smaller gulch to the south (Figure 41) where it also crosses at the most accessible location below the Jeep road. While Feature B once continued to both the northwest and southeast of the currently recorded section, no further physical remnants of the alignment were identified.



Figure 40. SIHP Site 29271 Feature B, view to the southeast.

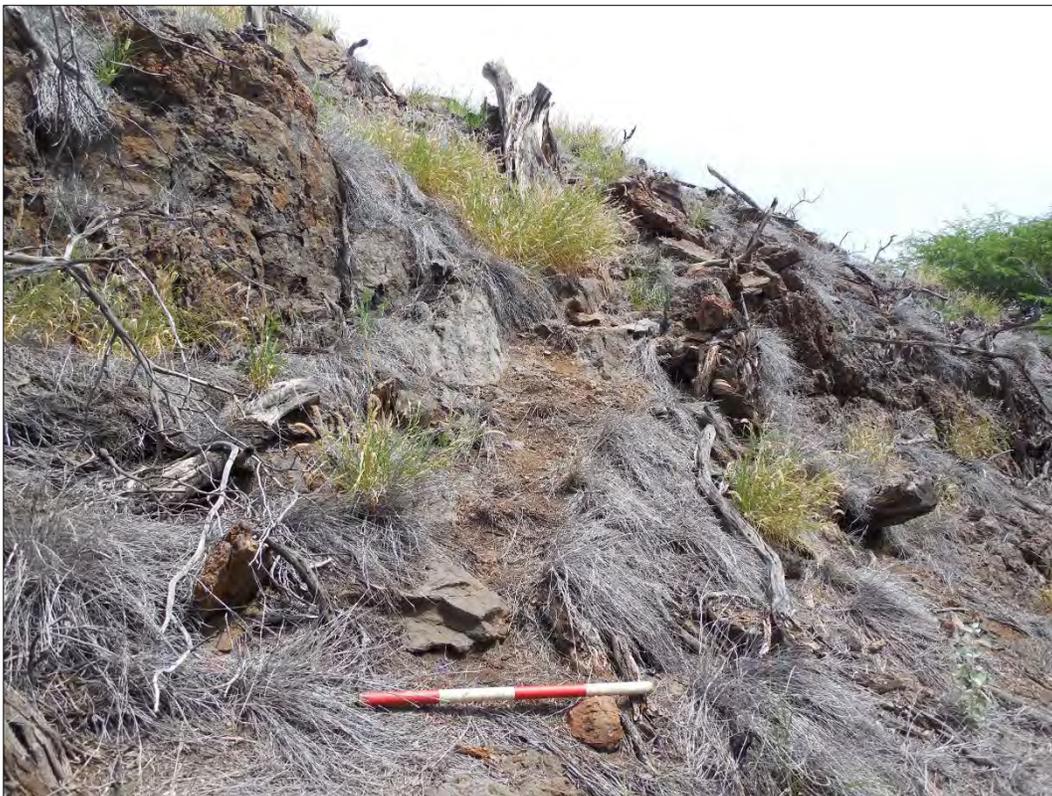


Figure 41. SIHP Site 29271 Feature B at unnamed gulch, view to the southwest.

### Feature C

Site 29271 Feature C consists of a possible, short remnant section of the *ala loa* trail that seems to correspond with the location shown on a 1931 map (see Figure 16), the more *mauka* placement of the trail. This section of trail is a worn pathway that measures between 50 and 75 centimeters wide that appears to have been cleared of larger rocks, some of which line the edge of the trail. This segment of trail is traceable for roughly 50 meters curving *mauka* then *makai* as it deviates from the Jeep road portion of the site (Feature A) just to the north of Keawewai Gulch (see Figure 35). This alignment appears to skirt the Site 4000/4004 burial complex. Feature C is currently bisected by a recent dirt road that extends in a *mauka/makai* direction between the highway and the shoreline. The section of trail on the southern side of the dirt road (Figure 42) measures roughly 20 meters; and the section on the northern side (Figure 43) extends for roughly 30 meters. Feature C seems to represent the location *ala loa* just prior to the construction of the 1940s Jeep road.



Figure 42. SIHP Site 29271 Feature C south of *mauka/makai* dirt road, view to the north.



Figure 43. SIHP Site 29271 Feature C north of *mauka/makai* dirt road, view to the southeast.

## 6. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

All forty archaeological sites that exist within the current study parcel have already been assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai'i Administrative Rules 13§13-284-6. The significance of these sites is presented below. The updated significance evaluations should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

Table 3 below presents a summary of the significance evaluation for all forty sites followed by a discussion.

As a result of the current study the original significance evaluation (Graves and Franklin 1998) and the subsequent DLNR-SHPD determination (DOC NO.: 9805PM21) has been modified for five of the previously recorded sites. Four of these (Sites 4000, 4010, 16132, and 16138) were not considered to be significant in the original study; however, all of these sites are part of a relatively intact archaeological landscape that documents evolving land use from Precontact times to the late Historic Period. As such, all four of these sites are now considered to be significant under Criterion d for their information content. Further, Site 2496 was originally determined to be significant solely under Criterion d; however, as this site is now known to contain a burial it is now also be considered significant under Criterion e.

**Table 3. Summary of site significance.**

<i>SIHP No.</i>	<i>Site Type</i>	<i>Temporal Association</i>	<i>Significance</i>
2496	Habitation/Burial	Precontact	d, e
2498	Habitation/Ceremonial	Precontact	c, d, e
2499	Habitation	Precontact/Historic	c, d
4000	Wall	Precontact/Historic	d
4002	Rock mound	Precontact	d
4003	Habitation	Precontact/Historic	d
4004	Burial	Precontact/Historic	d, e
4005	Habitation	Precontact/Historic	c, d
4010	Animal Enclosure	Historic	d
4011	Habitation	Precontact/Historic	d
4012	Habitation	Precontact/Historic	d
4013	Habitation/Burial	Precontact/Historic	d, e
4015	Habitation	Precontact	d
15261	Trail	Precontact/Historic	d, e
16131	Habitation	Precontact/Historic	d
16132	Wall	Historic	d
16133	Well/Reservoir	Historic	d
16134	Enclosure	Historic	d
16135	Wall	Precontact	d
16136	Habitation	Precontact	d
16137	Rock mound	Precontact	d

*continued on next page*

**Table 3. Continued.**

<i>SIHP No.</i>	<i>Site Type</i>	<i>Temporal Association</i>	<i>Significance</i>
16138	Platform and cairn	Precontact	d
16139	Habitation	Precontact	d
16140	Habitation	Precontact	d
16141	Habitation	Precontact	d
16142	Habitation	Precontact	d
16143	Habitation	Precontact	d
16144	Habitation	Precontact	d
16145	Habitation	Precontact	d
16146	Habitation	Precontact	d
16147	Habitation	Precontact	d
16148	Habitation/Burial	Precontact	d, e
16149	Habitation	Precontact	d
16150	Habitation	Precontact	d
16151	Habitation	Precontact	d
16162	Burial	Precontact	d, e
16163	Habitation	Precontact	d
16164	Habitation	Precontact	d
16167	Agricultural Terrace	Precontact/Historic	d
29271	Trail	Precontact/Historic	d, e

Given the current development proposal (a nine lot subdivision) for the study property (see Figures 8 and 10), site treatments are reconsidered and the existing preservation and burial treatment plans require revision. Table 4 shows the prior approved treatments and the proposed treatment recommendations. As can be seen in this table, the proposed treatment for several of the sites reverts back to that as was approved in the earlier AIS. The revised treatments were based on a very limited land use (one single-family residence) of the 37.8 acre parcel, and the current proposed treatments take into consideration the current proposed development plan. No further work continues to be the proposed treatment for two sites (Sites 16132 and 16136); both of these were substantially documented during either the original AIS (Graves and Franklin 1998) or the subsequent burial testing (PHRI 2005). Data recovery has already been completed for Site 4015 (O'Hare and Goodfellow 1999), thus no further work is recommended for this site. Two of the sites (Sites 4010 and 16138) that were earlier approved for no further work are now recommended for data recovery prior to their destruction; and one site (Site 4000) that was approved for no further work is now recommended for preservation as it appears to be a part of the Site 4004 burial complex.

The four previously identified burial sites (Sites 4004, 4013, 16148, and 16162) shall continue to be preserved, however the burial treatment plan (PHRI 2000a) should be updated to reflect the proposed change in land use and the newly identified burial site (Site 2496 Feature D) added to the plan. As stated in the burial treatment plan:

While it is the intent of the owner to develop only the western portion of the project area, and to leave the larger eastern portion in its present undeveloped condition, it is recognized that the possibility of changes in intended property use by the current or any subsequent owner may arise in the future. Therefore, any proposed future changes in land use for the eastern portion of the property will require the owner to return to the HIBC for possible reconsideration of the adequacy of the long-term preservation measures for the burial sites as proposed in this BTP. (PHRI 2000a:15)

Data recovery is now recommended for sixteen sites (4002, 4003, 4010, 4012, 16135, 16137, 16138, 16140, 16141, 16143, 16144, 16146, 16150, 16151, 16164, 16167) plus portions of two additional sites (Sites 2496 and 4013) that also contain preserved burial features. All of these sites were accepted for data recovery in the prior AIS (Graves and Franklin 1998) with the exception of Sites 4010 and 16138, which were accepted for no further work. It is believed that these two sites still retain information that could be recovered and aid in developing a specific chronology of the project area land use history. Pursuant to HAR 13§13-278, a plan addressing the data recovery of these eighteen sites should be prepared and submitted to DLNR-SHPD for review and acceptance.

Preservation is now recommended for sixteen sites (2498, 2499, 4000, 4005, 4011, 15261, 16131, 16133, 16134, 16139, 16142, 16145, 16147, 16149, 16163 and 29271) two of which (Sites 4000 and 15261) were approved for no further work as a result of the original AIS (Graves and Franklin 1998) and another (Site 29271), which was not identified at that time. A new preservation plan that addresses these sixteen sites should be prepared and submitted to DLNR-SHPD for review and acceptance in compliance with HAR 13§13-277.

**Table 4. Previously approved and current proposed treatment recommendations.**

<i>SIHP No.</i>	<i>Treatment in AIS*</i>	<i>Revised Treatment**</i>	<i>Proposed Treatment</i>
2496	Data Recovery	Preservation	Data Recovery/Burial Preservation
2498	Data Recovery/Preservation	Preservation	Preservation
2499	Data Recovery/Preservation	Preservation	Preservation
4000	No Further Work	No Further Work	Preservation
4002	Data Recovery	Preservation	Data Recovery
4003	Data Recovery	Preservation	Data Recovery
4004	Burial Preservation	Burial Preservation	Burial Preservation
4005	Data Recovery/Preservation	Preservation	Preservation
4010	No Further Work	No Further Work	Data Recovery
4011	Data Recovery	Preservation	Preservation
4012	Data Recovery	Preservation	Data Recovery
4013	Burial Preservation	Burial Preservation	Data Recovery/Burial Preservation
4015	Data Recovery Completed	Data Recovery Completed	No Further Work
15261	No Further Work	No Further Work	Preservation
16131	Data Recovery	Preservation	Preservation
16132	No Further Work	No Further Work	No Further Work
16133	Data Recovery	Preservation	Preservation
16134	Data Recovery	Preservation	Preservation
16135	Data Recovery	Preservation	Data Recovery
16136	No Further Work	No Further Work	No Further Work
16137	Data Recovery	Preservation	Data Recovery
16138	No Further Work	No Further Work	Data Recovery
16139	Data Recovery	Preservation	Preservation
16140	Data Recovery	Preservation	Data Recovery
16141	Data Recovery	Preservation	Data Recovery
16142	Data Recovery	Preservation	Preservation
16143	Data Recovery	Preservation	Data Recovery
16144	Data Recovery	Preservation	Data Recovery
16145	Data Recovery	Preservation	Preservation
16146	Data Recovery	Preservation	Data Recovery
16147	Data Recovery	Preservation	Preservation
16148	Burial Preservation	Burial Preservation	Burial Preservation
16149	Data Recovery	Preservation	Preservation
16150	Data Recovery	Preservation	Data Recovery
16151	Data Recovery	Preservation	Data Recovery
16162	Burial Preservation	Burial Preservation	Burial Preservation
16163	Data Recovery	Preservation	Preservation
16164	Data Recovery	Preservation	Data Recovery
16167	Data Recovery	Preservation	Data Recovery
29271	Not documented	Not documented	Preservation

\*Derived from Graves and Franklin (1998);\*\* PHRI (2000b); PHRI (2005).

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 5**

#### **Supplemental Design Concepts for Erosion and Sedimentation Control**

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**NATURAL AREA:**  
To ensure that significant natural characteristics such as landforms, vegetation, scenic qualities and open space are preserved, a significant portion of each lot should be reserved as Natural Area. No development will be allowed within the Natural Areas.

**BUILDING ENVELOPE (Lot 4 Representative Example):**  
A proposed Building Envelope should be identified within the predetermined *Suggested Building Site Location*. All site improvements should fall within the limits of the proposed Building Envelope. Site improvements include, but are not limited to, built structures, private outdoor spaces, pools, patios, spas, low walls, planting, grading, drainage, fencing, retaining walls, and other landscape improvements. Certain site improvements, such as utility connections, may fall outside of the Building Envelope. Building Envelopes should comply with all setback criteria, and respond to natural features such as topography and vegetation.

**ADDITIONAL NATURAL AREA (Lot 4 Representative Example):**  
Once the Building Envelope has been established and approved, the remainder of the *Suggested Building Site Location* will become Natural Area.

**SUGGESTED BUILDING SITE LOCATION, TYPICAL**

Public Parking and Trail Access

AKONI PULE HIGHWAY

Existing 24" Culvert

Existing 84" Culvert

Existing 36" Culvert

2 Existing 120" Culverts

Existing 60" Culvert

Drainageway

LOT 1

LOT 2

LOT 3

LOT 4

LOT 5

LOT 6

Drainageway

Drainageway

10' Wide Shoreline Access Easement

Keawewai Gulch

Ala Loa Trail

Drainageway

30' Setback

30' Setback

30' Setback

40' Elevation

6' Wide Shoreline Trail

PACIFIC OCEAN

**EXISTING KIAWE COVER:**  
Clearing and grading of the site should be done in such a way that existing, mature vegetation located above or below excavated areas is preserved. Vegetated buffers above construction sites aids in the prevention of high volume sheet flow across cut/fill areas. Vegetated buffers below construction sites help to filter and trap sediment before it can travel into existing waterways.

**DESIGN CONCEPTS FOR EROSION AND SEDIMENT CONTROL**  
Overall Site Plan Graphic

Prepared For:

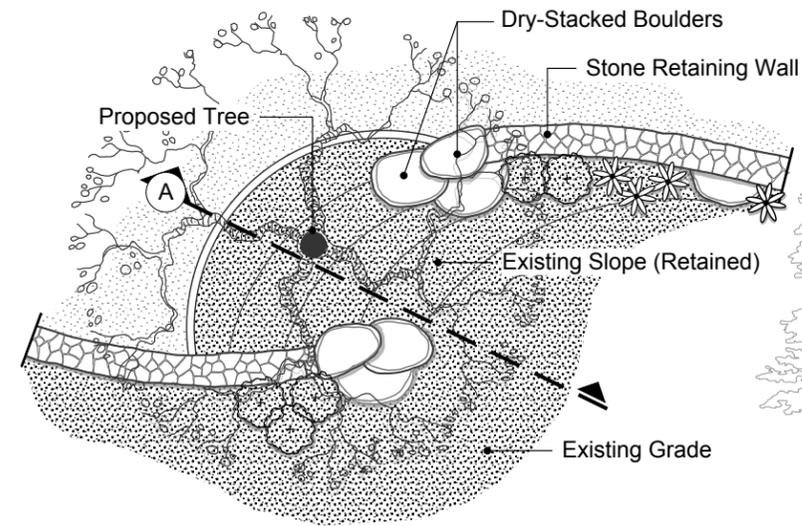
**Kohala Shoreline, LLC**  
TMK: (3) 5-9-001:008  
Kahualii'i, North Kohala, Hawaii  
April 15, 2019



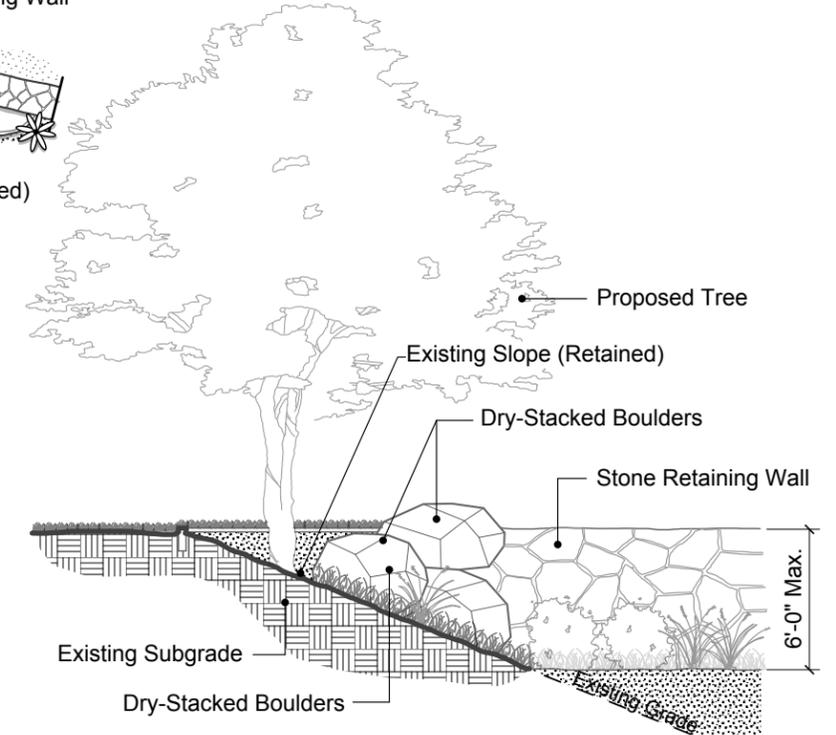
## ALTERNATE APPROACHES TO SLOPE RETENTION/STABILIZATION:

To the extent possible, site disturbance/grading should be limited in order to minimize erosion and sediment loss. Proposed development should be designed to fit the natural contours, where possible. The use of retaining walls and graded slopes may be required in order to build on hilly terrain. Retaining walls can be effective in controlling erosion because they break-up and slow down the rate of surface flow on a slope. Where retaining walls and graded slopes are utilized, the following should be considered as alternate approaches to slope retention and stabilization:

1. Retaining walls should be designed to blend in with the adjacent topography (see drawing examples on this, and the following page). Curved, organic forms are encouraged rather than straight lines. Where possible, utilize stone that is native to the area to construct the walls. Break-up long lengths of retaining walls with materials such as boulders and portions of dry-stacked boulder walls, or consider allowing portions of the existing slope to extend through the wall. Introduce plantings at the top and bottom of walls to create a softer look. Where terraced walls are utilized, incorporate planting between the terraces.
2. Existing vegetation should be retained wherever possible. When existing trees will be saved, the ground surface, and flow of water, should not be altered within an area that extends out 1-½ times the diameter of the drip line of the tree. Appropriate walls should be constructed to maintain existing grades.
3. All areas of exposed soil should be vegetated or covered with a stable layer of mulch as soon as the site grading is completed. All slope areas should be planted with trees, shrubs, and ground covers that are both appropriate for the area and are known to be effective for erosion control (see list of "Suggested Plants for Slope Retention/Stabilization").
4. All exposed slopes should be stabilized to prevent erosion and sedimentation. The following is a partial list of options to consider instead of (or in addition to) planting: geotextile mats, erosion control blankets, temporary/permanent seeding, reinforced mats, bonded fiber matrices and stone blankets.
5. Where possible, keep drainage as a natural, sheet surface flow. Runoff should be directed into grassed or vegetated swales, detention basins, landscaped areas, storm drains or other areas located downstream that are not prone to erosion.



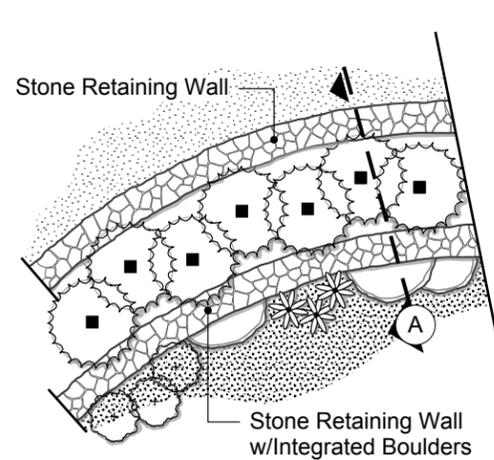
**Plan View**  
Dry-Stacked Boulder Wall



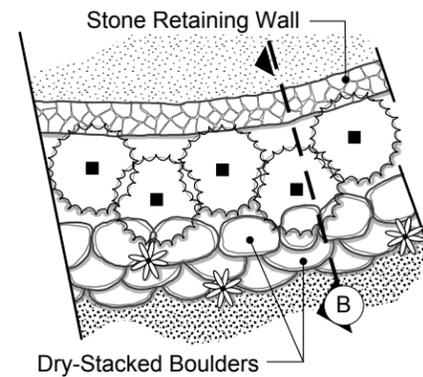
**Section View "A"**  
Dry-Stacked Boulder Wall

## STONE/ BOULDER RETAINING WALL/ EXISTING GRADES RETAINED

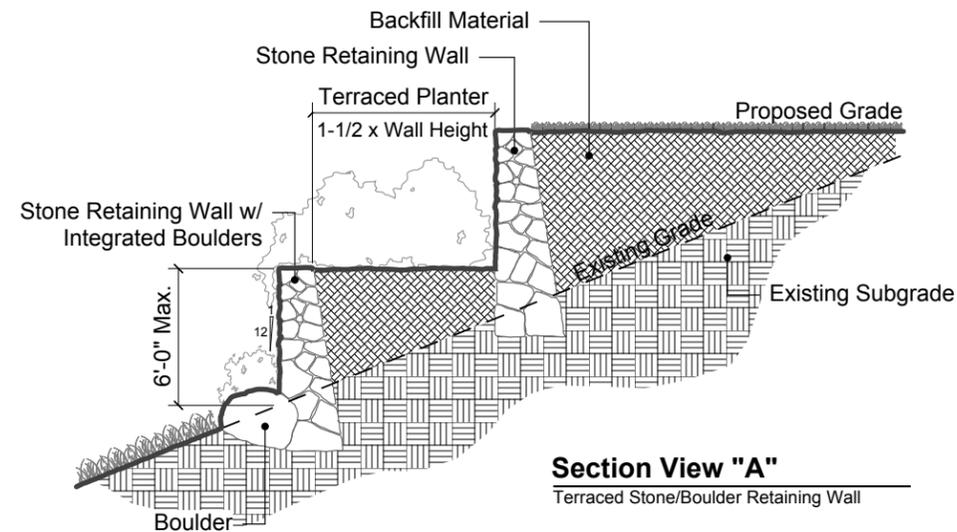
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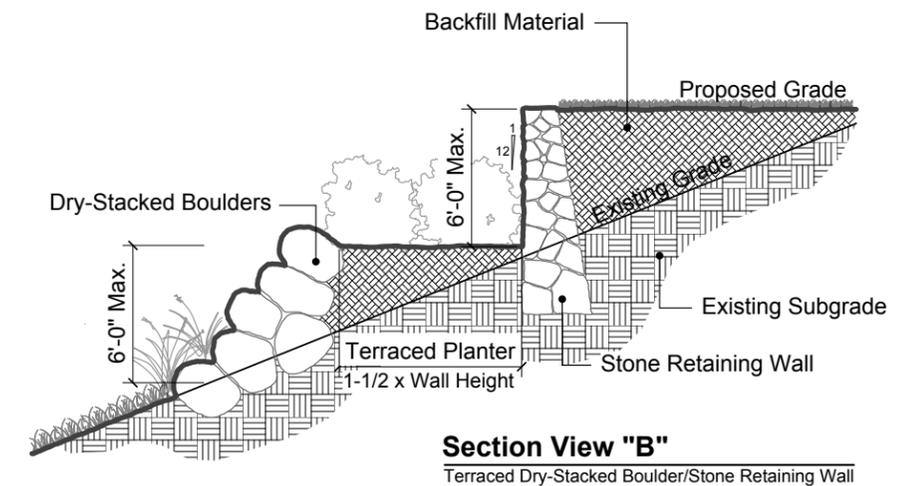
**Plan View**  
Stone Retaining Wall w/ Boulders



**Plan View**  
Dry-Stacked Boulder Wall



**Section View "A"**  
Terraced Stone/Boulder Retaining Wall



**Section View "B"**  
Terraced Dry-Stacked Boulder/Stone Retaining Wall

## TERRACED STONE/DRY-STACKED BOULDER RETAINING WALLS

Scale: 1/4"=1'-0"

