
Draft

**Archaeological Data Recovery Report for the
Queen Ka‘ahumanu Highway Widening Phase 2 Project,
Kalaoa, Kalaoa-‘O‘oma, ‘O‘oma 2, Kohanaiki, Kaloko,
Honokōhau 1–2 and Kealakehe Ahupua‘a,
North Kona District, Island of Hawai‘i
TMKs: [3] 7-3-009, 7-3-043, and 7-4-008**

VOLUME I

**Prepared for
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Management Summary

Reference	Archaeological Data Recovery Report for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1–2 and Kealakehe, North Kona District, Island of Hawai'i, TMKs: [3] 7-3-009, 7-3-043, and 7-4-008 (LaChance et al. 2017)
Date	October 2017
Project Number(s)	Cultural Surveys Hawai'i, Inc. (CSH) Job Code: KALAOA 19
Investigation Permit Number	CSH completed the archaeological data recovery (ADR) fieldwork under archaeological fieldwork permit numbers 15-03 and 11-17, issued by the Hawai'i State Historic Preservation Division (SHPD) per Hawai'i Administrative Rules (HAR) §13-282.
Agencies	State of Hawai'i, Highways Division, Department of Transportation (HDOT), Federal Highway Administration (FHWA), U.S. Department of Transportation; Hawai'i State Historic Preservation Office (SHPO), Department of Land and Natural Resources (DLNR)
Land Jurisdiction	The State of Hawai'i owns the land within the right-of-way (ROW).
Project Proponent	HDOT
Project Funding	FHWA, State of Hawai'i
Project Location	The initial project area in the final archaeological inventory survey (AIS) (Monahan et al. 2012a) consisted of the Queen Ka'ahumanu Highway ROW, an approximately 300-foot (ft) wide corridor, beginning (in the south) approximately 350 m (1,150 ft) south of Kealakehe Parkway (approximate Station 1110+00) and ending (in the north) at approximately 518 m (1,700 ft) north of Keāhole Airport Road (304.8 m [1,000 ft] + taper length; approximate Station 252+00). This initial project area and the expanded area of potential effect (APE; see discussion below) are depicted on the 1996 Keahole Point USGS 7.5-minute topographic quadrangle (see Figure 1).
Project Description	The undertaking consists of widening the Queen Ka'ahumanu Highway from two to four lanes from the north terminus of Phase I of the highway widening project south of Kealakehe Parkway to the north of Keāhole Airport Access Road. Ground disturbance associated with the project includes grading and filling portions of the ROW and connections with intersecting streets. Most of the major ground disturbance is on the <i>makai</i> (seaward) side of the existing highway.
Project Acreage and Area of Potential Effects (APE)	Subsequent to acceptance of the 2012 AIS report by Monahan et al., the project APE was expanded by a 2016 supplemental AIS (see Wilkinson et al. 2017) to include an additional 22.82 acres (9.23 hectares) comprising 13 discrete locations. These locations are depicted on the USGS topographic map and area location maps in relation to the overall

	<p>APE, but have no effect on the extent of the data recovery work for the project.</p> <p>The revised APE acreage is approximately 1,380 acres (558.5 hectares) and includes the Queen Ka'ahumanu Highway ROW, portions of intersecting streets, construction offices, base yards, storage areas, and the Kaloko-Honokōhau National Historical Park, which includes the Honokōhau Settlement National Historic Landmark (State Inventory of Historic Places [SIHP] # 50-10-27-4138). The APE is located in the <i>ahupua'a</i> (land divisions) of Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2, and Kealakehe, North Kona District, Hawai'i Island.</p>
Historic Preservation Regulatory Contextⁱ	<p>This data recovery investigation was designed to comply with both Federal and Hawai'i State environmental and historic preservation review legislation. Due to federal (FHWA) funding, this project is a federal undertaking, requiring compliance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and Section 4(f) of the Department of Transportation Act. As an HDOT project on Hawai'i State and private land, the project is also subject to Hawai'i State historic preservation review legislation (Hawai'i Revised Statutes [HRS] §343, HRS §6E-8 and HAR §13-275, respectively). This report fulfills state requirements for such reports pursuant to HAR §13-278.</p>
Fieldwork Effort	<p>Data recovery fieldwork commenced in October 2011 and was performed by Sarah Wilkinson, B.A., Olivier Bautista, B.A., and Trevor Yucha, B.A., who assisted project director Chris Monahan, Ph.D. However, due to a revision of the project scope, data recovery was halted during this fieldwork effort after approximately 12 person-days of work had been completed.</p> <p>Data recovery fieldwork then resumed in May and June 2015, when it was completed. The 2015 field crew included Olivier Bautista, B.A., Scott Belluomini, B.A., Johnny Dudoit, B.A., Angus Raff-Tierney, M.A., Andrew Soltz, B.A., Nifae Hunkin, B.A., Layne Krause, B.A., and Richard Stark, Ph.D., under the direction of project manager William Folk, B.A. The fieldwork required approximately 97 person-days to complete.</p> <p>All data recovery fieldwork was completed under the general supervision of the principal investigator, Hallett H. Hammatt, Ph.D. The results of both the 2011 and 2015 data recovery fieldwork are presented in Volume II of this report.</p>
Historic Properties Studied	<p>Data recovery efforts included the following:</p> <ul style="list-style-type: none"> Controlled excavation at 12 historic properties (SIHP #s 50-10-27-10154, -28778, -28785, -28786, -28807, -28812 through -28815, -29332, 29335, and -29345)

	<ul style="list-style-type: none"> • Artifact collection at two historic properties (SIHP #s -29348 and -28349) • Relocation of SIHP #s -29346 and -28808 Features D and E • Photo documentation of SIHP # -19947 • Characterization of 16 historic trail properties through historical research (SIHP #s -00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272)
Research Objectives	<p>Data recovery research objectives included the following:</p> <ol style="list-style-type: none"> 1. Research Objective 1 is to characterize the nature and distribution of trail types (e.g., those with formal features such as curbing and steppingstones versus those without) by developing a predictive model based on known trails in the North Kona region and by integrating this data with documented trails in the project area. 2. Research Objective 2 is to understand the nature and intensity of cultivation in the project area within the context of predictive models for North Kona based on variation in elevation and rainfall. 3. Research Objective 3 is to further evaluate a number of architectural features of indeterminate function through further documentation, primarily by excavation (i.e., subsurface testing and/or dismantling), in order to contribute to the understanding of both pre- and post-Contact utilization of the area. 4. Research Objective 4 is to determine the absolute dates of occupation of the project area, as may be available from data recovery sites at which excavation/dismantling is proposed.
Results of Data Recovery	<p>Research Objective 1 (trails):</p> <p>Archival research and analysis of trail characteristics indicate the majority of trails in the current data recovery project are <i>mauka-makai</i> (mountains to sea) oriented trails, with many likely dating to the pre- or early post-Contact period with use into the historic period. Some historic trails likely developed from earlier, traditional Hawaiian footpaths, which were subsequently improved for use by horses, carriages, and in some cases Jeeps. Only one trail, the Māmalahoa Trail (SIHP # -00002), is oriented across <i>ahupua'a</i> (traditional land division), and several of the other trails cross the Māmalahoa Trail on their way from the coast to the uplands. Some of these were major <i>mauka-makai</i> routes (e.g., SIHP #s -18099 [Road to Honokōhau], -10714 [Road to the Sea]) that allowed residents to travel between resource zones, while others appear to have been geared more toward localized travel. The majority of activity appears to have been concentrated in the Kaloko-Honokōhau area, where most of the trails were identified in the current project, as well as in previous studies.</p>

	<p>Research Objective 2 (cultivation):</p> <p>Pollen and starch analyses were performed on six sediment samples collected in lava features at four historic properties (SIHP #s -28778, -28785, -28786, and -28813), all of which were initially interpreted as traditional Hawaiian agricultural features. Based on the results of the analysis, SIHP # -28778 (<i>pāhoehoe</i> excavation) has been reinterpreted as a prospecting pit. SIHP # -28785 (enclosure) is reinterpreted as a historic feature used for animal husbandry. SIHP # -28786 (modified depression) was previously reinterpreted as a temporary shelter; however, the palynological evidence suggests it may have been used for animal husbandry as well. The recovery of large Poaceae pollen at SIHP # -28813 suggests the growth/use of <i>pili</i> grass, which was commonly used by Native Hawaiians for thatching.</p> <p>Research Objective 3 (function):</p> <p>Excavation and/or dismantling occurred at historic properties where the function could not be determined. The indeterminate historic properties included in data recovery excavation/dismantling are SIHP #s -28807, -28812, -28814, -28815, -29332, -29335, and -29345. Excavation and/or dismantling during data recovery fieldwork yielded new evidence for the function, or possible function, of six of the seven historic properties; only SIHP # -29335 failed to yield useful data. SIHP #s -28807 and -29345 (filled crevices) were determined to be modern activity areas, likely associated with commonly observed “Kona graffiti.” SIHP #s -28812 and -29332 were determined to be natural rock formations with no cultural function. SIHP # -28814 (lava tube) has been reassessed as a “potential subterranean resource.” SIHP # -28815 (<i>pāhoehoe</i> excavation) is reinterpreted as a resource prospecting pit.</p> <p>Research Objective 4 (temporal analysis):</p> <p>Radiocarbon analysis was performed on three samples from two historic properties, SIHP #s -28778 and -28785. All three samples yielded two-sigma calibrated date ranges indicating possible utilization as early as the late pre-Contact period; however, a historic or even modern origin could not be ruled out based on the radiocarbon results.</p>
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ⁱ The State of Hawai'i historic preservation review process is designed to identify and mitigate a project's impacts to significant historic properties. Historic properties are defined as “any building, structure, object, district, area, or site, including *heiau* [temple] and underwater site, which is over fifty years old” (HAR §13-284-2). The six potential historic preservation review steps include the following: 1) identification and inventory, to determine if historic properties are present in the project's area and, if so, to identify and document (inventory) them; 2) evaluation of historic property significance; 3) determination of project effect (impact) on significant historic properties; 4) mitigation commitments that commit to acceptable forms of mitigation in order to properly handle or minimize impacts to significant historic properties; 5) detailed mitigation plan, scope of work to properly carry-out the general mitigation commitments; and 6) verification of completion of detailed mitigation plan (HAR §13-284-3). A project's effect and potential mitigation measures are evaluated

based on the project's potential impact to "significant" historic properties [those historic properties determined significant following their evaluation of significance (HAR §13-284-6)].

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Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation, on behalf of the State of Hawai'i Department of Transportation (HDOT), Cultural Surveys Hawai'i, Inc. (CSH) conducted archaeological data recovery and prepared this archaeological data recovery (ADR) report for the proposed Queen Ka'ahumanu Highway Widening Phase 2 project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1–2, and Kealakehe, North Kona District, Island of Hawai'i, TMKs: [3] 7-3-009, 7-3-043, and 7-4-008. The 2011 data recovery was conducted in accordance with the Altizer and Monahan (2011) archaeological data recovery and preservation plan (ADRP), and the 2015 data recovery was conducted in accordance with the Shideler et al. (2012) ADRP and the Hammatt and Shideler (2014) archaeological preservation and mitigation plan (APMP).

The initial project area in the final archaeological inventory survey (AIS) (Monahan et al. 2012a) consisted of the Queen Ka'ahumanu Highway right-of-way (ROW), an approximately 300-foot (ft) wide corridor, beginning (in the south) approximately 350 m (1,150 ft) south of Kealakehe Parkway (approximate Station 1110+00) and ending (in the north) at approximately 518 m (1,700 ft) north of Keāhole Airport Road (304.8 m [1,000 ft] + taper length; approximate Station 252+00). Subsequent to acceptance of the 2012 report, the project's area of potential effect (APE) was expanded during a supplemental AIS (see Wilkinson et al. 2017) to include an additional 9.23 hectares (22.82 acres) comprising 13 discrete locations. These locations have no effect on the extent of the data recovery work for the project. The revised project area and APE are depicted in Figure 1 (U.S. Geological Survey [USGS] 7.5-minute Keahole Point topographic quadrangle), Figure 2 through Figure 4 (Tax Map Key [TMK] maps), and Figure 5 (aerial photograph).

The revised APE acreage is approximately 1,380 acres (558.5 hectares) and includes Queen Ka'ahumanu Highway ROW, portions of intersecting streets, construction offices, base yards, storage areas, and the Kaloko-Honokōhau National Historical Park, which includes the Honokōhau Settlement National Historic Landmark (State Inventory of Historic Places [SIHP] # 50-10-27-4138). The APE is located in the *ahupua'a* (land divisions) of Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1–2, and Kealakehe, North Kona District, Hawai'i Island. The historic properties addressed by this ADR report are illustrated in relation to the project area and APE in Figure 6.

The Queen Ka'ahumanu Highway Widening project (Phase 2) includes the design and construction services to widen the highway from the existing two lanes into a four-lane divided highway within the 300-ft ROW between Kealakehe Parkway and the Keāhole Airport Access Road. The project includes the construction, installation, and/or relocation of new pavements and pavement markings, drainage systems, sidewalks, traffic signal systems and traffic signs, guardrails, highway lighting, and utilities, as well as and landscape plantings. It should be noted that earlier in the project conception, the project area was divided into two segments—North and South—for pragmatic reasons related to construction schedules (Figure 7). This division of the project area is now obsolete, although two reports (Monahan and Wilkinson 2012; Monahan and

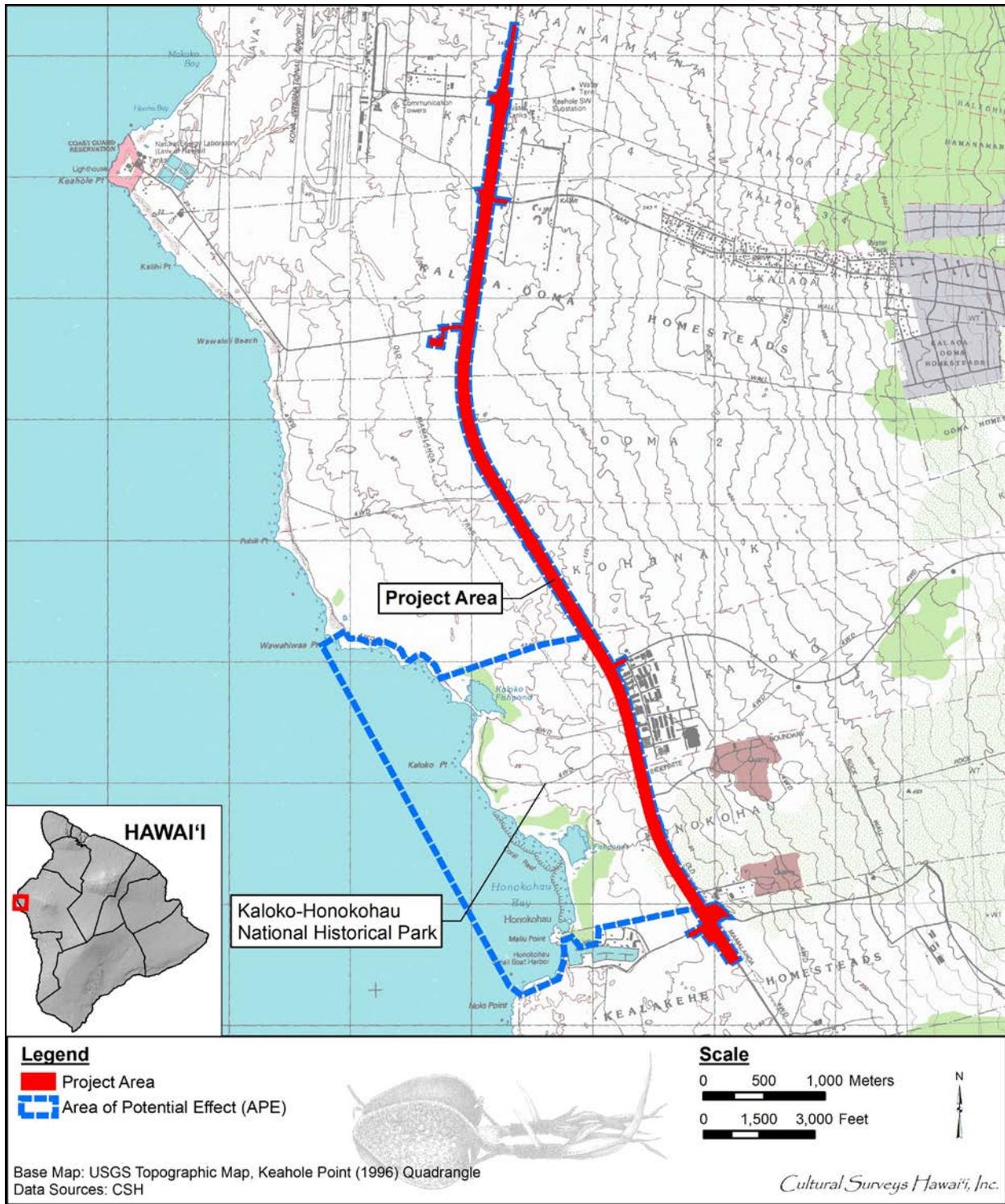


Figure 1. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing the Queen Ka‘ahumanu Highway Widening Phase 2 project area and APE

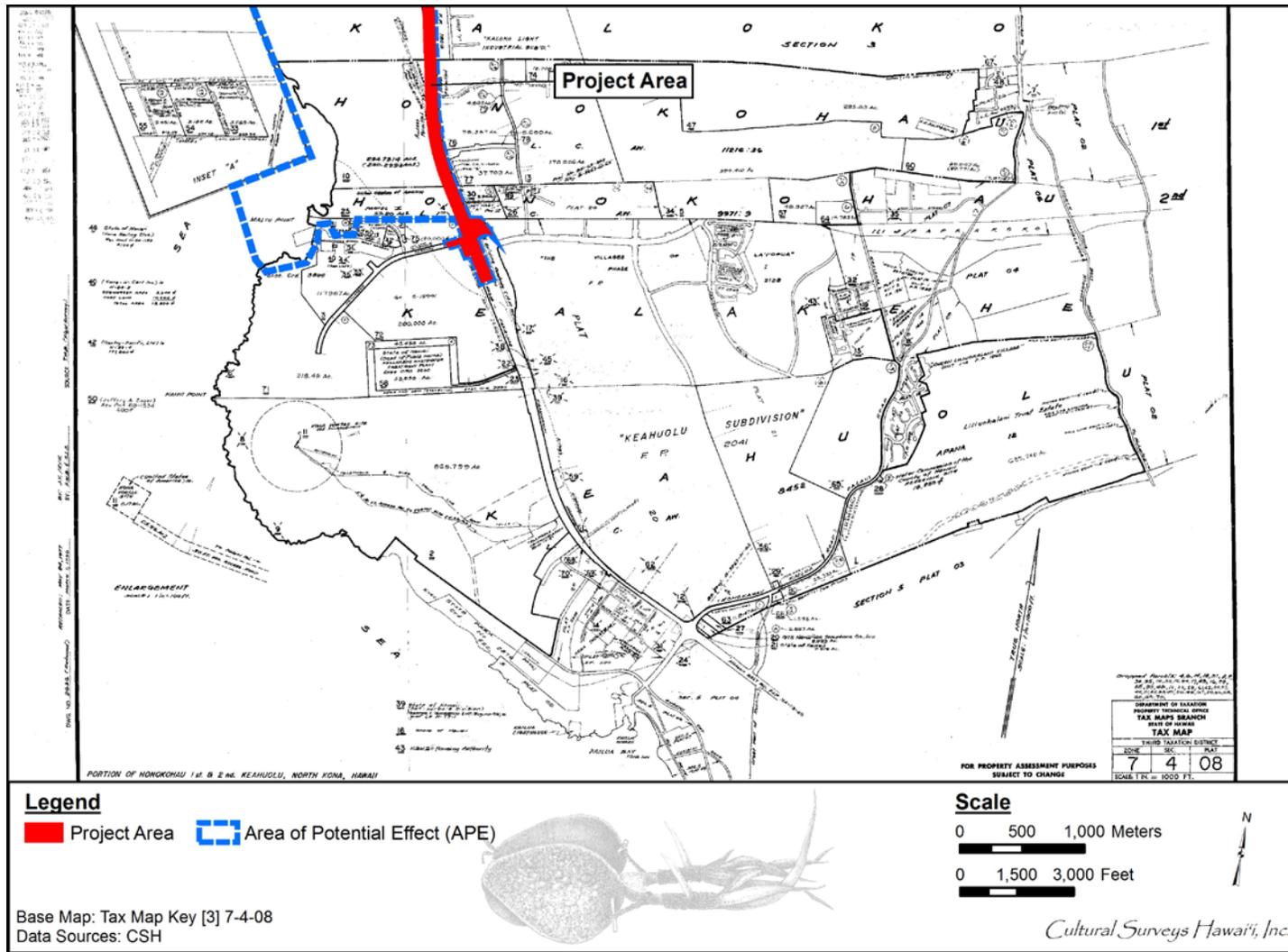


Figure 2. Tax Map Key (TMK) [3] 7-4-008, showing the Queen Ka‘ahumanu Highway Phase 2 project area and APE (Hawai‘i TMK Service 2014)

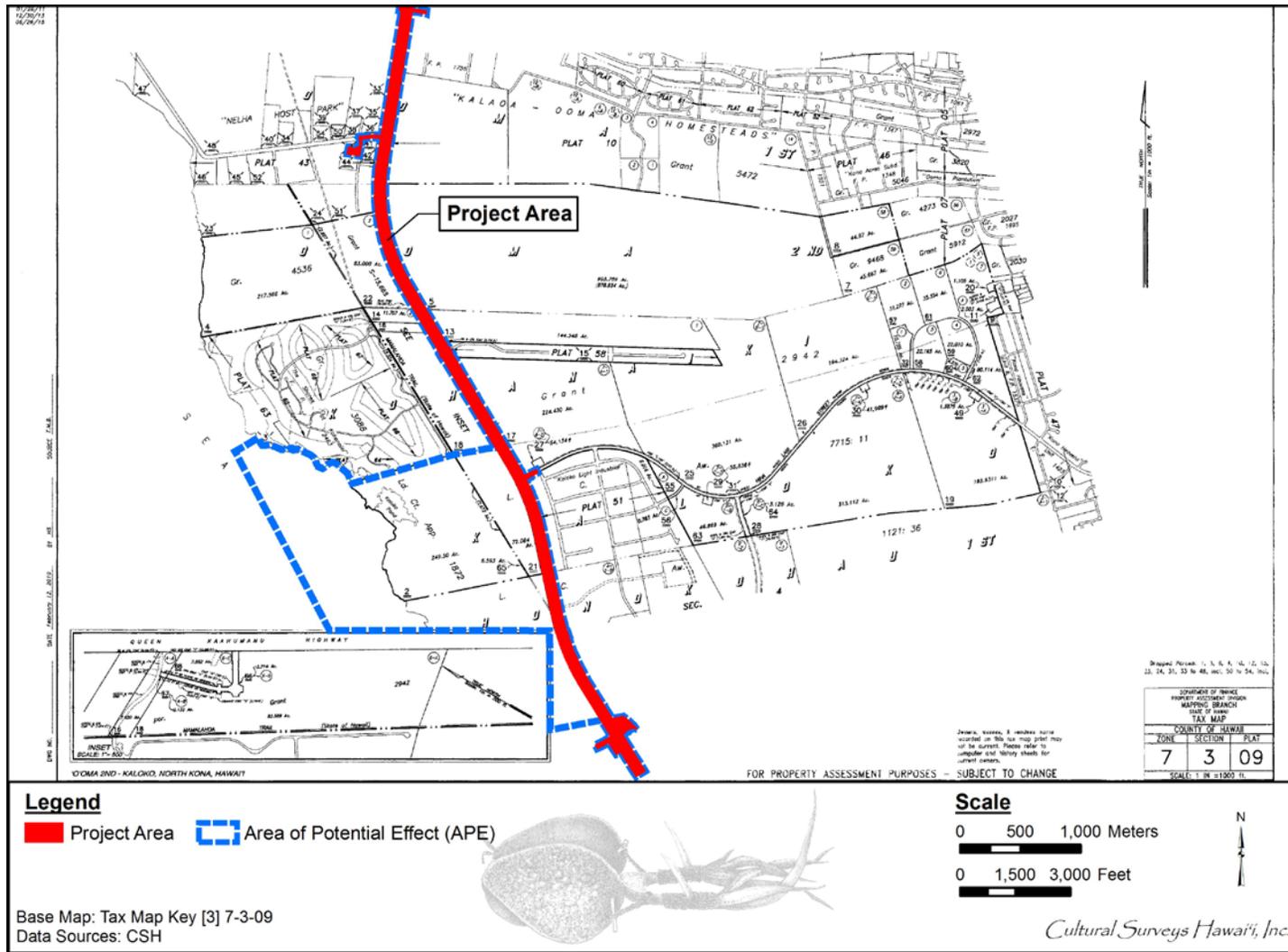


Figure 3. TMK: [3] 7-3-009, showing the Queen Ka'ahumanu Highway Phase 2 project area and APE (Hawai'i TMK Service 2014)

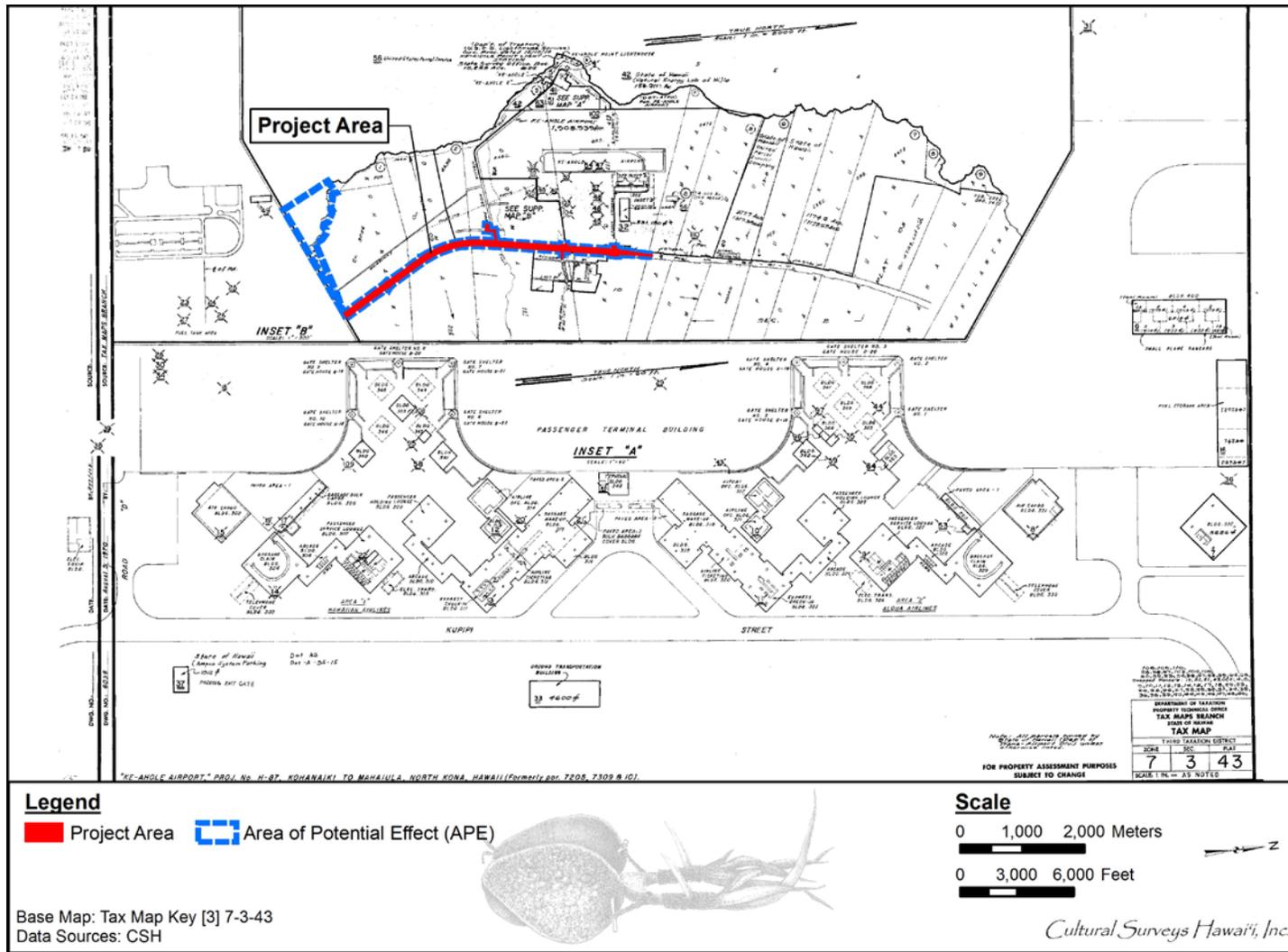


Figure 4. TMK: [3] 7-3-043, showing the Queen Ka'ahumanu Highway Phase 2 project area and APE (Hawai'i TMK Service 2014)