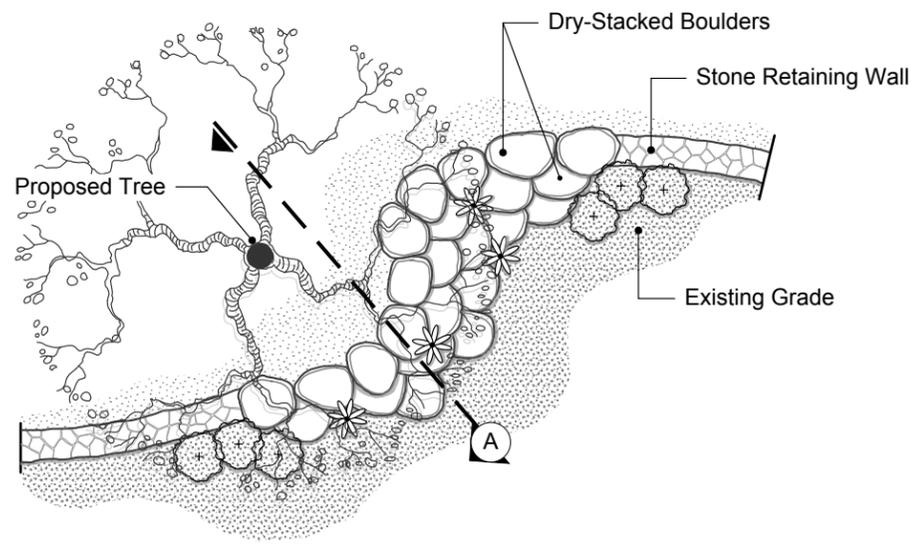
### DESIGN CONCEPTS FOR EROSION AND SEDIMENT CONTROL Alternate Approaches For Slope Retention/Stabilization

Prepared For:

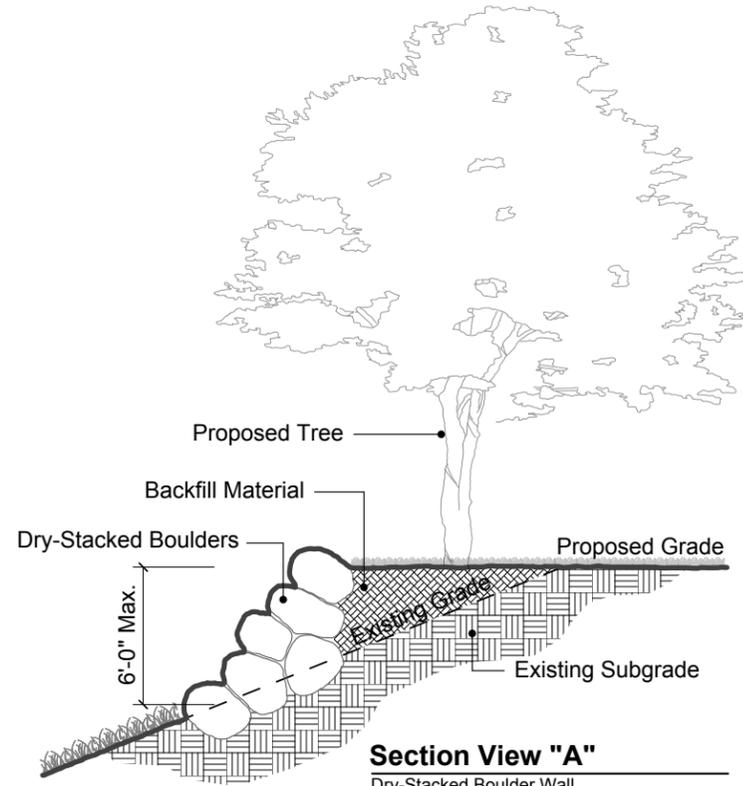
**Kohala Shoreline, LLC**

TMK: (3) 5-9-001:008  
Kahualii'i, North Kohala, Hawaii  
November 11, 2015

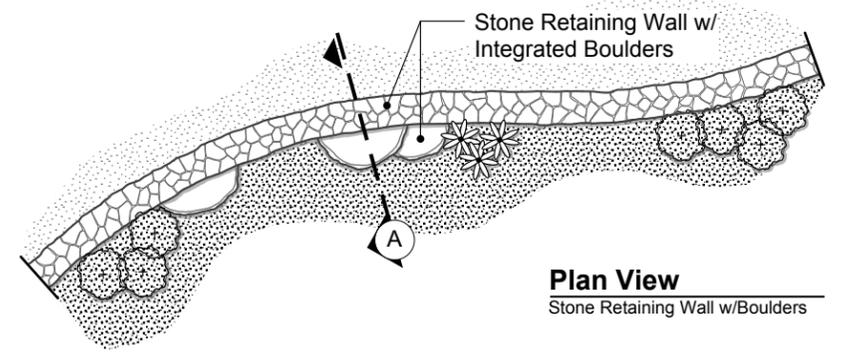




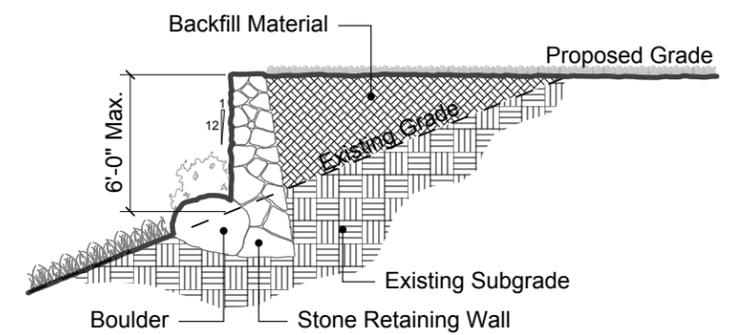
**Plan View**  
Dry-Stacked Boulder Wall



**Section View "A"**  
Dry-Stacked Boulder Wall



**Plan View**  
Stone Retaining Wall w/Boulders



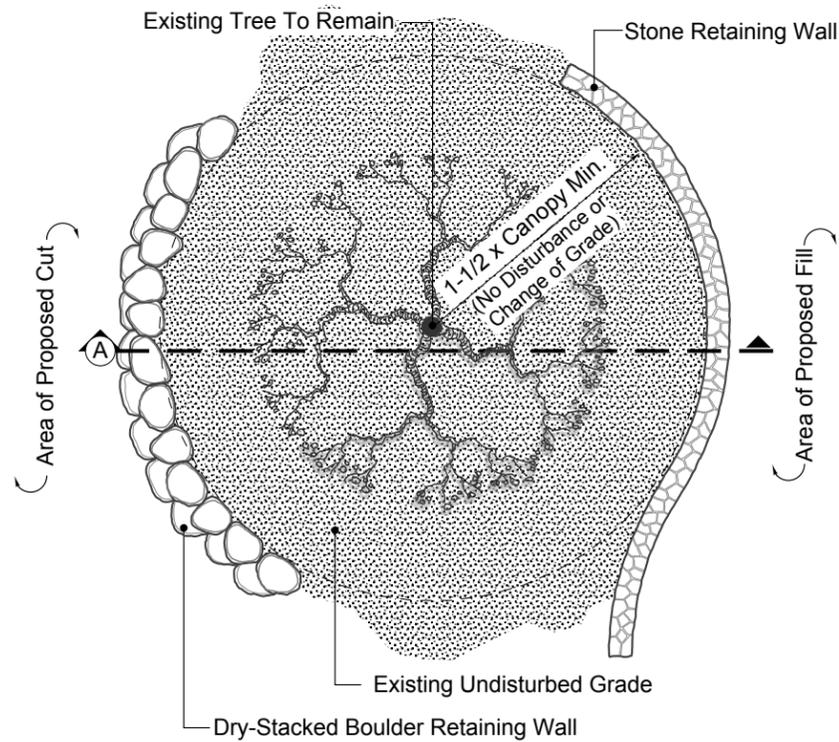
**Section View "A"**  
Stone Retaining Wall w/Boulders

**STONE RETAINING/ DRY-STACKED BOULDER WALL**

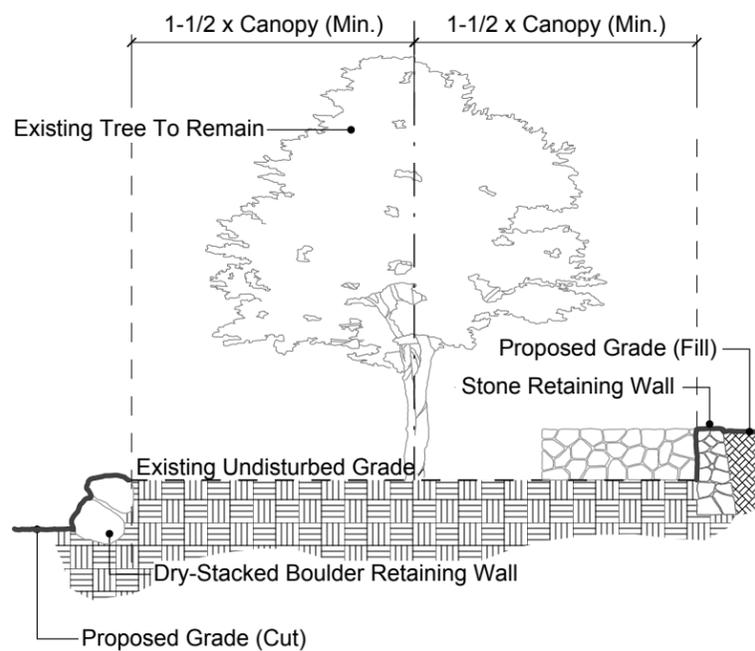
Scale: 1/4"=1'-0"

**STONE RETAINING WALL WITH INTEGRATED BOULDERS**

Scale: 1/4"=1'-0"



**Typical Plan View**  
Proposed Grade Change Around Existing Tree



**Typical Section View**  
Proposed Grade Change Around Existing Tree

Scale: 1/4"=1'-0"

**PROTECT EXISTING TREES**

**DESIGN CONCEPTS FOR  
EROSION AND SEDIMENT CONTROL**  
Alternate Approaches For Slope Retention/Stabilization

Prepared For:  
**Kohala Shoreline, LLC**  
TMK: (3) 5-9-001:008  
Kahualii'i, North Kohala, Hawaii  
November 11, 2015



bk design group, llc  
Landscape Architecture & Site Planning

# SUGGESTED PLANTS FOR SLOPE RETENTION AND STABILIZATION

## TREES:



Photo Credit: Forest & Kim Starr  
*Aleurites moluccana*  
Kukui



Photo Credit: Forest & Kim Starr  
*Cordia subcordata*  
Kou



Photo Credit: Forest & Kim Starr  
*Hibiscus tiliaceus*  
Dwarf Hau



Photo Credit: Forest & Kim Starr  
*Pandanus tectorius*  
Hala



Photo Credit: Forest & Kim Starr  
*Pritchardia* spp.  
Loulu



Photo Credit: Forest & Kim Starr  
*Prosopis pallida*  
Kiawe



Photo Credit: Forest & Kim Starr  
*Thespesia populnea*  
Milo



Photo Credit: Forest & Kim Starr  
*Tournefortia argentea*  
Beach Heliotrope

## SHRUBS:



Photo Credit: Forest & Kim Starr  
*Capparis sandwichiana*  
Maiapilo



Photo Credit: Forest & Kim Starr  
*Dodonaea viscosa*  
'A'ali'i



Photo Credit: Forest & Kim Starr  
*Gossypium tomentosum*  
Mao



Photo Credit: Forest & Kim Starr  
*Myoporum sandwicense*  
Naio



Photo Credit: Forest & Kim Starr  
*Nototrichium sandwicense*  
Kulu'i



Photo Credit: Forest & Kim Starr  
*Osteomeles anthyllidifolia*  
'Ulei



Photo Credit: Forest & Kim Starr  
*Scaevola taccada*  
Naupaka



Photo Credit: Forest & Kim Starr  
*Wikstroemia uva-ursi*  
'Akia

## GROUNDCOVERS AND GRASSES:



Photo Credit: Forest & Kim Starr  
*Eragrostis variabilis*  
Kawelu



Photo Credit: Forest & Kim Starr  
*Heteropogon contortus*  
Pili



Photo Credit: Forest & Kim Starr  
*Ipomoea pes-caprae brasiliensis*  
Pohuehue



Photo Credit: Forest & Kim Starr  
*Jaquemontia ovalifolia sandwicensis*  
Pa'u o Hi'iaka



Photo Credit: Forest & Kim Starr  
*Melanthera integrifolia*  
Nehe



Photo Credit: Forest & Kim Starr  
*Myoporum sandwicense*  
Naio Papa



Photo Credit: Forest & Kim Starr  
*Nephrolepis cordifolia*  
Kupukupu



Photo Credit: Forest & Kim Starr  
*Plumbago zeylanica*  
'Ilie'e



Photo Credit: Forest & Kim Starr  
*Sesuvium portulacastrum*  
'Akulikuli



Photo Credit: Forest & Kim Starr  
*Sida fallax*  
'Ilima



Photo Credit: Forest & Kim Starr  
*Sporobolus virginicus*  
'Aki'aki



Photo Credit: Forest & Kim Starr  
*Vigna marina*  
Nanea



Photo Credit: Forest & Kim Starr  
*Vitex rotundifolia*  
Pohinahina

**DESIGN CONCEPTS FOR  
EROSION AND SEDIMENT CONTROL**  
Alternate Approaches For Slope Retention/Stabilization

Prepared For:  
**Kohala Shoreline, LLC**  
TMK: (3) 5-9-001:008  
Kahuali'i'i, North Kohala, Hawaii  
November 11, 2015

**b+k design group, llc**  
Landscape Architecture & Site Planning

## MAXIMIZE PERCOLATION/ MINIMIZE RUNOFF:

Impervious surfaces such as roofs, driveway and parking areas, patios, pool decks, walkways, etc. reduce the absorption of rainwater into the ground and increase surface runoff. The following should be considered in the development of each parcel to maximize percolation and minimize runoff:

1. Impervious surfaces should be reduced to the smallest area possible. All other areas should be maintained as landscaped area and covered with planting, porous stone ground cover or mulch. All existing vegetated areas should be retained.
2. Utilize porous materials for driveways, parking areas, and outdoor spaces wherever possible. Rainwater from non-porous or semi-porous surfaces should be directed onto landscaped areas.
3. Existing vegetated areas and proposed landscaped areas will reduce the velocity of storm water runoff and prevent erosion. Landscaped areas allow runoff to percolate into the soil, which promotes groundwater recharge, filters sediment and other pollutants, and helps to prevent flooding.
4. Install grassed swales or drainage trenches, as needed, to direct and transmit excess surface flow to detention basins to collect and slow down runoff from impervious surfaces.

## EXAMPLES OF POROUS SURFACES:



Photo Credit: Geoblock  
Reinforced Turf  
(w/ Non-Visible Plastic Grid)



Photo Credit: Turfstone  
Reinforced Turf  
(w/ Visible Concrete Grid)



Photo Credit: Rockmolds  
Cast-In-Place Concrete  
(w/ Faux Lava/Planted Joints)



Photo Credit: Texture, Inc.  
Natural Cut Basalt Stone  
(w/ Planted Joints)



Photo Credit: Geopave  
Reinforced Stone  
(w/ Non-Visible Plastic Grid)



Photo Credit: Turfstone  
Reinforced Stone  
(w/ Visible Concrete Grid)



Photo Credit: Pavestone  
Pre-Cast Concrete Paver  
(w/ Crushed Stone Joints)



Photo Credit: Posillico Contracting  
Gravel w/Stone Edge  
(w/ Cut Stone Edge)

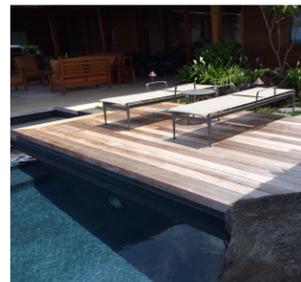
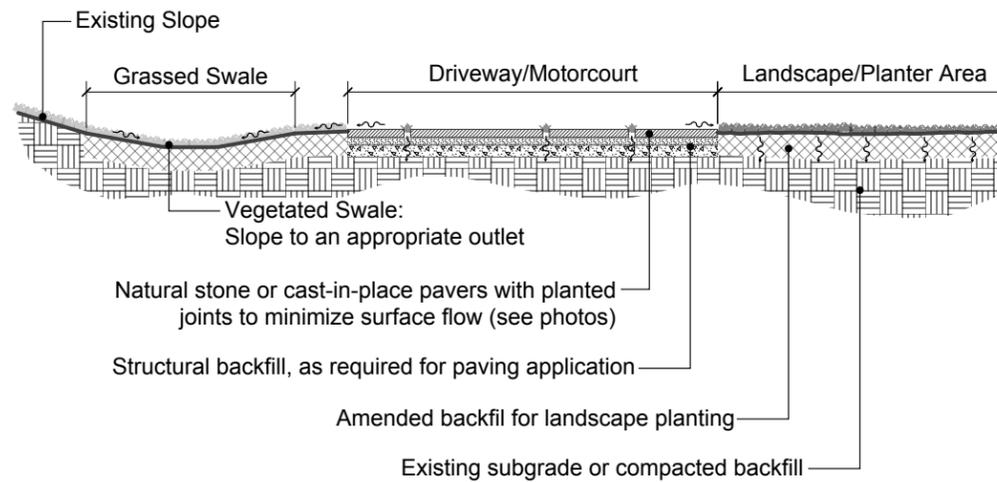
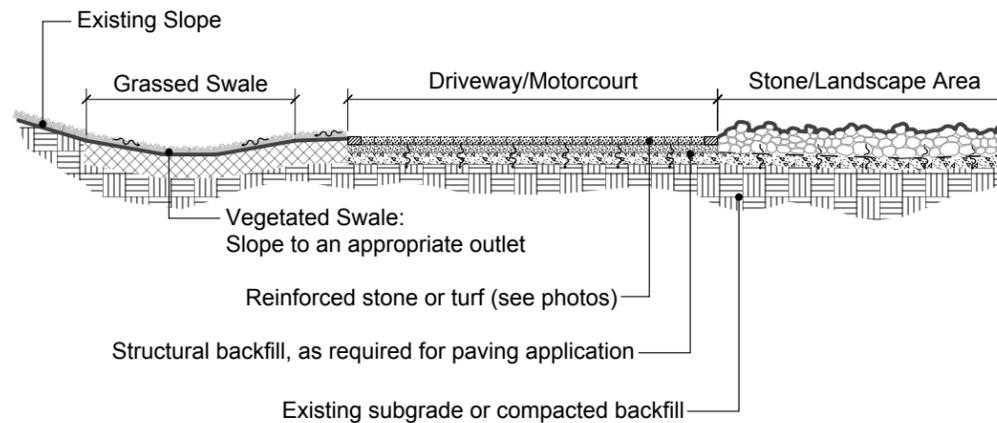


Photo Credit: b+k design group  
Decking vs. Pavement



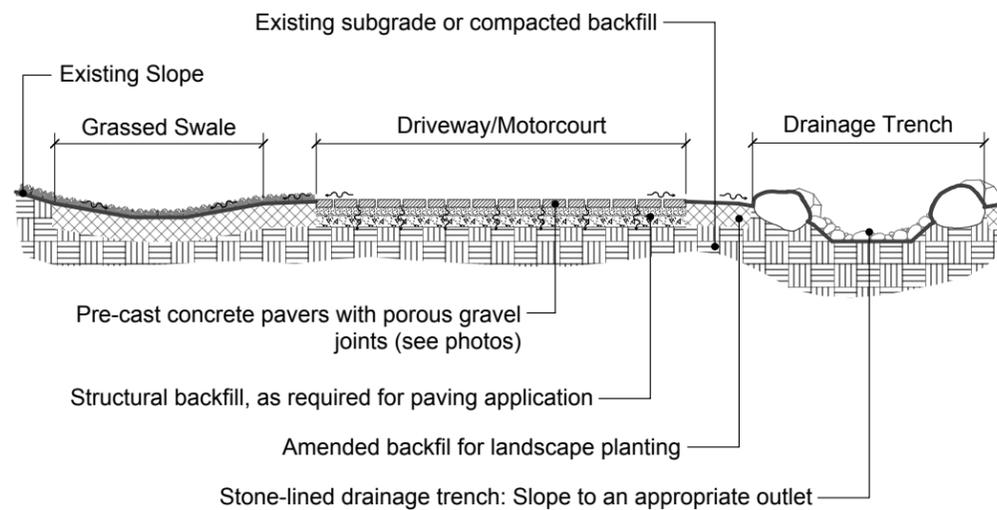
### Section View

Cut Stone or Cast-In-Place Concrete Paver w/ Planted Joints



### Section View

Reinforced Stone (Gravel) or Turf



### Section View

Pre-Cast Concrete Pavers w Gravel Joints

## POROUS PAVEMENT @ DRIVEWAY / MOTORCOURT

## IRRIGATION CONSIDERATIONS:

Proper design and monitoring of landscape irrigation is an important consideration in controlling erosion and sedimentation loss. The following should be considered in the development of each parcel when designing and maintaining an irrigation system:

1. Utilize low flow/low application rate irrigation heads and drip irrigation that will not apply water faster than it can be absorbed by the soil.
2. Separate irrigation valves/zones by plant type (combine plants with similar watering requirements), microclimate (ie. sunny areas vs. shady areas), and physical site differences (ie. slope areas vs. flat areas).
3. Install moisture sensors to monitor soil moisture and prevent over-saturation of the soil.
4. To prevent over-watering, install rain and wind sensors to by-pass the controller and shut off the irrigation in the event of rain or strong winds.
5. Install a flow sensor which will shut off the irrigation system in the event of a sudden pressure loss due to a broken head, ruptured mainline or lateral line, or defective valve.

Scale: 1/4"=1'-0"

## DESIGN CONCEPTS FOR EROSION AND SEDIMENT CONTROL

Maximizing Percolation/Minimizing Runoff

Prepared For:

**Kohala Shoreline, LLC**

TMK: (3) 5-9-001:008

Kahual'i'i'i, North Kohala, Hawaii

November 11, 2015



## TAKE A LESS ENGINEERED APPROACH TO SITE GRADING:

Minimizing the amount of disturbed area is an important consideration in terms of reducing erosion. The unique physical characteristics of a site are also important, and should be acknowledged and expressed in the site design and grading. Consider grading methods that strike a balance between the two and are not entirely focused on the efficiency of space. The following should be considered in the development of each parcel:

1. Encourage grading that keeps aesthetics in mind and is focused on the sense of place. All cut and fill slopes, retaining walls and other site features should be designed to blend into, and reflect the natural characteristic of the site and the surrounding area.
2. Consider the use of foundations and exterior spaces that step down with, or are set into, the natural topography.
3. Adjust site grading in order to retain existing vegetation and trees, wherever possible.

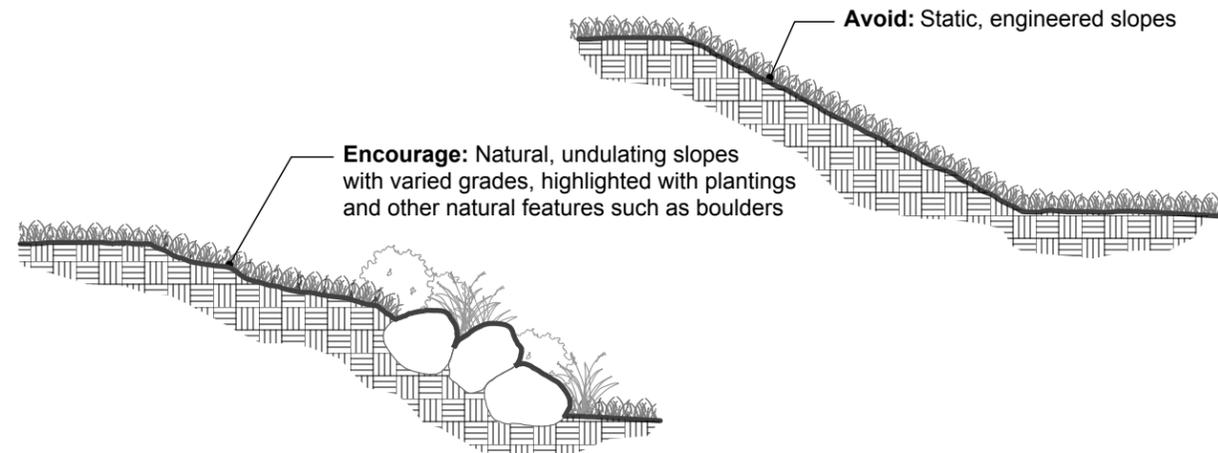


**Avoid:** Grading that has static, engineered slopes that look unnatural and do not blend in with the surrounding topography

**Encourage:** Grading that has natural, undulating slopes that mimic the adjacent landforms and blend into the surrounding topography

### GRADING CONCEPTS - Plan View

Not To Scale



**Encourage:** Natural, undulating slopes with varied grades, highlighted with plantings and other natural features such as boulders

**Avoid:** Static, engineered slopes

### GRADING CONCEPTS - Section View

Not To Scale

## DESIGN CONCEPTS FOR EROSION AND SEDIMENT CONTROL

Taking A Less Engineered Approach To Site Grading

Prepared For:

**Kohala Shoreline, LLC**

TMK: (3) 5-9-001:008  
Kahualii'i, North Kohala, Hawaii  
November 11, 2015



**bk design group, llc**  
Landscape Architecture & Site Planning

# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 6**

#### **Marine Research Consultants Baseline Data, November 2015**

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FIGURE 1. Aerial photograph of section of North Kohala shoreline showing the shoreline and inland boundary (Akoni Pule Hwy) of the Kohala Shoreline LLC project. Also shown are the locations of the three offshore water chemistry sampling transects that extend from the shoreline to open coastal waters.