Figure 5. Aerial photograph showing the Queen Ka‘ahumanu Highway Widening Phase 2 project area (Google Earth 2013)

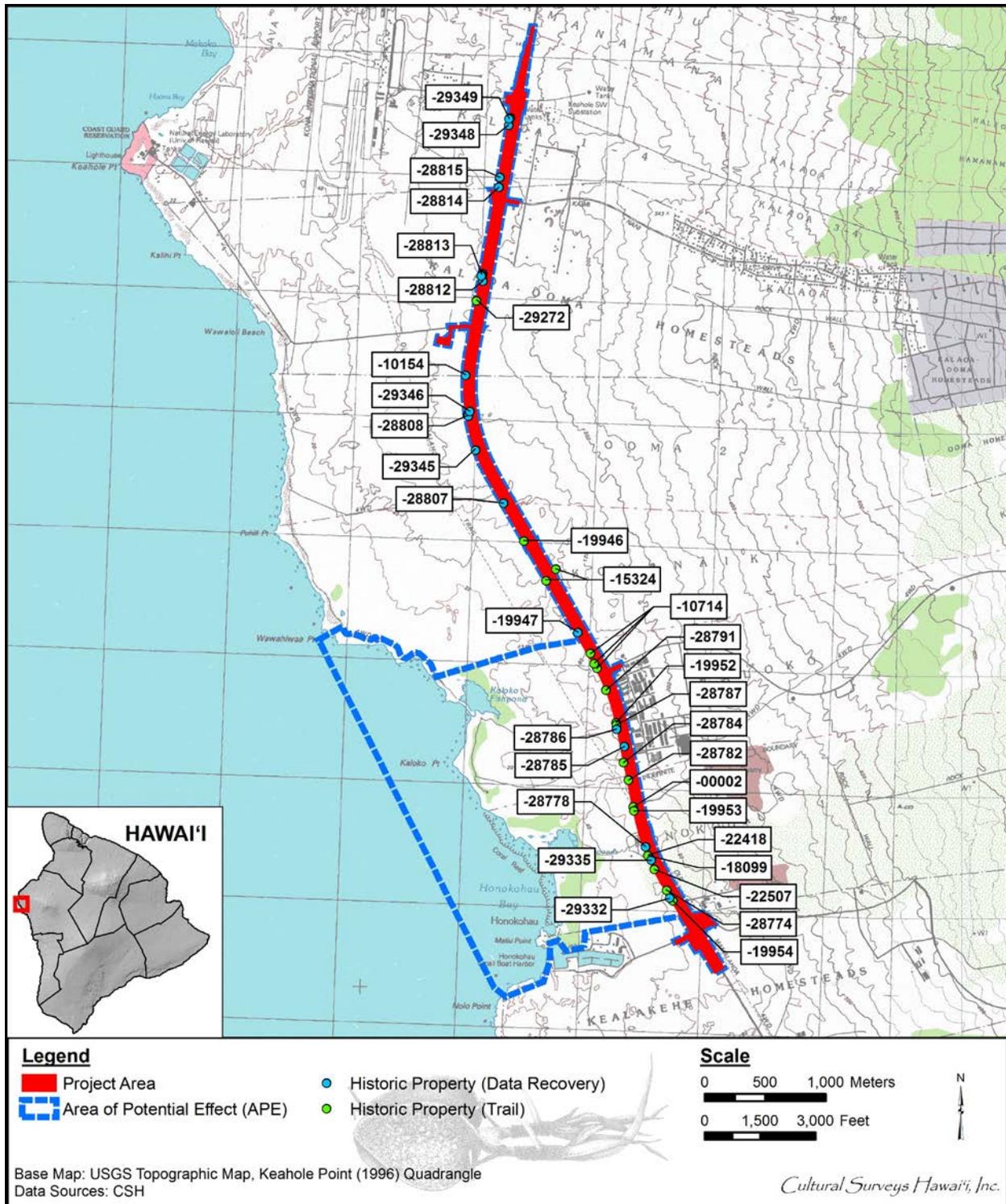


Figure 6. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing all ADR historic properties (trails indicted in green, all other ADR sites in blue) in relation to the Queen Ka‘ahumanu Highway Widening Phase 2 project area and APE

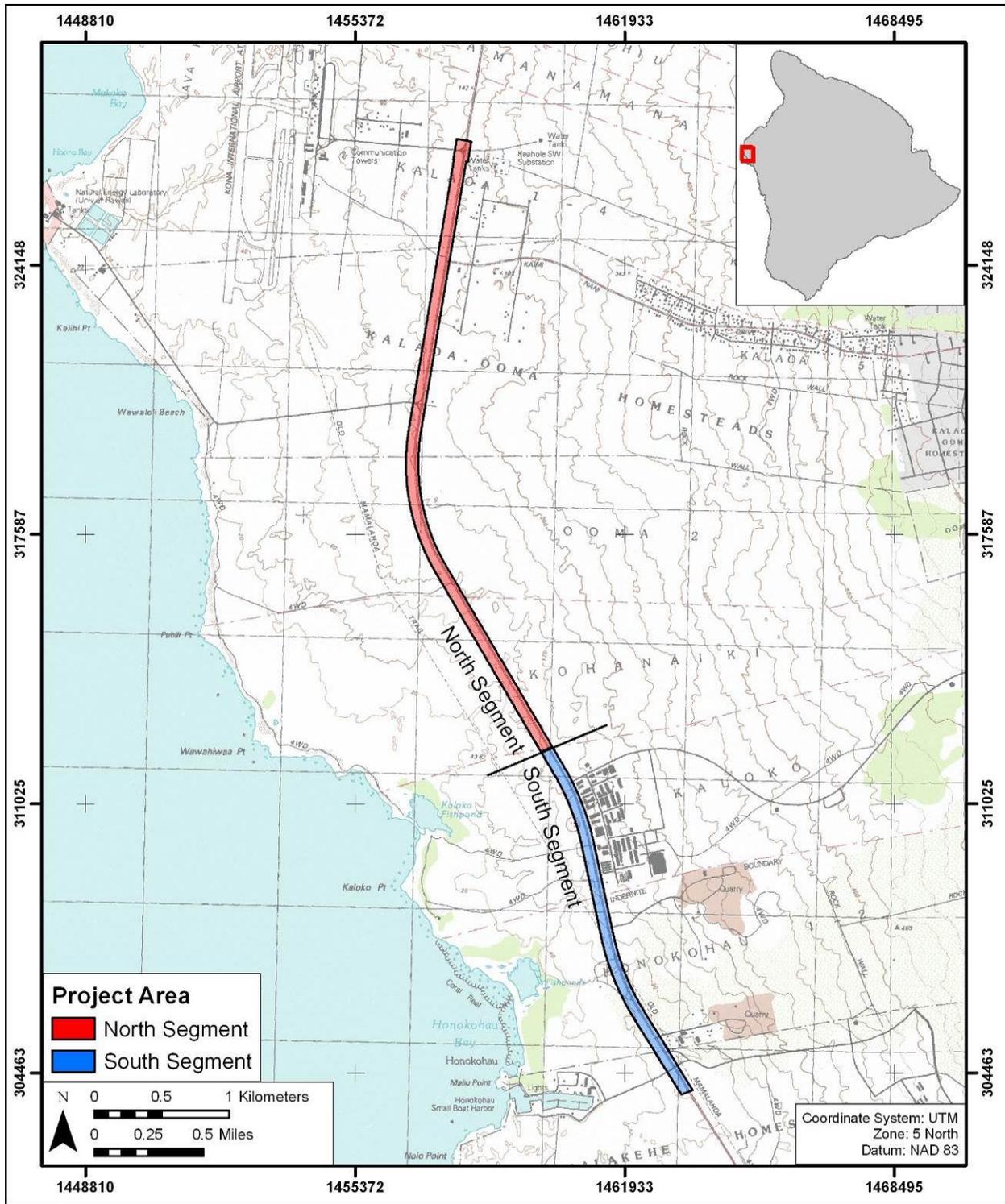


Figure 7. Schematic depiction of the now obsolete North and South segments of the project area

Yucha 2012) describing supplemental survey work with consulting parties include this north/south distinction in their titles and organization.

1.2 Historic Preservation Regulatory Context

This data recovery investigation was designed to comply with both Federal and Hawai'i State environmental and historic preservation review legislation. Due to federal (FHWA) funding, this project is a federal undertaking, requiring compliance with Section 106 of the National Historic Preservation Act (NHPA), the National Environmental Policy Act (NEPA), and Section 4(f) of the Department of Transportation Act. As an HDOT project within a state ROW, the project is also subject to Hawai'i State environmental and historic preservation review legislation (Hawai'i Revised Statutes [HRS] §343 and HRS §6E-8/Hawai'i Administrative Rules [HAR] §13-275, respectively). This report fulfills state requirements for such reports pursuant to HAR §13-278.

On 21 August 2012, an *Archaeological Inventory Survey for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2 and Kealakehe, North Kona District, Hawai'i Island, TMK: (3) 7-4-008, 7-3-009 & 7-3-043* (Monahan et al. 2012a) was reviewed and accepted by the SHPD (LOG NO.: 2012.1443, DOC. NO.: 1208MV01; Appendix A). At the request of the HDOT, CSH subsequently conducted a *Supplemental Archaeological Inventory Survey Report for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2 and Kealakehe, North Kona District, Hawai'i Island, TMKs: [3] 7-2-005, 7-3-009, 043, 049, 051, 058, 7-3-043:091, 083, 7-4-020* (Wilkinson et al. 2017), which addressed 13 supplemental project areas appended to the original project area of Monahan et al. (2012a). Further discussion of the AIS and supplemental AIS is included in Section 2.

This ADR report has been prepared in accordance with an *Archaeological Data Recovery and Preservation Plan for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2 and Kealakehe, North Kona District, Hawai'i Island, TMK: (3) 7-4-008, 7-3-009 & 7-3-043* (Shideler et al. 2012), which was reviewed and accepted by the SHPD in a Chapter 6E-8 and NHPA Section 106 Review dated 25 October 2012 (LOG NO.: 2012.3052, DOC. NO.: 1210MV25; see Appendix A). Additionally, the present report also follows *An Archaeological Preservation and Mitigation Plan [APMP] Addressing 23 Sites for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1-2 and Kealakehe, North Kona District, Island of Hawai'i, TMKs: [3] 7-4-008, 7-3-009, and 7-3-043* (Hammatt and Shideler 2014). This plan was prepared in response to SHPD §6E-8 and NHPA Section 106 reviews dated 23 July 2013 (LOG NO.: 2013.4167, DOC. NO.: 1307MV17) and 28 October 2013 (LOG NO.: 2013.4167, DOC. NO.: 1307MV17) (see Appendix A) following changes to the project. The APMP was reviewed and accepted by the SHPD in a §6E-8 and NHPA Section 106 review dated 9 April 2014 (LOG NO.: 2014.1379, DOC. NO.: 1404MV06; see Appendix A).

1.3 Scope of Work

The following ADR scope of work was developed and implemented in accordance with the SHPD rules governing standards for ADR and reports:

Archaeological Data Recovery Fieldwork

Field methods include documentation and excavation in arbitrary levels and collection of samples for potential lab analyses (see Section 3.1 for further detail of fieldwork methods).

1. Archaeological fieldwork is based on this project's data recovery plan (research design, as approved by the SHPD/Department of Land and Natural Resources [DLNR]). Data recovery fieldwork includes excavation and/or dismantling at 12 historic properties (SIHP #s 50-10-27-10154, -28778, -28785, -28786, -28807, -28812 through -28815, -29332, 29335, and -29345), artifact collection at two historic properties (SIHP #s -29348 and -28349), and relocation of SIHP #s -29346 and -28808 Features D and E.
2. All artifactual and faunal material and features will be documented and analyzed. If appropriate samples are found within the excavations, they will be analyzed for chronological and paleoenvironmental information.
3. Laboratory analyses of material collected during data recovery fieldwork will include identification and cataloguing of traditional Hawaiian and historic artifacts, invertebrate midden and vertebrate faunal material, and collected organic material (e.g., charcoal, faunal material) obtained within intact cultural deposits, as appropriate.

Archaeological Data Recovery Report

A draft data recovery report will be submitted for client review and to the SHPD. Based on review comments, a final report will be submitted for SHPD's final acceptance.

The report will include the following:

1. Description of research objectives and field methods used;
2. Description of all findings with selected photographs, plan drawings, and stratigraphic profiles;
3. Density contour maps (for cultural material and artifacts) and distribution maps (for cultural deposits and features) using plan and profile maps and documentation collected;
4. Results of laboratory analysis of artifacts, faunal and botanical remains, and samples for radiocarbon dating;
5. Historical and archaeological background sections summarizing pre-Contact and historic land use as they relate to the archaeological features and specifically a review of previous archaeological studies, including radiocarbon dates, within Kalaoa, Kalaoa-‘O‘oma, ‘O‘oma 2, Kohanaiki, Kaloko, Honokōhau 1–2, and Kealakehe Ahupua‘a will be completed; conclusions will be drawn from the archaeological field research, laboratory analyses, and background research.

1.4 Environmental Setting

1.4.1 Natural Environment

The project area lies between approximately 0.5 and 1.25 miles from the coastline, at elevations between 60 ft above mean sea level (AMSL) and 140 ft AMSL at the north end. Rainfall in the project area averages between 20 and 30 inches per year, and temperatures range from an average minimum of 62°-68° F to an average maximum of 78°-82° F (Armstrong 1973:57-58).

The land surface is composed predominately of undissected 'a'ā and pāhoehoe lava flows. The *Soil Survey of the Island of Hawaii* describes 'a'ā lava terrain as having “practically no soil covering and . . . bare of vegetation, except for mosses, lichens, ferns, and a few small *ohia* trees . . . This lava is rough and broken. It is a mass of clinkers, hard, glassy sharp pieces piled in tumbled heaps” (Sato et al. 1973:34). The same study describes pāhoehoe lavas as “a billowy, glassy surface that is relatively smooth. In some areas however, the surface is rough and broken and there are hummocks and pressure domes” (Sato et al. 1973:34). Figure 8 depicts the main soil types in the project area. Besides the 'a'ā flows (rLV) and pāhoehoe flows (rLW), the highway also crosses a few areas of Punaluu Extremely Rocky Peat, 6-20% slopes (rPYD). This soil series consists of very shallow, well drained organic soils, which formed in organic material mixed with minor amounts of basic volcanic ash over pāhoehoe lava.

Vegetation in the project area is identified as “Fountain Grass Grassland” in *The Botanical Survey of West Hawai'i Boundary Review* (Char & Char Associates 1992 in Head and Rosendahl 1993:2). This vegetation type typically consists of low tufts of grass with scattered shrubs and a few trees. Plants commonly observed within the project area include *pili* grass (*Heteropogon contortus*), Guinea grass (*Panicum maximum*), fountain grass (*Pennisetum setaceum*), *wilelaiki* or Christmas berry (*Schinus terebinthifolius*), *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis pallida*), and lantana (*Lantana camara*). In areas of Punaluu Stony Peat, common vegetation includes *koa haole* and Guinea grass.

1.4.2 Built Environment

The Queen Ka'ahumanu Highway extends through bare pāhoehoe and 'a'ā lava flows. There are three commercially developed areas adjacent to the *mauka* (inland) side of the highway: in Honokōhau for a gas station and quarry, in Kaloko for the Kaloko Industrial Park, and in Kohanaiki for the Kohanaiki Industrial Park. On the *makai* (seaward) side of the project area, there are several adjacent, developed areas and associated access roads including (from south to north) Honokōhau Harbor, Kaloko-Honokōhau National Historical Park, Shores at Kohanaiki, the Nature Energy Laboratory of Hawai'i Authority (NELHA), and the Kona International Airport. Approximately 50% of the project area consists of the existing highway and previously disturbed land along both the *mauka* and *makai* highway shoulders. Previous disturbance in the project area appears to be primarily a result of the original highway construction (both sides of the existing highway) and utility pole installation (*mauka* side).

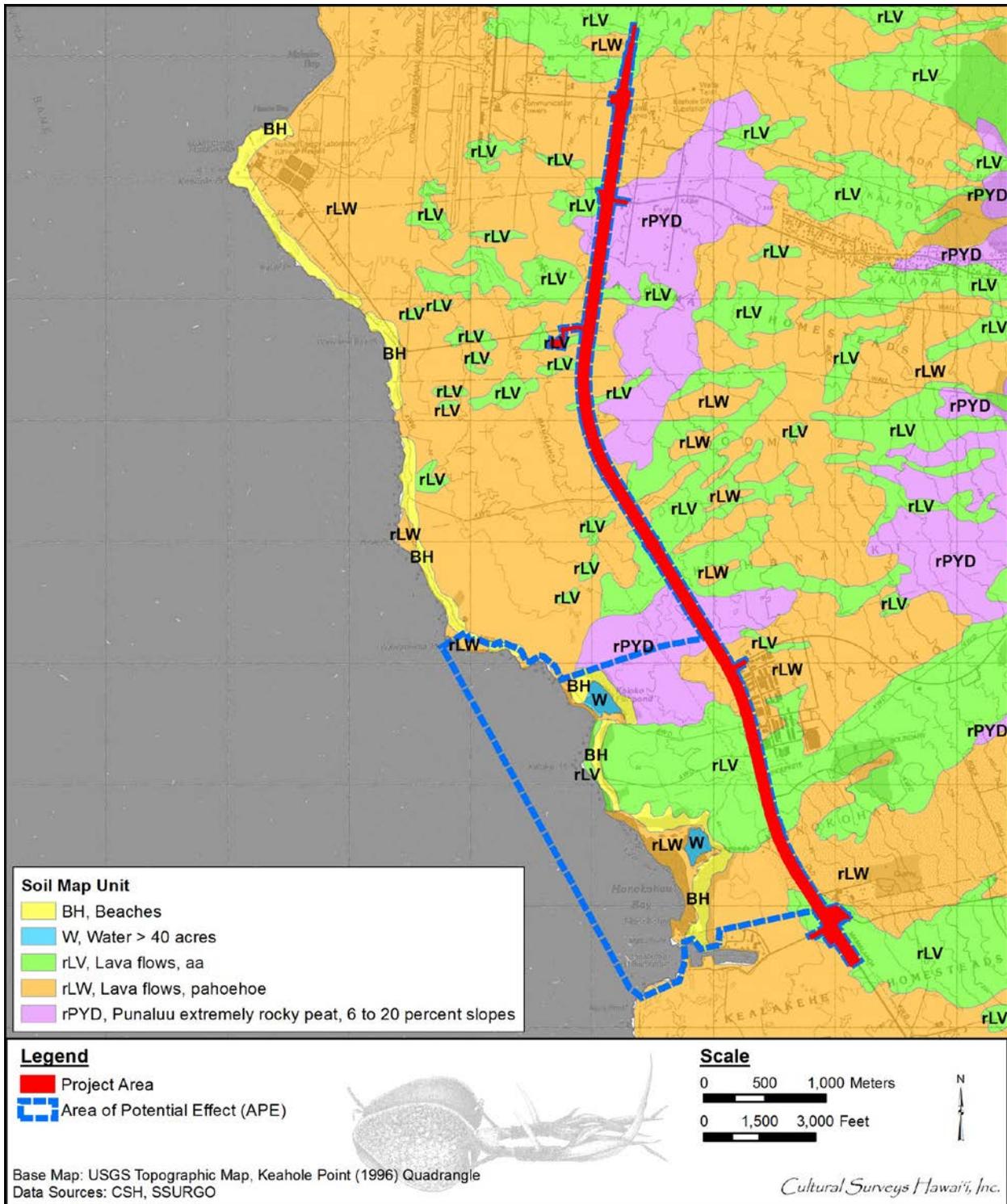


Figure 8. Overlay of *Soil Survey of the State of Hawaii* (Sato et al. 1973), indicating soil types within and surrounding the project area (U.S. Department of Agriculture Soils Survey Geographic Database [USDA SSURGO] 2001)

Section 2 Summary of AIS Results and Recommendations

2.1 Background to the Monahan et al. (2012a) AIS and Wilkinson et al. (2017) Supplemental AIS

In 1995, CSH conducted an AIS of the current project area (Walsh and Hammatt 1995), identifying 17 historic properties within the project area (as it was defined at that time). The survey report was reviewed and accepted by the SHPD in a letter (LOG NO.: 15956, DOC. NO.: 9511PM28) dated 22 November 1995.

In 1996, the FHWA and HDOT produced a Final Environmental Assessment (FEA), issued a finding of no significant impact (FONSI), and determined the proposed project “will not have any significant impact on the human environment.”

In 1999, a final archaeological treatment plan (FATP) and a memorandum of agreement (MOA) were completed to memorialize mitigation and protection measures for 12 historic properties identified by CSH (Walsh and Hammatt 1995) in partial fulfillment of the requirements of Section 106 of the NHPA.

Subsequently, staff working for the National Park Service (NPS), including the Honokōhau Settlement National Historic Landmark, the Kaloko-Honokōhau National Historical Park, and the Ala Kahakai National Historic Trail, raised concerns about historic properties they believed were overlooked during previous surveys. These NPS concerns were raised in response to the HDOT’s 2008 reissuance of the FONSI for the proposed project. In response to NPS concerns, CSH was contracted in 2010 to conduct a supplemental AIS of the project area, the results of which were reported by Monahan et al. The objective of the study was to conduct a complete re-survey of the entire Phase 2 project area. The AIS report was accepted by the SHPD in a letter (LOG NO.: 2011.1140, DOC. NO.: 1104TD12) dated 27 April 2011, with the stipulation that other consulting parties, in particular the NPS and Native Hawaiian organizations (NHOs), were satisfied with the report.

In 2011, an ADRP was accepted by the SHPD in a letter (LOG NO.: 2011.2598, DOC. NO.: 1110TD01) dated 5 October 2011. Data recovery was then initiated following the 2011 ADRP (Altizer and Monahan 2011); however, due to a revision of the project scope, data recovery was halted during this fieldwork effort. After halting fieldwork, consultation with interested parties continued. When it became clear, through continuing consultation, that the other consulting parties were not satisfied with the report, CSH undertook two supplemental studies of the project area (Monahan and Wilkinson 2012; Monahan and Yucha 2012). These studies, which included a limited amount of fieldwork investigation with the NPS and NHOs, yielded additional historic properties that were added to the AIS report. This report (Monahan et al. [2012a]) is an integration of information from three main documents: the original AIS by Monahan et al. (2011) and the two supplemental survey reports cited above.

Subsequent to acceptance of the 2012 report, the project APE was expanded. In consultation with the FHWA, SHPD, and HDOT, CSH conducted a supplemental AIS in December 2016 to address portions of the expanded APE not previously surveyed. The results of this study are presented in a report by Wilkinson et al. (2017).

2.2 Historic Properties Identified and Significance Criteria

Table 1 summarizes the 75 historic properties identified in the final AIS report for this project (Monahan et al. 2012a). Table 1 also includes significance assessments (i.e., eligibility criteria for inclusion on the State and/or National Registers of Historic Places). Figure 9 through Figure 22 depict the locations of the 75 historic properties, including the additional components of SIHP # -00002, which were documented during the supplemental AIS (Wilkinson et al. 2017). It is important to note that, in addition to historic properties in the ROW, the NPS has determined all historic properties within Kaloko-Honokōhau National Historical Park and Honokōhau Settlement National Historic Landmark are also eligible for inclusion on the National Register of Historic Places.

To be considered eligible for listing on the National and Hawai‘i Registers of Historic Places, a historic property must possess one or more of the following: integrity of location, design, setting, materials, workmanship, feeling, and/or association. The criteria, whose wording differs slightly between the National and Hawai‘i standards, are generally understood as follows:

- A Associated with events that have made an important contribution to the broad patterns of our history;
- B Associated with the lives of persons significant in our past;
- C Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value; also, for the National Register only, this criterion includes historic properties ‘that represent a significant and distinguishable entity whose components may lack individual distinction’ (see <http://www.achp.gov/nrcriteria.html>);
- D Has yielded, or is likely to yield information important for research on prehistory or history;
- E Has 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 history accounts – these associations being important to the group’s history and cultural identity. This last criterion is included only in the Hawai‘i Register language (see http://hawaii.gov/dlnr/hpd/pdfs/revproc_har/275_284/pdfs/275.pdf).

All 75 historic properties have been assessed as significant under Criterion D, meaning that each historic property has “yielded, or is likely to yield, information important for research on prehistory or history.” All 75 historic properties have also been assessed as significant under Criterion E in recognition of their “important value to the native Hawaiian people . . . due to associations with cultural practices once carried out, or still carried out, at the property,” as well as their “associations with traditional beliefs, events or oral history accounts.” This significance criterion was assigned in consultation with NHOs for this project.

Table 1. Significance evaluations for historic properties in the project area (arranged south to north)

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
19954	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
29332	Mound/paved area within naturally formed <i>pāhoehoe</i> depression	2	Indeterminate	Indeterminate, possible burial	D and E
29334	Rock mound within a naturally formed <i>pāhoehoe</i> depression	0	Indeterminate	Indeterminate, possible burial	D and E
28774	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
22507	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
29335	Rock wall segment	0	Indeterminate	Indeterminate	D and E
18099	Trail (<i>mauka-makai</i>)	0	Indeterminate, possibly historic	Transportation	A, C, D, and E
22418	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
22417	Modified lava blister	0	Pre-Contact	Agriculture / planting pit	D and E
28778	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Agriculture / planting pit	D and E
22415	Platform	0	Pre-Contact	Burial	D and E
29336	Rock terrace	0	Indeterminate	Indeterminate, possible burial	D and E
29337	Excavated pit	0	Indeterminate	Indeterminate, possible quarry or sweet potato planter	D and E

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
29339	Rock wall segment	0	Indeterminate	Indeterminate	D and E
29338	Excavated pit	0	Indeterminate	Indeterminate, possible quarry or sweet potato planter	D and E
29340	Rock mound	0	Indeterminate	Indeterminate, possible burial	D and E
29341	Excavated pits	2	Indeterminate	Indeterminate, possible quarry or sweet potato planter	D and E
29342	Excavated pit	0	Indeterminate	Indeterminate, possible quarry for cinder rock to repair nearby Māmalahoa Trail	D and E
00002	Māmalahoa Trail (cross slope, <i>ala loa</i> type)	0	Historic	Transportation	A, B, C, D, and E
19953	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
29343	Excavated pit	0	Indeterminate	Indeterminate, possible quarry or sweet potato planter	D and E
28780	'A'ā excavation	0	Indeterminate	Indeterminate, possible burial	D and E
28781	Paved / leveled area	0	Indeterminate	Indeterminate, possible agricultural clearing	D and E
28782	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
28783	Complex	6	Pre-Contact	Agriculture	D and E

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
28784	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
28785	Enclosure	0	Pre-Contact	Agriculture	D and E
29333	Rock stacking (possible <i>ahu</i>)	0	Indeterminate	Indeterminate	D and E
28786	Modified depression	0	Pre-Contact	Agriculture	D and E
28787	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
19952	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
28788	Modified outcrop complex	2	Pre-Contact	Agriculture	D and E
19951	Wall	0	Historic	Ranching / boundary	D and E
28789	Complex	6	Pre-Contact	Agriculture	D and E
19950	Modified outcrop complex	5	Pre-Contact	Agriculture	D and E
28790	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Quarrying	D and E
19949	Enclosure	0	Indeterminate, historic or possibly modern	Indeterminate, possible windbreak / temporary shelter	D and E
28791	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
28792	Petroglyph	0	Pre-Contact	Symbolic expression	D and E
29344	Excavated pit	0	Indeterminate, possibly pre-Contact	Indeterminate, possible quarry, sweet potato planter, or bird pit	D and E
10714	Trail system (<i>mauka-makai</i>), part of the "Road to the Sea Trail"	3	Pre- to Post-Contact	Transportation	A, C, D, and E

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
28794	Filled crevice	0	Indeterminate	Indeterminate, possible agricultural clearing feature	D and E
28797	Mound complex	2	Pre-Contact	Agriculture	D and E
19948	Complex	8	Pre-Contact	Agriculture and quarrying	D and E
28799	Excavated pit complex	3	Pre-Contact	Agriculture	D and E
28800	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Quarrying	D and E
28801	Modified outcrop complex	2	Pre-Contact	Agriculture	D and E
19947	Stacked rocks	3	Pre-Contact	<i>Ahupua'a</i> boundary markers	D and E
28802	Complex	3	Pre-Contact	Temporary habitation	D and E
28803	Complex	2	Indeterminate	Indeterminate, possible agricultural clearing feature	D and E
28804	Filled crevice	0	Indeterminate	Indeterminate, possible agricultural clearing feature	D and E
28805	Modified outcrop	0	Pre-Contact	Agriculture / clearing	D and E
15324	Trail (<i>mauka-makai</i>)	2	Indeterminate	Transportation	C, D, and E
19946	Trail (<i>mauka-makai</i>)	0	Indeterminate	Transportation	C, D, and E
28806	Mound	0	Indeterminate	Possible marker	D and E
28807	Filled crevice	0	Indeterminate	Indeterminate	D and E
29345	Coral-filled <i>pāhoehoe</i> crevice	3	Indeterminate	Indeterminate	D and E
28808	Mound complex	5	Indeterminate	Markers	D and E

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
28809	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Quarrying	D and E
28810	Lava tube	0	Pre-Contact	Indeterminate, possible water catchment	D and E
29346	Rock mound	0	Indeterminate	Indeterminate, possible marker or quarrying	D and E
10154	Walled enclosure	0	Historic	Indeterminate, possible habitation	D and E
06432	Core-filled stone wall	0	Historic	<i>Ahupua'a</i> boundary	D and E
29347	Rock mound	0	Indeterminate	Possible marker or quarrying	D and E
29272	Level area in 'a'ā with trail (<i>mauka/makai</i>)	2	Indeterminate	Possible temporary resting spot / work area and transportation	C, D, and E
28811	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Quarrying	D and E
28812	Possible filled crevice	0	Indeterminate	Indeterminate	D and E
28813	Modified lava blisters	5	Pre-Contact	Agriculture	D and E
28814	Lava tube	0	Pre-Contact	Indeterminate, possible water catchment	D and E
28815	<i>Pāhoehoe</i> excavation	0	Pre-Contact	Quarrying	D and E
19943	Lava tube	4	Pre-Contact	Temporary habitation	D and E
19945	Petroglyphs (n=2) and bashed/pecked <i>pāhoehoe</i> (n=7)	9	Pre-Contact	Symbolic expression and prospecting for voids in lava flow	D and E
29348	Boulder (<i>pāhoehoe</i> basher) in excavated pit	0	Pre-Contact	Prospecting for voids in lava flow	D and E

SIHP # ¹	Formal Type	No. of Features	Age	Function	Significance Criteria ²
29349	Boulder (<i>pāhoehoe</i> basher) and associated excavated pit	2	Pre-Contact	Prospecting for voids in lava flow	D and E

¹ These State Inventory of Historic Property (SIHP) numbers begin with "50-10-27-."

² See text above (Section 6 Significance Evaluations) for explanation of significance criteria.