**TABLE 1. Water chemistry measurements at three locations off of the Kohala coastline collected March 18, 2015 as part of the Kohala Shoreline LLC project. Nutrient concentrations are shown in micromolar units ( $\mu\text{M}$ ). Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity equal to or less than 32‰. For sampling transect locations, see Figure 1.**

TRANSECT	DFS (m)	DEPTH (ft)	PO <sub>4</sub> <sup>3-</sup> ( $\mu\text{M}$ )	NO <sub>3</sub> <sup>-</sup> ( $\mu\text{M}$ )	NH <sub>4</sub> <sup>+</sup> ( $\mu\text{M}$ )	Si ( $\mu\text{M}$ )	TOP ( $\mu\text{M}$ )	TON ( $\mu\text{M}$ )	TP ( $\mu\text{M}$ )	TN ( $\mu\text{M}$ )	TURB (NTU)	SALINITY (o/oo)	CHL a ( $\mu\text{g/L}$ )	TEMP (deg. C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	0.20	8.77	1.21	61.50	0.25	8.07	0.45	18.05	0.24	31.686	0.35	24.84	99.53	8.12
	1 S	1	0.17	3.46	0.66	33.91	0.28	7.82	0.45	11.94	0.23	33.237	0.39	24.95	100.66	8.13
	2 S	1	0.17	1.40	0.14	22.70	0.25	6.90	0.42	8.44	0.12	33.815	0.44	24.97	100.96	8.13
	3 S	2	0.16	1.36	0.14	23.67	0.24	6.33	0.40	7.83	0.11	33.784	0.39	25.02	101.54	8.13
	4 S	3	0.17	2.52	0.16	38.93	0.24	6.26	0.41	8.94	0.12	33.100	0.32	25.00	100.42	8.17
	5 S	1	0.14	0.60	0.14	11.84	0.26	6.15	0.40	6.89	0.09	34.184	0.20	25.02	100.48	8.16
	5 D	9	0.12	0.03	0.14	8.74	0.25	6.04	0.37	6.21	0.42	34.306	0.16	24.97	100.54	8.15
	10 S	1	0.15	0.76	0.19	13.40	0.24	5.81	0.39	6.76	0.08	34.133	0.19	25.05	100.57	8.15
	10 D	14	0.13	0.25	0.14	7.43	0.22	6.28	0.35	6.67	0.15	34.377	0.17	24.92	100.42	8.14
	50 S	1	0.15	0.81	0.12	15.12	0.24	6.32	0.39	7.25	0.10	34.077	0.16	25.07	100.35	8.15
	50 D	27	0.15	0.12	0.12	3.49	0.24	6.06	0.39	6.30	0.12	34.509	0.13	24.94	100.66	8.13
	100 S	1	0.17	0.48	0.11	12.10	0.24	6.16	0.41	6.75	0.06	34.194	0.18	25.08	101.43	8.13
	100 D	54	0.13	0.02	0.11	1.72	0.25	5.78	0.38	5.91	0.13	34.594	0.20	24.94	100.47	8.14
	200 S	1	0.15	0.05	0.13	1.47	0.26	6.59	0.41	6.77	0.07	34.527	0.11	25.10	100.57	8.15
200 D	73	0.12	BDL	0.12	1.53	0.27	5.88	0.39	6.00	0.12	34.546	0.09	24.95	100.12	8.15	
TRANSECT 2 (CENTER)	0 S	0	0.25	4.42	0.10	39.08	0.25	6.76	0.50	11.28	0.22	32.668	0.48	24.48	98.53	8.15
	1 S	1	0.30	5.58	0.22	44.32	0.22	6.80	0.52	12.60	0.20	32.483	0.23	24.77	99.34	8.15
	2 S	2	0.23	2.81	0.12	21.76	0.24	5.96	0.47	8.89	0.15	33.547	0.17	24.92	99.57	8.15
	3 S	2	0.19	1.95	0.12	19.89	0.24	6.11	0.43	8.18	0.23	33.545	0.16	24.98	100.32	8.15
	4 S	3	0.17	0.29	0.14	10.00	0.25	5.85	0.42	6.28	0.08	34.383	0.13	25.02	101.21	8.15
	5 S	1	0.20	1.27	0.14	17.60	0.23	6.74	0.43	8.15	0.14	34.027	0.14	25.02	100.56	8.15
	5 D	6	0.12	0.02	0.10	8.92	0.27	7.25	0.39	7.37	0.15	34.407	0.14	25.04	100.32	8.14
	10 S	1	0.17	1.58	0.08	21.49	0.27	6.30	0.44	7.96	0.16	33.847	0.17	25.25	101.21	8.15
	10 D	10	0.12	BDL	0.09	6.32	0.24	6.79	0.36	6.89	0.13	34.501	0.13	24.96	101.57	8.14
	50 S	1	0.18	0.34	0.10	9.10	0.24	6.42	0.42	6.86	0.10	34.375	0.12	25.16	101.95	8.14
	50 D	22	0.16	0.11	0.03	5.64	0.21	6.79	0.37	6.93	0.13	34.477	0.13	24.94	100.53	8.13
	100 S	1	0.14	0.61	0.12	14.95	0.29	6.02	0.43	6.75	0.10	34.157	0.14	25.17	101.21	8.12
	100 D	36	0.12	BDL	0.11	3.49	0.29	6.35	0.41	6.47	0.10	34.623	0.16	24.98	99.42	8.14
	200 S	1	0.15	BDL	0.14	3.22	0.25	6.40	0.40	6.55	0.05	34.511	0.09	25.08	101.21	8.15
200 D	54	0.15	BDL	0.13	3.15	0.23	6.62	0.38	6.76	0.13	34.546	0.11	24.97	100.60	8.14	
TRANSECT 3 (SOUTH)	0 S	0	0.19	5.10	0.63	34.34	0.24	8.01	0.43	13.74	0.56	33.667	0.23	24.76	99.43	8.13
	1 S	1	0.18	3.94	0.13	29.45	0.23	7.11	0.41	11.18	0.79	33.829	0.26	24.78	99.81	8.13
	2 S	1	0.11	3.72	0.10	29.04	0.26	6.62	0.37	10.44	0.54	33.831	0.25	24.80	100.21	8.14
	3 S	2	0.14	3.22	0.11	26.48	0.25	6.56	0.39	9.89	0.31	33.918	0.21	24.94	100.33	8.14
	4 S	3	0.10	2.64	0.14	26.04	0.26	6.84	0.36	9.62	0.29	33.978	0.18	24.98	101.21	8.14
	5 S	1	0.22	4.55	0.10	34.15	0.23	6.24	0.45	10.89	0.42	33.734	0.19	25.02	101.29	8.14
	5 D	6	0.71	0.04	0.09	10.08	0.20	7.09	0.91	7.22	0.21	34.417	0.14	25.00	100.21	8.14
	10 S	1	0.22	1.64	0.05	15.47	0.25	6.68	0.47	8.37	0.27	34.252	0.21	25.06	100.53	8.15
	10 D	14	0.23	0.02	0.09	5.50	0.23	7.23	0.46	7.34	0.48	34.532	0.13	24.94	100.57	8.15
	50 S	1	0.24	1.19	0.09	11.92	0.26	6.89	0.50	8.17	0.16	34.348	0.14	25.07	101.21	8.15
	50 D	25	0.16	0.03	0.03	2.75	0.26	6.84	0.42	6.90	0.26	34.569	0.11	25.00	100.53	8.15
	100 S	1	0.17	0.23	0.12	5.61	0.27	6.48	0.44	6.83	0.06	34.474	0.12	25.06	101.12	8.15
	100 D	38	0.19	0.03	BDL	3.49	0.22	6.17	0.41	6.20	0.19	34.541	0.12	24.98	100.58	8.15
	200 S	1	0.18	0.05	0.11	1.51	0.24	6.29	0.42	6.45	0.05	34.538	0.11	24.94	101.21	8.16
200 D	62	0.15	BDL	0.06	1.60	0.25	5.89	0.40	5.96	0.12	34.537	0.11	24.92	101.84	8.16	
WELL 1 (6549-01)			3.30	70.45	1.05	875	0.15	12.00	3.45	83.50	-	0.228	-			-
WELL 2 (6451-03)			1.50	92.05	1.30	962	0.65	1.75	2.15	95.10	-	1.712	-			-

TABLE 2. Water chemistry measurements (in µg/L) at three locations off of the Kohala coastline collected March 18, 2015 as part of the Kohala Shoreline LLC project. Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity equal to or less than 32‰. Shading indicates values higher than DOH Geometric mean standards for West Hawaii (GM standards are also shown). For sampling transect locations, see Figure 1.

TRANSECT	DFS (m)	DEPTH (ft)	PO <sub>4</sub> <sup>3-</sup> (µg/L)	NO <sub>3</sub> <sup>-</sup> (µg/L)	NH <sub>4</sub> <sup>+</sup> (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (o/oo)	CHL a (µg/L)	TEMP (deg.C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	6.20	122.8	16.94	1728	7.75	113.0	13.95	252.7	0.24	31.686	0.35	25.35	97.40	8.12
	1 S	1	5.27	48.44	9.24	952.9	8.68	109.5	13.95	167.2	0.23	33.237	0.39	25.46	99.43	8.13
	2 S	1	5.27	19.60	1.96	637.9	7.75	96.60	13.02	118.2	0.12	33.815	0.44	25.48	99.34	8.13
	3 S	2	4.96	19.04	1.96	665.1	7.44	88.62	12.40	109.6	0.11	33.784	0.39	25.53	100.23	8.13
	4 S	3	5.27	35.28	2.24	1094	7.44	87.64	12.71	125.2	0.12	33.100	0.32	25.51	100.53	8.17
	5 S	1	4.34	8.40	1.96	332.7	8.06	86.10	12.40	96.46	0.09	34.184	0.20	25.53	99.53	8.16
	5 D	9	3.72	0.42	1.96	245.6	7.75	84.56	11.47	86.94	0.42	34.306	0.16	25.48	98.34	8.15
	10 S	1	4.65	10.64	2.66	376.5	7.44	81.34	12.09	94.64	0.08	34.133	0.19	25.56	99.34	8.15
	10 D	14	4.03	3.50	1.96	208.8	6.82	87.92	10.85	93.38	0.15	34.377	0.17	25.43	97.45	8.14
	50 S	1	4.65	11.34	1.68	424.9	7.44	88.48	12.09	101.5	0.10	34.077	0.16	25.58	100.32	8.15
	50 D	27	4.65	1.68	1.68	98.07	7.44	84.84	12.09	88.20	0.12	34.509	0.13	25.45	99.43	8.13
	100 S	1	5.27	6.72	1.54	340.0	7.44	86.24	12.71	94.50	0.06	34.194	0.18	25.59	101.23	8.13
	100 D	54	4.03	0.28	1.54	48.33	7.75	80.92	11.78	82.74	0.13	34.594	0.20	25.45	99.42	8.14
	200 S	1	4.65	0.70	1.82	41.31	8.06	92.26	12.71	94.78	0.07	34.527	0.11	25.61	100.34	8.15
200 D	73	3.72	BDL	1.68	42.99	8.37	82.32	12.09	84.00	0.12	34.546	0.09	25.46	99.34	8.15	
TRANSECT 2 (CENTER)	0 S	0	7.75	61.88	1.40	1098	7.75	94.64	15.50	157.9	0.22	32.668	0.48	24.99	95.34	8.15
	1 S	1	9.30	78.12	3.08	1245	6.82	95.20	16.12	176.4	0.20	32.483	0.23	25.28	97.34	8.15
	2 S	2	7.13	39.34	1.68	611.5	7.44	83.44	14.57	124.5	0.15	33.547	0.17	25.43	98.34	8.15
	3 S	2	5.89	27.30	1.68	558.9	7.44	85.54	13.33	114.5	0.23	33.545	0.16	25.49	99.84	8.15
	4 S	3	5.27	4.06	1.96	281.0	7.75	81.90	13.02	87.92	0.08	34.383	0.13	25.53	99.98	8.15
	5 S	1	6.20	17.78	1.96	494.6	7.13	94.36	13.33	114.1	0.14	34.027	0.14	25.53	99.76	8.15
	5 D	6	3.72	0.28	1.40	250.7	8.37	101.5	12.09	103.2	0.15	34.407	0.14	25.55	98.34	8.14
	10 S	1	5.27	22.12	1.12	603.9	8.37	88.20	13.64	111.4	0.16	33.847	0.17	25.76	100.23	8.15
	10 D	10	3.72	BDL	1.26	177.6	7.44	95.06	11.16	96.46	0.13	34.501	0.13	25.47	100.34	8.14
	50 S	1	5.58	4.76	1.40	255.7	7.44	89.88	13.02	96.04	0.10	34.375	0.12	25.67	101.24	8.14
	50 D	22	4.96	1.54	0.42	158.5	6.51	95.06	11.47	97.02	0.13	34.477	0.13	25.45	99.34	8.13
	100 S	1	4.34	8.54	1.68	420.1	8.99	84.28	13.33	94.50	0.10	34.157	0.14	25.68	101.23	8.12
	100 D	36	3.72	BDL	1.54	98.07	8.99	88.90	12.71	90.58	0.10	34.623	0.16	25.49	98.30	8.14
	200 S	1	4.65	BDL	1.96	90.48	7.75	89.60	12.40	91.70	0.05	34.511	0.09	25.59	101.24	8.15
200 D	54	4.65	BDL	1.82	88.52	7.13	92.68	11.78	94.64	0.13	34.546	0.11	25.48	100.42	8.14	
TRANSECT 3 (SOUTH)	0 S	0	5.89	71.40	8.82	965.0	7.44	112.1	13.33	192.4	0.56	33.667	0.23	25.27	96.34	8.13
	1 S	1	5.58	55.16	1.82	827.5	7.13	99.54	12.71	156.5	0.79	33.829	0.26	25.29	97.83	8.13
	2 S	1	3.41	52.08	1.40	816.0	8.06	92.68	11.47	146.2	0.54	33.831	0.25	25.31	99.82	8.14
	3 S	2	4.34	45.08	1.54	744.1	7.75	91.84	12.09	138.5	0.31	33.918	0.21	25.45	99.10	8.14
	4 S	3	3.10	36.96	1.96	731.7	8.06	95.76	11.16	134.7	0.29	33.978	0.18	25.49	99.39	8.14
	5 S	1	6.82	63.70	1.40	959.6	7.13	87.36	13.95	152.5	0.42	33.734	0.19	25.53	100.20	8.14
	5 D	6	22.01	0.56	1.26	283.2	6.20	99.26	28.21	101.1	0.21	34.417	0.14	25.51	98.43	8.14
	10 S	1	6.82	22.96	0.70	434.7	7.75	93.52	14.57	117.2	0.27	34.252	0.21	25.57	100.35	8.15
	10 D	14	7.13	0.28	1.26	154.6	7.13	101.2	14.26	102.8	0.48	34.532	0.13	25.45	99.34	8.15
	50 S	1	7.44	16.66	1.26	335.0	8.06	96.46	15.50	114.4	0.16	34.348	0.14	25.58	101.24	8.15
	50 D	25	4.96	0.42	0.42	77.28	8.06	95.76	13.02	96.60	0.26	34.569	0.11	25.51	99.43	8.15
	100 S	1	5.27	3.22	1.68	157.6	8.37	90.72	13.64	95.62	0.06	34.474	0.12	25.57	100.23	8.15
	100 D	38	5.89	0.42	BDL	98.07	6.82	86.38	12.71	86.80	0.19	34.541	0.12	25.49	99.35	8.15
	200 S	1	5.58	0.70	1.54	42.43	7.44	88.06	13.02	90.30	0.05	34.538	0.11	25.45	101.32	8.16
200 D	62	4.65	BDL	0.84	44.96	7.75	82.46	12.40	83.44	0.12	34.537	0.11	25.43	100.93	8.16	
WELL 1 (6549-01)			102.3	986.3	14.70	24597	4.65	168.0	107.0	1169.0	-	0.228	-	-	-	-
WELL 2 (6451-03)			46.50	1288.7	18.20	27042	20.15	24.50	66.65	1331.4	-	1.712	-	-	-	-
WH GM std			5.00	4.50	2.50				12.50	100.0	0.10		0.30			

**TABLE 3. Water chemistry measurements at three locations off of the Kohala coastline collected December 17, 2009 as part of the Kohala Shoreline LLC project. Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity of 32‰. For sampling transect locations, see Figure 1.**

TRANSECT	DFS (m)	DEPTH (ft)	PO <sub>4</sub> <sup>3-</sup> (µM)	NO <sub>3</sub> <sup>-</sup> (µM)	NH <sub>4</sub> <sup>+</sup> (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	TURB (NTU)	SALINITY (o/oo)	CHL a (µg/L)	TEMP (deg.C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	0.04	0.12	0.85	4.90	0.34	11.16	0.38	12.13	0.49	34.557	0.50	25.35	97.40	8.18
	1 S	1	0.02	0.22	0.34	4.57	0.30	9.62	0.32	10.18	0.65	34.549	0.24	25.46	99.43	8.19
	2 S	1	0.03	0.05	0.14	4.83	0.29	8.04	0.32	8.23	0.20	34.543	0.14	25.48	99.34	8.21
	3 S	2	0.04	0.28	0.23	4.58	0.28	8.07	0.32	8.58	0.25	34.594	0.12	25.53	100.23	8.16
	4 S	3	0.05	0.19	0.06	3.55	0.32	9.51	0.37	9.76	0.19	34.575	0.09	25.51	100.53	8.17
	5 S	1	0.06	0.53	0.45	5.36	0.35	11.76	0.41	12.74	0.24	34.576	0.09	25.53	99.53	8.16
	5 D	9	0.03	0.25	0.14	3.78	0.30	9.11	0.33	9.50	0.16	34.574	0.13	25.48	98.34	8.17
	10 S	1	0.06	0.52	0.31	5.19	0.34	10.44	0.40	11.27	0.28	34.601	0.09	25.56	99.34	8.16
	10 D	14	0.04	0.13	0.04	3.07	0.28	10.44	0.32	10.61	0.13	34.599	0.07	25.43	97.45	8.17
	50 S	1	0.11	0.33	BDL	4.21	0.32	9.97	0.43	10.30	0.18	34.626	0.07	25.58	100.32	8.16
	50 D	27	0.05	0.21	0.36	2.82	0.32	11.77	0.37	12.34	0.12	34.610	0.05	25.45	99.43	8.16
	100 S	1	0.06	0.02	0.05	3.00	0.31	8.94	0.37	9.01	0.14	34.653	0.06	25.59	101.23	8.20
	100 D	54	0.05	0.09	0.05	1.91	0.29	7.76	0.34	7.90	0.10	34.644	0.07	25.45	99.42	8.21
	200 S	1	0.05	0.01	0.15	1.56	0.32	8.36	0.37	8.52	0.09	34.647	0.03	25.61	100.34	8.24
	200 D	73	0.06	BDL	0.15	1.33	0.42	7.65	0.48	7.80	0.11	34.644	0.03	25.46	99.34	8.23
	TRANSECT 2 (CENTER)	0 S	0	0.04	20.72	0.05	181.56	0.51	12.48	0.55	33.25	0.27	27.474	0.17	24.99	95.34
1 S		1	0.04	10.30	0.52	92.77	0.35	13.09	0.39	23.91	0.42	31.148	0.20	25.28	97.34	8.29
2 S		2	0.06	1.44	0.40	18.46	0.34	9.38	0.40	11.22	0.40	34.050	0.24	25.43	98.34	8.18
3 S		2	0.12	0.56	0.11	8.67	0.33	9.36	0.45	10.03	0.48	34.468	0.05	25.49	99.84	8.09
4 S		3	0.13	0.11	0.21	4.36	0.30	8.85	0.43	9.17	0.26	34.601	0.06	25.53	99.98	8.20
5 S		1	0.04	0.07	0.38	4.26	0.29	8.30	0.33	8.75	0.23	34.607	0.03	25.53	99.76	8.19
5 D		6	0.03	0.01	0.26	2.91	0.30	8.47	0.33	8.74	0.22	34.644	0.07	25.55	98.34	8.19
10 S		1	0.02	0.03	0.12	1.88	0.29	9.19	0.31	9.34	0.08	34.655	0.02	25.76	100.23	8.20
10 D		10	0.09	0.07	0.06	2.10	0.29	6.88	0.38	7.01	0.08	34.658	0.05	25.47	100.34	8.14
50 S		1	0.04	0.05	0.02	1.76	0.28	8.25	0.32	8.32	0.08	34.656	0.05	25.67	101.24	8.14
50 D		22	0.03	0.01	0.08	1.64	0.27	8.97	0.30	9.06	0.10	34.648	0.04	25.45	99.34	8.13
100 S		1	0.03	0.03	0.06	1.67	0.27	7.54	0.30	7.63	0.08	34.662	0.03	25.68	101.23	8.20
100 D		36	0.03	0.01	0.06	1.78	0.26	7.01	0.29	7.08	0.08	34.655	0.03	25.49	98.30	8.21
200 S		1	0.05	0.01	0.05	1.55	0.25	7.46	0.30	7.52	0.09	34.646	0.03	25.59	101.24	8.24
200 D		54	0.05	0.01	0.07	1.23	0.35	7.04	0.40	7.12	0.07	34.643	0.03	25.48	100.42	8.23
TRANSECT 3 (SOUTH)		0 S	0	0.12	3.54	0.23	28.49	0.28	7.67	0.40	11.44	1.11	33.927	0.17	25.27	96.34
	1 S	1	0.05	3.46	0.79	26.41	0.28	9.41	0.33	13.66	0.75	33.979	0.14	25.29	97.83	8.25
	2 S	1	0.09	3.25	0.07	26.63	0.27	6.34	0.36	9.66	0.68	33.970	0.18	25.31	99.82	8.17
	3 S	2	0.06	1.40	0.16	14.26	0.25	8.60	0.31	10.16	0.84	34.418	0.12	25.45	99.10	8.19
	4 S	3	0.09	0.77	0.36	9.55	0.27	8.68	0.36	9.81	0.55	34.499	0.12	25.49	99.39	8.20
	5 S	1	0.05	0.40	0.43	4.48	0.27	8.09	0.32	8.92	0.25	34.607	0.09	25.53	100.20	8.05
	5 D	6	0.07	0.28	0.29	4.74	0.28	8.47	0.35	9.04	0.26	34.590	0.07	25.51	98.43	8.05
	10 S	1	0.05	0.32	0.27	3.85	0.25	6.25	0.30	6.84	0.24	34.629	0.08	25.57	100.35	8.05
	10 D	14	0.18	0.32	0.36	2.81	0.27	7.87	0.45	8.55	0.16	34.650	0.07	25.45	99.34	8.05
	50 S	1	0.10	0.27	0.41	2.00	0.29	6.68	0.39	7.36	0.09	34.664	0.10	25.58	101.24	8.06
	50 D	25	0.04	0.25	0.06	2.73	0.27	9.74	0.31	10.05	0.18	34.640	0.05	25.51	99.43	8.06
	100 S	1	0.12	0.02	0.16	2.25	0.25	8.65	0.37	8.83	0.11	34.655	0.04	25.57	100.23	8.08
	100 D	38	0.08	0.01	0.06	1.78	0.21	7.02	0.29	7.09	0.08	34.601	0.03	25.49	99.35	8.21
	200 S	1	0.06	0.02	0.05	1.56	0.23	7.72	0.29	7.79	0.08	34.666	0.03	25.45	101.32	8.24
	200 D	62	0.04	0.01	0.04	1.24	0.23	7.10	0.27	7.15	0.06	34.642	0.03	25.43	100.93	8.22
	WELL 1 (6549-01)			3.30	70.45	1.05	875	0.15	12.00	3.45	83.50	-	0.228	-		
WELL 2 (6451-03)			1.50	92.05	1.30	962	0.65	1.75	2.15	95.10	-	1.712	-			-

**TABLE 4. Water chemistry measurements (in µg/L at three locations off of the Kohala coastline collected December 17, 2009 as part of the Kohala Shoreline LLC project. Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity of 32‰. For sampling transect locations, see Figure 1.**