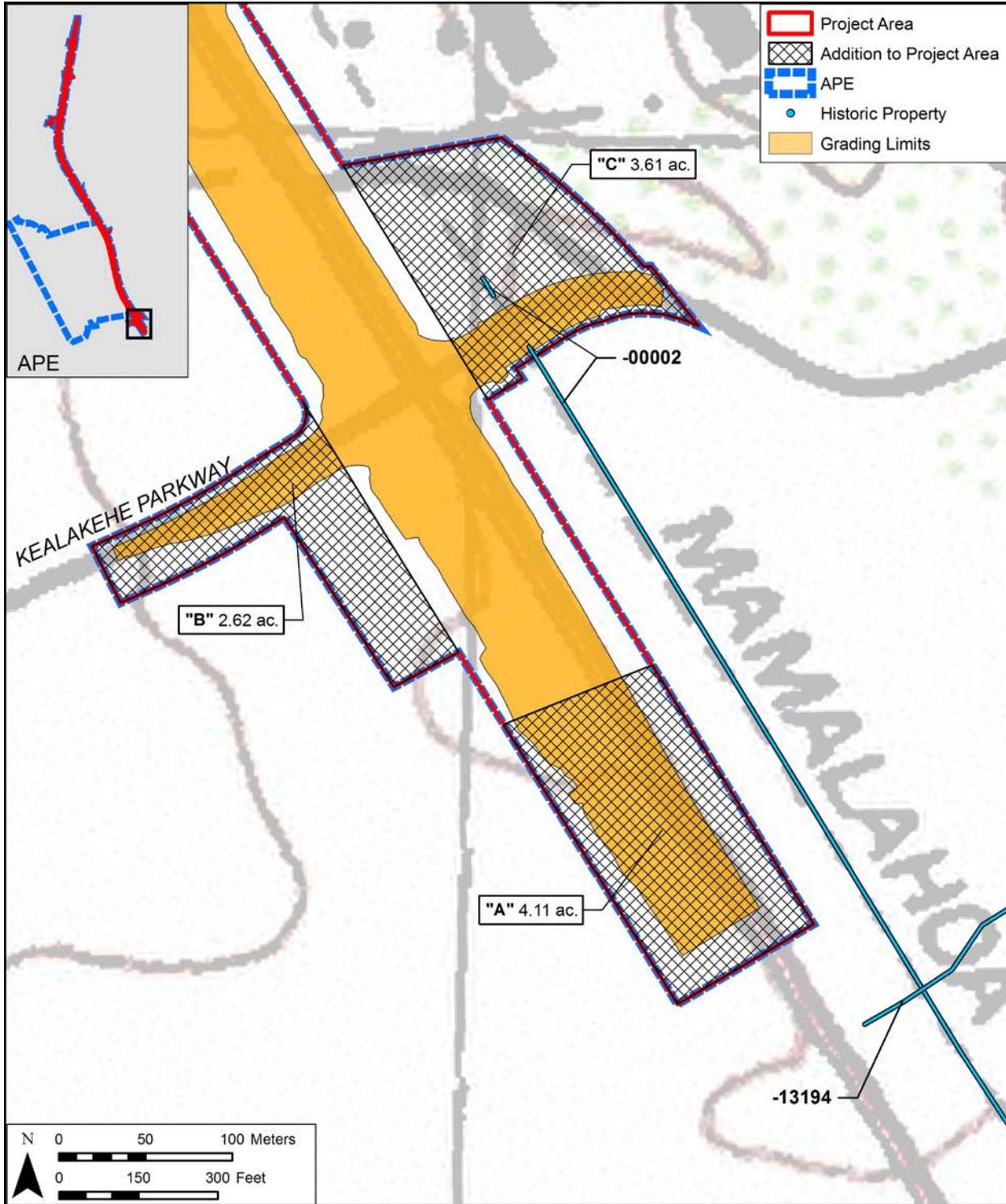


Figure 9. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

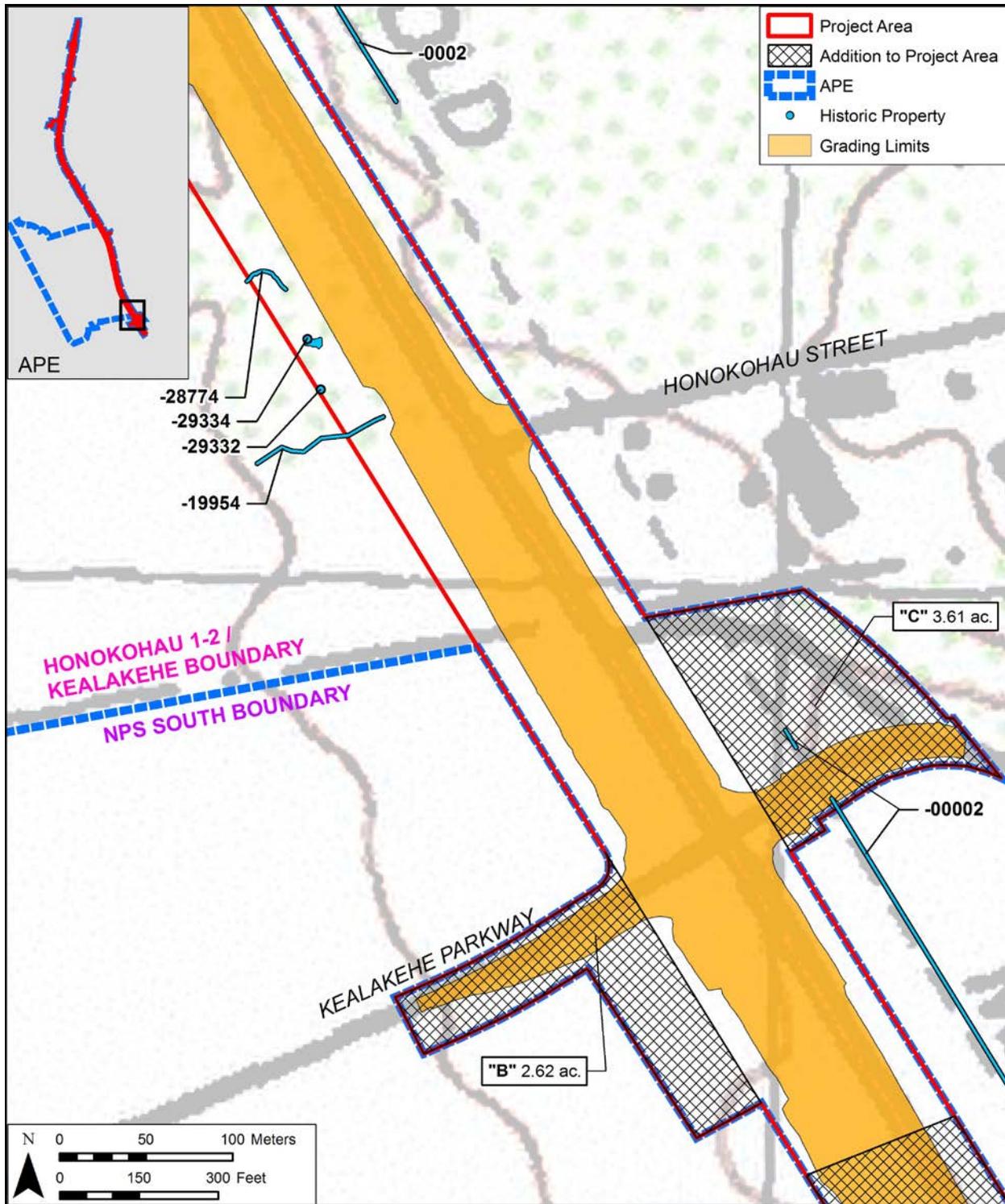


Figure 10. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

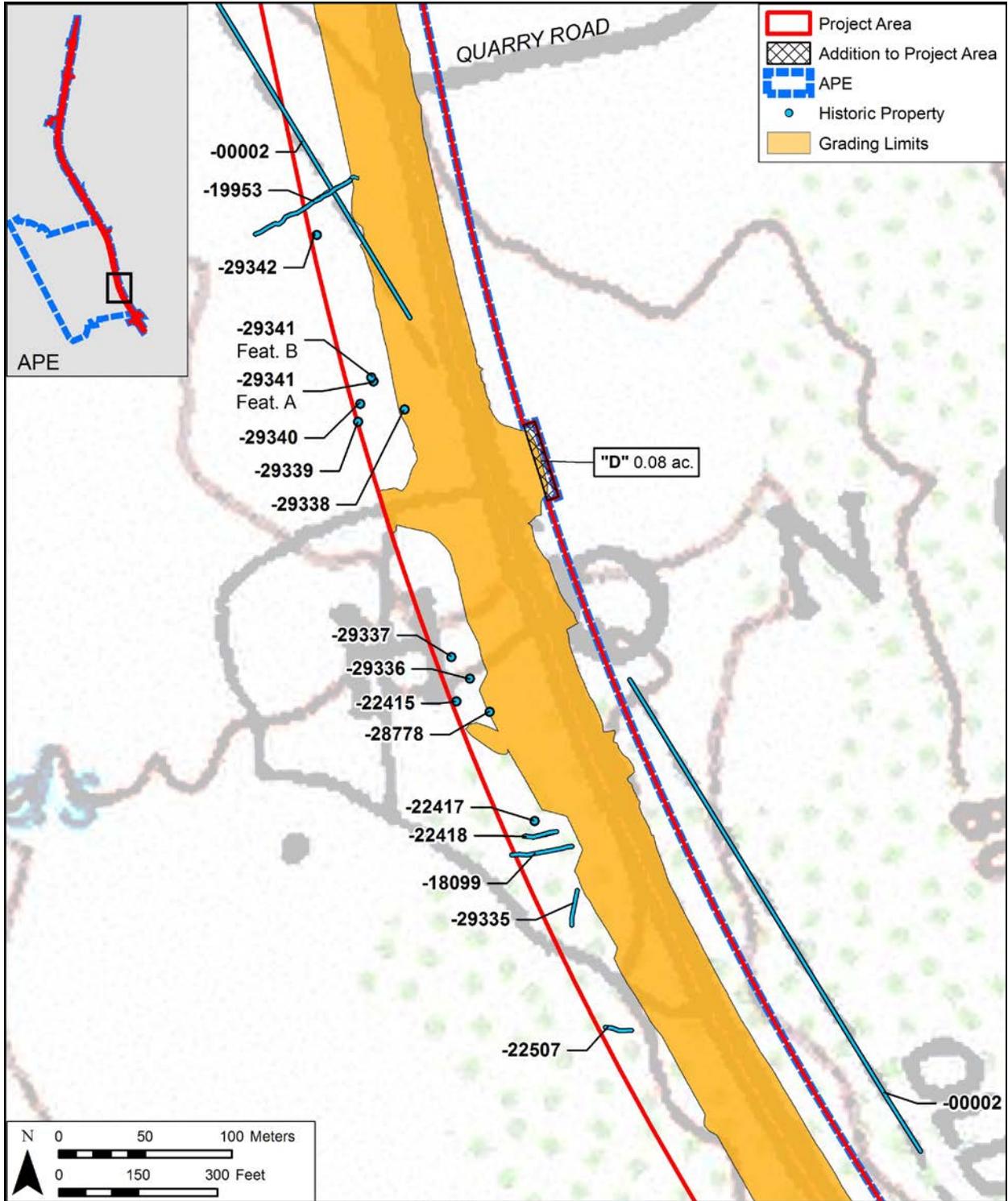


Figure 11. Portion of 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

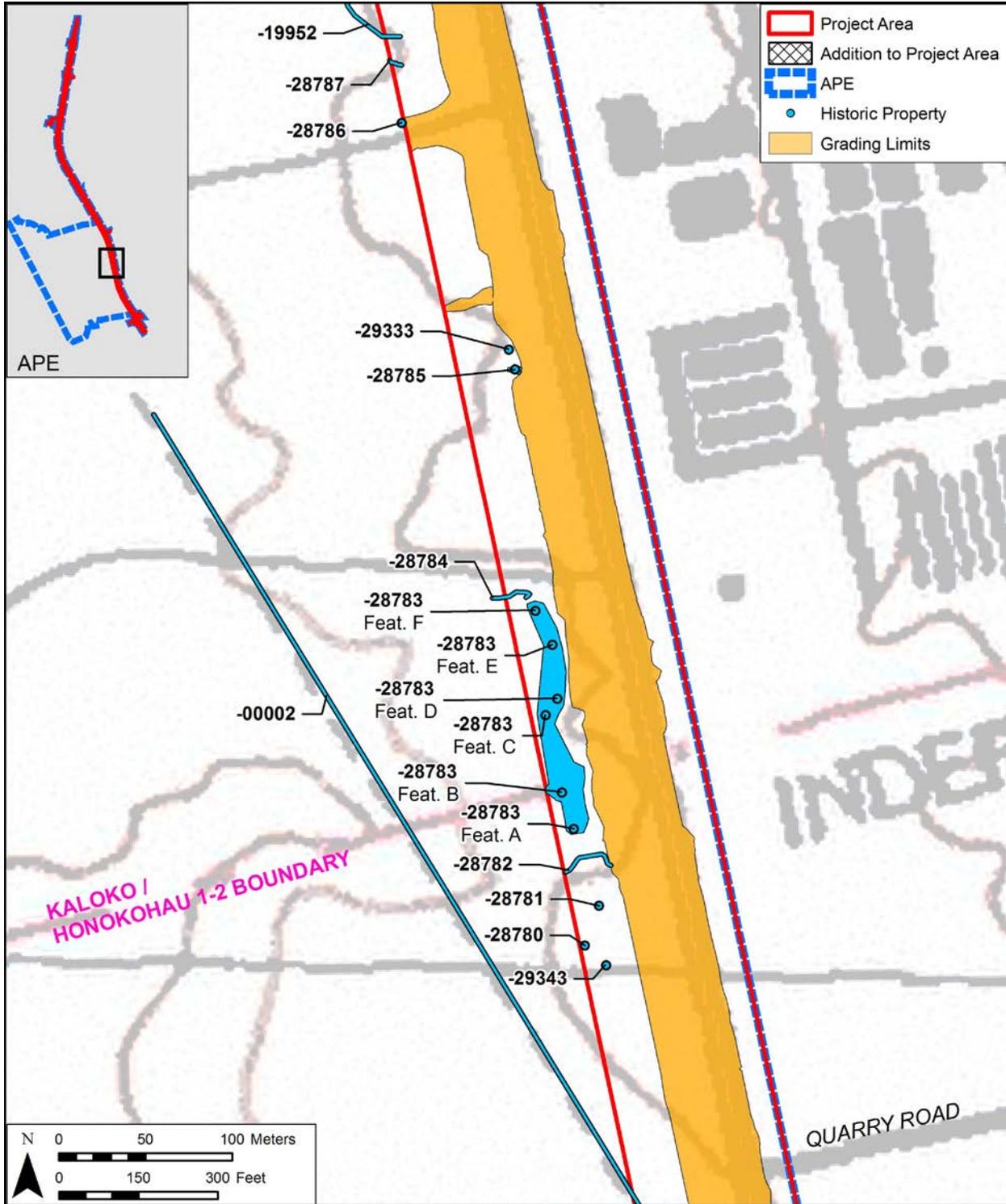


Figure 12. Portion of 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

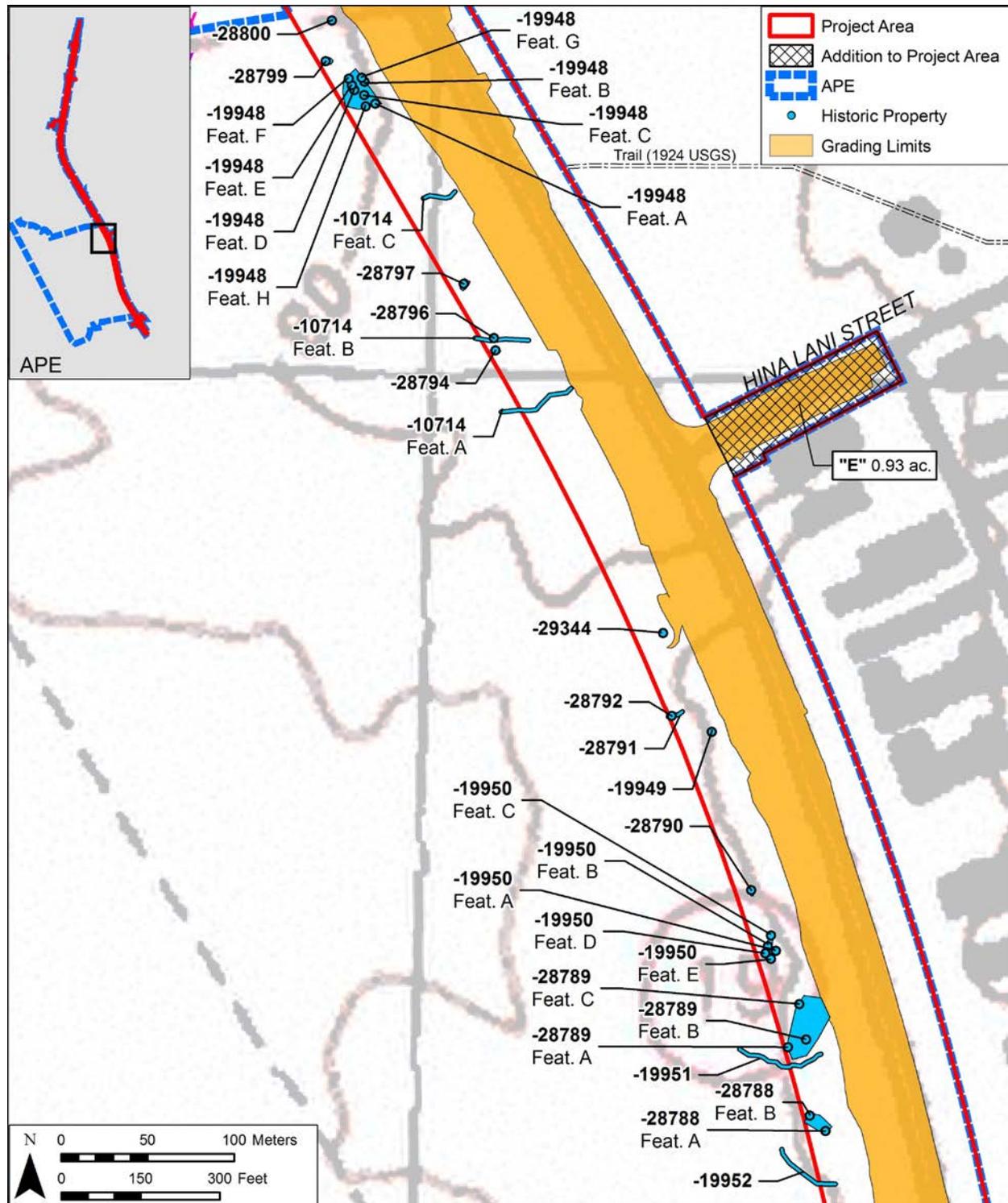


Figure 13. Portion of 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

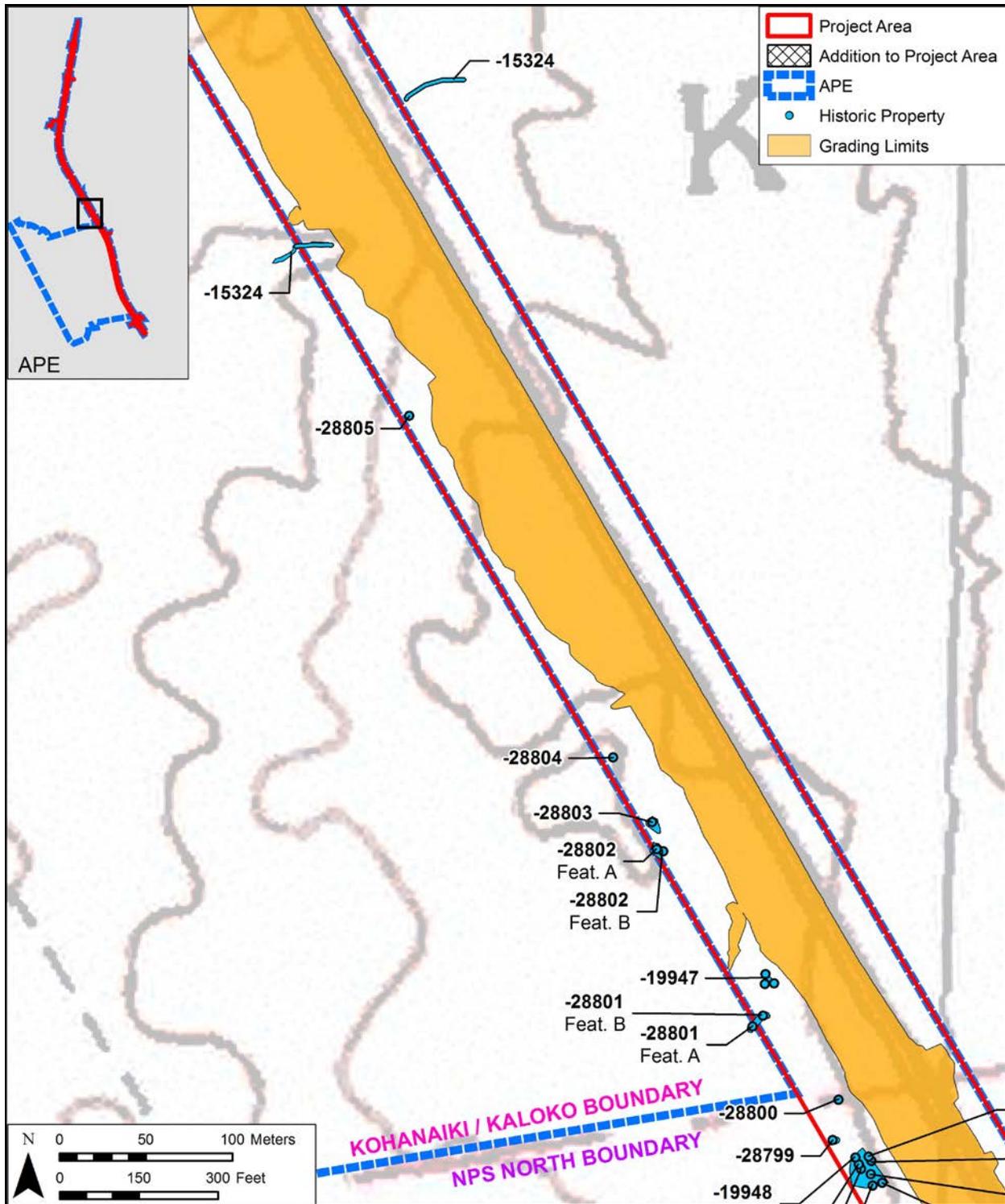


Figure 14. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

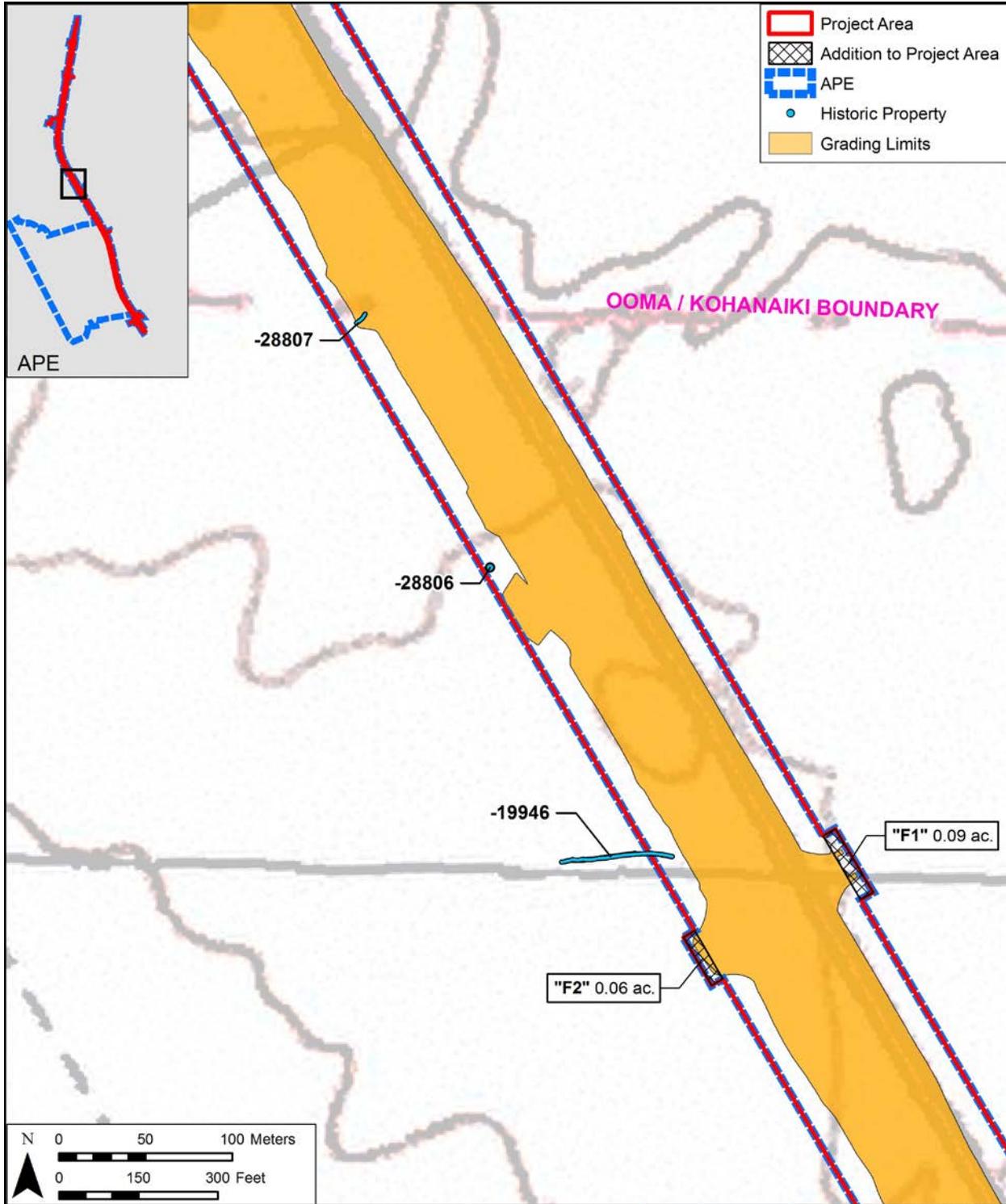


Figure 15. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

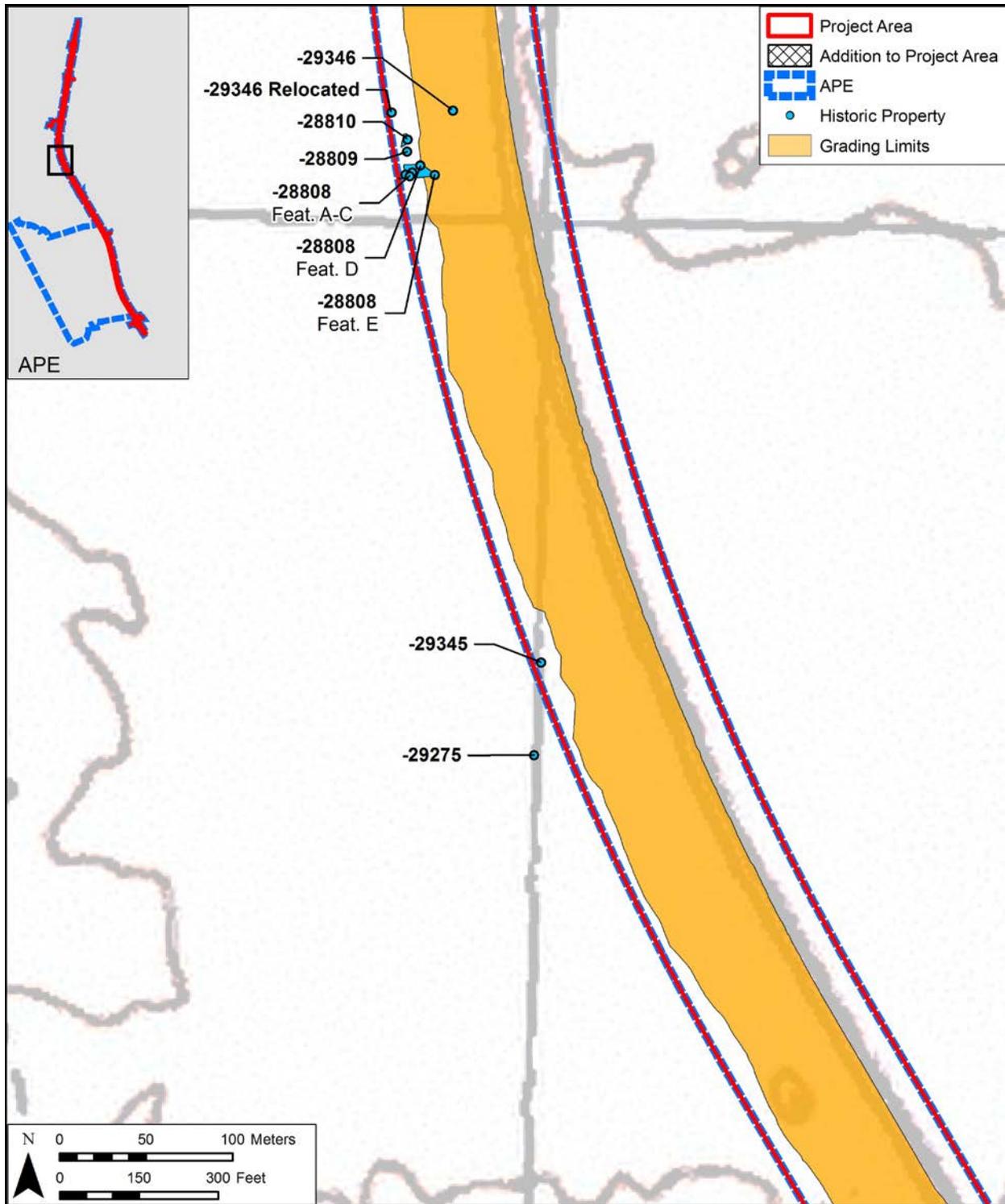


Figure 16. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

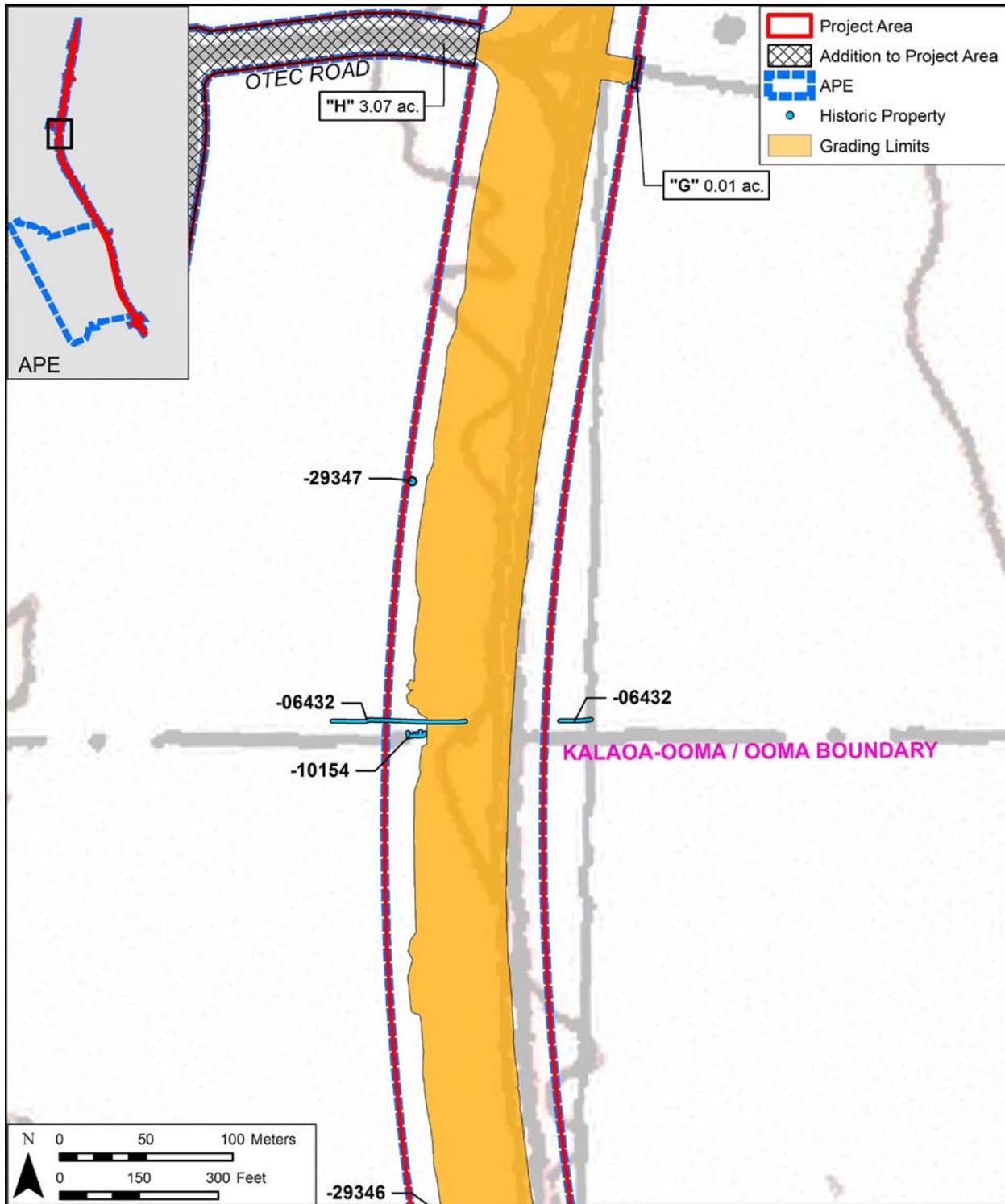


Figure 17. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

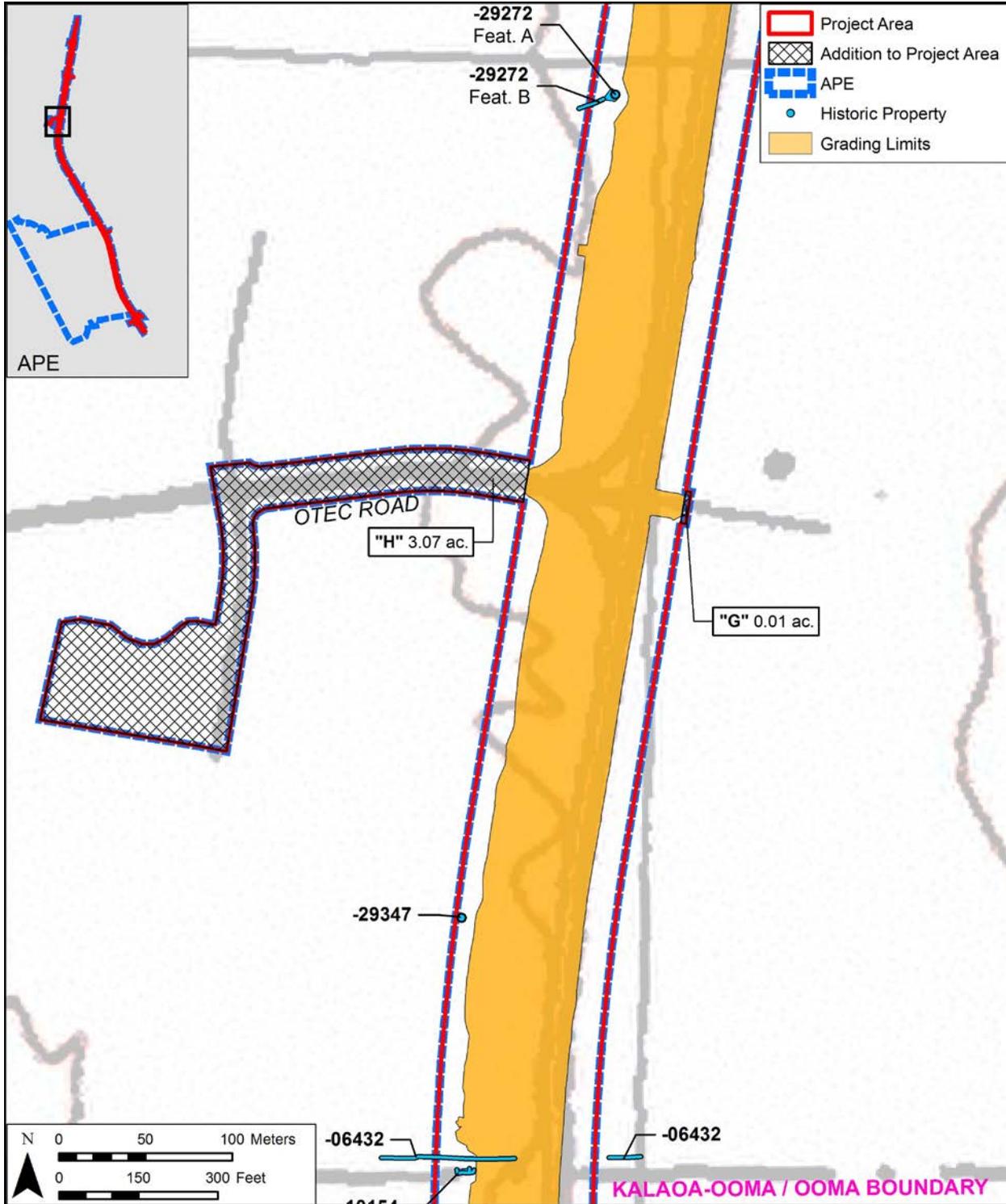


Figure 18. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

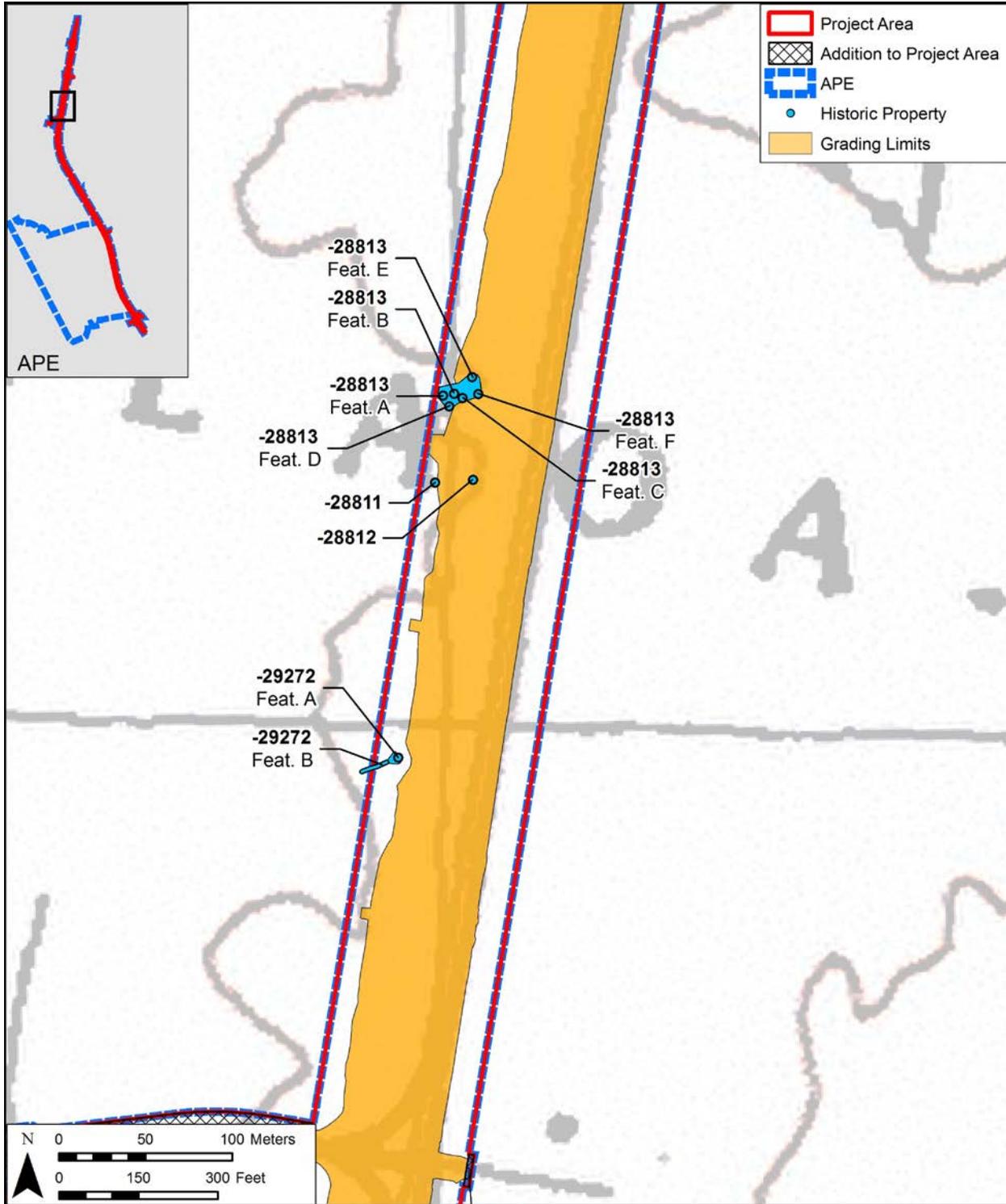


Figure 19. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

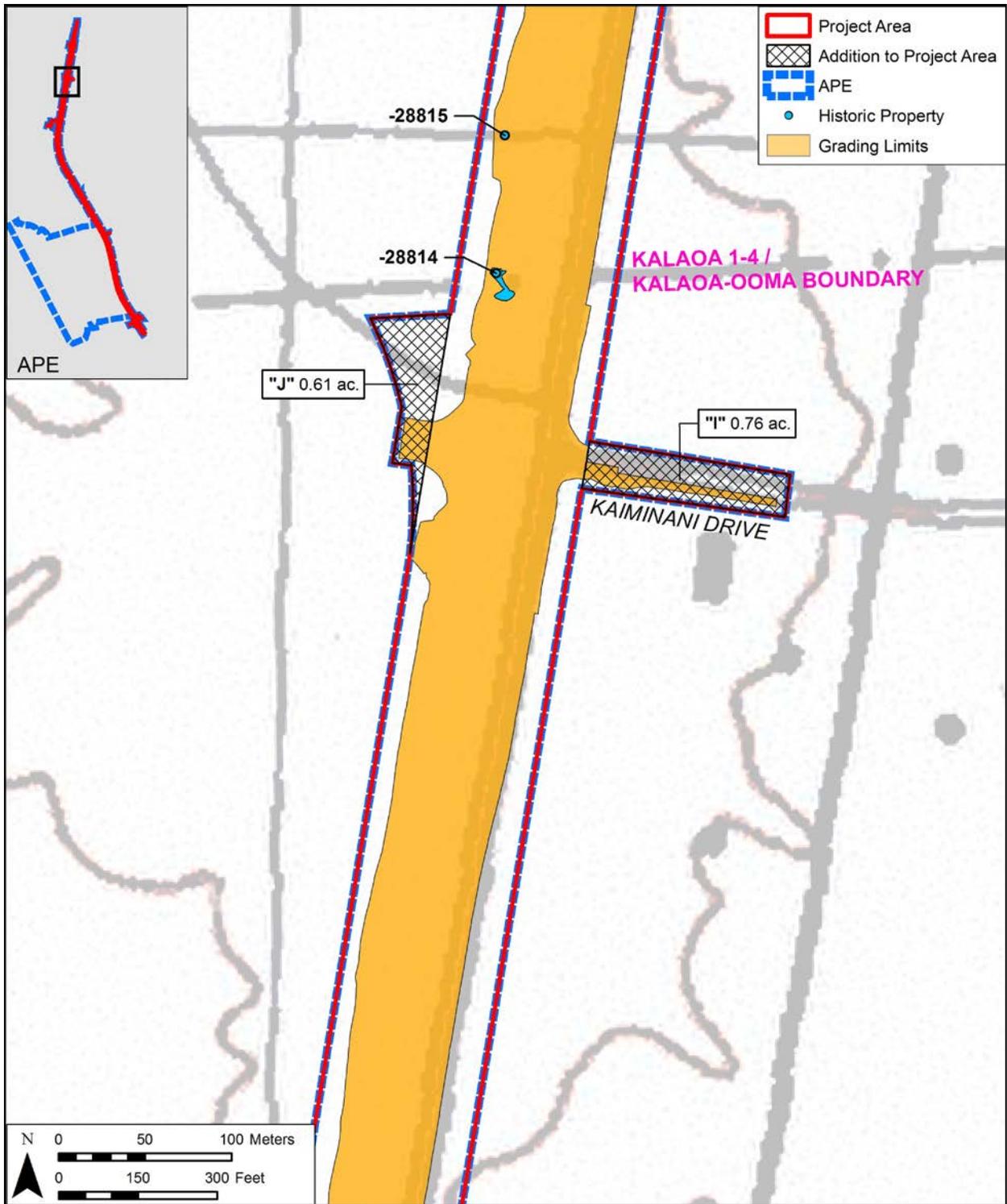


Figure 20. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

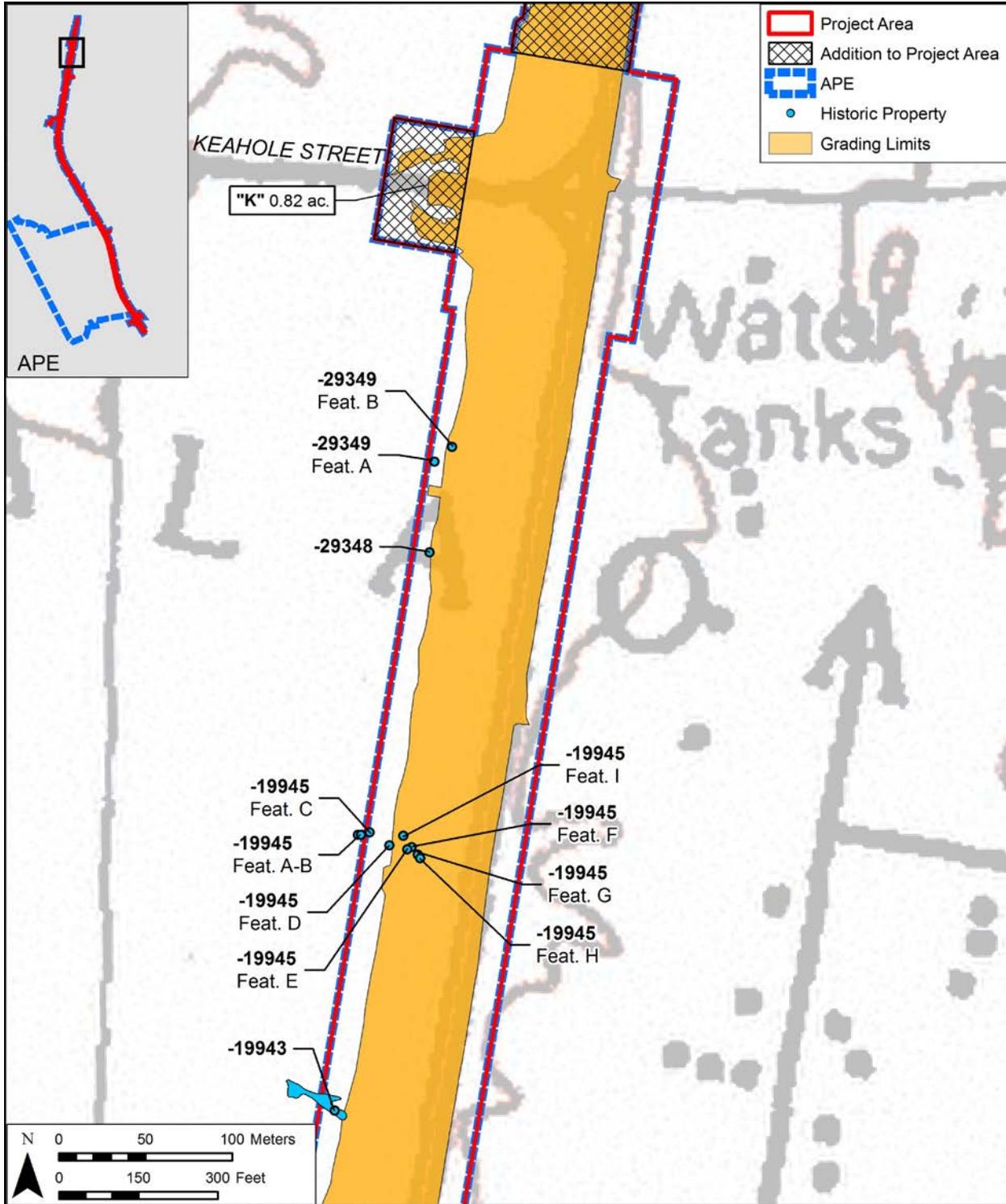


Figure 21. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

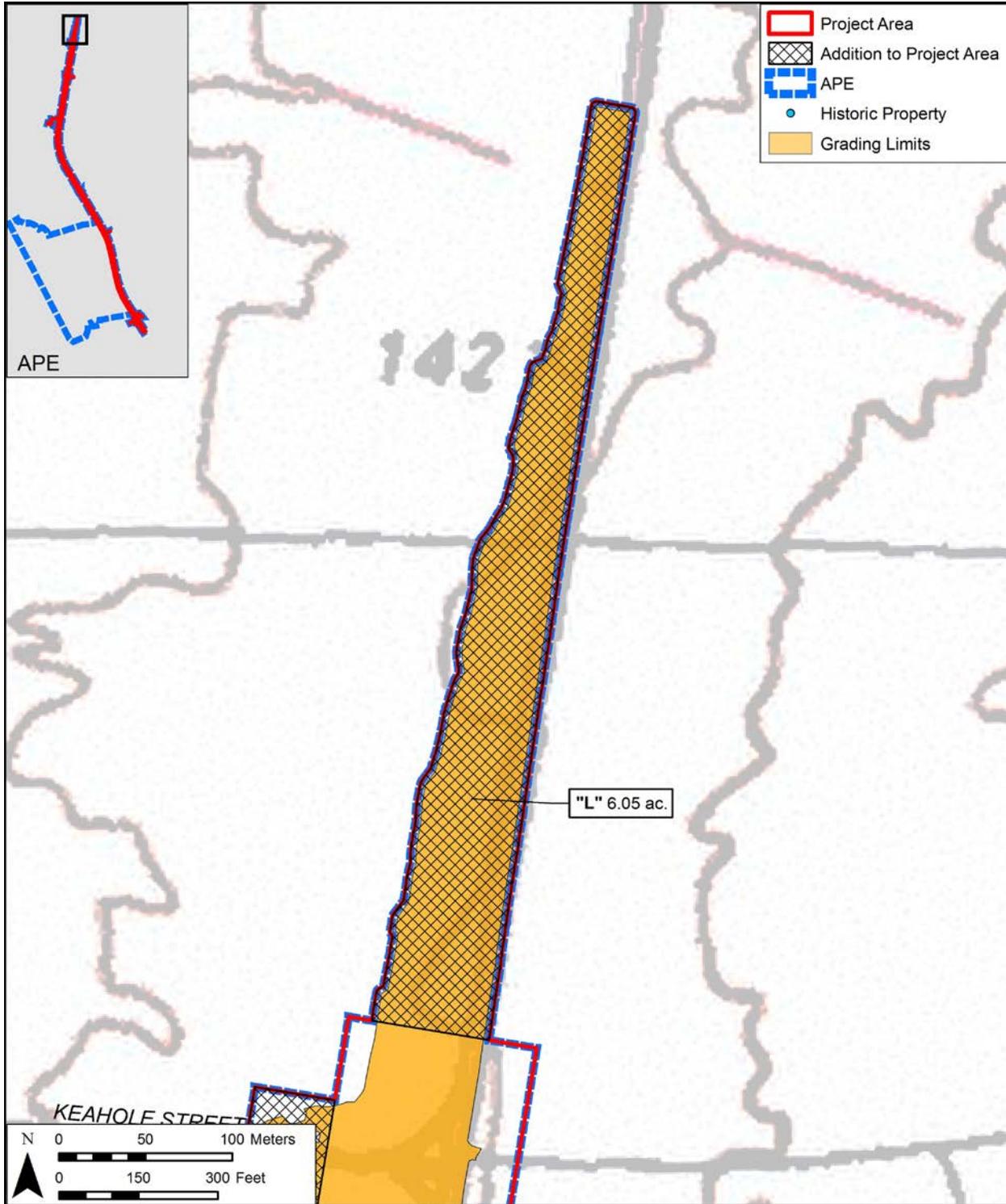


Figure 22. Portion of the 1996 Keahole Point USGS 7.5-minute topographic quadrangle showing historic properties identified within the project area and APE

All historic trail properties have also been evaluated as significant under Criterion C, in recognition of the fact that the short portions of these trails identified within the project area are components of much larger networks of trails extending down to the seashore and up the mountain slopes. In addition, two of these trails, SIHP # -10714 (the “Road to the Sea Trail”) and SIHP # -18099 (the “Trail to Honokōhau”), are also assessed as significant under Criterion A for their association with events that have made contributions to broad patterns of history in Hawai'i. The Māmalahoa Trail (SIHP # -00002) is a special case, as it has previously been evaluated in the project area by Walsh and Hammatt (1995) as significant under Criteria A, C, D, and E. However, it should also be considered eligible under Criterion B, in recognition of its association with Kuakini (Governor of Hawai'i from 1819-1844), who initiated a program of road building that included the Māmalahoa Trail (Kirch 1996).