TRANSECT	DFS (m)	DEPTH (ft)	PO <sub>4</sub> <sup>3-</sup> (µg/L)	NO <sub>3</sub> <sup>-</sup> (µg/L)	NH <sub>4</sub> <sup>+</sup> (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (o/oo)	CHL a (µg/L)	TEMP (deg.C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	1.24	1.68	11.90	137.7	10.54	156.2	11.78	169.8	0.49	34.557	0.50	25.35	97.40	8.18
	1 S	1	0.62	3.08	4.76	128.4	9.30	134.7	9.92	142.5	0.65	34.549	0.24	25.46	99.43	8.19
	2 S	1	0.93	0.70	1.96	135.7	8.99	112.6	9.92	115.2	0.20	34.543	0.14	25.48	99.34	8.21
	3 S	2	1.24	3.92	3.22	128.7	8.68	113.0	9.92	120.1	0.25	34.594	0.12	25.53	100.23	8.16
	4 S	3	1.55	2.66	0.84	99.8	9.92	133.1	11.47	136.6	0.19	34.575	0.09	25.51	100.53	8.17
	5 S	1	1.86	7.42	6.30	150.6	10.85	164.6	12.71	178.4	0.24	34.576	0.09	25.53	99.53	8.16
	5 D	9	0.93	3.50	1.96	106.2	9.30	127.5	10.23	133.0	0.16	34.574	0.13	25.48	98.34	8.17
	10 S	1	1.86	7.28	4.34	145.8	10.54	146.2	12.40	157.8	0.28	34.601	0.09	25.56	99.34	8.16
	10 D	14	1.24	1.82	0.56	86.27	8.68	146.2	9.92	148.5	0.13	34.599	0.07	25.43	97.45	8.17
	50 S	1	3.41	4.62	BDL	118.3	9.92	139.6	13.33	144.2	0.18	34.626	0.07	25.58	100.32	8.16
	50 D	27	1.55	2.94	5.04	79.24	9.92	164.8	11.47	172.8	0.12	34.610	0.05	25.45	99.43	8.16
	100 S	1	1.86	0.28	0.70	84.30	9.61	125.2	11.47	126.1	0.14	34.653	0.06	25.59	101.23	8.20
	100 D	54	1.55	1.26	0.70	53.67	8.99	108.6	10.54	110.6	0.10	34.644	0.07	25.45	99.42	8.21
	200 S	1	1.55	0.14	2.10	43.84	9.92	117.0	11.47	119.3	0.09	34.647	0.03	25.61	100.34	8.24
	200 D	73	1.86	BDL	2.10	37.37	13.02	107.1	14.88	109.2	0.11	34.644	0.03	25.46	99.34	8.23
	TRANSECT 2 (CENTER)	0 S	0	1.24	290.1	0.70	5101.8	15.81	174.7	17.05	465.5	0.27	27.474	0.17	24.99	95.34
1 S		1	1.24	144.2	7.28	2606.8	10.85	183.3	12.09	334.7	0.42	31.148	0.20	25.28	97.34	8.29
2 S		2	1.86	20.16	5.60	518.7	10.54	131.3	12.40	157.1	0.40	34.050	0.24	25.43	98.34	8.18
3 S		2	3.72	7.84	1.54	243.6	10.23	131.0	13.95	140.4	0.48	34.468	0.05	25.49	99.84	8.09
4 S		3	4.03	1.54	2.94	122.5	9.30	123.9	13.33	128.4	0.26	34.601	0.06	25.53	99.98	8.20
5 S		1	1.24	0.98	5.32	119.7	8.99	116.2	10.23	122.5	0.23	34.607	0.03	25.53	99.76	8.19
5 D		6	0.93	0.14	3.64	81.77	9.30	118.6	10.23	122.4	0.22	34.644	0.07	25.55	98.34	8.19
10 S		1	0.62	0.42	1.68	52.83	8.99	128.7	9.61	130.8	0.08	34.655	0.02	25.76	100.23	8.20
10 D		10	2.79	0.98	0.84	59.01	8.99	96.32	11.78	98.14	0.08	34.658	0.05	25.47	100.34	8.14
50 S		1	1.24	0.70	0.28	49.46	8.68	115.5	9.92	116.5	0.08	34.656	0.05	25.67	101.24	8.14
50 D		22	0.93	0.14	1.12	46.08	8.37	125.6	9.30	126.8	0.10	34.648	0.04	25.45	99.34	8.13
100 S		1	0.93	0.42	0.84	46.93	8.37	105.6	9.30	106.8	0.08	34.662	0.03	25.68	101.23	8.20
100 D		36	0.93	0.14	0.84	50.02	8.06	98.14	8.99	99.12	0.08	34.655	0.03	25.49	98.30	8.21
200 S		1	1.55	0.14	0.70	43.56	7.75	104.4	9.30	105.3	0.09	34.646	0.03	25.59	101.24	8.24
200 D	54	1.55	0.14	0.98	34.56	10.85	98.56	12.40	99.68	0.07	34.643	0.03	25.48	100.42	8.23	
TRANSECT 3 (SOUTH)	0 S	0	3.72	49.56	3.22	800.6	8.68	107.4	12.40	160.2	1.11	33.927	0.17	25.27	96.34	8.24
	1 S	1	1.55	48.44	11.06	742.1	8.68	131.7	10.23	191.2	0.75	33.979	0.14	25.29	97.83	8.25
	2 S	1	2.79	45.50	0.98	748.3	8.37	88.76	11.16	135.2	0.68	33.970	0.18	25.31	99.82	8.17
	3 S	2	1.86	19.60	2.24	400.7	7.75	120.4	9.61	142.2	0.84	34.418	0.12	25.45	99.10	8.19
	4 S	3	2.79	10.78	5.04	268.4	8.37	121.5	11.16	137.3	0.55	34.499	0.12	25.49	99.39	8.20
	5 S	1	1.55	5.60	6.02	125.9	8.37	113.3	9.92	124.9	0.25	34.607	0.09	25.53	100.20	8.05
	5 D	6	2.17	3.92	4.06	133.2	8.68	118.6	10.85	126.6	0.26	34.590	0.07	25.51	98.43	8.05
	10 S	1	1.55	4.48	3.78	108.2	7.75	87.50	9.30	95.76	0.24	34.629	0.08	25.57	100.35	8.05
	10 D	14	5.58	4.48	5.04	78.96	8.37	110.18	13.95	119.7	0.16	34.650	0.07	25.45	99.34	8.05
	50 S	1	3.10	3.78	5.74	56.20	8.99	93.52	12.09	103.0	0.09	34.664	0.10	25.58	101.24	8.06
	50 D	25	1.24	3.50	0.84	76.71	8.37	136.4	9.61	140.7	0.18	34.640	0.05	25.51	99.43	8.06
	100 S	1	3.72	0.28	2.24	63.23	7.75	121.10	11.47	123.6	0.11	34.655	0.04	25.57	100.23	8.08
	100 D	38	2.57	0.14	0.84	50.02	6.42	98.28	8.99	99.26	0.08	34.601	0.03	25.49	99.35	8.21
	200 S	1	1.86	0.28	0.70	43.84	7.13	108.1	8.99	109.1	0.08	34.666	0.03	25.45	101.32	8.24
200 D	62	1.24	0.14	0.56	34.84	7.13	99.40	8.37	100.1	0.06	34.642	0.03	25.43	100.93	8.22	
WELL 1 (6549-01)			102.3	986.3	14.70	24597	4.65	168.0	107.0	1169.0	-	0.228	-	-	-	-
WELL 2 (6451-03)			46.50	1288.7	18.20	27042	20.15	24.50	66.65	1331.4	-	1.712	-	-	-	-
WH GM std			5.00	4.50	2.50				12.50	100.00	0.10		0.30			

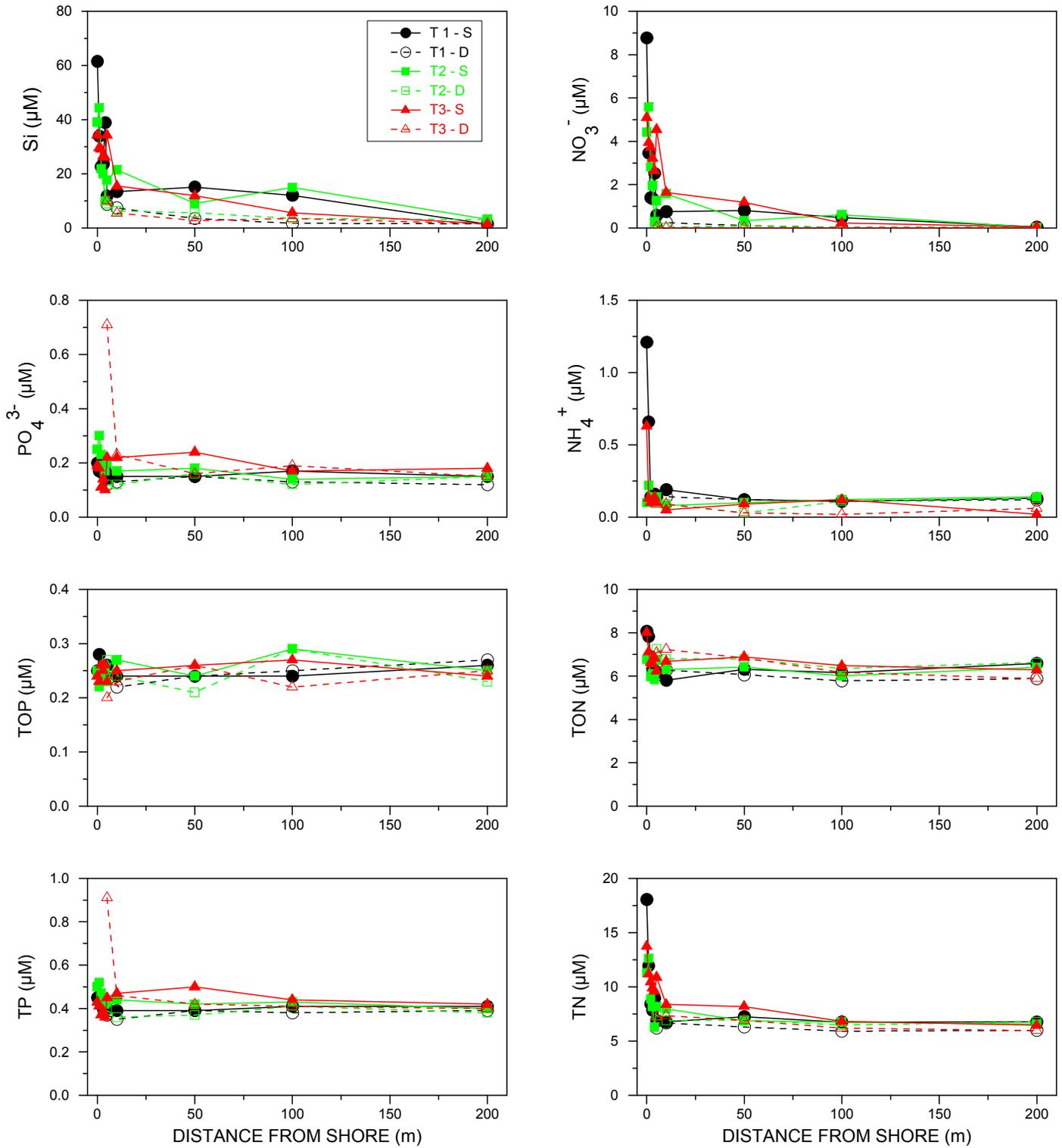


FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along transects offshore of Kohala on March 18, 2015 as a function of distance from the shoreline. For transect locations, see Figure 1.

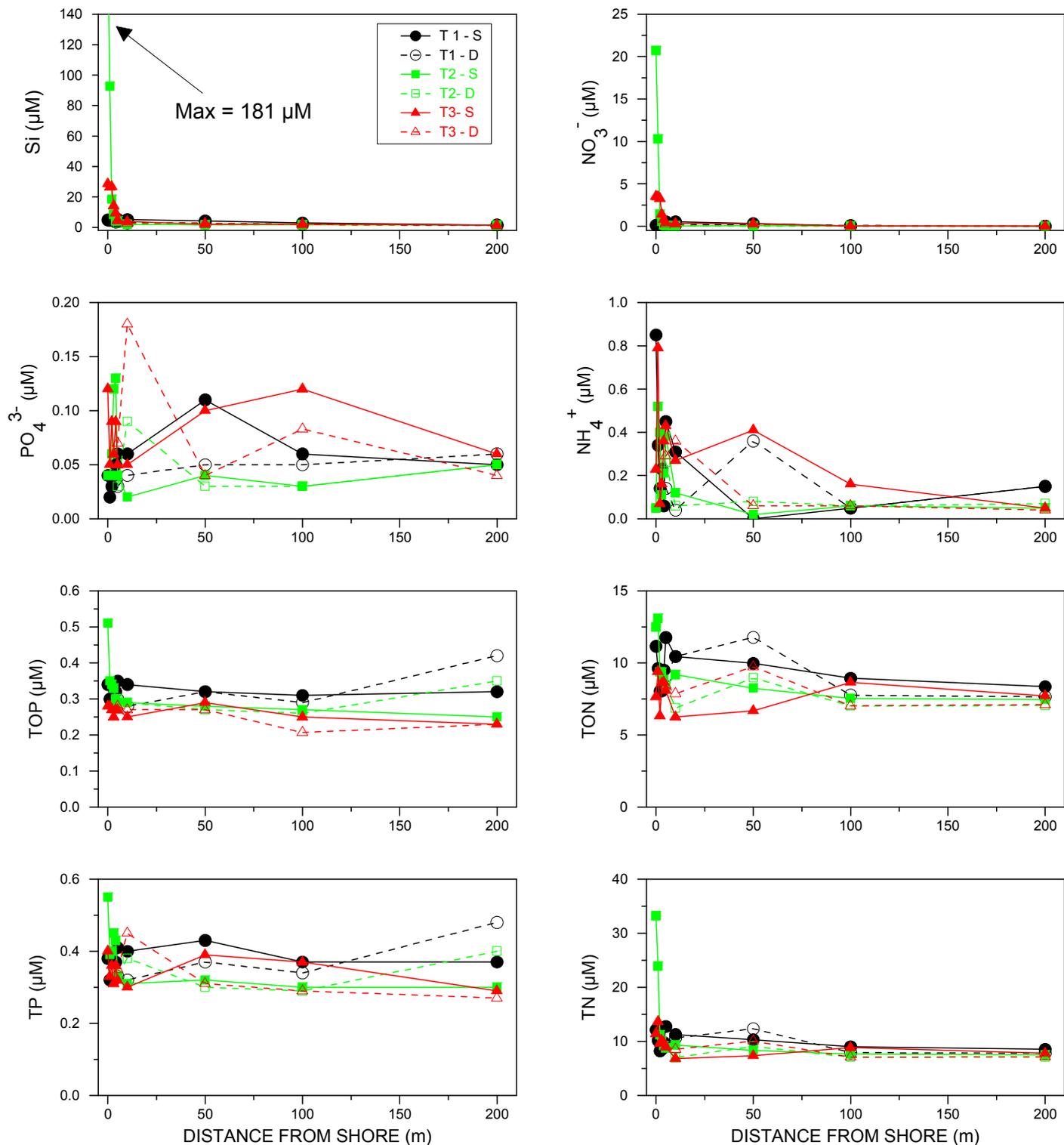


FIGURE 3. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along transects offshore of the Kohala Shoreline LLC property collected on December 17, 2009 as functions of distance from the shoreline. For transect locations, see Figure 1.

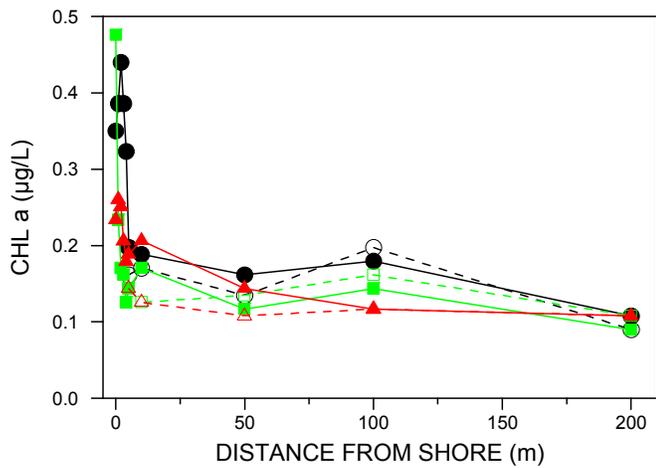
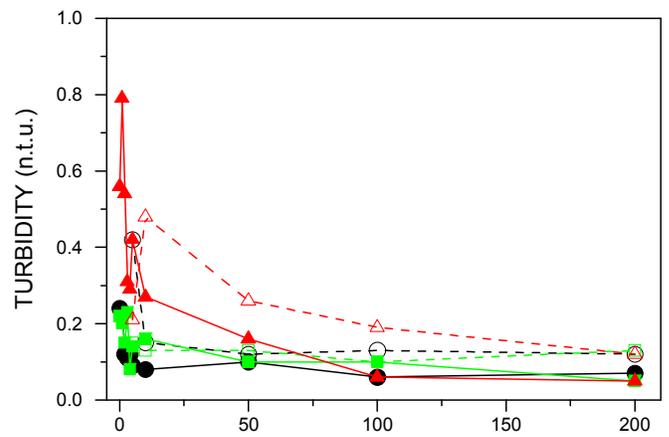
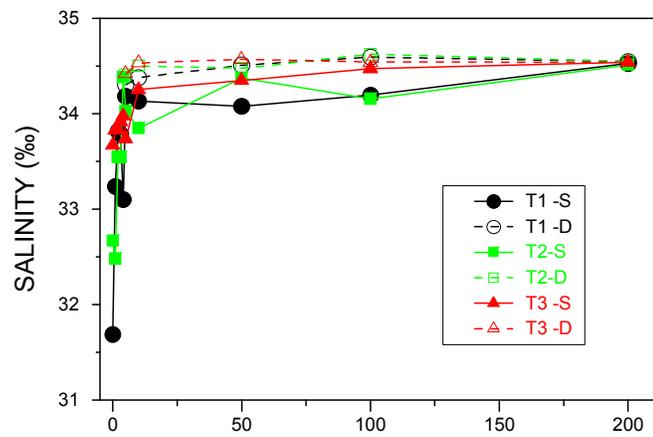


FIGURE 4. Plots of water chemistry constituents in surface (S) and deep (D) samples collected along three transects off Kohala on March 18, 2015 as a function of distance from the shoreline. For transect locations, see Figure 1.

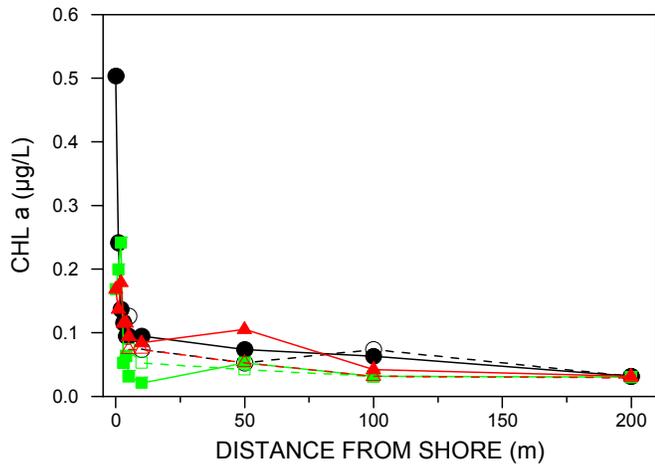
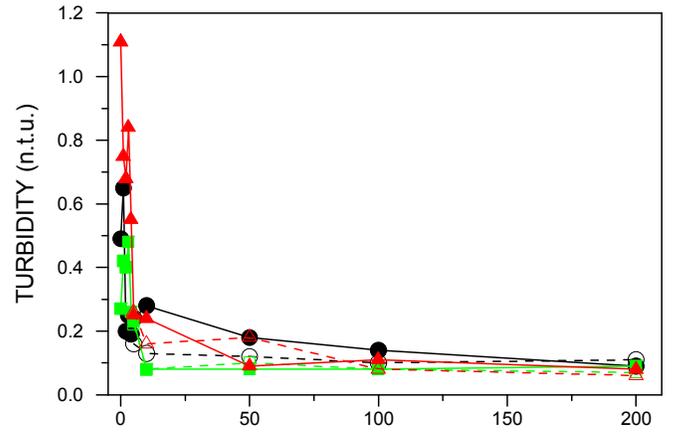
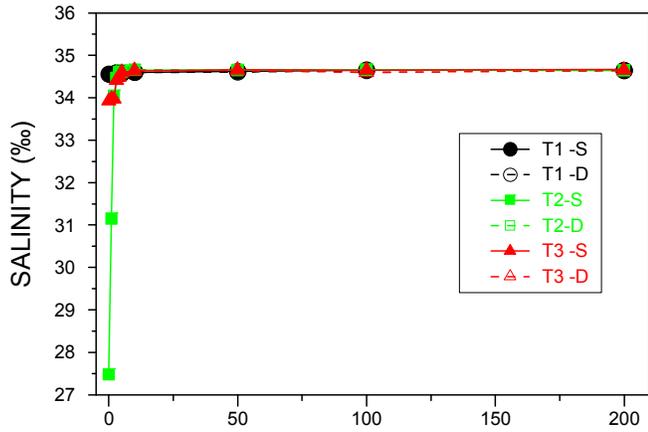


FIGURE 5. Plots of water chemistry constituents in surface (S) and deep (D) samples collected along three transects off the Kohala Shoreline LLC property on December 17, 2009 as functions of distance from the shoreline. For transect locations, see Figure 1.

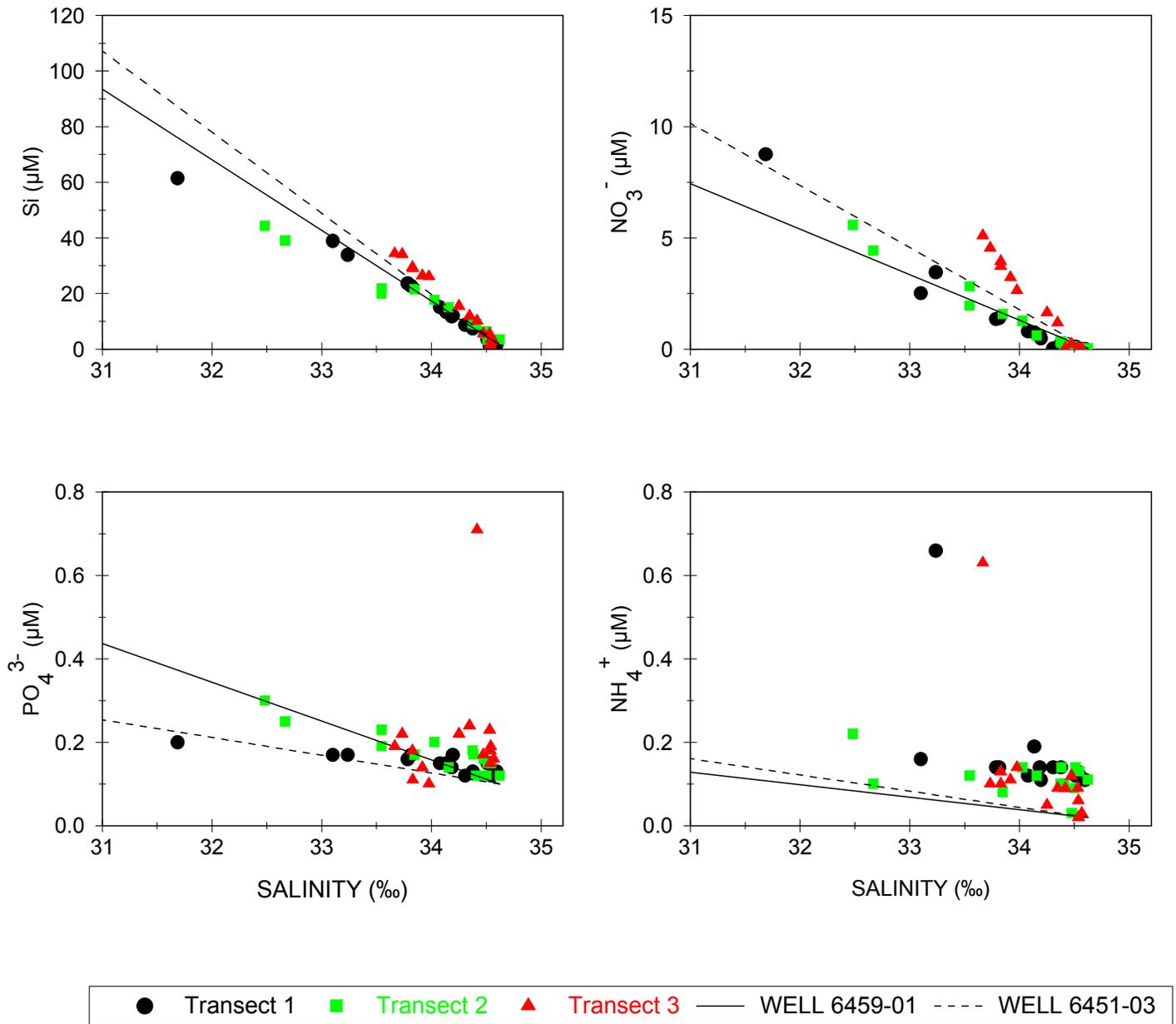


FIGURE 6. Mixing diagram showing concentration of dissolved nutrients from samples collected along three transects offshore of Kohala on March 18, 2015 as functions of salinity. Straight lines in each plot are conservative mixing lines constructed by connecting the concentrations in open ocean water with water from two groundwater wells upslope of the sampling area. For transect locations, see Figure 1.

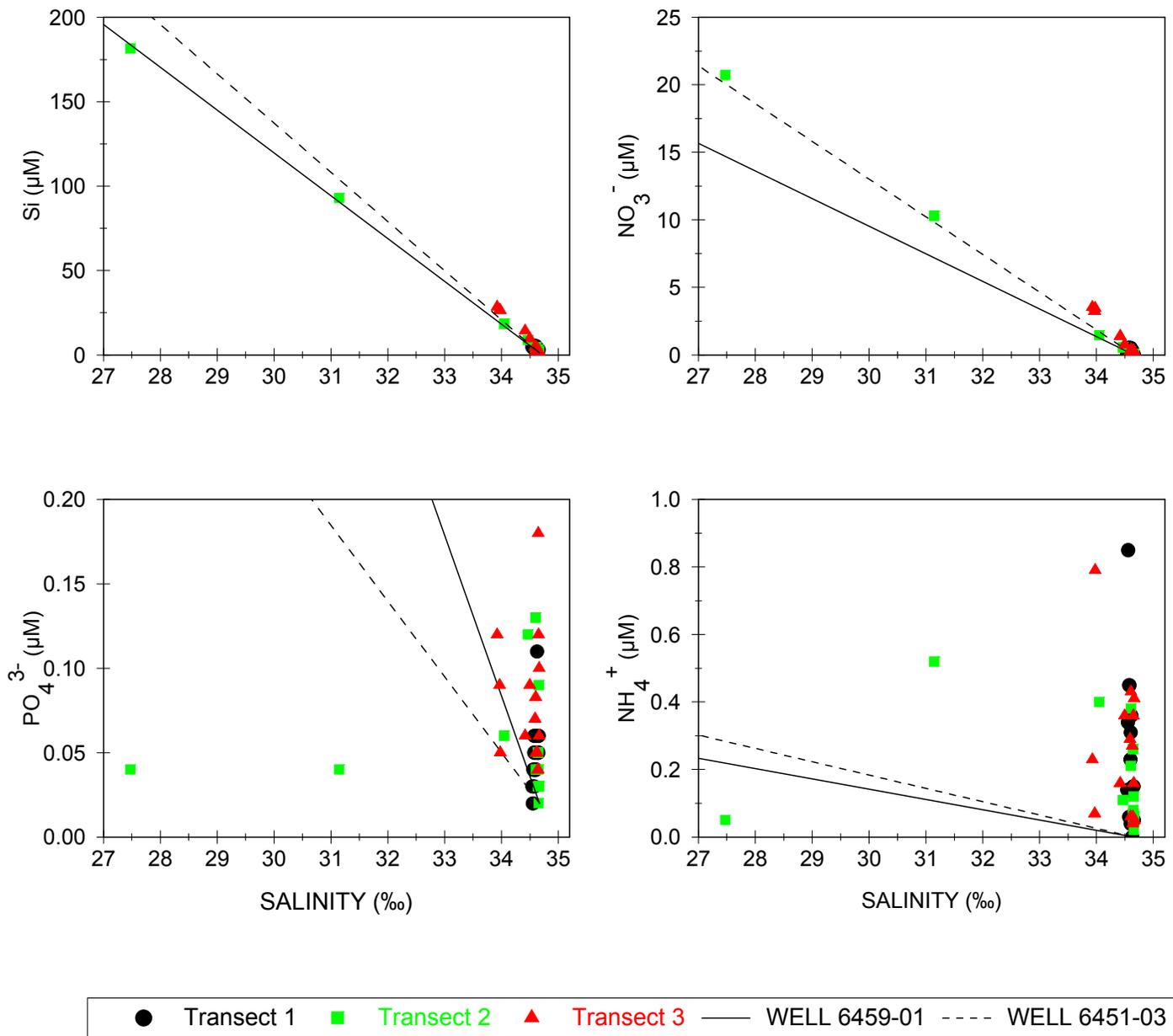


FIGURE 7. Mixing diagram showing concentration of dissolved nutrients from samples collected along three transects offshore of Kohala on December 17, 2009 as functions of salinity. Straight lines in each plot are conservative mixing lines constructed by connecting the concentrations in open ocean water with water from two groundwater wells upslope of the sampling area. For transect locations, see Figure 1.

TABLE 5. Slopes of linear regressions of nutrient concentrations (in units of  $\mu\text{g/L}$ ) as functions of salinity for surface samples on two transects offshore of the Kohala Shoreline LLC project. For 2009 Transect 1 is not included as none of the nutrient vs salinity regressions were significant. In 2015, only Transect 1 had salinity less than 32‰. Also shown are West Hawaii DOH compliance slopes. Shaded values indicate absolute value of upper confidence limit exceeding the DOH compliance slope.

2009

NUTRIENT	DOH SLOPE	TRANSECT 2			TRANSECT 3		
		SLOPE	LOWER CI	UPPER CI	SLOPE	LOWER CI	UPPER CI
$\text{NO}_3^-$	-31.92	-40.52	-40.09	-40.95	-66.69	-71.43	-61.96
TDN	-40.35	-51.23	-56.30	-46.31	-70.86	-107.12	-34.61
$\text{PO}_4^{3-}$	-3.22	0.06	-0.24	0.37	-0.25	-2.83	2.32
TDP	-2.86	-0.81	-1.29	-0.33	-1.22	-4.44	2.00

2015

NUTRIENT	DOH SLOPE	TRANSECT 1		
		SLOPE	LOWER CI	UPPER CI
$\text{NO}_3^-$	-31.92	-40.37	-45.93	-34.82
TDN	-40.35	-55.18	-65.04	-45.33
$\text{PO}_4^{3-}$	-3.22	-0.73	-0.43	-1.03
TDP	-2.86	-0.79	-1.22	-0.35



FIGURE 8. View of typical shoreline cliffs along the coastal boundary of the Kohala Shoreline LLC property (top) in 2009. Underwater view of rock bottom at base of cliffs (bottom).



FIGURE 9. Two views of nearshore *Pocillopora* zone near northern boundary of Kohala Shoreline LLC property in 2009. Pitted surface on spur in bottom photo is the result of bioeroding action of the sea urchins *Echinometra matheai* and *Echinostrphus aciculatus*. Water depth is approximately 8-10 feet.

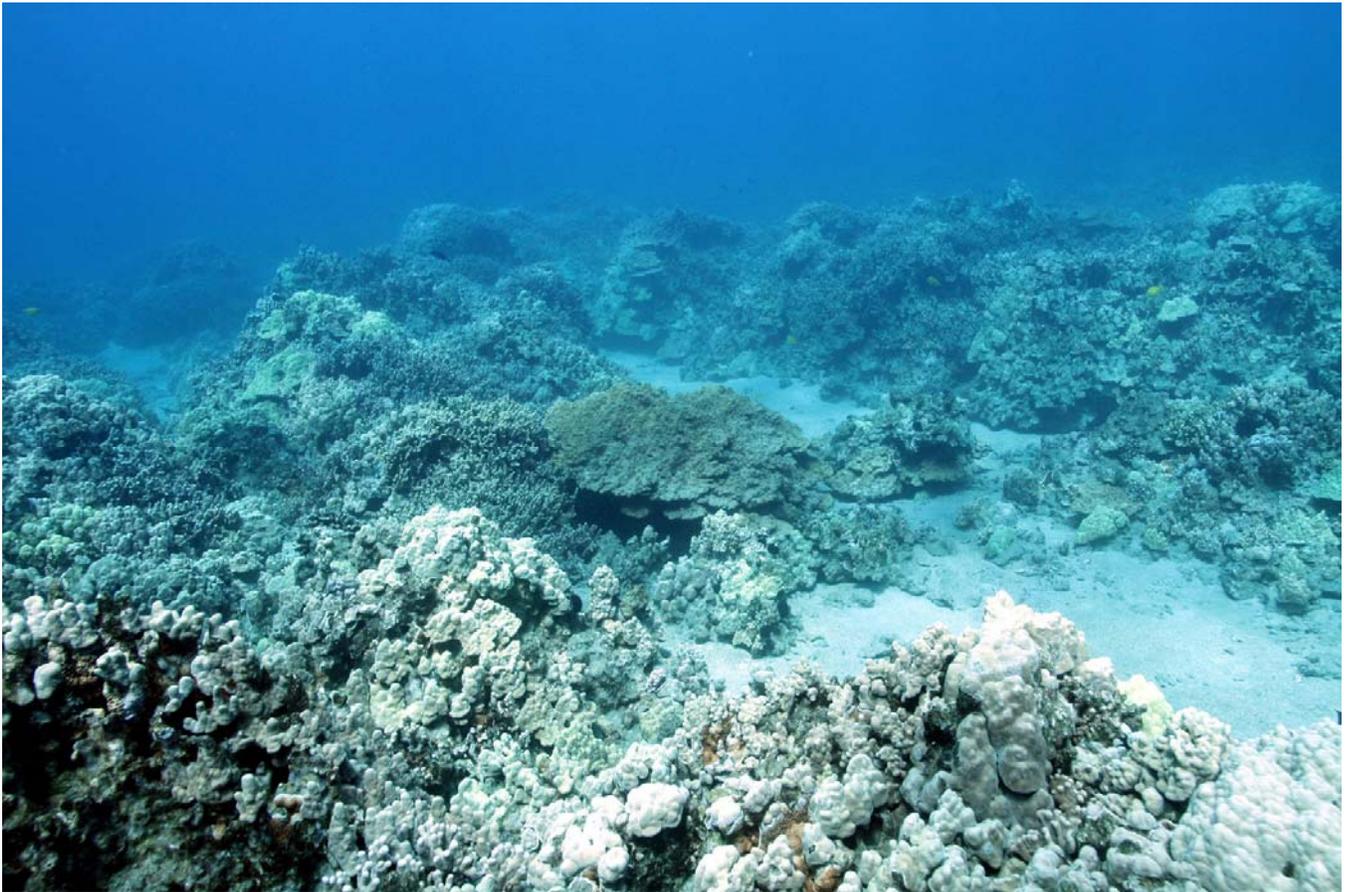
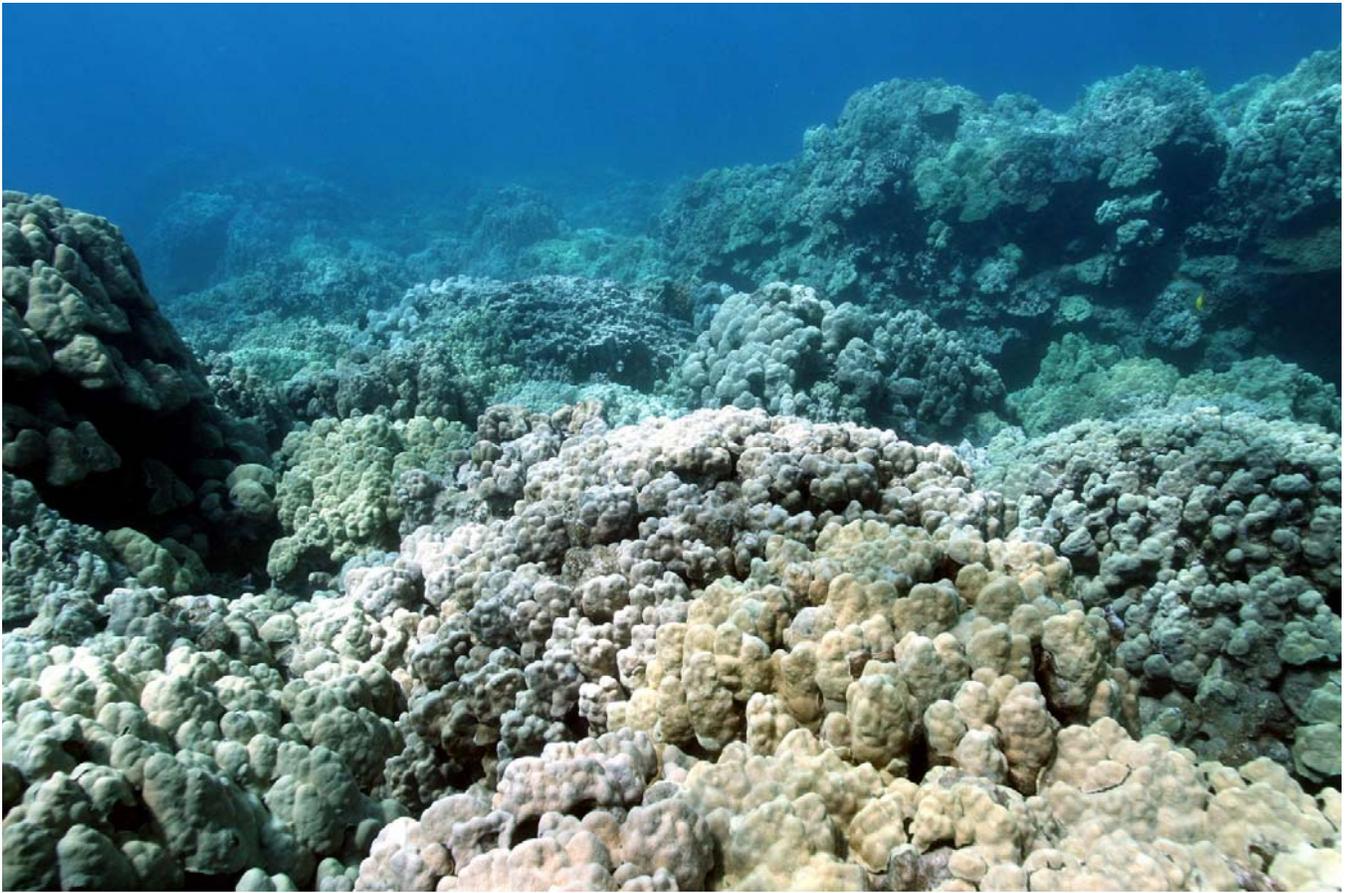


FIGURE 10. Two views of *Porites lobata* reef platform zone that extends throughout the Kohala Shoreline LLC property in 2009. Water depth is approximately 25-30 feet.

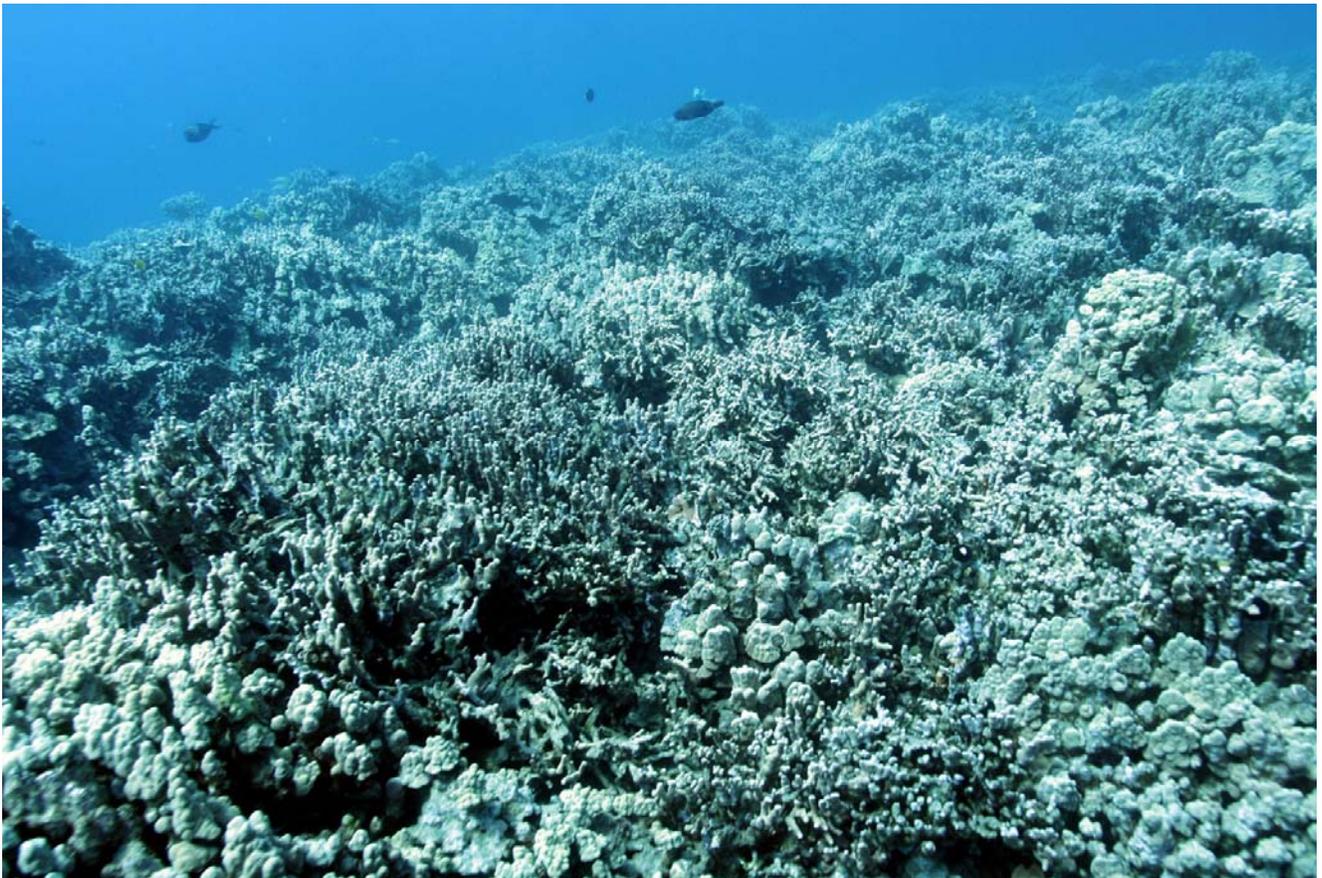
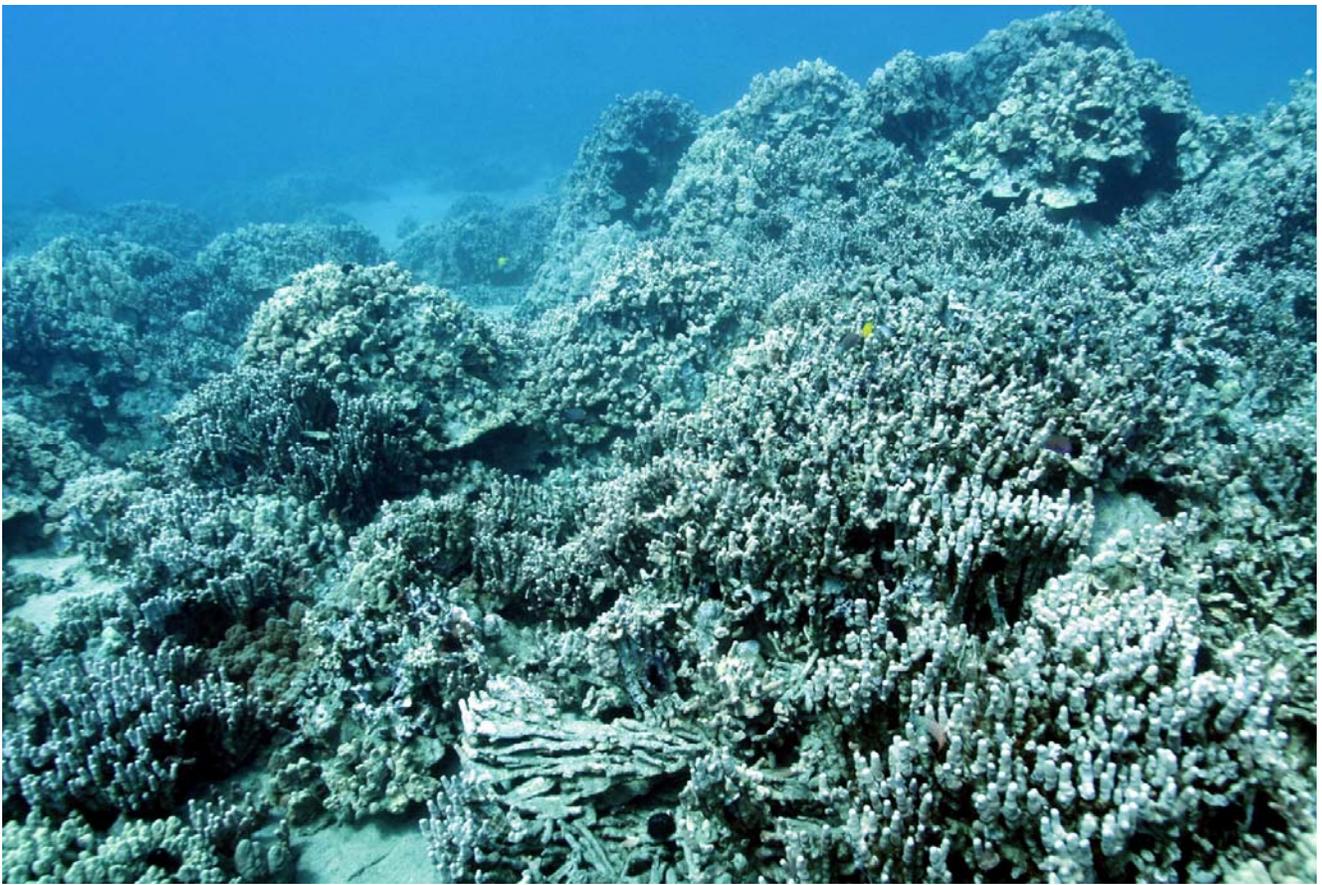


FIGURE 11. Two views of *Porites compressa* slope zone that extends throughout the Kohala Shoreline LLC property in 2009. Water depth is approximately 40-50 feet.



FIGURE 12. *Porites compressa* slope zone that extends throughout the Kohala Shoreline LLC property (top. Slope zone terminates in sand plain with interspersed corals and coral rubble at a depth of about 60 feet (bottom). Photos taken in 2009.



FIGURE 13. Two views of boulders in the nearshore area fronting the area south of the Kohala Shoreline LLC property in 2009 showing extensive recent recruitment of small coral colonies. In upper photo, small corals can be identified as branching *Pocillopora*. In bottom photo, all white spots are new living coral recruits. Water depth is approximately 10 feet.

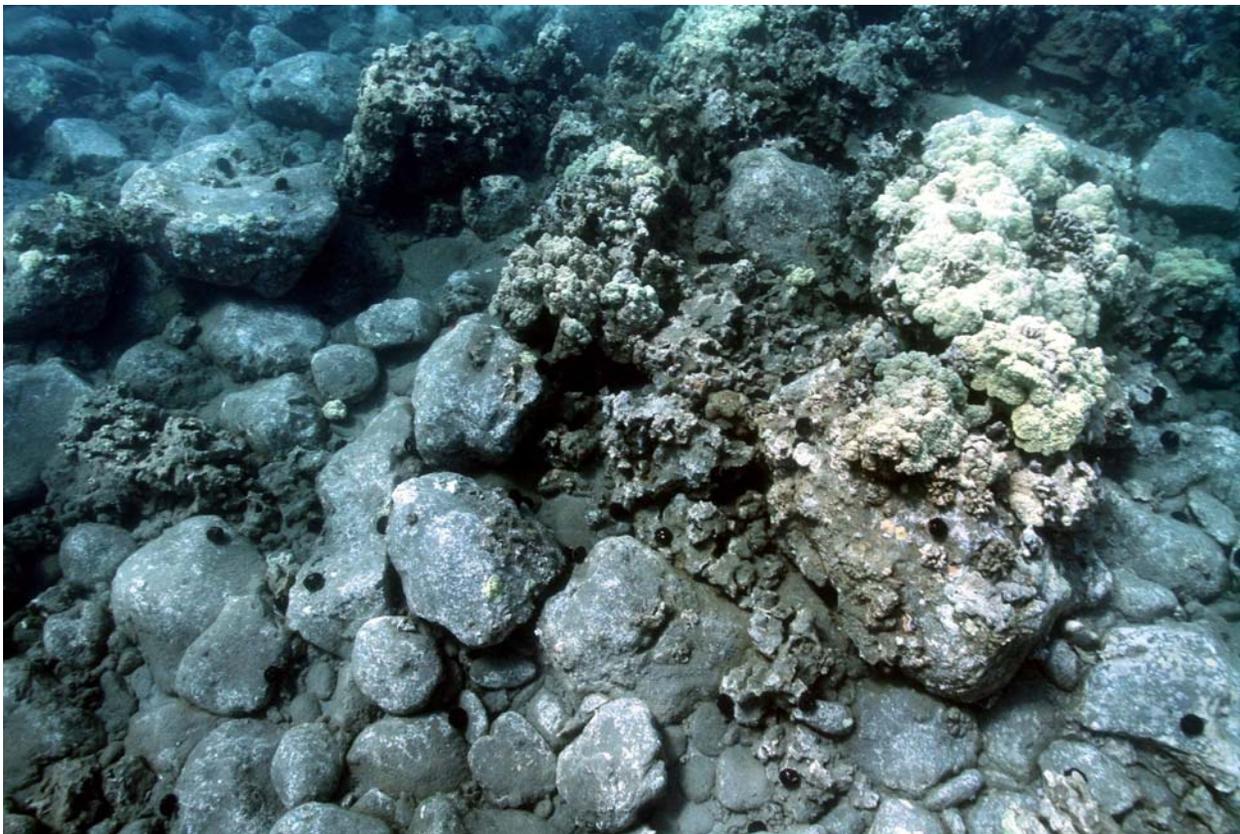


FIGURE 14. Upper photo shows numerous new coral recruits to otherwise barren boulders in nearshore area off central region of Kohala Shoreline LLC property in 2009 (recruits are visible as white dots). Bottom photo shows distinct boundary between area of primarily barren boulders with new recruits (bottom left) and area of well-established corals (upper right). The distinct boundary likely represents the seaward margin of the effects of natural sediment input from land to reef community structure. Water depth is approximately 18 feet.