Finally, it is important to state that some NHOs consulted during this project believe all 75 historic properties should be considered eligible under Criterion B due to associations “with the lives of persons significant in our past.” Citing Cordy et al.'s (1991) classic historical and archaeological study of Kaloko-Honokōhau, these NHOs highlighted the project area's associations with certain historically significant Hawaiian *ali'i* (chief, or person of royal birth) including Laeanuikaumanamana, Liloa, Kame'eiamoku, Kamehameha I, Kamehameha V (a grandson of Kamehameha I, also known as Kapuāiwa or Lot Kapuāiwa), and others. CSH believes these associations highlight the overall historical significance of the entire North Kona district, or the traditional region known as Kekaha; however, specific associations between the historic properties and these historical persons in the project area are lacking (with the exception of the Māmalahoa Trail).

2.3 Project Effect and Mitigation Recommendations

This discussion is based on the final AIS report by Monahan et al. (2012a), CSH's communication with agents for the project proponents regarding the project's potential impacts to the identified historic properties, and consultation with the HDOT, FHWA, SHPD, NPS, OHA, and other NHOs.

2.3.1 Project Effect

The AIS investigations identified 74 historic properties within the project area, and one historic property (SIHP # -29275, a burial cave) in the vicinity of, but outside, the project area. The burial cave is described in more detail in an appendix to the AIS report (see Monahan et al. 2012a: Appendix C) and is the subject of a separate burial treatment plan (BTP). Under Hawai'i State historic preservation review legislation, the project-specific effect recommendation was “effect, with proposed mitigation commitments.” Under federal historic preservation review legislation, a project effect recommendation of “adverse effect” was warranted, with the understanding that the proposed mitigation measures (described below) are carried out to mitigate the undertaking's potential effect on Hawai'i and National Register-eligible historic properties. Table 2 provides a summary of the mitigation recommendations for these 75 historic properties, as described in the ADRP by Shideler et al. (2012).

2.3.2 Mitigation Recommendations

The subsequent APMP by Hammatt and Shideler (2014) addresses 23 historic properties previously proposed to be directly impacted by construction, but which will now be avoided as a

Table 2. Summary of proposed mitigation (Shideler et al. 2012)

Item	Action (SIHP # 50-10-27)	No. Historic Properties
1	Burial treatment plan —preservation in place (-22415, -29275 [contingent upon consent of the landowner])	2
2	Preservation (-10154, -19943, -19950, -19951, -28780, -28781, -28788 through -28790, -28792, -28797, -28799, -28802, -28806, -28810)	15
3	Preservation and no further work (19945—two petroglyphs will be preserved; no further work for remaining features)	1
4	Avoidance during construction (-28794, -28801, -28803 through -28805, -28809, -29337, -29341 through -29343, -29347)	11
5	No further work (-06432, -29338; note damage to -06432 will be minimized through archaeological and cultural monitoring)	2
6	Relocation (-19447, -29346)	2
7	Relocation and preservation (-28808; relocation of two features, preservation of three features)	1
8	Data recovery (excavation/dismantling) (-19949, -22417, -28778, -28785, -28786, -28800, -28807, -28811, -28812, -28814, -28815, -29332 through -29336, -29339, -29340, -29344, -29345)	20
9	Data recovery (archival research) and partial preservation (-00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22507, -28774, -28782, -28784, -28787, -28791)	14
10	Data recovery (archival research) and partial preservation (-29272 Feature B) and data recovery (excavation) (-29272 Feature A)	1
11	Data recovery (archival research) (-22418)	1
12	Data recovery (collection and curation of portable artifacts) (-29348, -29349)	2
13	Data recovery (excavation) and preservation (-19948, -28783, -28813)	3
	Total	75

result of the project redesign. Ten of the historic properties (SIHP #s -15324, -18099, -19946, -19953, -19954, -22418, -22507, -28774, -28782, and -29272) are trails previously proposed to be partially destroyed, with mitigation in the form of archival research and preservation of the undisturbed portion of the trail. The other 13 were previously proposed to be totally or partially destroyed, with data recovery excavation for 12 historic properties (SIHP #s -19948, -19949, -22417, -28783, -28800, -28811, -29333, -29334, -29336, -29339, -29340, and -29344) and relocation for one (SIHP # -19947). Table 3 provides a revised summary of the mitigation recommendations for the 75 historic properties, as described in the APMP by Hammatt and Shideler (2014).

In addition to the mitigation recommendations listed in Table 3, CSH also recommended archaeological and cultural monitoring of all original ground disturbing activities in the project area (ROW). The archaeological and cultural monitoring is ongoing and is performed whenever disturbance of original (previously undisturbed) ground is conducted in the project area. The archaeological monitoring is conducted in accordance with an archaeological monitoring plan (AMP; Monahan et al. 2012b) prepared in accordance with HAR §13-279.

Table 3. Revised summary of proposed mitigation (Hammatt and Shideler 2014)

Item	Action (SIHP # 50-10-27)	No. Historic Properties
1	Burial treatment plan —preservation in place (-22415, -29275 [contingent upon consent of the landowner])	2
2	Preservation (-10154, -19943, -19950, -19951, -28780, -28781, -28788, -28789, -28790, -28792, -28797, -28799, -28802, -28806, -28810)	15
3	Preservation and no further work (-19945—two petroglyphs will be preserved; no further work for remaining features)	1
4	Avoidance during construction (-28794, -28801, -28803, -28804, -28805, -28809, -29337, -29341, -29342, -29343, -29347)	11
5	No further work (-06432; note damage to -06432 will be minimized through archaeological and cultural monitoring; -29338)	2
6	Relocation (-29346)	1
7	Relocation and preservation (-28808; relocation of two features, preservation of three features)	1
8	Interim preservation and commitment to mitigation (relocation) prior to any future land disturbance (-19947)	1
9	Data recovery (excavation/dismantling) (-28778, -28785, -28786, -28807, -28812, -28814, -28815, -29332, -29335, -29345)	10
10	Data recovery (archival research) and preservation (-00002, -10714, -15324, -18099, -19946, -19952, -19953, -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791)	15
11	Data recovery (collection and curation of portable artifacts) (-29348, -29349)	2
12	Data recovery (excavation) and preservation (-28813)	1
13	Interim preservation and commitment to mitigation (data recovery) prior to any future land disturbance (-19948, -19949, -22417, -28783, -28800, -28811, -29333, -29334, -29336, -29339, -29340, -29344)	12
14	Data recovery (archival research) and preservation (-29272 Feature B) and interim preservation and commitment to mitigation (data recovery) prior to any future land disturbance (-29272 Feature A)	1
	Total	75

Section 3 Methods

3.1 Fieldwork Methods

Data recovery fieldwork occurred during both the 2011 and 2015 field seasons. The results of data recovery fieldwork from both seasons are presented in Volume II of this report. The fieldwork methods for each season are presented below.

3.1.1 2011 Fieldwork Methods

In October 2011, Sarah Wilkinson, B.A., Olivier Bautista, B.A., and Trevor Yucha, B.A., assisted project director Chris Monahan, Ph.D., with the fieldwork effort. Data recovery fieldwork was completed under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). Data recovery during the 2011 field season followed an ADRP by Altizer and Monahan (2011:138–139), which recommended data recovery at four historic properties (SIHP #s -10154, -28812, -28813, and -28814) as follows:

- SIHP # -10154—Three 1.0 by 1.0 m test units will be excavated within the interior area of the site in locations of maximum soil-sedimentary deposition, with possibly two or all of the units contiguous in order to obtain a more complete stratigraphic profile of the deposits.
- SIHP # -28812—One 1.0 by 1.0 m test unit will be excavated within the filled crevice.
- SIHP # -28813—Two 1.0 by 1.0 m test units will be excavated within the interior area of the site.
- SIHP # -28814—Two 1.0 by 1.0 m test units will be excavated within the lava tube, just inside the opening; if the deposit measures less than 2.0 sq m in lateral extent, the entire soil-sedimentary deposit will be removed.

Furthermore, the following field methods would be employed (Altizer and Monahan 2011:139–140):

- a. Hand excavation using trowel and brush (no shovels);
- b. Excavated sediments will be screened through 1/8 inch mesh screen;
- c. All artifacts, including shell and bone midden, will be recovered from the screens;
- d. In situ charcoal samples and charcoal samples from the screening of sediments will be collected for wood species identification and radiocarbon dating as appropriate. In situ charcoal samples will be directly transferred from their soil-sedimentary locus to aluminum foil or plastic bags (see below) using a trowel. Three-dimensional provenience will be recorded for in situ charcoal samples. CSH will follow Beta Analytic's handling and packaging instructions, which are to "place large samples for radiocarbon analysis directly into ziplock bags. The bags will not contaminate the sample. Small samples or those with fine particles should be wrapped in aluminum foil to contain them in a pouch. Place each foil-wrapped pouch into a labeled ziplock bag. Always handle ONLY one sample at a

- time. Begin and end the packaging process for each sample prior to beginning the next. This will best ensure mix-ups are avoided during packaging of samples”;
- e. Pollen samples will be collected from three historic properties: SIHP # -10154, a possible habitation; SIHP # -28813, an agricultural feature; and SIHP # -28814, a lava tube/possible water-catchment feature. CSH will follow PaleoResearch Institute’s manual for pollen sampling (<http://www.paleoresearch.com/mainsite/manuals/manual.html>), the relevant parts of which are as follows: (1) A surface sample shall be collected at each site prior to clearing or excavation to provide data for comparison of the modern environment with that of the past; (2) After excavation has been completed at each site, a stratigraphic column at 2-cm intervals will be sampled in the deepest portion of the site’s excavation; (3) Collection method—(i) Scrape trowel free of dirt, scrape area to be sampled to remove accumulation of modern pollen, (ii) Clean trowel of dirt; spray trowel with distilled water and wipe with paper towel, (iii) Quickly remove pollen sample (approximately 100 cc or ½ cup) and place into Zip-lock bag and secure, (iv) Use the trowel to scrape a vertically thin (less than 1 cm) sample: extend the sample as far as needed laterally within the stratigraphic unit to recover enough sediment to make roughly 1/2 cup, (v) Place the plastic sample bag into a second plastic bag or a paper bag, record the sample data in pencil on an inventory card, and place it between the two plastic bags or write using a Sharpie marker on the paper bag. Double bagging will help protect the sample bag from puncture and provide a convenient place to record sample information. Do not use paper bags as the only means of containing your samples, even if they are taped closed seemingly securely.
 - f. A minimum of two stratigraphic profiles from each unit will be recorded by scale drawing. The two profiles will be recorded on excavation faces that are perpendicular to each other. In addition to being informative about natural and cultural depositional processes, the profiles will illustrate the stratigraphic relationship of structural elements to sediment layers;
 - g. All units will be excavated to culturally sterile sediments or bedrock; and
 - h. Excavation will proceed in arbitrary, 10-centimeter (cm) levels only when natural/cultural layers are in excess of 10 cm thick. Otherwise, when layers are less than 10 cm thick, excavation will proceed by natural/cultural layers.
 - i. Existing drawings will be updated to depict the location of excavation units;
 - j. A sub-meter accurate Trimble GPS unit will be used to record the center point of each unit; and
 - k. SIHP # -10154 will be mapped in its entirety, using scaled tape and compass method, since it was not adequately mapped by Barrera (1989). The field map will be marked with a site datum.

3.1.2 2015 Fieldwork Methods

In 2015, data recovery efforts (following the Shideler et al. [2012] ADRP and the Hammatt and Shideler [2014] APMP) included the following: controlled excavation at 12 historic

properties (SIHP #s -10154, -28778, -28785, -28786, -28807, -28812 through -28815, -29332, -29335, and -29345); artifact collection at two historic properties (SIHP #s -29348 and -29349); confirmation of SIHP #s -29346 and -28808 Features D and E; and characterization of 16 historic trail properties through historical research (SIHP #s -00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272; see Volume III). In May and June 2015, Olivier Bautista, B.A., Scott Belluomini, B.A., Johnny Dudoit, B.A., Angus Raff-Tierney, M.A., Andrew Soltz, B.A., Nifae Hunkin, B.A., Layne Krause, B.A., and Richard Stark, Ph.D., assisted project director William Folk, B.A., with the fieldwork effort, which required approximately 97 person-days to complete. Data recovery fieldwork was completed under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).

Data recovery fieldwork focused on the collection of data to support the project's research objectives on temporal analysis, function, and cultivation (see Section 9.2 through 9.5). Eighty-two excavation units comprising approximately 81.5 sq m of surface area were excavated in 2015. Field methods were nearly identical to those described in the Altizer and Monahan (2011) study (see above), with the following exceptions (Shideler et al. 2014:267–268):

- Pollen samples will be collected from all agricultural and probable/possible agricultural sites (SIHP #s -28813, -28778, -28785, -28786, and -29344).
- Two historic properties (SIHP #s -29348 and -29349) each contain one rounded boulder (probable *pāhoehoe* bashers) in association with an excavated pit. Each of these portable artifacts will be collected and curated in accordance with the curation agreement in the final amendment to the MOA.

3.2 Laboratory Methods

Materials collected during data recovery fieldwork were identified and catalogued at CSH's laboratory facilities in Hilo, Hawai'i. Analysis of collected materials was undertaken using standard archaeological laboratory techniques. Materials were washed, sorted, measured, weighed, described, and/or photographed.

3.2.1 Sediment Sample Analysis

Sediment samples collected from potential cultural strata and/or features were examined within the CSH laboratory to aid in characterizing the cultural content and chronology of these deposits. Samples were collected and screened in the field and/or collected as bulk samples. All samples were labeled with provenience information, and the volume of each sample was recorded so that comparisons could be made between samples. Samples screened in the field utilized 1/8-inch wire mesh to remove the sedimentary matrix from the cultural content (i.e., faunal, floral, and artifactual remains). In the lab, bulk sediment samples were screened through 1/16-inch wire mesh. Wet screening of samples was performed as necessary. As applicable, the cultural material was washed, sorted, measured, weighed, described, photographed, identified, and catalogued.

3.2.2 Artifact Analysis

In general, artifact analysis focused on establishing, to the greatest extent possible, material type, function, cultural affiliation, and age of manufacture. As applicable, artifacts were washed,

sorted, measured, weighed, described, photographed, and catalogued. Diagnostic (dateable or identifiable) attributes of artifacts were researched.

Traditional Hawaiian artifactual material was identified, and forms and functions determined, using standard reference materials (e.g., Barrera and Kirch 1973; Brigham 1974; Buck 2003; Emory et al. 1968; Graves and McElroy 2004). Historic artifacts were identified using standard reference materials (e.g., Elliott and Gould 1988; Fike 1987; Godden 1964; Kovel and Kovel 1986; Lehner 1988; Lindsey 2014; Millar 1988; Munsey 1970; Toulouse 1971; Whitten 2009; and Zumwalt 1980), as well as resources available on the internet. Analyzed materials were tabulated and are presented in Section 8.1.

3.2.3 Faunal Analysis

Faunal analysis generally focused on species identification and evidence of food consumption. For collected invertebrate remains, shell midden was first separated from non-midden shell. Non-midden shell was then weighed as a bulk total with no additional analysis warranted. Shell midden was identified to the lowest possible taxa, weighed, and analyzed. Common shells were identified and analyzed using an in-house comparative collection and reference texts (e.g., Abbott and Dance 1990; Eisenberg 1981; Kay 1979; Titcomb 1979). An outside expert was consulted for identification of rare and/or extinct invertebrates. Collected non-human vertebrate skeletal material was identified to the lowest possible taxa and analyzed using an in-house comparative collection and reference texts (e.g., Adams and Crabtree 2012; Olsen 1964; Schmid 1972; Sisson 1953). Analyzed materials were tabulated and are presented in Section 8.2.

3.2.4 Floral Analysis

Floral analysis included several types of plant analyses including palynological analysis, starch analysis, macrofloral analysis, and radiocarbon analysis. Results are presented in Section 8.3.

3.2.4.1 Palynological and Starch Analysis

Select sediment samples were submitted to PaleoResearch Institute, Inc. in Golden, Colorado for pollen and starch grain analysis (Cummings and Kovacik 2016; Appendix C). In that laboratory, a chemical extraction technique based on flotation is the standard preparation technique used for recovering pollen grains from sediments. This process was developed to extract pollen from soils in which preservation has been less than ideal, and the pollen density is lower than in peat. A light microscope was used to count the pollen grains at a magnification of 500x. An extensive comparative reference housed at PaleoResearch Institute aided pollen identification to the family, genus, and species level, where possible.

Because pollen extraction retains starch grains, starch grains were recorded during the pollen count, as well as during an additional search.

3.2.4.2 Macrofloral Analysis

Select bulk samples were submitted to PaleoResearch Institute, Inc. in Golden, Colorado for macrofloral analysis. In that laboratory, the bulk samples were floated using a modification of procedures outlined by Matthews (1979). The light fractions (floating material) were weighed, then passed through a series of graduated screens to separate the charcoal debris and sort the

remains. Charcoal pieces larger than 0.5 mm in diameter were separated from the rest of the light fraction, and the total charcoal was weighed. Charcoal pieces in a representative sample were broken to expose fresh cross, radial, and tangential sections, then examined under a binocular microscope at a magnification of 70x and under a Nikon Optiphot 66 microscope at magnifications of 320–800x. Weights of each charcoal type within the representative sample were recorded. Material that remained in the screens was scanned under a binocular stereo microscope at a magnification of 10x.

Heavy fractions were scanned at a magnification of 2x for the presence of botanic remains. Macrofloral remains, including charcoal, were identified using manuals (e.g., Carlquist 2001; Hoadley 1990; Martin and Barkley 1961) and through comparison with modern and archeological references. Clean laboratory conditions were maintained during flotation and identification to avoid contamination of charcoal and botanic remains to be submitted for radiocarbon dating. All instruments were washed between samples, and the samples were protected from contact with modern charcoal.

3.2.4.3 Wood Taxa Analysis

Select samples of charcoal material were analyzed for species identification. Samples were sent to International Archaeological Research Institute, Inc. (IARII) for taxa identification. The samples were viewed under magnification of a dissecting microscope and then compared with anatomical characteristics of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai'i, as well as in published descriptions. Taxa identification of wood samples provides useful information for interpreting the environmental and cultural history of the project area and helps to determine a general time frame of land use. Analysis by IARII can also identify short-lived plant species used for radiocarbon dating. Following analysis, samples were returned to the CSH laboratory.

3.2.5 Radiocarbon Analysis

Select charcoal and faunal samples were analyzed by PaleoResearch Institute, Inc. in Golden, Colorado and Beta Analytic, Inc. in Miami, Florida for radiocarbon dating analysis. Charcoal samples from short-lived plant species were selected as they provide a tighter time frame for possible radiocarbon dates. The samples were analyzed using the accelerator mass spectrometry (AMS) method. The conventional radiocarbon age was then calibrated to calendar ages using IntCal13 curves on Oxcal version 4.2.4, developed by the University of Oxford Radiocarbon Accelerator Unit.

3.3 Disposition of Materials

Materials collected during the current data recovery will remain temporarily curated at the CSH office in Hilo, Hawai'i. CSH will make arrangements with the landowner regarding the disposition of this material. Should the landowner request different archiving of material, an archive location will be determined in consultation with the SHPD. All data generated during the course of the ADR is stored at the CSH offices.

Section 4 Traditional and Historical Background

This section summarizes aspects of the traditional and historical importance of the project area, including descriptions of place names and *wahi pana* (legendary places), *‘ōlelo no‘eau* (poetical sayings), and significant historical events and persons.

4.1 *Wahi Pana* (Place Names)

Wahi pana (“legendary place” Pukui and Elbert 1986:376) or “place names” are an integral part of Hawaiian culture. “In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time” (McGuire and Hammatt 2000:23). The *wahi pana* are then passed on through language and oral tradition, thus preserving the unique significance of the place. Hawaiians have named a wide variety of objects and places, including points of interest that may have gone unnoticed by persons of other cultural backgrounds. Hawaiians have named taro patches, rocks, and trees that represent deities and ancestors, sites of houses and *heiau* (places of worship), canoe landings, fishing stations in the sea, resting places in the forests, and the tiniest spots where miraculous or interesting events are believed to have taken place (Pukui et al. 1974:x).

The primary compilation source for place names in this section is the online database of Lloyd Soehren’s (2010) *Hawaiian Place Names*. Soehren has compiled all names from mid-nineteenth century land documents, such as Land Commission Awards (LCAs) and Boundary Commission Testimony (BCT) reports. The BCT lists boundary points for many (but not all) of the *ahupua‘a* (land division usually extending from the uplands to the sea). The names of *‘ili ‘āina* (land units within an *ahupua‘a*) and *‘ili kū* (land units rewarded separately from a specific *ahupua‘a*) are compiled from the testimony in Māhele LCAs, from both awards successfully claimed and from those rejected. Place names found by the authors on USGS maps and Hawai‘i Survey Registered Maps (RM) have been added to the Soehren database.

The Soehren database includes place name meanings from the definitive book on Hawaiian place names, *Place Names of Hawai‘i* (Pukui et al. 1974). Where Pukui et al. (1974) do not provide a translation, Soehren often suggests a meaning for simple names from the *Hawaiian Dictionary* (Pukui and Elbert 1986). Thomas Thrum (1922) also compiled a list of place names in the 1922 edition of Lorrin Andrews’s *A Dictionary of the Hawaiian Language*, although these meanings are considered to be less reliable than those in *Place Names of Hawai‘i*.

Many of these place names are shown on historic maps (Figure 23 through Figure 26). In many cases, the exact locations of place names are not known, only their general location between two other points along an *‘ahupua‘a* boundary. These cannot be placed accurately on any maps, so their position is only noted in the following place name tables. Abbreviations used in the Soehren database are presented in Table 4.