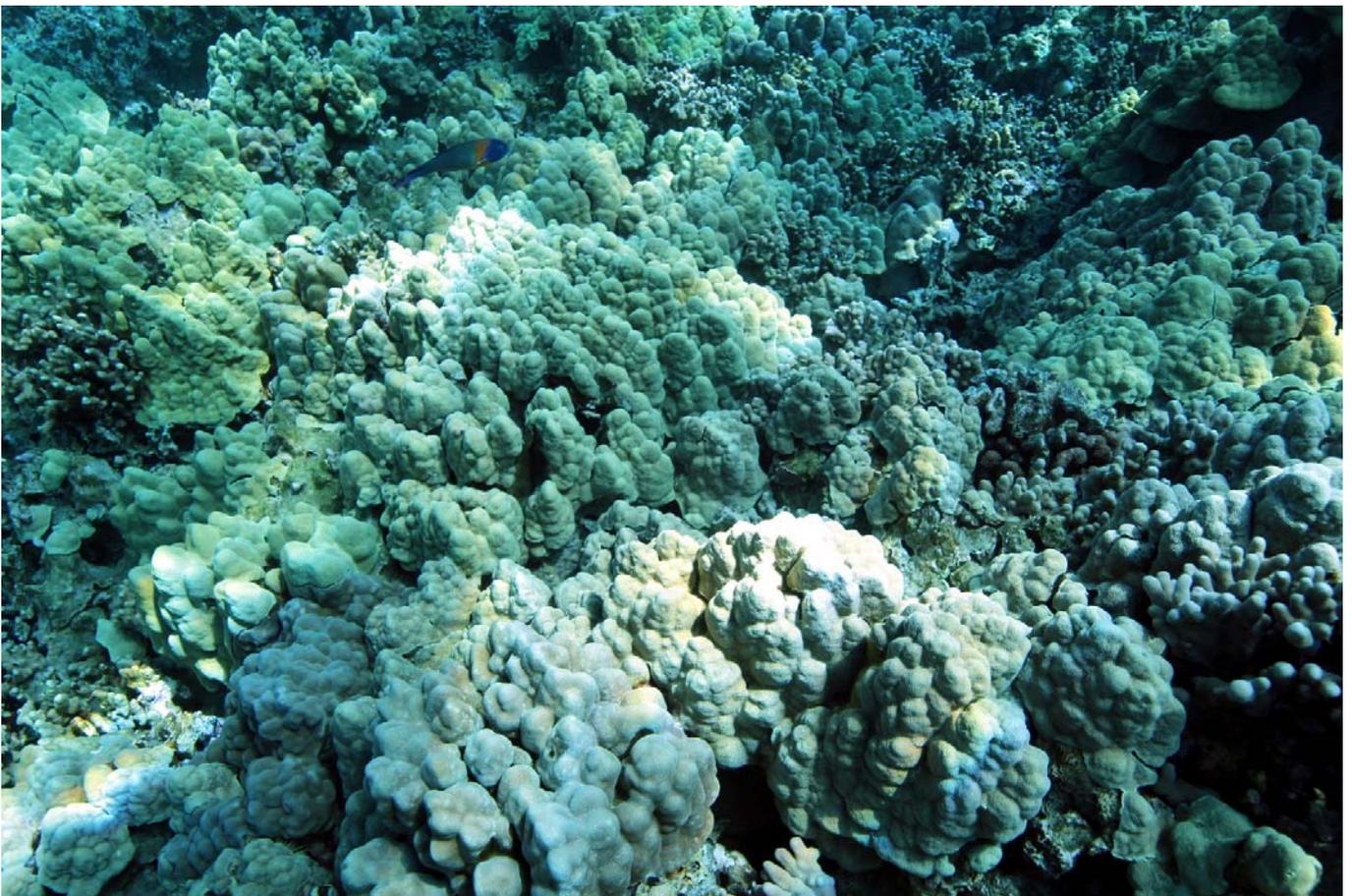
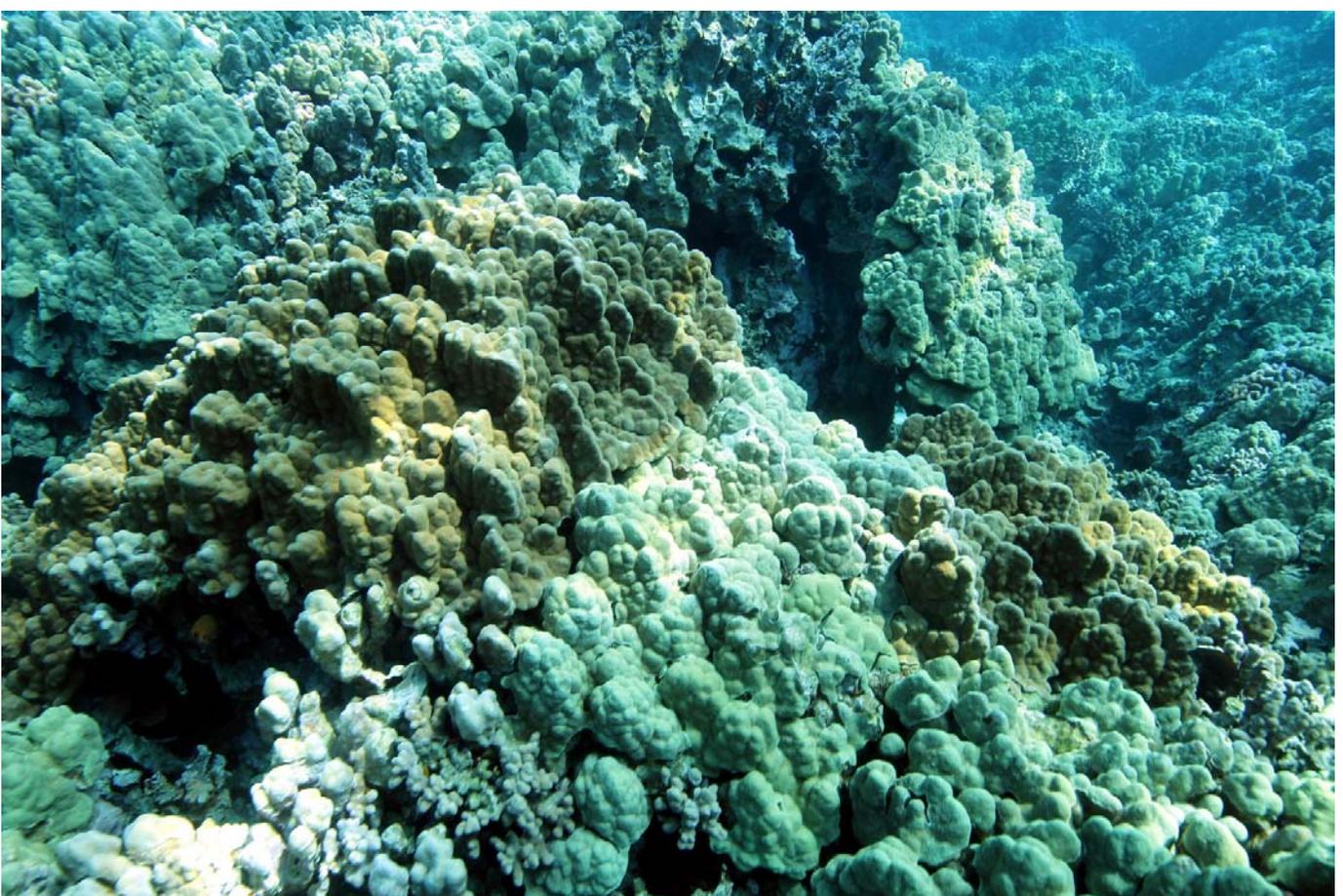


FIGURE 15. Two views of *Porites lobata* reef building zone off the site of the proposed Kohala Shoreline LLC project in March 2015. Note lack of sediment on reef surface.

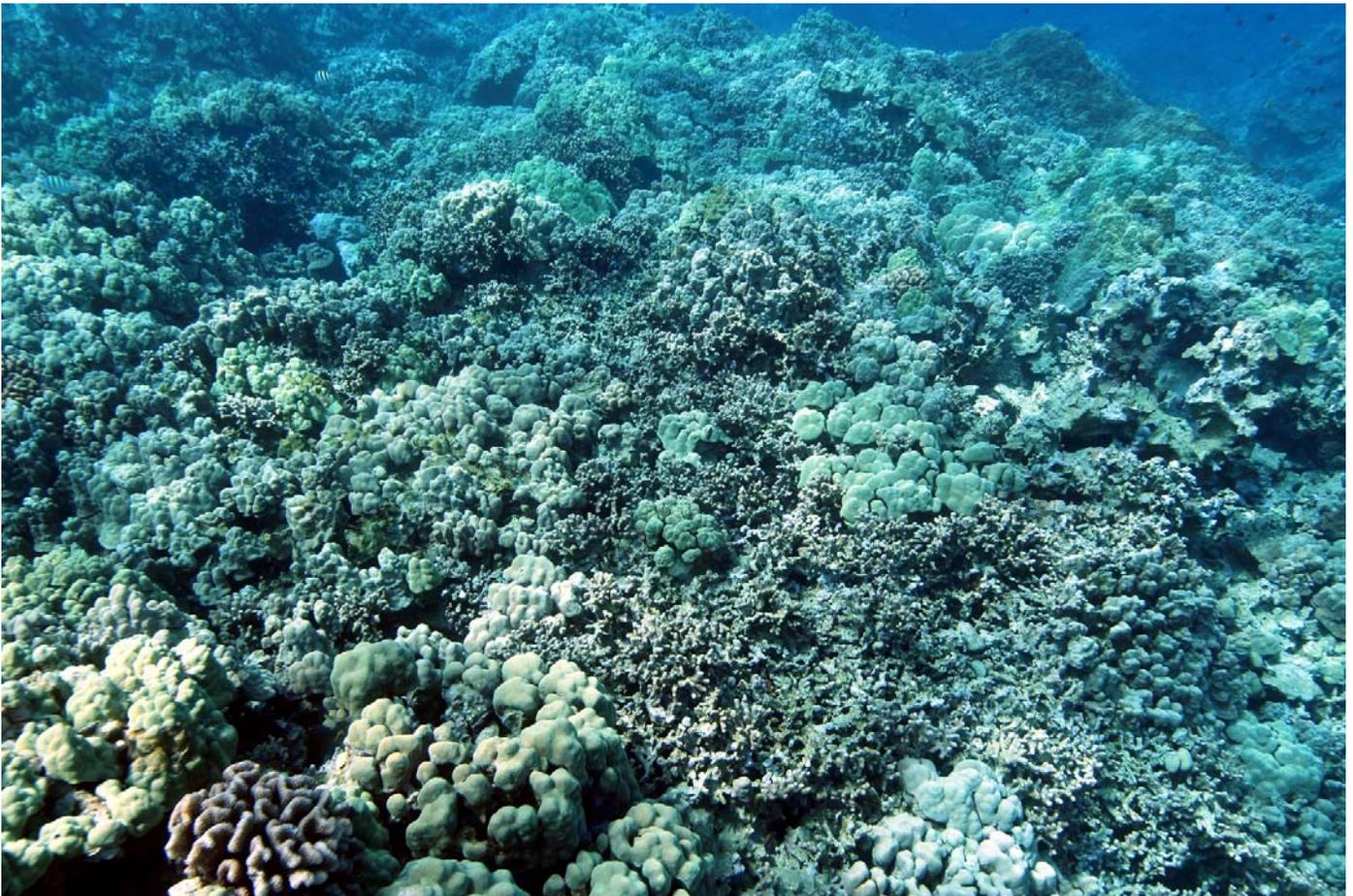
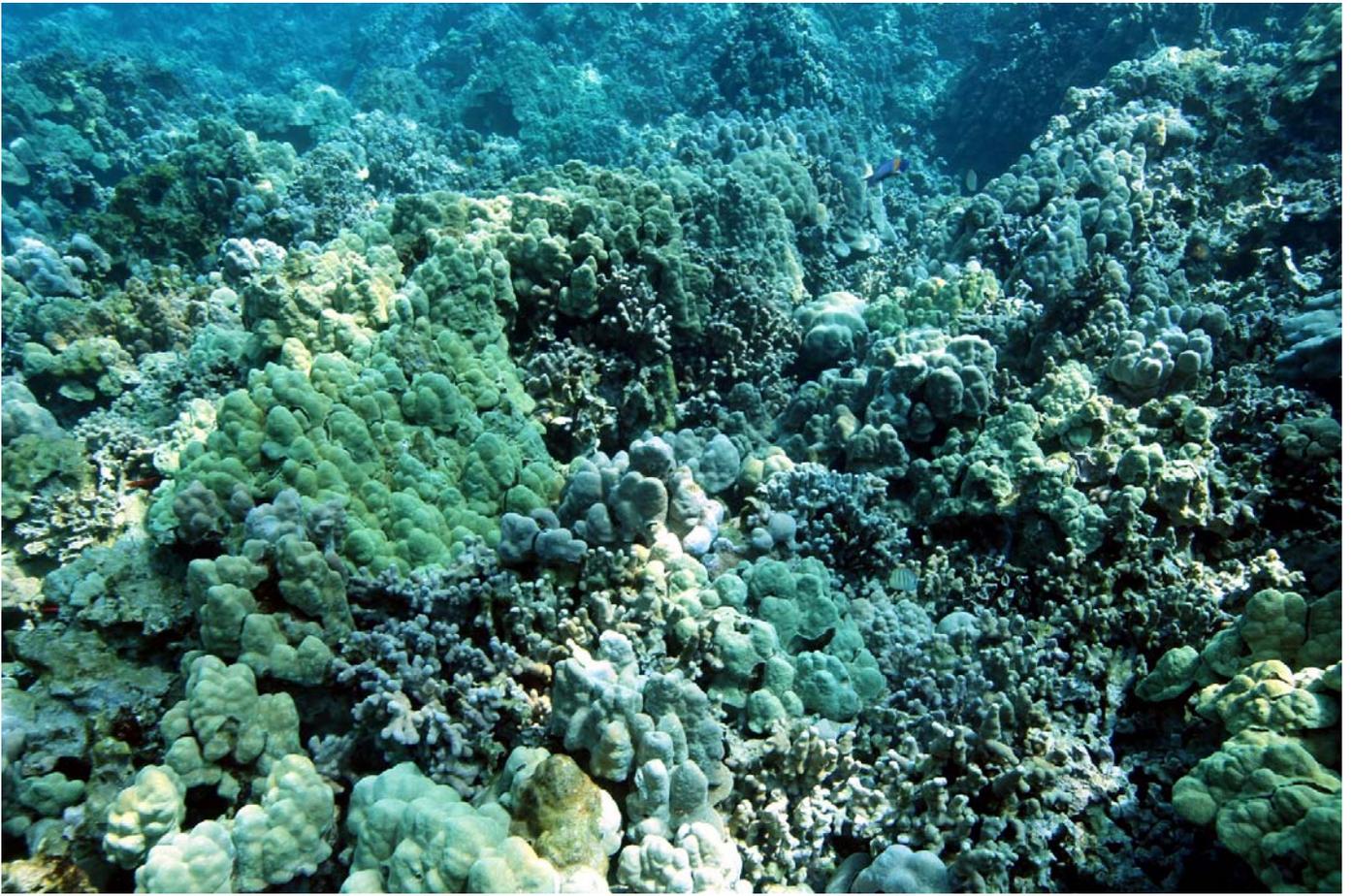


FIGURE 16. Two views of *Porites lobata* reef building zone off the site of the proposed Kohala Shoreline LLC project in March 2015. Note lack of sediment on reef surface.

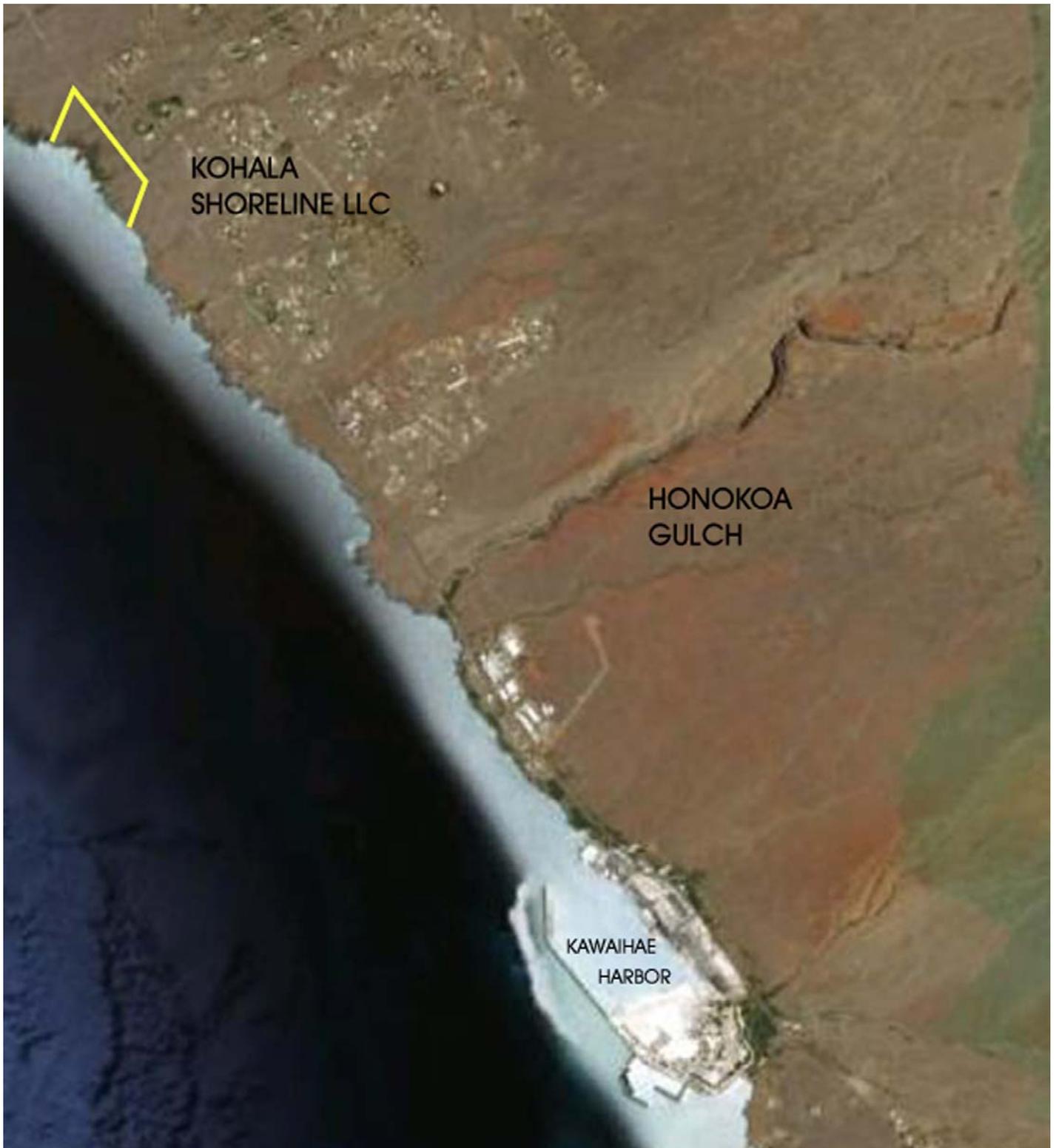


FIGURE 17. Aerial photograph of section of North Kohala coastline extending from Kawaihae Harbor to Kohala Shoreline LLC property. Also shown is Honokoa Gulch north of Kawaihae. Honokoa Gulch is a major geological feature and discharge from episodes of high rainfall and runoff have influenced the offshore marine environment through geologic time.



FIGURE 18. Top photo shows boulder beach at shoreline discharge point of Honokoa Gulch in 2009. Bottom photo shows boulders near the shoreline directly off the discharge point of Honokoa Gulch. Boulders are colonized by numerous small coral colonies recognizable primarily as *Porites lobata* and *Pocillopora meandrina*. Water depth is approximately 6 feet.



FIGURE 19. Two views of ocean floor directly off of Honokoa Gulch in 2009 covered with thick layer of land-derived sediment from upland erosion of the gulch. The large extent of the sediment cover, in terms of both depth and area suggests that such input has been a normal occurrence of the area through geologic time, and is not solely a response to activities of humans. Water depth is approximately 20 feet.

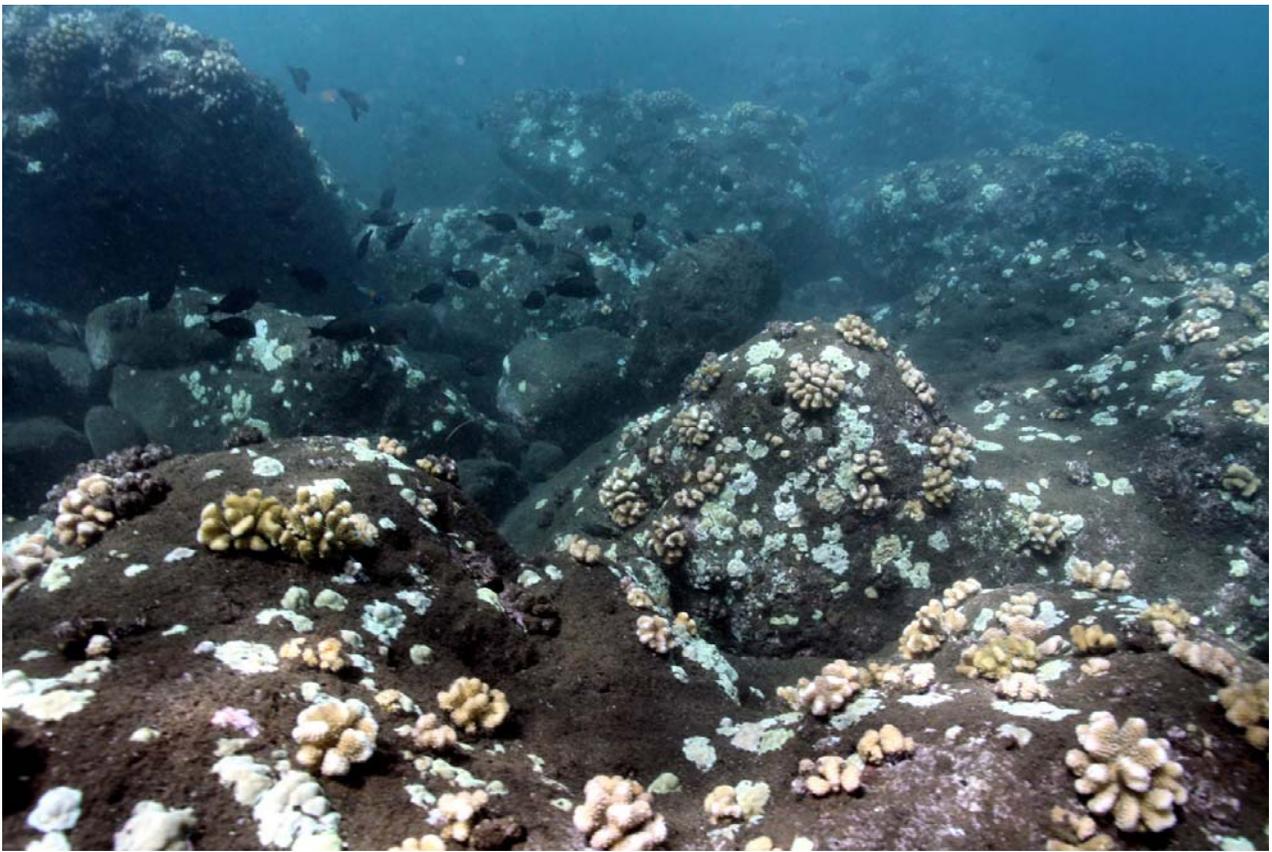


FIGURE 20. Two views of rock surfaces on ocean floor directly off of Honokoa Gulch in 2009. Substantial recolonization of the rock surfaces by corals is evident. Brown areas between living coral colonies contain a thin layer of fine-grained mud that is likely a permanent feature of the area. No dead corals are evident in either photo. Water depth is approximately 20 feet.