4.1.1 Kealakehe Place Names

Kealakehe was assigned as Government Land during the Māhele, but there were 23 Land Commission claims with information on *‘ili* names. Although there is no specific Boundary Commission survey for Kealakehe, Keahuolū, the *ahupua‘a* to the south, was surveyed with the result that the boundary points along the southern boundary of Kealakehe are in the boundary

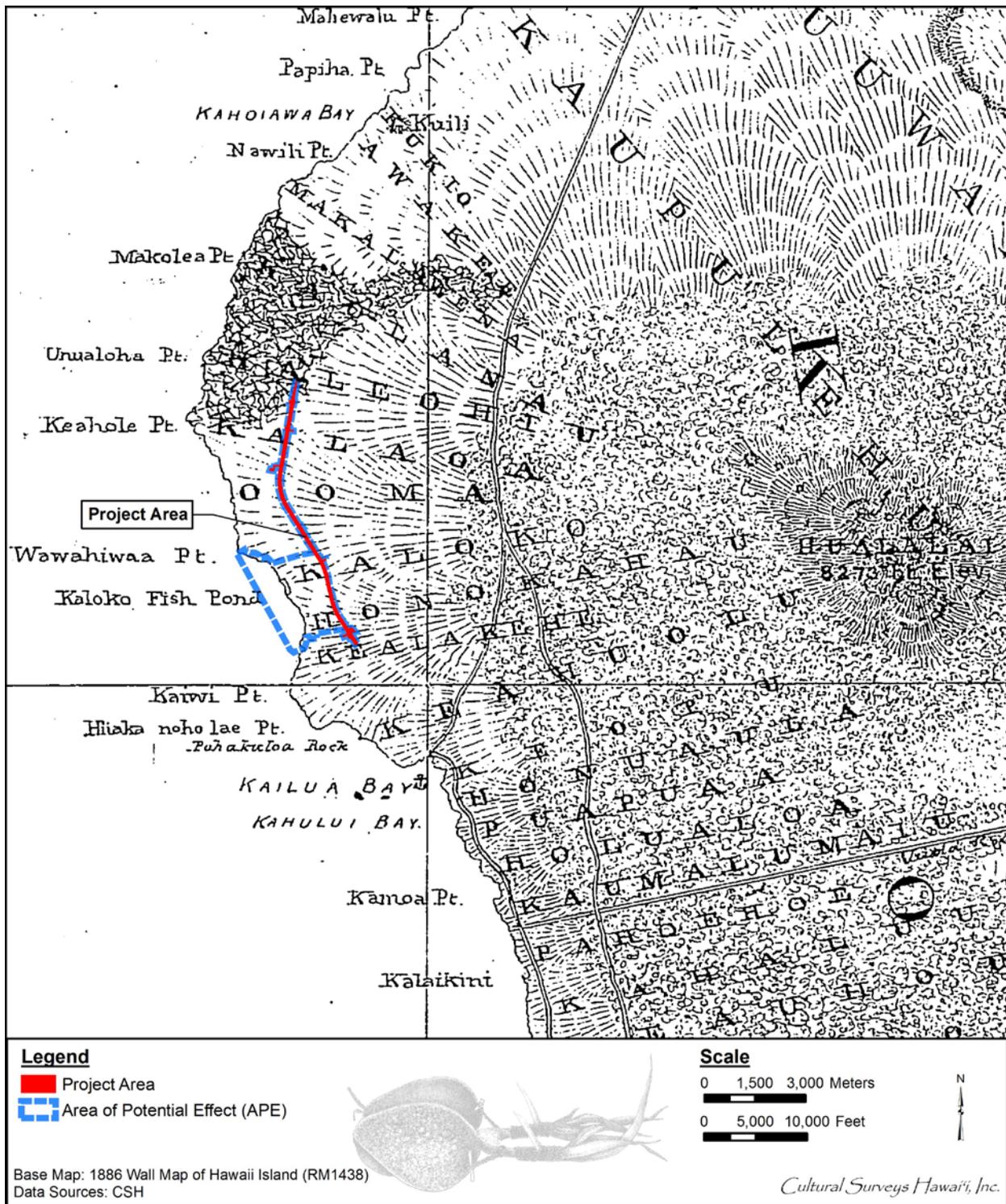


Figure 23. 1886 map of Hawai'i (portion) by W.A. Wall, depicting the project area through Kealakehe, Honokōhau, Kaloko, 'O'oma, and Kalaoa (south to north); note coastal place names

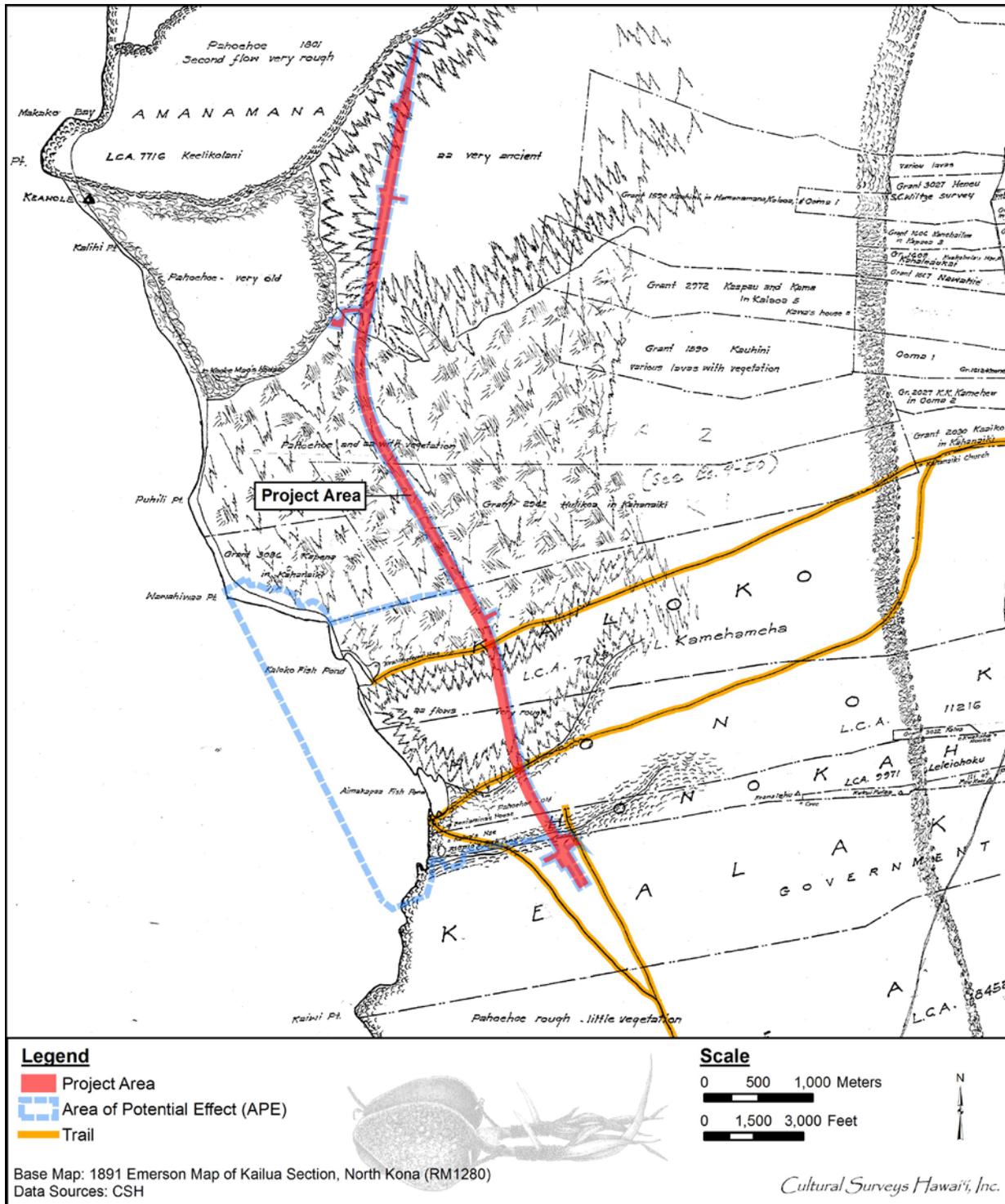


Figure 24. 1891 map (portion), Kailua section of North Kona (Hamanamana to Puapua‘a) by J.S. Emerson; note *mauka-makai* trails in Kaloko (SIHP # -10714, “Road to the Sea”) and Honokōhau I (SIHP # -18099, “Trail to Honokōhau”)

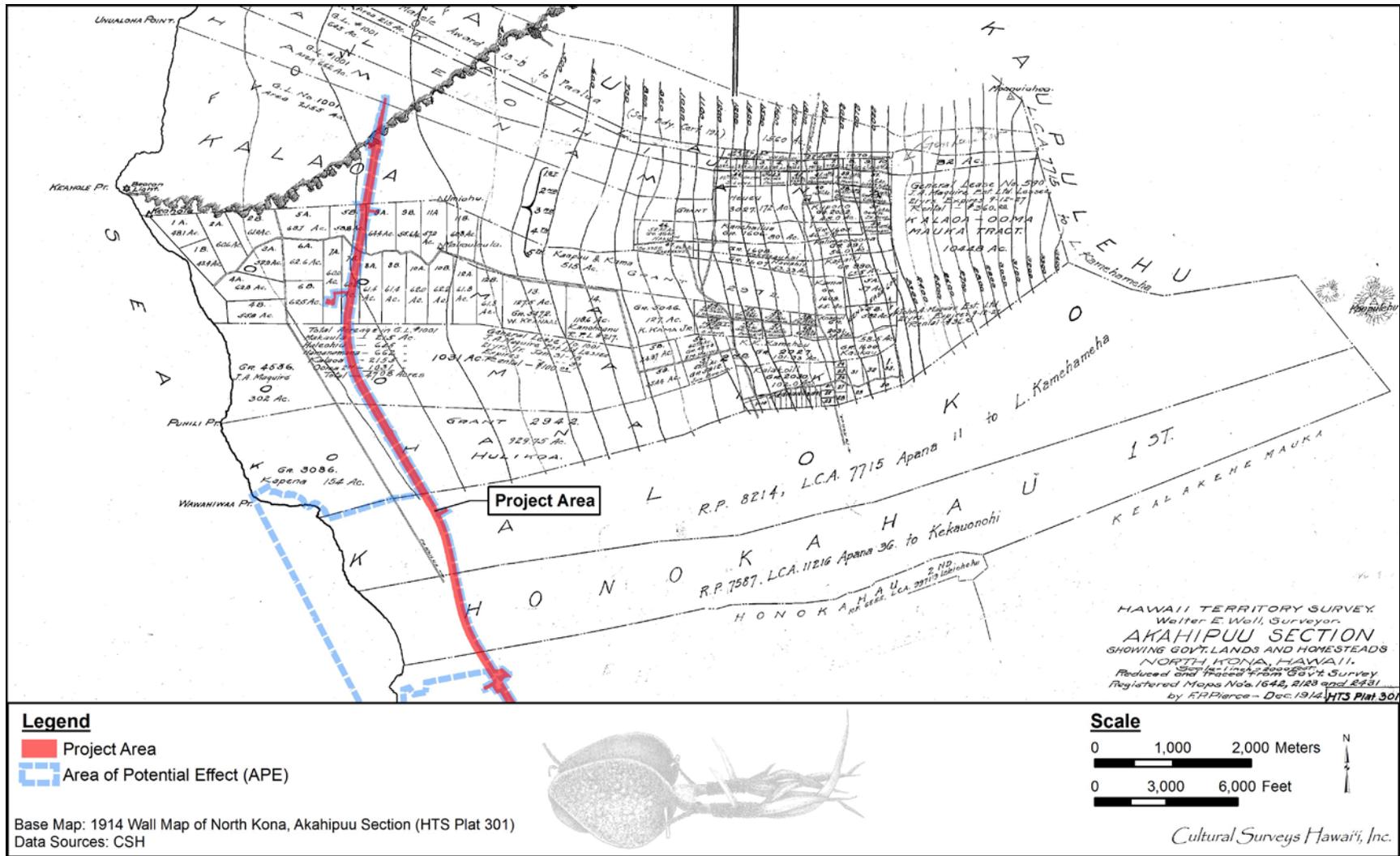


Figure 26. 1914 map of Akahipu‘u Section of Kailua-Kona, depicting the numerous Government Lands and land grants in ‘O‘oma and Kalaoa

Table 4. Abbreviations for Table 5 through Table 12

Abbreviation	Full Name
BC	Boundary Certificate Number
BCT	Boundary Commission Testimony
FB	Field Book Register
FR	Land Commission, Foreign Register
FT	Land Commission, Foreign Testimony
NR	Land Commission, Native Register
NT	Land Commission, Native Testimony
RM	Registered Map
RPG	Royal Patent Grant
TM	Tax Map
USGS	U.S. Geological Survey

commission testimony (BCT). The exact locations of most of the places are not known, but the general order of the names, from the *makai* boundary point at the coast to the *mauka* point of the *ahupua'a*, can be determined. In Table 5, these boundary points are numbered one through 12, from the shore to the *mauka* point. In the Boundary Commission, several witnesses recorded their memories of the boundary points, which resulted in different sequences, as some place names appeared in only one of the testimonies. For instance, one sequence listed the following:

Pu'u Nāhāhā, Pu'u Hulihuli, and Ka'e'ku

Another sequence lists the following:

Pu'u Nāhāhā, Ka'ena'ena, and Ka'e'ku

Thus, it is not possible to determine if Pu'u Huliuli or Ka'ena'ena is *mauka* of the other, or even if they are variant names for the same place. In this case, the names are listed with a sub-number (e.g., Boundary Point 5a and 5b). The boundary points between Kealakehe and Honokōhau are presented in the following section on Honokōhau place names.

4.1.2 Honokōhau Place Names

Honokōhau was awarded to two high *ali'i* in the Māhele, and 32 commoner LCAs were claimed. The lands (Honokōhau 1 and Honokōhau 2) were surveyed, and the testimony for the boundary points is recorded in the Boundary Commission Books. This resulted in a great deal of information on place names for Honokōhau. Table 6 lists the place names and their meanings. Table 7 presents additional information on boundary points—including their numbered order—for the Honokōhau Ahupua'a/Kealakehe Boundary. Table 8 presents the boundary points for the border between Honokōhau 1 and 2.

Few of the boundary points between the *ahupua'a* of Honokōhau and Kealakehe or between Honokōhau 1 and Honokōhau 2 are known exactly. The tables present the general location information from the BCTs in order of occurrence as one would walk from the shore to the *mauka* point of the *ahupua'a*. Estimates of the elevation along this boundary line are from USGS maps, registered maps, and from estimates by Lloyd Soehren (2010). For points along the Honokōhau/Kaloko Ahupua'a boundary, see the next section in this report.

4.1.3 Kaloko Place Names

Place names of Kaloko Ahupua'a, as well as boundary points along the Honokōhau/Kaloko Ahupua'a boundary, are presented in Table 9.

4.1.4 Kohanaiki Place Names

The entire *ahupua'a* of Kohanaiki was classified as Government Lands (Indices of Awards 1929) in the Māhele. Two LCA claims were made, but neither was awarded, and so there are few sources for *'ili* names. The boundary of the *ahupua'a* was not surveyed, so there are no Boundary Commission sources for place names. Some land was later sold by the government as land grants, and place names are occasionally mentioned in these documents. J.S. Emerson mapped a portion of Kohanaiki on his Kona Coast Registered Map (RM 2035) and listed the names of several triangulation stations, which he had named. Thus, we have little information on traditional place names in Kohanaiki, except for those presented in Table 10.

Table 5. Kealakehe place names (compiled by Lloyd Soehren, with additions)

Place Name	Type	Comments	Name Meaning
Kealakehe	<i>Ahupua'a</i>	Māhele Book	The bend of a road (Thrum 1922)
Haleoloni	<i>'Ili 'āina</i>	LCA 8608 testimony	House of Lono (Pukui et al. 1974)
'Ilioa	<i>'Ili 'āina</i>	LCA 8608 testimony	Long <i>'ili</i> (Pukui and Elbert 1986)
Ka'ōhia	<i>'Ili 'āina</i>	LCA 7483, 8608, 10950 testimony	The <i>'ōhi'a</i> tree
Kalihi	<i>'Ili 'āina</i>	LCA 8608 testimony	The edge (Pukui et al. 1974)
Kani'ohale	<i>'Ili 'āina</i>	LCA 9252, 10070, 10306, 10671 testimony	The house doorway (Pukui and Elbert 1986)
Kukui'ōmino	<i>'Ili 'āina</i>	LCA 8608, 7897, 10597, and 10671 testimony	Stunted <i>kukui</i> tree (Pukui and Elbert 1986)
Makakilo'i'a	<i>'Ili 'āina</i>	LAC 8608 testimony	Fish-observing point (Pukui et al. 1974)
Pū'ohē	<i>'Ili 'āina</i>	LCA 8608 testimony	–
Hale o Mono (or Mano)	<i>Heiau</i>	1982 U.S.G.S.	–
Haleokane	<i>Heiau</i>	Site 33: Reinecke called this simple platform <i>heiau</i> “Hale o Lono”; called “Hale of Kane” by surveyors in 1883 (Reinecke ms [1] 9: FB 294:135; FB 493:94)	–
Haleoloni	<i>Heiau</i>	1959 USGS	Likely Makaopio Heiau
Kalualapauila	<i>Heiau</i>	The Kealakehe/ Keahuolū boundary passes “a few fathoms on the north side of a heiau called Kalualapauila” (BCT 1:355); also called Luapauwila; see BC 45 (3:44); FB 294:610-62	–
Luapauwila (Kalualapauila)	<i>Heiau</i>	Said to be a walled structure on the 'Emakule homestead, RPG 3765, 3.5 miles from sea (Stokes 1991:40)	–

Place Name	Type	Comments	Name Meaning
Maka'ōpio	<i>Heiau</i>	Called "Hale o Lono Heiau" on USGS 1959, a generic name for temples dedicated to Lono; Reinecke Site 35; Emory and Soehren Site D11-7 (Emory and Soehren 1971:9; Reinecke ms [1]:10)	A variety of taro (Pukui and Elbert 1986)
Ālula	Canoe landing	Site 34 (Reinecke ms [1]:10): A small sandy cove south of Honokōhau small boat harbor; here Punia tricked the shark king, Kaialeale, into coming ashore where he was killed	Possibly named for the endemic lobelia, <i>'alula</i> (Pukui and Elbert 1986)
Ka'omalō	Canoe landing	Canoe landing near or the same as Alula (FB 243:191)	Perhaps, dry desert (Pukui and Elbert 1986)
Makauhele-hele	Canoe landing	(FB 306:136)	—
Kalokoloa	Inlet	A narrow inlet at the shore, probably a collapsed <i>pāhoehoe</i> lava tube, between Kaluakauaka and Noio Point (FB 306:135)	The long pond (Pukui and Elbert 1986)
Kaluakauaka	Inlet	Between Kaiwi Point and Kalokoloa (FB 243:191–192)	The pit [where] lightning flashes
Noio	Coastal point	(USGS 1982)	Tern (Pukui and Elbert 1986)
Ōpilopilo	Stream	"[T]urn north to kahawai Opilopilo, the <i>mauka</i> corner of Kealakehe"	—
Keomano	<i>Pōhaku</i>	A rock outside Alula, below Hale on Kane Heiau (FB 294:135–136; FB 493:94)	—
Kaiwi Point	Boundary Point 1 (at coast)	Kealakehe/Keahuolū boundary at shore (USGS 1998)	The bone (Pukui et al. 1974)

Place Name	Type	Comments	Name Meaning
Pu'u o Kāloa	Boundary Point 2	Kealakehe/Keahuolū boundary. Kamakau: "The spot where [Kealii-o-kaloa] was killed was called Puu-o-Kaloa, situated between Kailua and Honokōhau." 'Ī'ī places it along the trail from Kamakahonu to Kiholo. An <i>oioina</i> (resting place), on Kealakehe/Keahuolū boundary (BCT 1:355; Kamakau 1961:35; 'Ī'ī 1959:120)	Hill of Kāloa (Pukui and Elbert 1986)
Pu'u 'Ula'ula	Boundary Point 3	Kealakehe/Keahuolū boundary; "hill between Puu o Kaloa & Puu Nahaha" (BCT 1:356)	Red hill (Pukui and Elbert 1986)
Pu'u Nāhāhā	Boundary Point 4	Kealakehe/Keahuolū boundary, "a hill of aa called Puu Nahaha" between Puu Ulaula and Puu o Hulihuli (BCT 1:355, 356)	Shattered hill (Pukui et al. 1974)
Pu'u Hulihuli (Puohuliuliu)	Boundary Point 5a	Kealakehe/Keahuolū boundary between Puu Nahaha and Kalualapauwila, about 220 ft elev (BC 45 [3:44]; BCT 1:356; FB 294:61–62; USGS 1924)	Hill of Hulihuli (Pukui and Elbert 1986)
Ka'ena'ena	Boundary Point 5b	Kealakehe/Keahuolū boundary—hill between Pu'u Nahaha and Kae'eku (BCT 1:356, 358)	—
Ka'e'ku	Boundary Point 6	Kealakehe/Keahuolū boundary, hill between Kaenaena and Kalualapauila (BCT 1:356, 358)	—
Kaluapau-wila	Boundary Point 7	Kealakehe/Keahuolū boundary passes "a few fathoms on the north side of a heiau called Kalualapauila" (BCT 1:355)	—
Lae Niau (Kalaeniau)	Boundary Point 8	Kealakehe/Keahuolū boundary, an <i>ahu pohaku</i> at the Government road (1:355); "a puu makai of said road" [Old Upper Govt. road on TM]; between Kalualapauila and Keahupuaa (BCT 1:355, 1:366, 358)	—

Place Name	Type	Comments	Name Meaning
Keahupua'a	Boundary Point 9	Kealakehe/Keahuolū boundary "and ahua pohaku at the mauka [Old Upper] Government road"; between lae Niau and Kahihi'ie (BCT 1:357)	The pig altar (Pukui and Elbert 1986)
Kahuaa-ka'ūlei	Boundary Point 10	Kealakehe/Keahuolū boundary between Keahuuaa and Ohiawela (BCT 1:358)	The fruit of the 'lei shrub (Pukui and Elbert 1986)
'Ōhi'awela	Boundary Point 11	Kealakehe/Keahuolū boundary; "I have not been there, but have heard that there is a spring there"; Between Kahuaakaulei and Kahihiia (BCT a:358)	—
Kahihi'ie	Boundary Point 12a (<i>mauka</i>)	Kealakehe/Keahuolū boundary at the corner of the lands of Kealakehe, Keahuolū, and Lanihauiki (BC 45 [3:44]; BCT:1:358, 364, 365)	—
Kaohiamoekanaka (Ohiakaukanaka)	Boundary Point 12b (<i>mauka</i>)	Kealakehe/Keahuolū, "corner of Keahuolū is an Ahua called Kaohiamoekanaka, thence makai along Kealakehe" (BCT 1:356)	—

Table 6. Honokōhau place names (compiled by Lloyd Soehren 2010, with additions)

Place Name	Location	Type	Source	Meaning
'Ai'ōpio	Honokōhau 2	Fishpond	—	Youth eating (Pukui et al. 1974)
'Aimakapā	Honokōhau	Hishpond	—	—
Ahupua'a	Honokōhau 2	<i>Pu'u</i> , boundary point	—	Pig altar
'Elepaio	Honokōhau 2	<i>'Ili kū</i>	LCA 10319 testimony b	Pukui et al. 1974: flycatcher (a Hawaiian bird, <i>Chasiempis sandwichensis</i>); Pukui and Elbert 1986: a variety of taro
Hale o Mano (sometimes written as Mono)	Honokōhau	<i>Heiau</i>	—	—

Place Name	Location	Type	Source	Meaning
Haleamahuka	Honokōhau 1	<i>'Ili 'āina</i>	LCA 10521 testimony	Fugitive house (Pukui and Elbert 1986)
Halekū'ō	Honokōhau 1	<i>Heiau</i>	–	–
Haleolono	Honokōhau	<i>'Ili 'āina</i>	LCA 10319 testimony	House of Lono (Pukui et al. 1974)
Hanapouli	Honokōhau	<i>'Ili 'āina</i>	LCA 7890, LCA 10319, and 10949 testimony	–
Honokōhau	Honokōhau 1, 2	<i>Ahupua'a</i>	USGS 1982	Bay drawing dew (Pukui et al. 1974)
Honokōhau	Honokōhau 1, 2	Village	–	Bay drawing dew (Pukui et al. 1974)
Honokōhau	Honokōhau	Bay	–	Bay drawing dew (Pukui et al. 1974)
Hulipia	Honokōhau 2	<i>'Ili 'āina</i>	LCA 9231 testimony	–
Hulipia	Honokōhau 2	Boundary point	–	–
Iakahale	Honokōhau 3	Boundary point	–	–
Ikuana	Honokōhau 1	Residence	–	–
Iiala	Honokōhau 2	Boundary point	–	–
Kaaiakuli	Honokōhau 2	Boundary point	–	–
Kaero	Honokōhau 1	<i>'Ili 'āina</i>	LCA 9236 testimony	Winner (Thrum 1922)
Kahawaiaina	Honokōhau 2	Boundary point	–	–
Kāne'ōpua	Honokōhau 2	Boundary point	–	–
Kapiopio	Honokōhau 1	Boundary point	–	–
Kauakahihale	Honokōhau 1	<i>'Ili 'āina</i>	LCA 9114 testimony	–
Keanakāhuapua'a	Honokōhau 1	Boundary point	–	The cave [for] baking pig (Pukui and Elbert 1986)
Kuakahela	Honokōhau 1	Boundary point	–	–
Kuanawai	Honokōhau 1	Coastal point	–	–
Kūkāno'ono'o	Honokōhau 2	Residence	–	–

Place Name	Location	Type	Source	Meaning
Kukuioahulani	Honokōhau 2	Boundary point	–	–
Kukuipuloa	Honokōhau 2	Boundary point	–	–
Kumumāmaki	Honokōhau 1	Boundary point	–	Trunk of <i>māmaki</i> tree (Pukui and Elbert 1986)
Mākūiki	Honokōhau 1	<i>'Ili 'āina</i>	LCA 10699 testimony	Small hibiscus (Pukui and Elbert 1986)
Malai'ula	Honokōhau 1	Boundary point	–	Variant of <i>palai'ula</i> , a fern (Pukui and Elbert 1986)
Maliu	Honokōhau 2	Coastal point	–	Look upon (Pukui et al. 1974)
Maluhia	Honokōhau 3	Boundary point	–	Peace, quiet, security (Pukui and Elbert 1986)
Mī'ala	Honokōhau 2	Boundary point	–	Same as <i>miki'aala</i> : alert, prompt (Pukui and Elbert 1986)
Mumuku	Honokōhau 1	Boundary point	–	–
Nāunu	Honokōhau 1	Boundary point	–	–
Nu'uhiwa	Honokōhau 2	<i>'Ili 'āina</i>	LCA 10559 testimony	A variety of banana (Pukui and Elbert 1986)
'Ōhi'akaumai'a	Honokōhau 1	Boundary point	–	–
'Ōhi'awela	Honokōhau 1	Boundary point	–	–
'Ōnea	Honokōhau 1	<i>'Ili 'āina</i>	LCA 7490 and LCA 9158 testimony	Desolate (Pukui and Elbert 1986)
Paehala	Honokōhau	<i>'Ili 'āina</i>	LCA 9158 testimony	Cluster of <i>pandanus</i> trees (Pukui and Elbert 1986)
Pāhoehoea	Honokōhau 2	Boundary point	–	–
Papa'akoko	Honokōhau 2	<i>'Ili kū</i>	RPG 3456 testimony	Secured blood (Pukui et al. 1974)
Pōhakuha'ikū	Honokōhau 1	Boundary point	–	–
Pu'u Kou	Honokōhau	<i>'Ili 'āina</i>	LCA 7396 testimony	–

Place Name	Location	Type	Source	Meaning
Pu'u Mau	Honokōhau 1	Boundary point	–	–
Pu'u Noho	Honokōhau 2	Boundary point	–	–
Pu'u Oina	Honokōhau 2	<i>Heiau</i>	–	–
Pukaalani	Honokōhau 2	Boundary point	–	–
Pūnāwai	Honokōhau 1	Boundary point	–	Water spring (Pukui and Elbert 1986)
‘Ulukūkahi	Honokōhau 1	Boundary point	–	Breadfruit tree standing alone (Pukui and Elbert 1986)
Waihā	Honokōhau 2	<i>‘Ili ‘āina</i>	LCA 9161 testimony	Trough water (Pukui and Elbert 1986)
Waihā	Honokōhau 2	Boundary point	–	Trough water (Pukui and Elbert 1986)
Waiopapa	Honokōhau 2	Boundary point	–	–
Waipi‘o	Honokōhau 2	<i>‘Ili ‘āina</i>	LCA 7870 testimony	Curved water (Pukui et al. 1974)

Table 7. Honokōhau / Kealakehe Ahupua‘a boundary points (in order from the coast to the *mauka* point; compiled by Lloyd Soehren 2010, with additions)

Boundary Point	Order	Elev. (ft)	Description
Maliu	Boundary Point 1 (at coast)	0	Variiously described as a <i>lae</i> (point), a <i>pōhaku</i> (stone), a point of rocks (USGS 1982; BCT 1:364,365; BC 27; BCT 1:366)
Halekū‘ō	Boundary Point 2	–	“. . . a heiau named Halekūo . . .” is above Maliu Point, but the same witness earlier placed Halekūo, “a wall above the School house” (BCT 1:365)
Malihia	Boundary Point 3	–	“. . . a kula mahiai, ahua, and iwi aina . . . [dryland field, mound, wall]” between Maliu and Kahawaiaina (BCT 1:365)
Pāhoehoea	Boundary Point 4	–	On <i>pāhoehoe</i> near shore, between Maliu Point and Puu Noho (BCT 1:364)
Pu‘u Noho	Boundary Point 5	–	“. . . on the pāhoehoe, said place is an Ahua . . .” between Pāhoehoea and (BCT 1:364)
Kahawaiaina	Boundary Point 6	–	“. . . a mahina ai [cultivated patch] in aa . . .” (p.364); “. . . an ahua pohaku . . . [stone mound]” (p.365); between Puu Noho and Kukuipuloa (BCT 1:364, 365)

Boundary Point	Order	Elev. (ft)	Description
Kukuioahulani	Boundary Point 7a	200	“... at a place called Kukuioahulani ...” between Maliu Point and Iiala (BC 27, 1:366)
Iiala	Boundary Point 7b	430	“... to Iiala a point 23 ft. southwest of a tree ...” between Kukuioahulani and Hulipia (BC 27; 1:366)
Hulipia	Boundary Point 7c	660	“... a place called Hulipia ...” about 690 ft elev, between Iiala and Kukuipuloa at lower end of Papa‘akoko (BC 27 (1:367); NT 4:542)
Keanalehu	Boundary Point 8	720	RM 1280—shown as the <i>makai</i> corner of the ‘ <i>ili</i> of Papa‘akoko near a marked cave
Kukuipuloa	Boundary Point 9	790	“... an ahua pohaku (resting place) ... in the kula mahiai and goat ground” (p.364); “... an old resting place, under a kukui tree ...” (p.365); between Hulipia and Kukanoonoo, at the north end of Kealakea Street (BC 27 [1:367]; BCT 1:364, 365)
Pu‘u Kou	Boundary Point 10	1,040	RM 1280 shown as peak just below the lower government road
Kūkāno‘ono‘o	Boundary Point 11	–	“... an old kulana kauhale ... [house complex]” between Kukuipuloa and Kaneopua
Kāne‘ōpua	Boundary Point 12	–	“... an oioina [resting place] on the boundary, below the Government road ...” between Kukanoonoo and Waiopapa (BCT 1:364)
Papa‘akoko	Boundary Point 13	1,400	Above the upper govt road (RM 1280)
Waiopapa	Boundary Point 14	1,760	“... a punawai [spring] and Ahua above the Government road, where you can look out to sea ...” between Ahupuaa and Waiha (BCT 1:364)
Waihā	Boundary Point 15	2,000	“... along Kealakehe to Waiha a punawai at the old kulana kauhale, below the woods ...” (p.364) Between Waiopapa and Malaiula (BCT 1:364,365; NT 8:652)
Miala	Boundary Point 16	–	Between Kukanoonoo and Ahupuaa (BCT 1:365)
Ahupua‘a	Boundary Point 17	–	“... a place called Ahupuaa a puu pohaku at the Government road at the makai corner of my land [LCAw.7870] ...”; probably a Makahiki altar at the land boundary (Malo 1951:146; BCT 1:354)