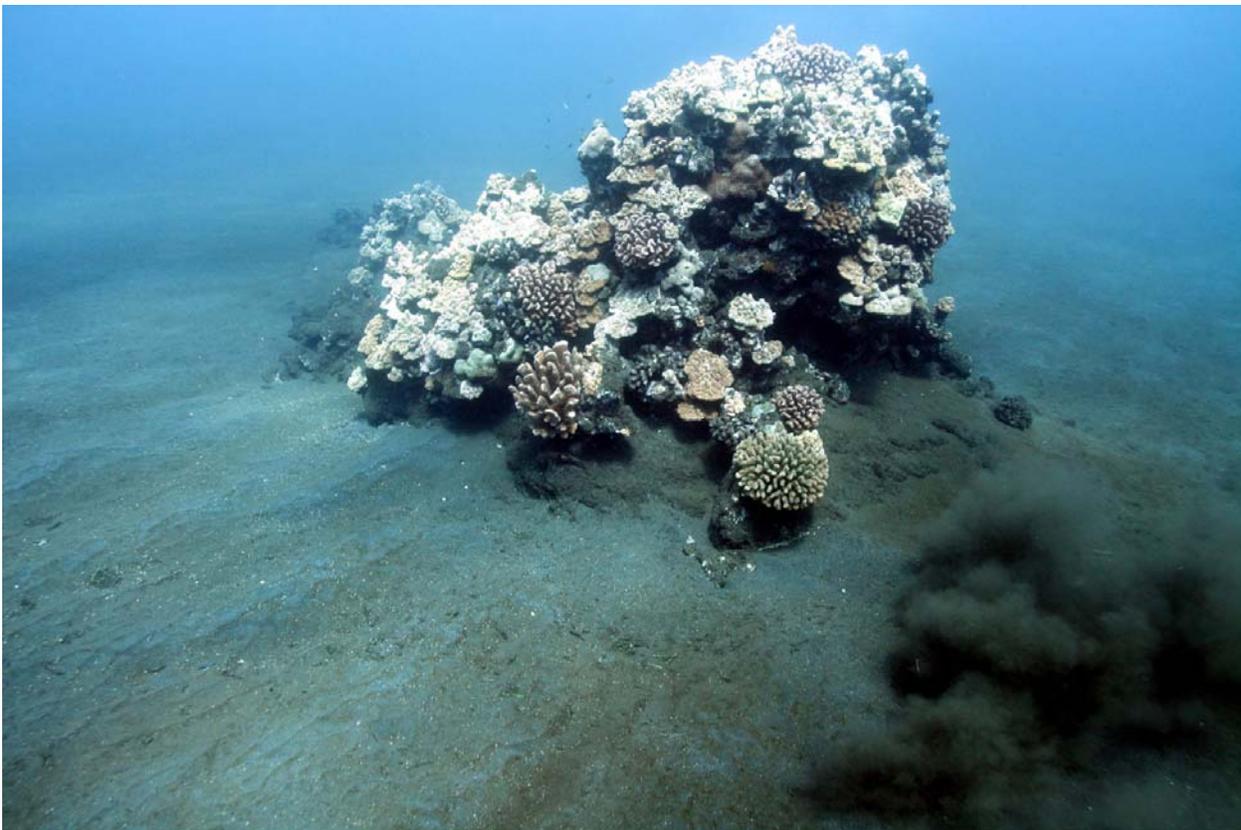
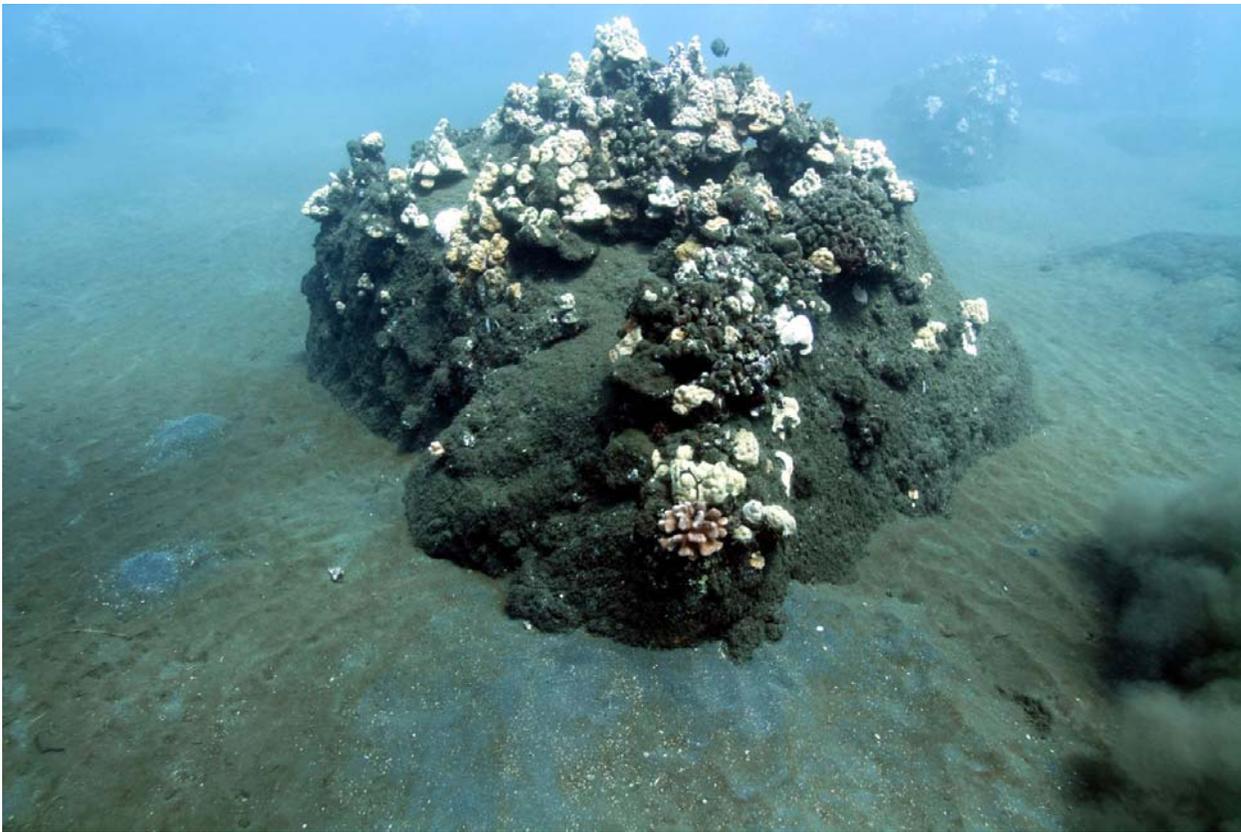


FIGURE 21. Two views of elevated rock reefs rising out of mud floor directly off of Honokoa Gulch in 2009. Note cloud of resuspended sediment created by divers in lower right of both photo. Substantial colonization by corals of rock surfaces elevated above the mud floor is evident. Water depth is approximately 35 feet.

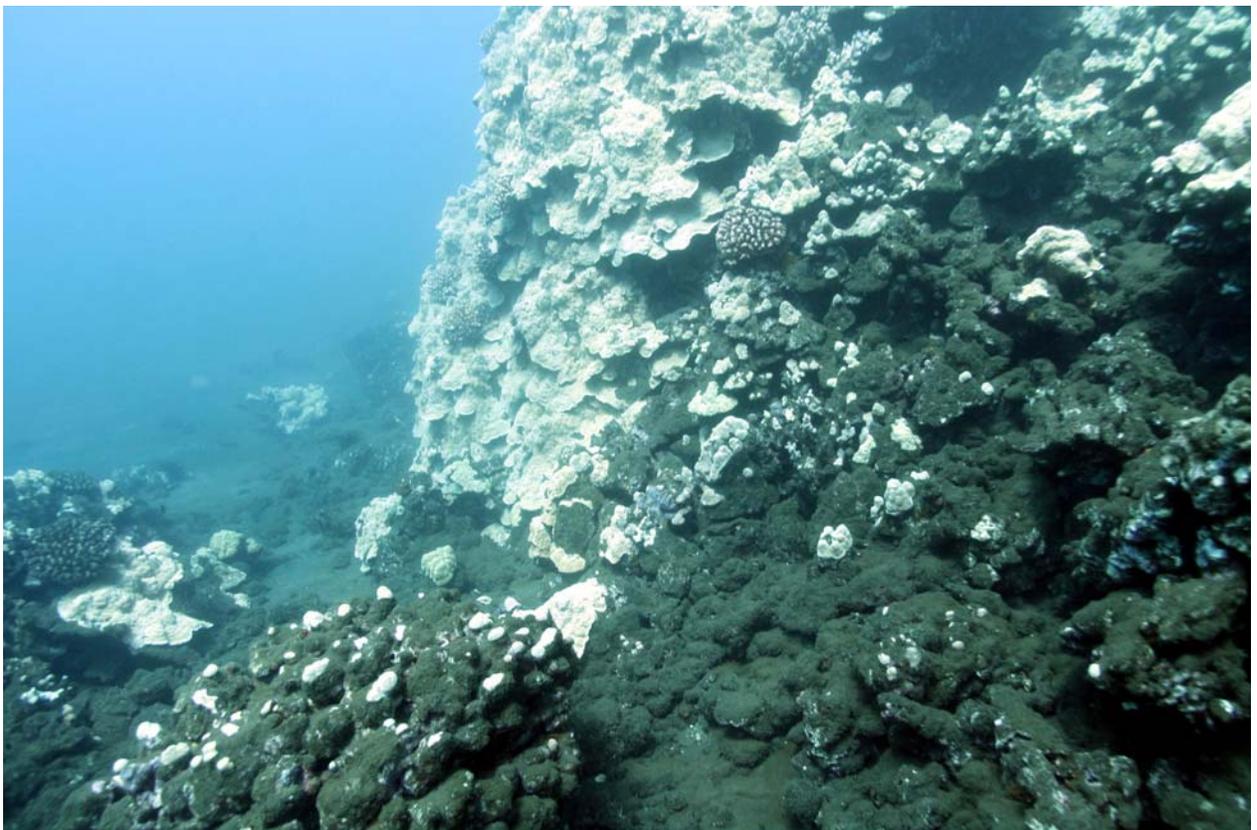
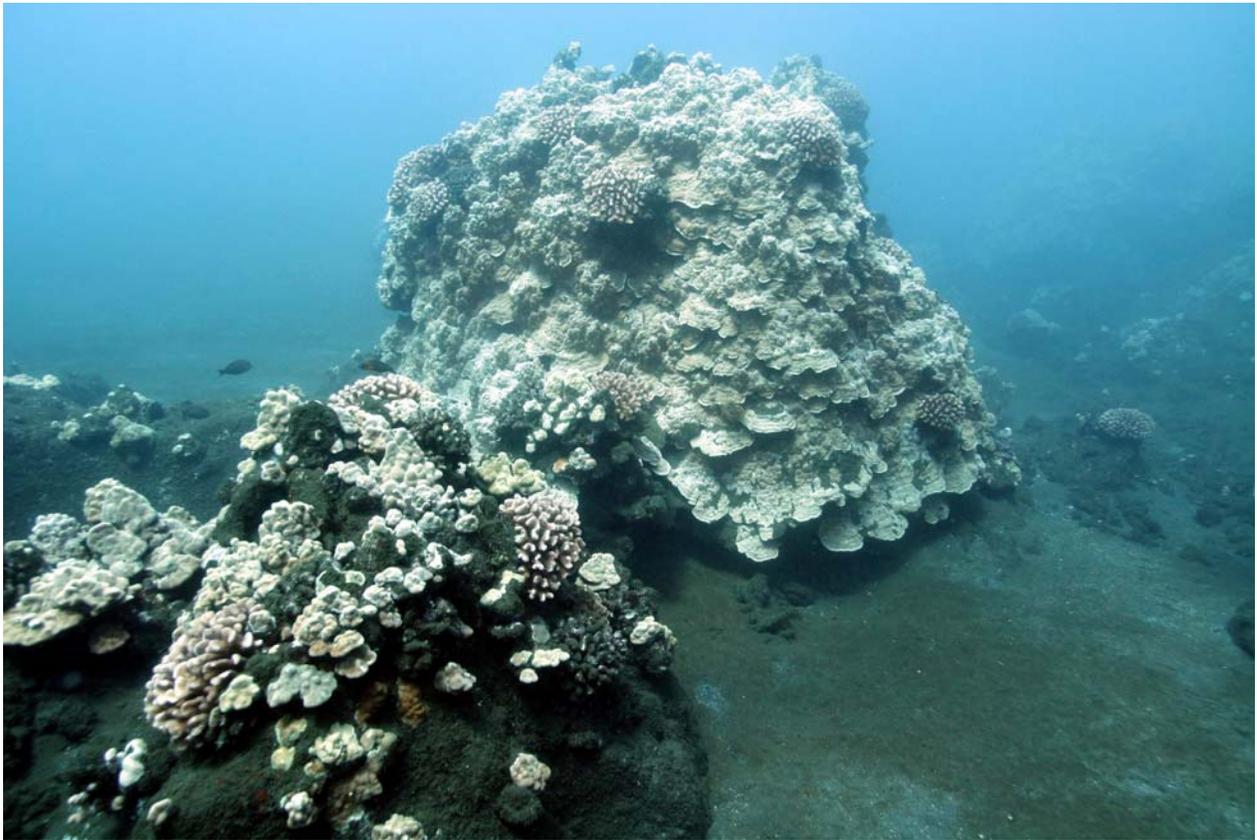


FIGURE 22. Top photo shows large colony of *Porites rus* growing above sediment surface off Honokoa Gulch, North Kohala in 2009. Bottom photo shows overlapping plates of *P. rus* on side of rock outcrop in same area as top photo. Note areas of dead, sediment covered coral in lower right of bottom photo adjacent to areas of living colonies. *Porites rus* was not observed in other areas of North Kohala that were not subjected to intermittent extreme sediment input. Water depth is approximately 35 feet.



FIGURE 23. Two views of boulders in nearshore zone off of Honokoa Gulch in March 2015 following episode of heavy rainfall.. Note sediment cover and number of dead coral skeletal remains.



FIGURE 24. Two views of boulders in nearshore zone off of Honokoa Gulch in March 2015 following episode of heavy rainfall.. Note sediment cover and number of dead coral skeletal remains. Very little recruitment of new corals was noted on boulders as were evident in 2009.

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# **ENVIRONMENTAL ASSESSMENT**

## **Kohala Shoreline Six-Lot Subdivision**

### **APPENDIX 7**

#### **Water Resources Impact Assessment**

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Assessment of the Impact on  
Water Resources of the Kohala Shoreline LLC Project on  
TMK 5-9-1:08 in North Kohala, Hawaii

*Prepared for:*

Kohala Shoreline LLC  
3150 139<sup>th</sup> Avenue SE, Building 4, Suite 500  
Bellevue, WA 98005

*Prepared by:*

Tom Nance Water Resource Engineering  
560 N. Nimitz Hwy., Suite 213  
Honolulu, Hawaii 96817

Revised January 2019  
April 2015  
February 2010

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## Introduction

This report provides an assessment of the potential impacts on water resources of the proposed Kohala Shoreline LLC project on TMK 5-9-1:08 in North Kohala, Hawaii. Figure 1 shows the location of the 38-acre project site. It is on the makai side of Akoni Pule Highway and directly across from the Kohala Ranch development. An original assessment of project was done in February 2010 and subsequently revised in April 2015. This present assessment is based on the land use plan shown on Figure 2. The project will incorporate the following aspects in the proposed development:

- The number of residential lots will be six (6);
- All home sites will be on the mauka side of the Ala Loa Trail;
- Project CC&Rs will restrict landscape for homes to be natural (kiawe, uhaloa, and/or buffelgrass) or extreme xerophyte plants;
- The maximum allowed water use per lot will be 750 gallons per day (GPD);
- The maximum irrigated landscaped area shall be 0.5 acres per lot;
- Irrigated landscaping at the Gated Entry and 4-stall public parking area will be not more than 0.25 acres;
- No other common area landscape irrigation, such as along roadways, will be allowed; and
- Each lot owner will be required to install an aerobic individual wastewater system (IWS) with a properly designed leach field for disposal of the treated effluent.

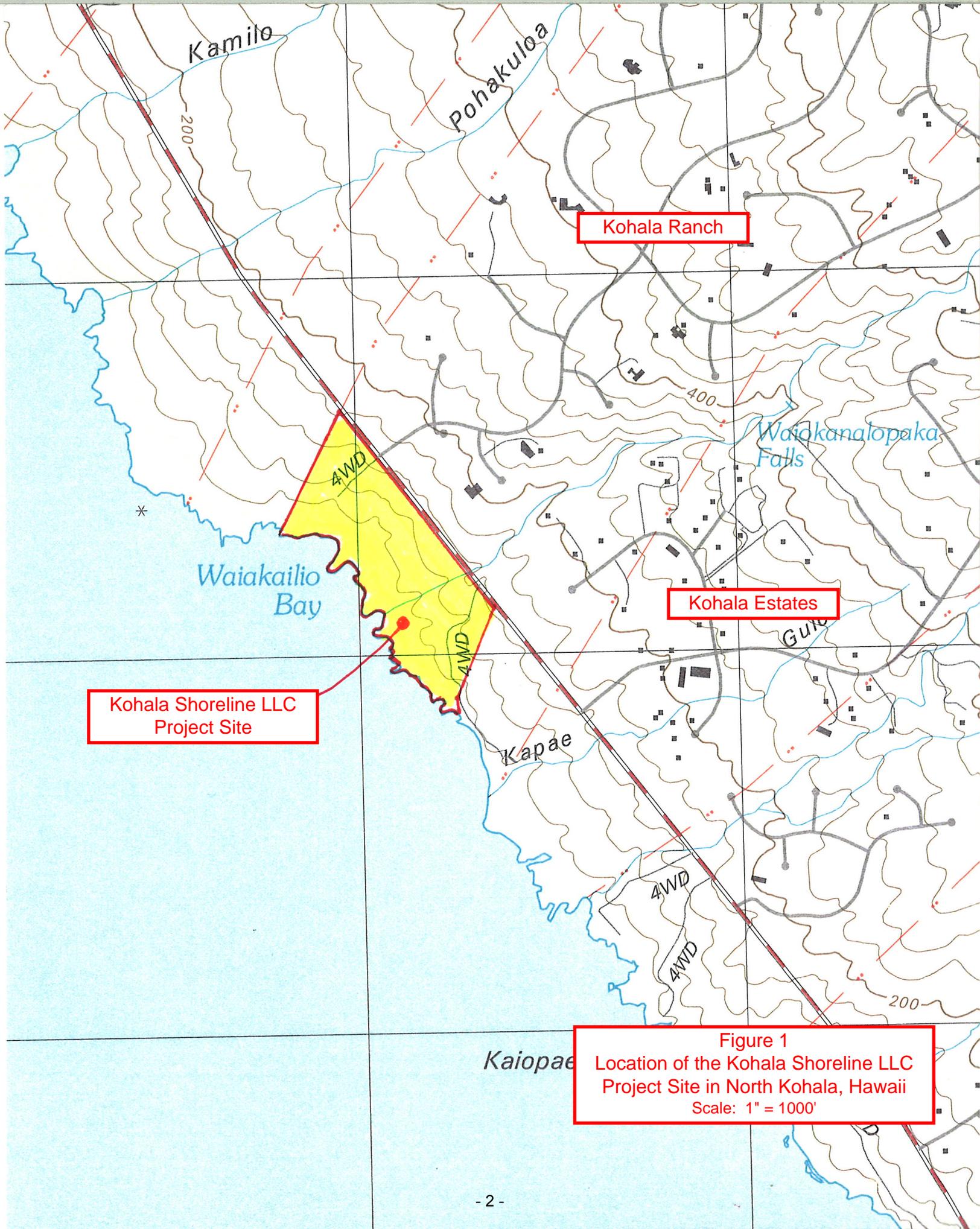
## Description and Quantification of Aspects of the Project which have the Potential to Impact Water Resources

Four aspects of the project's development have the potential to impact water resources. These are: use of groundwater for potable consumption and landscape irrigation; generation, treatment, and disposal of domestic wastewater; increase in rainfall-runoff; and percolation to groundwater of excess water applied to landscaping. Each of these is described and quantified in the sections following.

Use of Groundwater. Water for potable consumption and landscape irrigation will be provided by the Kohala Ranch system. Sources of supply for that system currently consist of two wells (Nos. 6549-01 and -02 on Figure 3). With the 750 GPD per lot restriction and another 1000 GPD for the Entry Feature irrigation, the project's total water use would be 5500 GPD. To see the potential impact that a failure to comply with this water restriction would have, water use at 1500 GPD per lot plus 1500 GPD for the Entry Feature landscaping, a total of 10,500 GPD for the project, is also be analyzed.

Wastewater Generation, Treatment, and Disposal. Each homesite will have its own aerobic treatment system with disposal of the treated wastewater in leach fields. Wastewater will percolate from the leach fields to the groundwater below, eventually to discharge into the marine environment along the project's shoreline. As a year-round average, it is assumed that wastewater disposal will average 300 GPD per homesite or 1800 GPD for the 6-lot project.

Increase in Rainfall-Runoff. Average annual rainfall across the undeveloped 38-acre project site is about ten inches. Given the permeability of the ground surface at present, runoff is likely to be no more than 20 percent of this, equivalent to an annual volume of 276,000 cubic feet or 2.1 million gallons (MG). Based on the project's six lot plan presented on Figure 2, an estimated 2.5 acres would be developed as impervious surfaces (roads, parking, driveways, rooftops, and other hardscape). If runoff from these

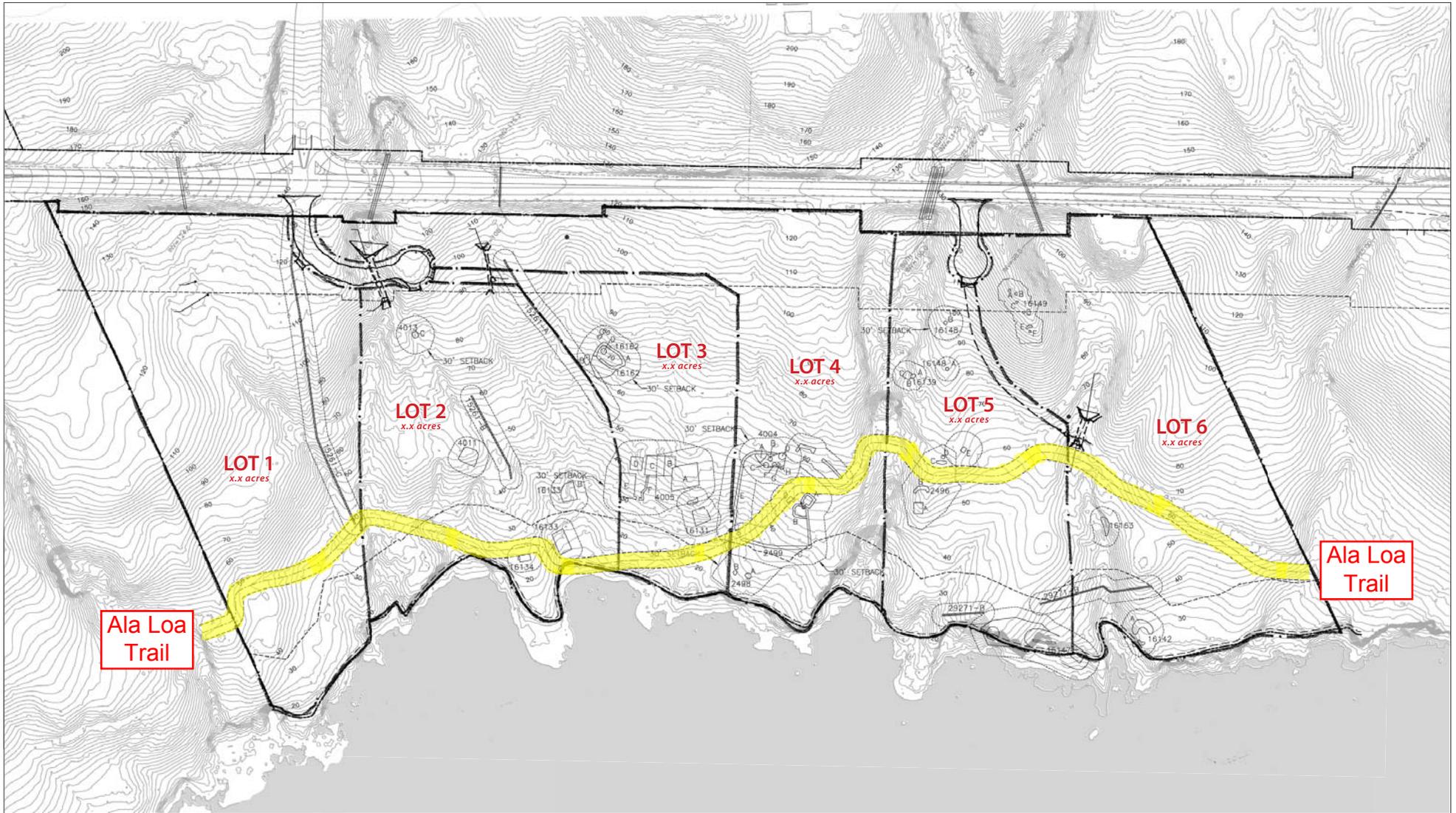


Kohala Shoreline LLC  
Project Site

Kohala Ranch

Kohala Estates

Figure 1  
Location of the Kohala Shoreline LLC  
Project Site in North Kohala, Hawaii  
Scale: 1" = 1000'



NOTE: Includes 20-foot setbacks from non-burial preservation sites and 30-foot setback around burial preservation sites.



## ALTERNATIVE LOTTING CONCEPT Kohala Shoreline

Prepared for: Kohala Shoreline, LLC

January 19, 2018

**Figure 2  
Site Plan**



surfaces amount to 95 percent of the annual rainfall and runoff from the balance of the project area (including landscaping) remains about the same, then the annual runoff volume would be increased by about 0.5 MG. This would amount to an increase of about 25 percent from the project site over existing conditions. However, most of this increase in runoff would be delivered to dry wells and ultimately percolate to the groundwater below.

Percolation to Groundwater of Excess Landscape Irrigation. At water use restricted to 750 GPD per lot and 300 GPD of it becoming domestic wastewater, the remaining 450 GPD per lot would be landscape irrigation. Added to the 1000 GPD of irrigation at the Entry Feature, total irrigation would be 3700 GPD. If it is conservatively assumed that 15 percent of this would be in excess of plant uptake, 555 GPD of applied landscape irrigation would percolate to the groundwater below.

For the parallel set of calculations with water use at 1500 GPD per lot and 1500 GPD to irrigate the Entry Feature, the total irrigation use would be 8200 GPD. Percolation to groundwater at 15 percent of the applied landscape irrigation would be 1230 GPD.

### **Water Resources in the Project Area**

Groundwater. Knowledge of groundwater conditions in the vicinity of the project site comes primarily from the wells identified on Figure 3 and also listed in Table 1. Groundwater beneath the project site exists as a thin, brackish to saline basal lens overlying saltwater at depth and in hydraulic contact with seawater at the shoreline. The most recent, most sophisticated, and presumably most accurate calculation of groundwater recharge in the project area is in USGS Scientific Investigations Report 2011-5078 (Engott, 2011). The State Commission on Water Resource Management (CWRM) has delineated aquifer system boundaries throughout the State. The Kohala Shoreline LLC project is toward the south end of the CWRM-delineated Mahukona Aquifer. Engott (2011) calculates this aquifer's recharge at 23 million gallons per day (MGD). Over the aquifer's 15-mile shoreline expanse, that represents an average groundwater discharge into the marine environment of 1.53 MGD per coastal mile. It is not equally distributed along the shoreline, however. A greater amount of groundwater flow occurs in the south end of the aquifer where the project site is located. This part of the aquifer has a more extensive and wetter upland watershed than toward the north. Assuming a 50 percent greater than average recharge in the vicinity of the project site would translate to a rate of 2.3 MGD per coastal mile. Since the project site spans about a 0.5-mile coastal width, groundwater flow beneath the site and discharging along its shoreline is on the order of 1.15 MGD. This amount does not consider ongoing pumpage by wells upgradient of the project site. This adjustment to the groundwater flow is quantified in a section following.

In contrast to the thin and brackish basal lens that occurs beneath and near to the project site, several of the wells at higher elevation have demonstrated some interesting anomalies, including the following:

- The two wells that are furthest inland in the Kohala Ranch property (Nos. 6649-01 and -02 on Figure 3) encountered high level (rather than basal) groundwater, an unexpected result. Subsequent geophysical surveys (Blackhawk, 1990) indicated that this non-basal condition exists over the relatively wide area indicated on Figure 3. It includes the two-lower elevation Kohala Ranch wells. Given the location of this high-level groundwater occurrence, the subsurface features creating this anomaly are likely to be layers of poorly permeable lava flows or extensive ash deposits that have been weathered to clay.

Table 1

Summary of Available Information on the  
14 Wells in the General Vicinity of the Kohala Shoreline LLC Project Site

State Well No.	Well Name or Owner	Year Drilled	Ground Elevation	Casing Diameter	Total Depth	Static Water Level	Chlorides ( MG/L )	Hydraulic Performance ( Drawdown @ GPM )	Present Use
6549-01	Kohala Ranch 1	1979	1460	12	1550	7.2	65	6.4 @ 700	} Potable Supply for Kohala Ranch Water System
6549-02	Kohala Ranch 2	1982	1449	12	1560	--	70	3.0 @ 600	
6649-01	Kohala Ranch 3	1989	1840	18	1925	136	35	3.0 @ 1200	} Unused Kohala Ranch Water System Wells
6649-02	Kohala Ranch 4	1993	1746	18	1830	17.7	45	18.6 @ 1200	
6448-01	Kawaihae (DHHL)	1990	1341	Uncased	1465	1.0	2500	Not Tested	Unused
6549-03	Kawaihae (DHHL)	1992	1651	18	1700	6.3	170	4.2 @ 130	Unused
6450-02	Walsh Lot 39	1984	801	12	835	--	180-200	--	Landscape Irrigation
6550-01	Kahua (Sherrod)	1986	675	8	700	3.7	260	--	Landscape Irrigation
6450-04	Waika-Fischer	1996	653	6	670	2.0	230	0.0 @ 16	Landscape Irrigation
6450-01	Virgil Place	1980	395	4	412	--	1320 (?)	--	Unused
6450-05	Virgil Place	1996	370	8	383	2.81	960	0.45 @ 60	Agricultural Irrigation
6451-01	Kahuna Ranch Test Hole	1963	60	2	90	--	--	--	Unused
6451-02	Kawamata 1	1987	238	6	245	2.6	1235	--	Landscape Irrigation
6451-03	Kawamata 2	1987	395	6	405	--	700	--	Landscape Irrigation

Note: Information from the files of the State Commission on Water Resource Management.

- The State DHHL test well (No. 6549-03), located near to and south of the two Kohala Ranch Water System wells (Nos. 6549-01 and -02) was more saline than expected. It may be that subsurface features which create high level groundwater further inland are also limiting the mauka-to-makai groundwater flow at this test well site.
- Another State DHHL test well further to the south (No. 6448-01) had completely anomalous results. It had a very low static water level (only 1.0 feet as compared to an expected 4 to 5 feet) and high salinity (chlorides of 2500 mg/l as compared to an expected 150± mg/l). Due to these results, the borehole was not pump tested or completed as a production well.

To provide an indication of groundwater quality, two wells in the mauka-makai corridor of the project were sampled. Sampling was also done at the three shoreline locations shown on Figure 3 to characterize the groundwater at its point of shoreline discharge. All of these water quality results are compiled in Table 2.

Figure 4 plots these results for NO<sub>3</sub> and PO<sub>4</sub> on mixing lines of these constituents. The mixing lines are linear plots using two end points, the well furthest inland (No. 6549-01) and the ocean offshore. If the samples collected along the shoreline plot above the line, it demonstrates an enrichment of that constituent in the groundwater's travel to and discharge at the shoreline. If the intervening sample plots on the mixing line, it would be a simple dilution of the two endpoints and indicate no change to that constituent. Finally, if the intervening sample plots below the mixing line, it indicates a depletion of that constituent. These results show that there is an apparent enrichment of NO<sub>3</sub> by natural processes and/or inputs from the upgradient Kohala Ranch and Kohala Estates developments. In contrast, there appears to be a depletion of PO<sub>4</sub>.

## Potential Impacts to Water Resources

Use of Groundwater from the Kohala Ranch Water System Wells. At present, supply to customers of the Kohala Ranch Water System is provided by Wells 6549-01 and -02. These wells are 2.6 miles inland and at about 1460-foot elevation. Based on data reported to the CWRM, pumpage has average about 0.7 MGD since 2008 (refer to Figure 5). The project's estimated average use of 5500 or 10,500 GPD would represent an increase of pumpage of about one (1) percent, well within the capacity of the system. It is estimated that groundwater withdrawal by either of these well pumps affects the shoreline groundwater across a width of about 1.4 miles, potentially including the southern half of the Kohala Shoreline LLC project site. Two other aspects of this ongoing pumpage are notable:

- The 0.7 MGD average pumpage by the Kohala Ranch Water System wells has reduced the input of nitrogen and phosphorus into the marine environment substantially. This flowrate and nutrient reduction need to be accounted for in assessing impacts of the Kohala Shoreline project.
- The "safe yield" of the two Kohala Ranch wells, defined as their capacity with one well as standby, is about 1.0 MGD. This amount is being approached by their current summertime pumpage. A necessary increase in supply capability is foreseeable. It will entail outfitting one or the other of its two unused wells on the Kohala Ranch property (Nos. 6649-01 or -02 on Figure 3).

Table 2

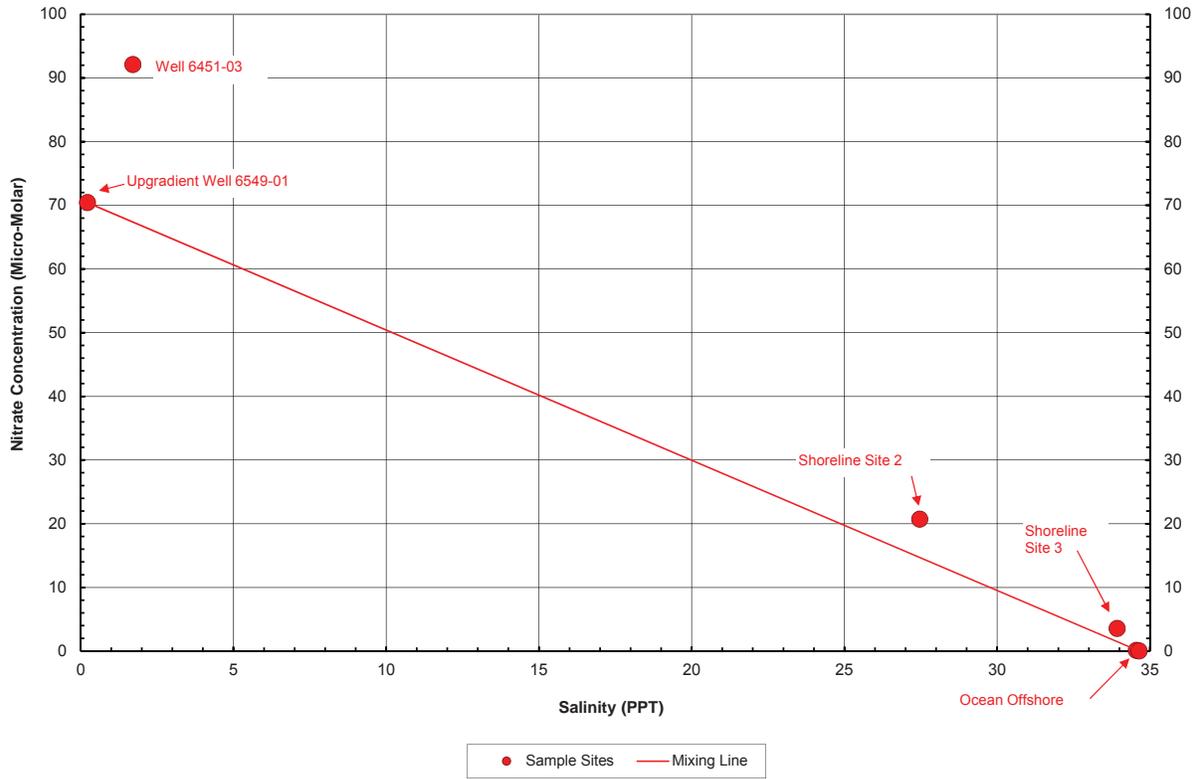
Laboratory Results of Samples Collected in the  
Mauka-Makai Corridor of the Kohala Shoreline LLC Project Site

Sample Location	NO <sub>3</sub> ( μM )	NH <sub>4</sub> ( μM )	DON ( μM )	TN ( μM )	PO <sub>4</sub> ( μM )	DOP ( μM )	TP ( μM )	Silica ( μM )	Salinity ( PPT )
Well 6549-01	70.4	1.05	12.0	83.5	3.30	0.15	3.45	875	0.228
Well 6451-03	92.1	1.30	1.75	95.1	1.50	0.65	2.15	962	1.712
Shoreline Site 1	0.12	0.85	11.2	12.1	0.04	0.34	0.38	4.90	34.56
Shoreline Site 2	20.7	0.05	12.5	33.2	0.04	0.51	0.55	182	27.47
Shoreline Site 3	3.54	0.23	7.7	11.4	0.12	0.28	0.40	28.5	33.93
Ocean Offshore	0.01	0.12	7.8	7.9	0.10	0.28	0.38	1.8	34.65

- Notes:
1. Samples collected on December 17, 2009 by Steve Dollar and Tom Nance.
  2. Laboratory analyses by Marine Analytical Specialists (EPA Labcode: HI 00009).
  3. Results presented in micro-molar (μM) units can be converted to milligrams per liter by multiplying by the atomic weight and dividing by 1000.

Figure 4. Mixing line Analyses of Nitrate and Phosphate Concentrations

Mixing Line Analysis of Nitrate Concentrations



Mixing Line Analysis of Phosphate Concentrations

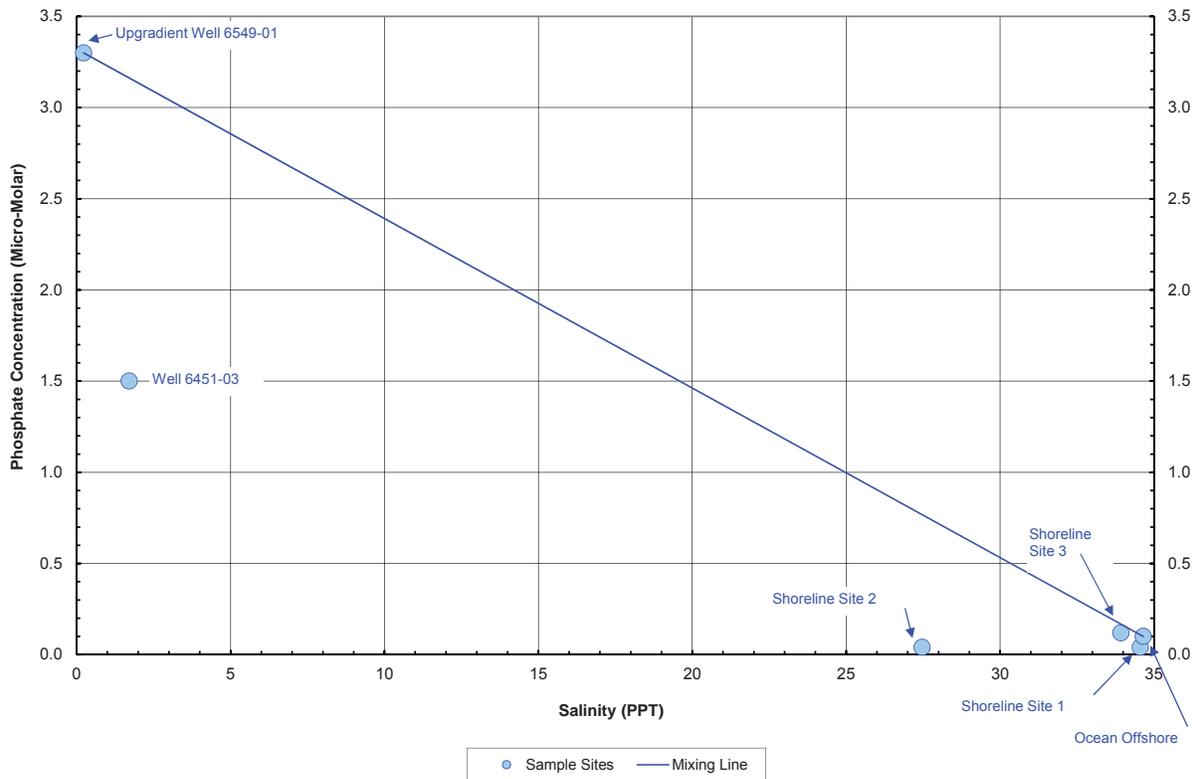
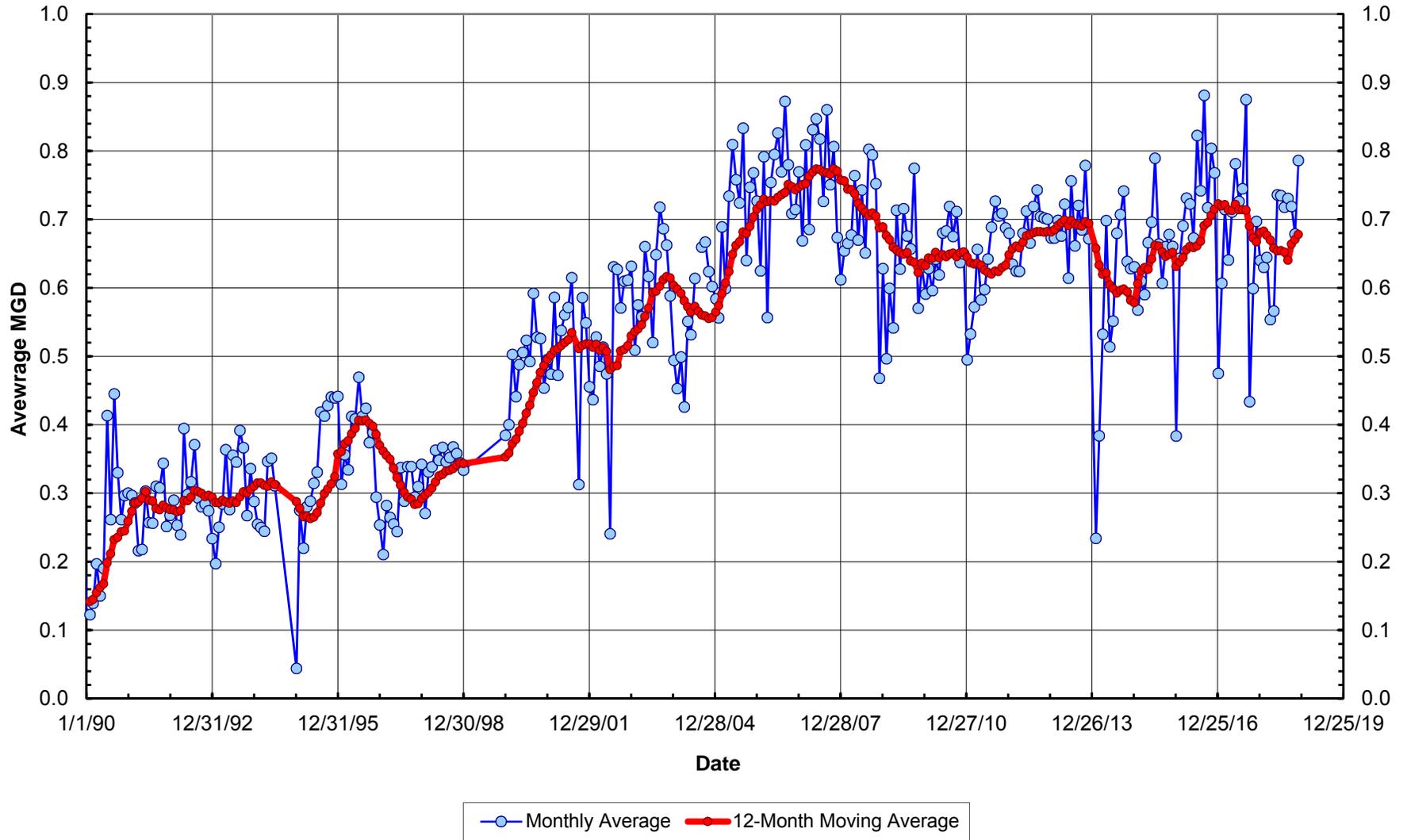


Figure 5. Pumpage by the Kohala Ranch Wells as Reported to the Commission on Water Resource Management



Potential Impacts to Groundwater of Activities on the Kohala Shoreline LLC Project Site. Tables 3 and 4 are compilations of potential impacts to groundwater flowrate and nitrogen and phosphorus loading due to activities on the project site for project water use of 5500 and 10,500 GPD. In addition to the data and calculations presented previously, the following assumptions are incorporated in the results on Tables 3 and 4:

- The estimated 1.15 MGD of groundwater flowing beneath the Kohala Shoreline LLC project site and discharging along its 0.5-mile long shoreline has been reduced by about 0.35 MGD by the pumping of upgradient wells. This leaves a residual flowrate beneath the project site of about 0.80 MGD.
- A portion of the pumpage of the Kohala Ranch wells to supply the Kohala Shoreline project, would reduce the flowrate beneath the project. It is assumed that half of this upgradient increase in well pumpage would impact the project's shoreline.
- For wastewater treatment and disposal, all six residences would use systems such as the Cyclical Biological Treatment (CBT) system evaluated in Babcock et al (2006).
  - Wastewater generation would be 300 GPD per lot, 1800 GPD for the six lots.
  - Raw wastewater would contain total nitrogen (TN) at 50 milligrams per liter (MG/L) and total phosphorus (TP) at 10 MG/L.
  - Removal rates the CBT system would be 85 percent for TN and 75 percent for TP
  - Effluent from the CBT system would be disposed of in leach fields.
  - Upon passage through the leach fields, the effluent would travel downward through unsaturated lava flows and then travel with the basal groundwater to discharge along the project's shoreline.
  - Removal of TN and TP during passage through the leach field and unsaturated lavas are conservatively assumed to be 70 and 90 percent, respectively.
- Total applied irrigation use would amount to 3700 GPD for water use at 750 GPD per lot and 8200 GPD for use at 1500 GPD per lot
  - 15 percent of applied irrigation water would pass below the root zone, ultimately reaching the groundwater below
  - The TN and TP of the percolating applied irrigation water would be twice as great as in the applied irrigation water.
  - Natural TN and TP removal rates during downward passage through unsaturated lavas and lateral travel with the groundwater to the shoreline are conservatively to be 50 and 60 percent, respectively.
- As presented previously, the increase in rainfall runoff due to the project would amount to 0.5 MG annually, equivalent to a year-round daily average of 0.0014 MGD (1400 GPD).
  - TN and TP concentrations in the rainfall runoff would be 1.3 and 0.1 MG/L, respectively.
  - All of the additional rainfall runoff would be captured in dry wells, ultimately reaching the groundwater below.
  - Natural removal rates of TN and TP in the downward travel through unsaturated lavas and lateral travel with groundwater to the shoreline would be 50 and 60 percent, respectively.

Table 3

Potential Changes to Groundwater Discharging Along  
the 0.5-Mile Long Project Shoreline for Project Water Use of 5500 GPD

Component of Flow	Flowrate ( MGD )	Nitrogen ( lbs / day )	Phosphorus ( lbs / day )
Existing Conditions	0.8000	7.7902	0.7127
Changes as a Result of the Project			
▪ Draft from Kohala Ranch Wells	-0.0028	-0.0268	-0.0024
▪ Generation, Treatment, and Disposal of Domestic Wastewater	+0.0018	+0.0337	+0.0037
▪ Percolation of Excess Applied Landscape Irrigation	+0.0006	+0.0054	+0.0005
▪ Capture and Disposal of the Increase in Rainfall-Runoff in Dry Wells	+0.0014	+0.0076	+0.0005
Post Development Conditions	0.8010	7.8101	0.7150
▪ Percent Change	+0.12%	+0.26%	+0.32%

Table 4

Potential Changes to Groundwater Discharging Along  
the 0.5-Mile Long Project Shoreline for Project Water Use of 10,500 GPD

Component of Flow	Flowrate ( MGD )	Nitrogen ( lbs / day )	Phosphorus ( lbs / day )
Existing Conditions	0.8000	7.7902	0.7127
Changes as a Result of the Project			
▪ Draft from Kohala Ranch Wells	-0.0052	-0.0512	-0.0046
▪ Generation, Treatment, and Disposal of Domestic Wastewater	+0.0018	+0.0337	+0.0037
▪ Percolation of Excess Applied Landscape Irrigation	+0.0012	+0.0120	+0.0010
▪ Capture and Disposal of the Increase in Rainfall-Runoff in Dry Wells	+0.0014	+0.0076	+0.0005
Post Development Conditions	0.7992	7.7923	0.7133
▪ Percent Change	-0.10%	+0.03%	+0.08%

## Summary of Findings and Conclusions

1. Implementation of the revised project plan would create six (6) residential lots on the 38-acre site.
2. The project represents that, through restrictions in its CC&Rs, water use would be limited to 750 GPD per residential lot. Allowing for landscape irrigation on 0.25 acres of its entry feature, the project's potable water use under this restriction would be 5500 GPD. The report presents an analysis of potential impacts on groundwater for this water use rate and the requirement to use individual aerobic treatment systems and leach fields for the treatment and disposal of domestic wastewater.
3. To compare the impact on groundwater if the water use rate is greater than 750 GPD per residence, an analysis of potential impacts for water use of 1500 GPD per lot is also presented.
4. Tables 3 and 4 compare respective impacts on groundwater for the 750 and 1500 GPD water use rates per residence. For both rates of water use, the potential impact on groundwater beneath the project site and ultimately discharging along its shoreline is very modest. At either of the water use rates, for example, increases in nitrogen and phosphorus are calculated to be substantially less than one (1) percent.
5. Probably contrary to expectation, the additions of nitrogen and phosphorus discharging into the marine environment for the 1500 GPD per residence greater water use rate are actually less than for water use at 750 GPD per lot. The reason for this is that the removal of nitrogen and phosphorus by the increased draft from the Kohala Ranch wells more than offsets the increase in the amount of excess applied irrigation water reaching the groundwater below.
6. The calculated potential changes to groundwater discharging along the project's shoreline are so small as to not be detectable relative to natural seasonal variations of these parameters.

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