Boundary Point	Order	Elev. (ft)	Description
Kaaiakuli	Boundary Point 18	–	“ . . . passing to the south side of Kaaiakuli and the mauka corner of my land [LCA 7870]”; between Waiha and Malaiula (BCT 1:365)
Malai‘ula	Point 19	2,130	“ . . . a banana grove, in the edge of the ohia woods where Honokōhau Nui & Kealakehe unite, thereby cutting Honokōhau Iki off” (BCT 1:364, 365; BC 27 [1:367])
Nāunu	Point 20	2,200	“The lands of Kealakehe & Honokōhaunui meet at a place called Naunu, an ahu makai of the koa”; this point at end of Honokōhauiki is called Kumumamaki elsewhere (BCT 1:369, 372)
‘Ōhi‘awela	Point 21	5,800	“[A] pali [cliff] on Honokōhaunui where olona grows” (p.369); “Honokōhaunui ends at Ohiawela, a pali” (p.371); “on the road through the woods . . . above Honokōhaunui” (BCT 1:369, 371)

Table 8. Honokōhau 1 / Honokōhau 2 boundary points (in order from the coast to the *mauka* point; compiled by Lloyd Soehren 2010, with additions)

Boundary Point	Order	Elev. (ft)	Description
Kuanawai [Punawai]	Boundary Point 1	0	“ . . . a place called Kuanawai, said place is in the water . . .” (1:363) “ . . . a lae pohaku named Kuanawai, on the North side of the point . . .” (1:365) “ledge of rocks at shore . . . called Punawai or Kuanawai . . .” (BCT 1:368; BCT 1:363, 365; BC 27 [1:368])
Pōhaku ha‘ikū	Boundary Point 2	20	“ . . . up the sand beach to a place called Pohakuhaiku a heiau on the pāhoehoe” (Bishop Museum site HA-D12-14?) (1:363, Hoohia testifying); between Kuanawai and Puu Mau (BCT 1:363, 365)
Pu‘u Mau	Boundary Point 3	–	“ . . . an oiaina or Ahua, an old resting place, where a koa tree used to stand . . .” (1:363) “ . . . a puu pohaku above the makai government road . . .” (1:365) between Pohakuhaiku and Keanakaluapuaa (BCT 1:363, 365)
Keanakāluapua‘a	Boundary Point 4	–	“ . . . a cave” between Puu Mau NS Ulukukahi (BCT 1:363, 365)
‘Ulukūkahi	Boundary Point 5	620	“ . . . a breadfruit tree . . .” (1:363) “ . . . a lae kukui” (1:365); between Keanakaluapuaa and Pukaalani
Puka‘alani	Boundary Point 6	800	grove of <i>puhala</i> [pandanus] tree (BCT 1:365)

Boundary Point	Order	Elev. (ft)	Description
‘Ōhi‘akaumai‘a	Boundary Point 7	–	“... ohia fruit trees [‘ōhi‘a ai, mountain apple] . . .” (1:365); between Ulukukahi and Kuakahela (BCT 1:363, 365)
Kuakahela	Boundary Point 8	1,100	“... a lae ohia fruit trees [‘ōhi‘a ai, mountain apple] . . .” (1:364) “... a place called Kuakahela . . .”; between Pukaalani and Mumuku (BCT 1:364,365; BC 27, 1:367)
Mumuku	Boundary Point 9	1,260	“... to a Bread fruit tree . . . at place called Mumuku . . .” (BCT 1:367); between Palani Rd AND Māmalahoa Hwy; between Kuakahaela and Iakahale (BCT 1:364,365; BC 27 [1:367])
Ikuana	Boundary Point 10	1,400	between Mumuku and Kapiopio, above Māmalahoa Hwy (BCT 1:364, 365)
Iakahale	Boundary Point 11	1,610	“... to Iakahale kihapai [cultivated patch], the boundary passing on the North side and crossing the road . . .”; between Mumuku AND Ikuana, near Māmalahoa Hwy (BCT 1:365)
Kapiopio	Boundary Point 12	2,060	“... a punawai [spring or well] in the fern [ama‘u] . . .” between Ikuana AND Kumumamaki (BCT 1:364, 365; BC 27, 1:367)
Kumumāmaki	Boundary Point 13	2,160	“... a water hole and bathing place . . . on the edge of the woods. The water hole is above here . . .” (BCT 1:364, 365; BC 27 [1:367]); “Honokōhauiki [Honokōhau 2] is cut off at Kumumamaki by Honokohanui [Honokōhau 1] and Kealakehe” (BCT 1:365)

Table 9. Kaloko place names (compiled by Lloyd Soehren, with additions)

Place Name	Type	Comments (Source)	Place Name Meaning
Kaloko	<i>Ahupua‘a</i>	MB 13; IN 64; BCT 1:371; USGS 1982	The pond (Pukui et al. 1974)
Hale‘ape	<i>‘Ili ‘āina</i>	LCA 10327 testimony	House of ‘ape [a taro like plant]
Haleolono	<i>‘Ili ‘āina</i>	LCA 9243 testimony	House of Lono (Pukui et al. 1974)
Kanaio	<i>‘Ili ‘āina</i>	LCA 9160 testimony	The false sandalwood tree (Pukui et al. 1974)

Place Name	Type	Comments (Source)	Place Name Meaning
Kealaehu	<i>'Ili 'āina</i>	LCA 10951, 10346, 10693, and 9243 testimony	The dusty road (Pukui and Elbert 1986)
Ki'iki'i	<i>'Ili 'āina</i>	LCA7797, 10951, 10346, and 9242 testimony	—
Kikahala	<i>'Ili 'āina</i>	LCA 10694 testimony	—
Kukuiha'a	<i>'Ili 'āina</i>	LCA 9238 and 9241 testimony	Low candlenut tree (Pukui and Elbert 1986)
Luahine'eku	<i>'Ili 'āina</i>	LCA 9241 and 9243 testimony	—
Makaawe	<i>'Ili 'āina</i>	LCA 7909 testimony	—
Oloupe	<i>'Ili 'āina</i>	LCA 9237 testimony	—
Pāpua'a	<i>'Ili 'āina</i>	LCA 9238 testimony	Pig fence or enclosure (Pukui and Elbert 1986)
Ulawini	<i>'Ili 'āina</i>	LCA 7797 testimony	—
Ulukukahi	<i>'Ili 'āina</i>	LCA 9060 testimony	—
Waimea	<i>'Ili 'āina</i>	LCA 10693 testimony	Reddish water (Pukui et al. 1974)
Kaloko	Coastal point	U.S.G.S. 1982	The pond (Pukui et al. 1974)
Pu'u Iki	<i>Pu'u</i>	Kaloko/Honokōhau boundary Course 1, 6,864 ft from shore; elev. about 260 ft (BC 138, 3:348)	Small hill (Pukui et al. 1974)
Kaloko	Fishpond	USGS 1983	—
Kaukahokū	Survey station	A survey station located near the Kohanaiki/Kaloko boundary, TMK 7324:16; elev. about 1,900 ft (RM 2035)	The star appears (Pukui et al. 1974)
Pālahalaha	Water hole	Near the Kaupulehū boundary, about 4,200 ft elev. (BC 160 4:55)	Broad, spread out, flattened (Pukui and Elbert 1986)
Okuhi	Boundary Point 1 (at shore)	Kaloko/Honokōhau boundary at shore; “. . . an awaawa [gulch, ravine] in the sea with a point on each side of it” (BCT 1:371)	Probably <i>'okuhe</i> , a variety of <i>'ō'opu</i> fish (Pukui and Elbert 1986)
Kaewewai	Boundary Point 2	Kaloko/Honokōhau boundary near shore road “. . . an awaawa with water . . .” between Okuhi and Kaohe (BCT 1:371)	—

Place Name	Type	Comments (Source)	Place Name Meaning
Kaohe	Boundary Point 3	“. . . a grove of trees . . .” above the <i>a'a</i> , between Kaewewai and Kiikii [Kīkī] (BCT 1:371)	–
Ki'iki'i	Boundary Point 4	Kaloko/Honokōhau boundary, between Kaohe and Kapokalani (BCT 1:371)	Possibly to fetch, summon, procure (Pukui and Elbert 1986)
Kapokalani	Boundary point 5 (SE corner)	Kaloko-Honokōhau boundary—SE corner; “. . . along an iwi aina [field wall] to Kapokalani at the Govt. road [Old Upper Road on TM 7301]” (BCT 1:371)	–

Table 10. Kohanaiki place names (compiled by Lloyd Soehren, with additions)

Place Name	Type	Comments (Source)	Name Meaning
Hālau	Triangulation station	SW corner of RPG 3086, on Kohanaiki/Kaloko boundary about 250 ft from shore; elev. <20 ft (RM 2035)	Canoe shed; meeting house (Pukui and Elbert 1986)
Haleolono	<i>'Ili 'āina</i>	LCA 7987 testimony	House of Lono (Pukui et al. 1974)
Ho'okēkē	Place	“Area in upper Kohanaiki, Kona, Hawai'i. See Mai'a-loa”	Crowded (Pukui et al. 1974:51)
Kananaka	Triangulation station	SE corner of RPG 3086 on Kohanaiki/Kaloko boundary at the Lower Gov. road; elev. about 40 ft; named by surveyor (RM 2035)	–
Kānoa	Place, boundary point	“. . . in scrub trees above the woods where Kaloko is cut off by Kaupulehu. It is on the <i>makai</i> side of an ahua called Kapulehu [Pulehu on TM 7301]” (BCT 1:370)	Bowl (Pukui et al. 1974)
Kapa	Triangulation station	SE corner of RPG 2942, on the Kohanaiki/Kaloko boundary between Nawahiahu and the upper GovT. road; named by surveyor (RM 2035)	–
Kohanaiki	<i>Ahupua'a</i>	–	Small barrenness (Pukui et al. 1974)

Place Name	Type	Comments (Source)	Name Meaning
Kumu'ohe	Triangulation station	Located on RPG 2942, on the Kohanaiki/Kaloko boundary between Kananaka and Nawahiahu; elev. about 320 ft; named by surveyor (RM 2035)	Trunk of 'ohe tree (<i>Reynoldsia sandwicensis</i>)
Kumua	<i>Pu'u</i> , triangulation station	Located on RPG 4787, about 200 ft <i>mauka</i> of the upper GovT. road; elev. about 1,750 ft	First Kū, or to stand forward
Mai'aloa	Pit	"Pit at Ho'o-kēkē in upper Kohanaiki, Kona, Hawai'i"; Fictitious place in tale of Kamiki, "the sacred plantation of the chief Pohakuokane [in which] was grown the 'awa of Pohakuokane . . . in a small crater or hollow-like area . . ."	Long banana (Pukui et al. 1974)
Nalowale	<i>Heiau</i>	A <i>heiau</i> whose name is lost (<i>nalowale</i>) USGS 1959	Lost, forgotten (Pukui and Elbert 1986)
Nāwahiahu	Triangulation station	RPG 2942, TMK 7309:17, on Kohanaiki/Kaloko boundary between Kumuohe and Kapa; elev. about 500 ft; named by surveyor (RM 2035)	—
Wāwahiwa'a	Coastal point	USGS 1982	Wreck canoe (Pukui and Elbert 1986)

4.1.5 'O'oma Place Names

Similar to Kohanaiki, 'O'oma became Government Land; thus, there is no BCT for 'O'oma. Only three LCAs were granted, all in the same 'ili. J.S. Emerson included 'O'oma in his Kona Coast map (RM 2035) and recorded several triangulation stations, which he had named. Table 11 presents the scant information on place names in the *ahupua'a* of 'O'oma.

4.1.6 Kalaoa Place Names

Kalaoa was designated as Government Land in the Māhele, and only two LCAs were claimed. Thus, there were few early surveys of the land, and many of the traditional place names were lost. J.S. Emerson completed a survey of Kalaoa government lands, in which he gave new names to many triangulation stations and boundary points at the corners of land grants. The few traditional boundary point names that are known are presented in Table 12.

4.2 'Ōlelo (Poetical Sayings) and Mo'olelo (Stories)

The project area is located within the Kekaha region of North Kona District. Based on a recent translation of the "Legend of Ka-Miki" by Kepā Maly (cited in Henry et al. 1993) the region or *'okana* of Kekaha extends from Keahuolū northward to the Kona/Kohala boundary. The Kekaha region is also called *Kekaha wai'ole*, or "waterless place," a name that reflects its dry and barren appearance. Despite its desolate appearance, legends and other traditional accounts indicate Kekaha was once a populous and productive region.

The character of Kekaha, as it had been established in the Hawaiian consciousness, is represented in a traditional saying recorded by Mary Kawena Pukui and in a brief description by John Papa 'Ī'ī. The saying, "*Kekaha wai 'ole na Kona*," translates to "waterless Kekaha of the Kona district." Pukui states that "Kekaha in Kona, Hawai'i, is known for its scarcity of water but is dearly loved by its inhabitants" (Pukui 1983:184). However, water could come in the form of early morning mists and rains, as shown in this account of a hill, located in either Kealakehe, or the adjacent Keahuolū, as recounted in the Legend of Kamiki:

Ka-noenoe (The mist, fogginess) The mound-hill called Pu'u-o-Kalao sits upon the plain of Kanoenoe which is associated with both Keahuolu and Kealakehe. The settling of mists upon Pu'u-o-Kalao was a sign of pending rains; thus the traditional farmers of this area would prepare their fields. This plain was Honokōhau. The inheritance lands included everything from the uplands of Hikuhia above Nāpu'u and the lands of the waterless Kekaha, which spanned from the rocky plain of Kanikū (Keahualono) to the plain of Kanoenoe at Pu'ukalao. [*Ka Hoku o Hawai'i* 25 October 1917, translated by Maly 1994:A-4]

Another legendary account discusses the hill called Pu'u-o-kalao:

Pu'u-o-kalao is a mound-hill site in the lands of Keahuolu-Kealakehe, not far from the shore of Kaiwi and Hi-iakanoholae. During periods of dry weather (*Ka lā malo'o*) when planted crops, from the grassy plains to the 'ama'uma'u (fern forest zone), and even the ponds (*ki'o wai*) were dry, people would watch this hill for signs of coming rains. When the *lihau* (light dew mists) sat atop the hill of Pu'u-o-kalao, rains were on the way. Planters of the districts agricultural fields

Table 11. 'O'oma place names (compiled by Lloyd Soehren 2010, with additions)

Place name	Type	Location (Source)	Name Meaning
'O'oma 1, 2	<i>Ahupua'a</i>	–	Concave (Pukui et al. 1974)
Puhili	Coastal point	'O'oma 2, the boundary between 'O'oma and Kohanaiki at the shore is at Puhili point; "Said to be named for a priest of the same name . . ." (Pukui et al. 1974; TM 7300; RM 2035)	To thwart (Pukui et al. 1974)
Anakauao-kahokukahi	Cave	'O'oma 1, "the vertical entrance of a famous 'ana kaua' [cave] which extends for a long distance to the east and to the west" is located about 500 ft north of Kahokukahi trig. Station; a refuge cave during time of war; elev. about 400 ft (RM 2035; FB 291:197)	War cave of Kahokukahi (Pukui and Elbert 1986)
Hālawa	Triangulation station	Located between Kekee and Kalamanamana on 'O'oma 2/Kohanaiki boundary, at NW corner of RPG 2030, TMK 7307:36; elev. about 1100 ft; named by surveyor (RM 2035)	Curve (Pukui et al. 1974)
Kahōkūkahī	Triangulation station	Located on the 'O'oma 1/'O'oma 2 boundary at the NE corner of Lot 29C, SW corner of TMK 7310:4x; elev. about 360 ft; named by surveyor (RM 2035)	The first star (Pukui and Elbert 1986)
Kalamanamana	Triangulation station	Located at NE corner of RPG 2030, TMK 7307:50, on 'O'oma 2/Kohanaiki boundary; elev. about 1,740 ft; named by surveyor (RM 2035)	–
Kauloku	Triangulation station	'O'oma 2, located on <i>mauka</i> boundary of RPG 2027 at Gov. road, TMK 7336:10; elev. about 1,720 ft; named by surveyor (RM 2035)	The pouring rain (Pukui and Elbert 1986)
Keke'e	Triangulation station	Located between Puhili trig. station and Halawa on 'O'oma 2/Kohanaiki boundary at Lower Govt. road, the NE corner of RPG 3086, TMK 7309:3; elev. about 70 ft; also written "Keekee" on TM 7309; named by surveyor (RM 2035)	Crooked, twisted; same as <i>ke'eke'e</i> (Pukui and Elbert 1986)

Place name	Type	Location (Source)	Name Meaning
Kekuaio	Triangulation station	'O'oma 1, located on Lot 29B, TMK 7310:6x.; elev. about 280 ft; coordinates estimated; named by surveyor (RM 2035)	The border or bank between cultivated fields (Pukui and Elbert 1986)
Kuhiaka	Triangulation station	Located at the NE corner of RPG 1600 on the 'O'oma 1/'O'oma 2 boundary, TMK 7306:22.; elev. about 2,100 ft; named by surveyor (RM 2035)	–
Pihapono	Triangulation station	'O'oma 2, located near center of RPG 1600, TMK 7306:20; elev. about 1,860 ft; named by surveyor (RM 2035)	Completely full (Pukui et al. 1974)
Pu'u Kou	Triangulation station	'O'oma 2; located on the <i>makai</i> side of RPG 2027, TMK 7397:37; elev. about 1,125 ft; named by surveyor (RM 2035)	–

Table 12. Kalaoa place names (compiled by Lloyd Soehren, with additions)

Place Name	Type	Location (Source)	Name Meaning
Kalaoa	<i>Ahupua'a</i>	Māhele Book	The eel gorge, choker (Pukui et al. 1974)
Kahuku	<i>'Ili 'āina</i>	LCA 7937 testimony	The projection (Pukui and Elbert 1986)
Kaweo	<i>'Ili 'āina</i>	LCA 7899 testimony	–
Ahupua'a	<i>Ahu</i> (mound)	At the Govt. road on the Hamanamana/Kalaoa boundary; probably a Makahiki altar at the land boundary (Malo 1951:146; BCT 2:265)	Pig altar (Pukui and Elbert 1986)
Kanakamake	Place	On the Hamanamana/Kalaoa boundary; "There used to be an old trail from [Kapulehu] along this boundary to a place called Kanakamake" (BCT 2:263)	Dead man (Pukui and Elbert 1986)
Unualoha [Unuhoaloha]	Boundary Point 1a (at coast)	Kalaoa/Hamananmana coastal boundary point (USGS 1982; RM 2035)	–

Place Name	Type	Location (Source)	Name Meaning
Kahua	Boundary Point 1b (at coast)	Kalaoa/Hamananmana coastal boundary point “. . . a lae at the shore . . .” (BCT 2:263,264; RM 2035; USGS 1924)	–
Kelehua	Boundary Point 2	Kalaoa/Hamanamana “. . . an ahua and kipuka the boundary running through the kipuka” (BCT 2:264); “. . . ohia trees growing on the aa . . .” (BCT 2:265); between Kahua and Laeakailio (BCT 2:264, 265)	–
Laeaka‘īlio [Kalaeka‘ilio]	Boundary Point 3	Kalaoa/Hamananmana boundary “. . . on the Kona side of the aa” at 395 ft elev. below Gr. 3027. “Laeokailio” (RM 2035); between Kelehua and Kaiwiholehole (BCT 2:264, 265; RM 2035; USGS 1924)	Point of the dog (Pukui and Elbert 1986)
Kaiwiholehole	Boundary Point 4	Kalaoa/Hamananmana boundary, “a lauhala grove” between Govt. road and Kalaeakailio; Claim 10523 by Nawahie is for “kekahi pauku o keia ili o Kaiwiholehole, o Kaloaloa ka inoa o ka pauku” (BCT 2:264; NR 8:597; RM 2035; USGS 1924)	–
Ho‘ona	Coastal bay	A place on shore and a small bay north of Keāhole Point	To relieve pain, soothe, comfort; to end, as a taboo; settle a claim (Pukui and Elbert 1986)
Makako	Coastal bay	USGS. 1982	–
Kalihi	Coastal point	USGS 1982	The edge (Pukui et al. 1974)
Keāhole	Coastal point	USGS 1959; Kamakau 1961:185,193; Reinecke ms (1):17	The āhole fish
Kapeke	Triangulation station	SE corner of RPG 3750, TMK 7310:29 on Kalaoa 4/Kalaoa 5 boundary; elev. about 1,040 ft; named by surveyor (RM 2035)	The dwarf (Pukui and Elbert 1986)

Place Name	Type	Location (Source)	Name Meaning
Pāhinahina	Triangulation station	SE corner of Lot 16, TMK 7310:32 (dropped), on Kalaoa 1/Kalaoa 2 boundary (Kona Highlands subdivision); elev. 1,160 ft; named by surveyor (RM 2035)	–
Kuanalua	Triangulation station	“This station was named after Kuanalua, a warrior chieftain of Kamehameha I, whose house once stood among the trees back of the station”; located on <i>mauka</i> side of Govt. road in Kalaoa 1, TMK 7302:12; elev. about 1,780 ft (RM 2035; FB 291:49)	–
Ipuu	Triangulation station	Kalaoa 4, at south side center of RPG 990, TMK 7304:14, almost on Kalaoa 4/Kalaoa 5 Boundary; elev. 200 ft; named by surveyor (RM 2035)	–
Kaaipuaa	Triangulation station	Kalaoa 3, located near SW corner of RPG 3764, TMK 7302:25; elev. about 2,100 ft; named by surveyor (RM 2035)	–
Kaeu	Triangulation station	Kalaoa 2, boundary point “. . . in the iwi aina north side of the ‘kihapai koele’ Kaeu, formerly cultivated with taro”; TMK 7302:10; elev. 1,880 ft (RM 2035; FB 291:53)	–
Kahouhale	Triangulation station	Kalaoa 2, boundary point “. . . in the iwi aina north side of the ‘kihapai koele’ Kaeu, formerly cultivated with taro”; TMK 7302:10; elev. about 1,880 ft (RM 2035; FB 291:53)	–
Kalaehumuhumu	Triangulation station	NW corner of RPG 1606, at SE corner of TMK 7301:31, on Kalaoa 2/Kalaoa 3 boundary; elev. about 1,020 ft; named by surveyor (RM 2035)	The <i>humuhumu</i> (fish) point (Pukui and Elbert 1986)
Keanalele	Triangulation station	Kalaoa 2, near NE corner of RPG 2032 [erroneously printed 3032 on RM 2035], TMK 7302:9; elev. about 2,060 ft; named by surveyor; coordinates estimated (Cf. Analele 394.21.001; RM 2035)	The flying cave (Pukui and Elbert 1986)

Place Name	Type	Location (Source)	Name Meaning
Kumumamane	Triangulation station	SW corner of RPG 3027, TMK 7310:31, on Kalaoa 2/Kalaoa 3 boundary; elev. about 850 ft; named by surveyor (RM 2035)	<i>Māmane</i> tree (<i>Sophora chrysophylla</i>) trunk (Pukui and Elbert 1986)
Makaulaula	Triangulation station	Kalaoa 5, located near SW corner of RPG 2972, TMK 7310:25x in Kalaoa 5; named by surveyor; elev. about 280 ft; coordinates estimated (RM 2035)	Pinkeye; inflamed or bloodshot eye (Pukui and Elbert 1986)
Pu'u Oina (Puoina)	Triangulation station	Kalaoa 3, located "on hill over cave, in woods" N side center of RPG 3764, TMK 7302:25; elev. about 2,160 ft; named by surveyor, perhaps after the <i>heiau</i> at the shore; coordinates estimated; Cf Puu Oina, the preferred spelling (RM 2035; FB 291:55)	–
'Umiahu	Triangulation station	Located on Kalaoa 2/Kalaoa 5 boundary, at NW corner of RPG 2972, TMK 7310:33; named by surveyor; elev. 280 ft (RM 2035)	Cairn of 'Umi (Pukui and Elbert 1986)

watched for omens at Pu'ukaloa, and it was from keen observation and diligent work that people prospered on the land. If a native of the land was hungry and came asking for food, the person would be asked:

Ua ka ua i Pu'ukaloa, ihea 'oe?

When rains fell at Pu'ukaloa, where were you? (If the answer was...)

I Kona nei no!

In Kona (there would be no sweet potatoes for this person)

But if the answer was:

I Kohala nei no!

In Kohala! (The person would be given food to eat for they had been away, thus unable to accomplish the planting). [*Ka Hōkū o Hawai'i* 19 March 1914, translated by Maly 1994:A-5]

These legendary accounts emphasize the importance of rainfall in this relatively dry region for farmers who were cultivating sweet potatoes and other crops on the plains of Kekaha.

‘Ī‘Ī describes the winds of Kekaha:

. . . a cold wind from Kekaha, the Hoolua. Because of the calm of that land, people often slept outside of [*sic*] the tapa drying sites at night. It is said to be a land that grows cold with a dew-laden breeze, but perhaps not so cold as in Hilo when the Alahonua blows. [‘Ī‘Ī 1959:122]

These passages suggest Kekaha was firmly identified with its austere physical environment. A legend told in Maguire (1966:28–32) reveals the importance of water resources in this general area (see also Wolforth et al. 2005:8–9). The story takes place at the Cave of Mākālei, located outside the current project area near ‘Akahipu‘u (a nearby mountain). The story focuses on a man named Ko‘amokumokuhe‘eia, who moved to this area and was told by the current residents that water was very scarce. Water, he was told, could be obtained in “celebrated” caves, but these caves were *kapu* (forbidden), and if caught, trespassers would be killed by the owner of the cave. However, Ko‘amokumokuhe‘eia discovered a very small cave entrance no else knew about. The cave had water dripping from its roof (Maguire 1966:30). Ko‘amokumokuhe‘eia and his father used carved ‘*ōhi‘a* (*Metrosideros polymorpha*) and *wiliwili* (*Erythrina sandwicensis*) trees to capture the dripping water, and his family was thus able to survive during dry spells. This legend clearly demonstrates the importance of water as a resource that is difficult to procure and highlights the importance of water collection caves.

John Ka‘elemakule Sr., a Kekaha native, wrote newspaper articles between 1928 and 1930 that provide details about life and customs in the last half of the nineteenth century. Kepā Maly (Maly and Maly 2003) translated these serial accounts that appeared in *Ka Hoku o Hawai‘i*. The two following excerpts provide additional details related to water collection:

. . . There were not many water holes, and the water that accumulated from rain dried up quickly. Also there would be weeks in which no rain fell . . . The water which the people who lived in the uplands of Kekaha drank, was found in caves. There are many caves from which the people of the uplands got water . . . (September 17, 1929:3). [Maly and Maly 2003:42]

. . . The *kūpuna* had very strict *kapu* (restrictions) on these water caves. A woman who had her menstrual cycle could not enter the caves. The ancient people kept this as a sacred *kapu* from past generations. If a woman did not know that her time was coming and she entered the water cave, the water would die, that is, it would dry up. The water would stop dripping. This was a sign that the *kapu* of Kāne-of-the-water-of-life (Kaneikawaiola) had been desecrated. Through this, we learn that the ancient people of Kekaha believed that Kāne was the one who made the water drip from within the earth, even the water that entered the sea from the caves. This is what the ancient people of Kekaha wai 'ole believed, and there were people who were *kia'i* (guardians) who watched over and cleaned the caves, the house of Kāne . . . (September 24, 1929:3). [Maly and Maly 2003:42]

Native historian Samuel Kamakau relates that in the fifteenth century, High Chief 'Umi-a-Liloa fished for *aku* (skipjack tuna; *Katsuwonus pelamis*) along the Kekaha coast, and around 1810, Kamehameha I also fished the shores of Kekaha (Kamakau 1961:20, 203). Pukui (1983:271) also relates the importance of fishing in the following:

Ola aku la ka aina kaha, ua pua ka lehua i kai.

Life has come to the *kaha* lands for the *lehua* blooms are seen at sea.

Pukui (1983:271) further explains this saying: “Kaha lands refers to Kekaha. When the season for deep-sea fishing arrived, expert fishermen and their canoes headed for the ocean.”

However, Kekaha was “valued by ruling chiefs, inhabited by attendant chiefs, and upon occasion abused by warring chiefs” (Kamakau 1979:31). Kamakau (1961) reports that during the war between Alapa'inui of Hawai'i and Kekaulike of Maui, Kekaulike “abused the country people of Kekaha” by destroying all the coconut groves and slaughtering “the country people.” The destruction of these valuable trees was devastating.

Describing the apportioning of land by the *ali'i* (royalty) before the ascendancy of Kamehameha, Kamakau records this information about the lands of Kekaha:

Waimea [in this case Waimea, O'ahu] was given to the Pa'ao kahuna class in perpetuity and was held by them up to the time of Kamehameha III when titles had to be obtained. But there was one land title held by the kahuna class for many years and that was Puuepa in Kohala. In the same way the land of Kekaha was held by the kahuna [priests] class of Ka-uahi and Nahulu. [Kamakau 1961:231]

Kamakau further records that during the 1770s, “Kekaha and the lands of that section” were held by descendants of the Nahulu line, the Ka-me'e-ia-moku and Ka-manawa, the twin half brothers of Ke'e-au-moku, the Hawai'i island chief (Kamakau 1961:310). The Great Seal of the State of Hawai'i depicts Kame'eiamoku and Kamanawa (Springer 1989:23).

A great deal of primary research on legendary references and place names of Kekaha has been undertaken by Kepā Maly and Lehua Kalima. The results of some of this research can be found in “The Historical Documentary Research by Kepa Maly and Lehua Kalima” presented in Paul H. Rosendahl Inc.'s (PHRI) Report No. 1275-071493: *Archaeological Assessment Study, Kailua to Keāhole Region State Lands LUC Project* (Henry et al. 1993).

4.2.1 The Story of Ka-Miki

Kepā Maly (1993) translated the “Kaaoo Hooniua Puuwai no Ka-Miki” (The Heart stirring Story of Ka-Miki) that appeared in the newspaper *Ka Hoku o Hawai'i* between 1914 and 1917. The legend provides details about life and the environment of Kekaha, as well as the entire island of Hawai'i. Ka-Miki, the quick or adept one, and his brother Maka'iole (“rat or squinting eyes”), traveled around the island to participate in competitions ca. the thirteenth century, when Pili-a-Ka'aiea was the chief of Kona. The boy's parents were Pōhaku-o-Kāne (male) and Kapa'ihilani (female), the *ali'i* of Kaloko and Kohanaiki. The legend relates that the supernatural brothers

Were empowered by their ancestress Ka-uluhe-nui-hihi-kolo-i-uka (the great entangled growth of *uluhe* fern which spreads across the uplands), a reincarnate form of the earth-mother goddess, creative force of nature Haumea (also called Papa) who dwelt at Kalama'ula on Hualālai, in the uplands of Kohana-iki, Kona. [Maly 1993:21–22]

The twins were raised by Ka-uluhe, who taught them how to use their supernatural powers.

Portions of the legend that are relevant to the current study follow. The following excerpt discusses the division of property within Ka-loko (the pond):

The wood carved for the makaha (fish pond gates) came from 'Iwa'awa'a (near a halau ali'i [royal compound] and kahua [contest arena] of the chief Pohaku-o-Kane, on the plains of Kohana-iki next to Kaloko [1/15/1914]). The lands of Kaloko and Kohana-iki were jointly governed by Pohaku-o-Kane, though the ponds were under guardianship of other god-chiefs and chiefesses. [21 May 1914]

Several of the stories identify *heiau* of Kaloko and Kohanaiki. The first appeared between 16 and 30 April 1914:

The ocean at 'Ohiki was named Kauahia or Kai o Kauahia. After an 'awa ceremony with Ka-uluhe ma, Ka-Miki went to the shore of 'Ohiki to fish, in the pond waters of the chief Ahauhale. 'Ohiki was the name given for several places, including: a heiau; a cove; and an 'ili of Kaloko. The 'ili land parcel came to be known as Ki'ikahala after the punishment of the dual formed priest-shark Kalua'olapauila.

On the night of Kāne the priests, chiefs, and people were observing the kapu of silence and all was being made ready to dedicate the royal compound of Ka'aipu'a at Kohanaiki. Ka-Miki and Maka'iole descended to the coastal region of Kaloko and Kohanaiki from Kalama'ula and beat the drums in the heiau of Pohakea, 'Ohiki, Kaukeano, 'O'unui, Honu'iwa, Pu'uho'olelelupe, Kauki'eki'e, and Hale-o-Lono. The sound of the pahu heiau (temple drums) greatly startled the people, and caused the priests and chiefs of Kaloko to grumble amongst themselves. The sequence of events which followed, led to the naming of Hi'iakanoholae.

A spring in the land parcel was also named 'Ohiki. The ocean of this area was named Kauahia before 'Ohiki came about, and following the death of the shark-

priest Kalua'olapauila, the land section and temple of 'Ohiki came to be called Ki'ikahala.

The following appeared between 8 and 15 January 1914 and describes Hale-o-Lono, or house of Lono, a *heiau* in Kohanaiki where prayers for rain and abundant growth were offered:

Hale-o-Lono was the husband of Pipipi'apo'o, a daughter of the deified beings Kumua and Ka-uluhe. Hale-o-Lono excelled at farming, and had the plain of Nanawale, Kohaha-iki well cultivated. His plantation was marked by Nahiahu, also called Nawahiahu (the alignment of cairns) on the makai side of this feature.

Additional information about Na'wahi'ahu was published between 8 and 29 January 1914:

Na-wahi-ahu (the place [of] cairns) [or] Mahiahu is identified as a line of cairns which marked the agricultural fields of Hale-o-Lono, and the sacred plantation of Ka'aipu'a at Kohana-iki. Before Hale-o-Lono established his fields in this area this portion of Kohanaiki was called Nanawale (to look about—because of the extensive fields).

Details about why this area of Kohanaiki became important appeared between 8 January and 28 May 1914, as well as 6 December 1917:

Ka-uluhe-nui-hihi-kolo-i-uka a reincarnate form of Haumea (also called Papa) lived at Kalama'ula in the uplands of Kohana-iki, below Hainoa. Ka-uluhe was the wife of Kumua, and the hill site at which Kumua dwelt is also called Kumua; it is below Kalama'ula, a little above the hidden spring of Kapa'ihi. The reason that Kumua lived at this hill was because it allowed him clear view of the coastal lands of Kohana-iki, which is where his children and grand children lived. One of the children of Kumua ma was Pipipi'apo'o and she was married to Hale-o-Lono (an agriculturalist and temple type, coastal Kohana-iki) who was an exceptional farmer. Hale-o-Lono excelled in his trade, and the place upon which he farmed was called Nanawale, and because he marked the area with many cairns, it came to be called Nahiahu, also called Nawaiahu, the place of cairns.

Nawahi ahu appears on Emerson's RM 1449 and RM 1512, dating to 1888 and 1889, respectively.

A more recent translation of the legend of Ka-Miki by Maly and Maly (2003:15) includes the following additional information about Nāwahiahu:

Pipipi'apo'o was another daughter of Kūmua and Ka-uluhe-nui-hihi-kolo-i-uka. She married Haleolono, one who cultivated sweet potatoes upon the *'ilima* covered flat lands of Nānāwale, also called Nāhiahu (Nāwahiahu), as it has been called from before and up to the present time. Cultivating the land was the skill of this youth Haleolono, and because he was so good at it, he was able to marry the beauty, Pipipi'apo'o. Pipipi'apo'o skill was that of weaving pandanus mats, and there grow there many pandanus trees to this day. The grove of pandanus trees and a nearby cave, is called Pipipi'apo'o . . .

Maly (1993:28) notes Hale-o-Lono, Ki'ikahala, and 'Ohiki are associated with sites and/or place names shared by Kaloko and Kohanaiki.

In 'O'oma and Kalaoa, the priests of the different *ahupua'a* are named:

'Elepaio was the high priest of Honokōhau. The place where he dwelt bears the name 'Elepaio [an *'ili* in Honokōhau]. It is in the great grove of *'ulu* (*kaulu' ulu*) on the boundary between Honokōhau-nui and Honokōhau-iki [Honokōhau I and II] . . . (23 April 1914)

Puhili was the high priest of 'O'oma and Kohanaiki, the place where he lived is on the plain of Kohanaiki, at the shore, and bears his name to this day. It is on the boundary between Kohanaiki and 'O'oma.

Kalua'ōlapa was the high priest of Hale'ōhi'u and Kamāhoe, that is the waterless land of Kalaoa (*Kalaoa wai 'ole*). The place where he lived was in the uplands of Maulukua on the plain covered with *'ilima* growth. This place bears his name to this day.

Kalua-ōlapa-uwila was the high priest of Kealakehe and Ke'ohu'olu (Keahuolu), and it was he who built the *heiau* named Kalua'ōlapa-uwila, which is there along the shore of Kealakehe, next to the road that goes to Kailua. The nature of this priest was that of a shark and a man. The shark form was named Kaiwi, and there is a stone form of the shark that can be seen near the *heiau* to this day. (30 April 1914).

Ka-Miki completed his journey around the Big Island and,

. . . became the foremost champion of Pili (7/26/1917). It was at this time that Ka-Miki learned about the sacred palama chiefess Paehala of Honokōhau; lands also called Na-Hono-i-na-Hau-'Elua (the bays of the two dews). Pili gave Ka-Miki permission to wed Paehala if she and her family agreed, and Paehala was the foremost beauty of Kona.

When the chiefess agreed to marry Ka-Miki, Pili told Ka-Miki, that he would also, 'oversee the chiefs' sacred fishponds [at Kaloko and Pa'aiea]; the schools of kala, uhu, and palani; and all the lands of Kekaha from Hikuhia which is above Napu'u u (also called Napu'upo'alu); and lands between Keahualono at Kaniku to the plain of Kanoenoe, marked by the hill of Pu'uokaloa at Keahuolu' (10/18/1917). [Maly 1993:22]

The following passage is from Kihe and appeared in *Ka Hoku o Hawai'i* between 31 January and 10 April 1928. It relates the variety of agricultural crops that grew in Kohanaiki and Kaloko:

Departing from O'ahu, Makalie and his family landed at Hale 'uki, Ka'upulehu and were greeted by Ke'awalena a chief and overseer of the Kekaha region. Ka'upulehu and all Kekaha were extensively cultivated at this time. Dependent on seasons, the uplands were used for residences and farming, and the coastal lands for residence and fishing. Pao wai (dug out water catchments) on the pāhoehoe and in upland fields were a means of water catchment. Crops grown here included: taro, sweet potatoes, sugar canes, bananas, and 'awa . . . [Maly 1993:25]

Maly (1993:29) explains that traditional accounts of Kaloko and Kohanaiki describe a lush environment that differs from its current state due to several factors. The Hualālai lava flow in

1801 covered the former agricultural and forested lands, residential areas, and fishponds. The loss of forests began the decrease in rainfall exacerbated by the introduction of livestock and ranching. Goats and cattle stripped the vegetation from the lands, causing water resources to dry up. Thus, over the last 150 years, the environment has been significantly altered.

4.2.2 Other Legends

4.2.2.1 Honokōhau and the Spy

The nineteenth century Hawaiian historian Samuel M. Kamakau mentions Honokōhau in an account of an extraordinary day's reconnaissance of the west coast of Hawai'i Island by the spy Ka-uhi-o-ka-lani, sent to the island by Kama-lala-walu, chief of Maui. Having reached Kawaihae by canoe at night, Ka-uhi-o-ka-lani "ran about that same evening [reaching as far south as Ka'awaloa] and returned before the canoes were dismantled . . ." Ka-uhi-o-ka-lani, recounting his journey and the landmarks he had observed, mentions, "I went on to the long stretch of sand, to the small bay with a point on that side and one on this side. There are large inland ponds." He is told that the "sandy stretch is 'Ohiki, and the walled-in ponds are Kaloko and Honokōhau" (Kamakau 1961:56).

Kamakau also includes Honokōhau in a litany of lands inquired about following the division of Hawai'i Island *ahupua'a* among the *ali'i* after the death of Kalaniopu'u in 1782. Keoua Kuahu-ūla asks Kiwala'o:

'Are Ola'a and Kea'au ours?' The chief answered, 'They have been given away; they are not ours.' 'How about Waiakea and Ponahawai?' 'They have been given away; they are not ours.' . . . 'The two Napu'u and the two Honokahau are ours?' 'They have been given away; they are not ours.' [Kamakau 1961:120]

4.2.2.2 Kaloko Fishpond

There are numerous versions of *mo'olelo* about the famous fishpond along the seashore at Kaloko Ahupua'a, including some suggesting the remains of Kamehameha I may have been buried there. In his chapter recounting the death of Hawai'i's greatest leader, Kamakau states,

After the kahuna had performed his office [ritual duties], Ulu-maheihei prepared to carry out the command of Kamehameha given before his death . . . to secret his bones in a place where they could not be found . . . to put them in a place which could never be pointed out to anyone. At midnight, therefore, when black darkness had fallen and no one was likely to be on the road and the rough lava plains of Pu'uokaloa lay hushed, Hoa-pili sent his man, Ho'olulu, to bring the container of wicker work in which the bones of Kamehameha were kept to Kaloko in Kekaha [the coast of North Kona] . . . The next morning Hoa-pili and Ke-opu-o-lani took care to Kaloko where Hoa-pili met the man who had charge of the secret cave and together they placed the bones there. 'The morning star alone knows where Kamehameha's bones are guarded.' [Kamakau 1961:215]

4.2.2.3 Kahinihini'ula

Kahinihini'ula is the name of a bathing pool along the boundary between Kaloko Ahupua'a and Honokōhau I Ahupua'a, west and *makai* of the subject project area.

According to Maly's extensive research (Maly 2000; Maly and Maly 2002) translating Hawaiian language documents and interviewing *kūpuna* (elders), this bathing pool is associated with *mo'o* (supernatural water spirits), who ensured the water stayed clean and free from pollutants. Kama'āina Kihe, born in the area in the middle nineteenth century, had this to say about Kahinihini'ula:

This is a bathing pool of the chiefs of days gone by. It is a beautiful pond, with cool water that causes the skin of the sweetheart that bathes there to tingle. The pool is on the shore in the middle of a lava flow, entirely surrounded by stone. It is there on the boundary of the ahupua'a of Kaloko and Honokōhau-Nui. It is there that one will find this famous swimming pond of the chiefs of days gone by. Here is the tradition of this pond—

In ancient times, the chiefs would regularly live along the shore, that is, the chiefs of Kaloko and Honokōhau. At the place called Ahauhale, is where the chiefs of Kaloko lived. The place called Waihalulu, is where the chiefs of Honokōhau lived.

In the times when all was still and the sun glistened above the aa and the sands, that is when they would go swim in this cool pond (kiowai), Kahinihiniula, which caused the skin to tingle. When they were finished bathing, they would go to the enclosure (pa) that was near the pond. Then the one who had been bathing would say, 'What is it about the pond of Kahinihiniula? It is cold and pinches the skin, like a sweetheart one holds close to the breast.'

The pond is still there to this day, at the place of the chiefs of past time. They have returned to the earth, but the pond is still there today. This pond is an unforgettable monument for those ancient people who have gone. Those works of old and the pond may be seen by travelers of this generation. [J.W.H.I. Kihe in "Na Hoonanea o ka Manawa," *Ka Hoku o Hawai'i*, 13 September 1923; translated by Maly 2000]

4.2.2.4 'Ōhiki and Kaiwi

Pukui et al. (1974:70) described Kaiwi, a coastal point in Kealakehe, as "[l]and points near Kai-lua, Kona, Hawai'i, and farther north in the same district." This entry summarizes *mo'olelo* originally documented by Fornander about the sandy beach area between Kaloko and Honokōhau known as 'Ōhiki:

At one of the points [along this coast] is a rock believed to be a petrified shark, the shark form of a priest (Ka-lua-lapa-uila). When the priest was about to be burned at 'Ōhiki, a legendary hero, Ka-miki, prayed to Pele and a terrible storm arose. The priest's shark-form was turned to stone as it tried to enter the *heiau* to save the human form of the priest. One of Pele's sisters, Hi'iaka-noho-lae (Hi'iaka living [at the] point), came to live here, making the place sacred and forbidden to Pele. [Pukui et al. 1974:70]

4.2.2.5 Punia

Pukui et al. (1974:70) also note Kaiwi Point in Kealakehe is related to the shark Punia: “In the story of Punia, the shark Kai‘ale‘ale, who had swallowed Punia, came here and was cut open by the people; Punia came out alive but was bald.” This refers to a story about a shark named Punia, who was born in Kohala (Fornander 1959:9–17). He wished to trap lobsters for his mother, but the cave pool with the lobsters was guarded by a school of sharks led by the shark Kai‘ale‘ale. Punia killed all of the other sharks and tricked Kai‘ale‘ale into swallowing him whole:

Once inside Kai‘ale‘ale, Punia rubbed two sticks together to make a fire to cook the sweet potatoes he had brought with him. He also scraped the insides of Kai‘ale‘ale, causing great pain to the shark. In his weakened state, Kai‘ale‘ale swam along the coast of Kekaha, and finally beached himself at Alula, near the point of Maliu in the land of Kealakehe. The people of Alula, cut open the shark and Punia was released. [Fornander 1959:10]

All the Hawaiians along the Kekaha coast lived at Alula at this time, since the rest of the area was inhabited by ghosts. Punia again used his skill of trickery to convince the ghosts to follow him into the ocean. When they dove below the surface, he caught them in his nets and killed them, until only one was left. “The ghost fled and Kekaha became safe for human habitation” (Fornander 1959:17).

4.2.2.6 Kona Legends Concerning ‘O‘oma

There are only a few listings for the *ahupua‘a* of Kealakehe, Honokōhau, Kaloko, Kohanaiki, ‘O‘oma, and Kalaoa in the definitive bibliographic source on Hawaiian *mo‘olelo*, the *Hawaiian Legends Index* (Gotanda 1989). However, several of the stories written about the Ka-Miki tale in Hawaiian language newspapers were used as the basis for Eliza Maguire’s *Kona Legends*. One of these concerns the Pond of Wāwālololi on the ‘O‘oma shore.

This little pool of water is situated near the seashore between ‘O‘oma and Kaloko. The story of this pool has been handed down from generations past to the present day, and is related thus:

Wāwālololi was the name of a certain *loli* (a sea slug). He was a *kupua* (wizard). He had two bodies, a limpsy fish body and the body of a man.

There lived in the uplands covered with *‘ilima*, a man by the name of Kalua‘ōpala and his wife, and their beautiful and charming daughter, Malumaluiki. [Maguire 1966:21]

Malumaluiki traveled to the shore to collect *limu* (seaweed) and *‘opihi* (limpets). When she bent down to get a drink from the pool, a handsome man arose. He was the charmer Wāwālololi, and the girl fell in love with him. Each day she returned to the pool, crying out a chant, and her lover would join her. However, the girl could not eat or sleep, and one day her father followed her. Seeing the form of her lover, he vowed to trap him. He memorized the chant and disguised his voice to make the *loli* appear, then caught him in a net. He gave the captured *loli* to a priest, Pāpa‘apa‘o, baked the *loli* in an *imu* (underground oven), and saved the life of Malumaluiki (Maguire 1966:21–32).

Wawālohi is also mentioned in the legend of the fishpond of Pā'aiea, which was destroyed by the Hualālai lava flow of 1801:

This was a very large fishpond extending from *Ka'elehuluhulu* [in Kaulana Ahupua'a], adjoining the little fishing hamlet of *Mahai'ūla* [Mahai'ula Ahupua'a] and as far as *Wawālohi* on the boundary of 'O'oma [Kalaoa/'O'oma boundary]. This pond was not far from *Ka-Lae-O-Keāhole*, (Fisherman's Point) which is the extreme western point, or cape on the island of *Hawai'i*, and on which there is a lighthouse. . . .

The Fish-Pond of *Pā'aiea* was three miles long, and a mile and a half wide. The fishermen going to *Kailua* and further south, often took a short cut by taking their canoes into the pond and going across, thus saving time and the hard labor of paddling against the 'eka [strong southern breeze] and also against the strong current from *Keāhole*. [Maguire 1966:13]

Pele came to visit the pond in her guise as an old woman and asked the *konohiki* (overseer) of the pond for some fish or shrimp. The *konohiki* refused, and that night the lava flowed down to the shore, completely destroying and filling the fishpond in revenge for the stinginess of the fishpond manager (Maguire 1966:13–17).

4.3 Early Historic References

4.3.1 Explorers and Visitors

Archibald Menzies, the first foreigner to record his visit to Kekaha, accompanied Captain Vancouver in 1792. He described the land as “barren and rugged with volcanic dregs and fragments of black lava . . . in consequence of which the inhabitants were obliged to have recourse to fishing for their sustenance” (Menzies 1920:99). On 17 January 1792, Menzies hiked to the top of Hualālai, and observed the following:

We commenced our march with a slow pace, exposed to the scorching heat of the meridian sun, over a dreary barren track of a gradual ascent, consisting of little else than rugged porous lava and volcanic dregs, for about three miles, when we entered the bread fruit plantations whose spreading trees with beautiful foliage were scattered about that distance from the shore along the side of the mountain as far as we could see on both sides. Here the country began to assume a pleasant and fertile appearance through which we continued our ascent for about two miles further, surrounded by plantations of the esculent roots and vegetables of the country, industriously cultivated . . . From this place we had a delightful view of the scattered villages and shore underneath us, and of the luxuriant plantations around us . . .

January 18th . . . We observed here and there on the path little maraes [shrines] pointed out by taboo sticks in the ground round a bush or under a tree. In passing these places the natives always muttered a prayer or hymn, and made some offering as they said, to their akua, by leaving them a little piece of fruit, vegetable or something or other at these consecrated spots. Even in this distant solitary hut, we found a corner of it consecrated by one of these taboo sticks

which the natives earnestly requested us not to remove when we took possession of it, and we very strictly obeyed their injunction, conceiving that religious forms whatever they are, ought to be equally inviolable everywhere. [Menzies 1920:151–160]

Vancouver, referring to the North Kona coast in 1794 stated: the adjacent shores . . . chiefly composed of volcanic matter, and producing only a few detached groves of cocoa nut trees, with the appearance of little cultivation, and very few inhabitants . . . [Vancouver 1798:III:62 in Cordy 1985:34]

In 1823, William Ellis referred to the 1801 Huehue lava flow from Hualālai, which covered parts of Kekaha just to the north of the present project area, as having “inundated several villages, destroyed a number of plantations and extensive fish ponds, filled up a deep bay twenty miles in length and formed the present coast . . . stone walls, trees and houses all gave way before it” (Ellis 1963:30–31).

In 1840, Captain Charles Wilkes of the American Exploring Team observed the following:

. . . a considerable trade is kept up between the north and south end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of the south, for food and clothes. [Wilkes 1845:91]

4.3.2 Cultivation

The project area is in the central portion of the North Kona District at the boundary of two distinct ecological zones. Lands to the south of Lanihau, known as *Kona kai 'opua* (Kona of the distant horizon clouds above the ocean), between Kailua Bay and Keauhou Bay, are generally recognized as the fertile agricultural district and population center of North Kona (Kirch 1985:166; Kelly 1983). The relatively dry *Kekaha-wai-'ole* (the waterless place) area of North Kona to the northwest, which includes the six *ahupua'a* of the current project area, is characterized by coastal fishponds and relatively barren lava inlands.

Despite descriptions of the lava-covered terrain, various crops were traditionally cultivated within Kekaha, and sweet potato is likely to have been the most abundantly grown crop because of its adaptability to stony, dry environments. It was commonly planted in mounds and in *pāhoehoe* excavations. Henry J. Lyman, son of missionaries who first arrived in Hilo in 1831, describes features in Puna similar to *pāhoehoe* clearings in the project area that were cultivated with sweet potatoes:

Wherever the lava could be pounded into scoria, a plantation of sweet potatoes was laboriously formed by digging among the stones and filling in the holes with dried grass brought from the mountainside. Placed in the nest, the tuberous buds were covered with gravel, and there grew with astonishing luxuriance, yielding the largest and finest potatoes on the island. [Lyman in Frierson 1991:167]

During the mid-1800s, Captain Wilkes commented on the agricultural use of *pāhoehoe* excavations (similar to the modification of *pāhoehoe* outcrops in the project area) that he observed specifically in the Kona region:

Cultivation is carried on in many places where it would be deemed almost impracticable in any other country. The natives, during the rainy season, also plant, in excavations among the lava rocks, sweet potatoes, melons, and pine-apples, all of which produce a crop. [Wilkes 1845:91]

Sweet potatoes were also cultivated within walled fields or depressions in the walls themselves. E.S. Craighill Handy and Elizabeth Green Handy discuss this method in an account that appeared in the Hawaiian newspaper *Ka Nupepa Ku'oko'a* (24 March 1922):

Rocky lands in the olden days were walled up all around with the big and small stones of the patch until there was a wall (*kuaiwi*) about 2 feet high and in the enclosure were put weeds of every kind, 'ama'u tree ferns and so on, and then topped well with soil taken from the patch itself, to enrich ti, or in other words to rot the rubbish and weeds to make soil.

After several months, the rotted weeds were converted into soil of the best grade. The farmer waited for the time when he knew that the rains would fall, then he made the patch ready for planting. If for sweet potatoes, he made mounds for them and for taro too, on some places on Hawai'i. [Handy and Handy 1972:131]

4.3.3 Population in Kekaha

Early missionary residents made the first estimates of the population of the North Kona District. Asa Thurston estimated a population of not less than 20,000 people along a 30-mile stretch of the Kona coast. These residents were clustered on the coast, but some families also lived in a habitation belt about 2 miles inland (Kelly 1983:14). A formal census was conducted in 1832, and 12,432 people were recorded for the district of Kona. By 1835, this number had declined to 5,957. By 1853, the number had dropped to 2,210 (Schmitt 1973:21, 29, 31). The missionary, William Ellis (1979:32), visited the Kona area in 1822 and noted deserted villages and abandoned fields "everywhere to be met with."

Missionary censuses of the 1830s also chart the diminishing population of Kekaha. In 1834, the total population of Kekaha is recorded as 1,244, comprising 21% of the total North Kona population of 5,957 (Schmitt 1973:31). The North Kona figure represents a population loss of 692 since the previous census of 1831 (during which no figure specific to Kekaha was noted), that recorded 6,649 persons in the district (Schmitt 1973:9). One factor (inter-island migration) inducing the diminishing population of Kona was specifically noted by missionaries in 1832:

We have been sensible for some time that the number of inhabitants in this island is on the decrease. There is an almost constant moving of the people to the leeward islands, especially since the removal of the governor (Kuakini) to Oahu. Some leave by order of the chiefs, and others go on their own responsibility. [Schmitt 1973:16]

The movement of people from Hawai'i Island to O'ahu and Kaua'i, in particular, was also related to economic opportunities to own land or work for money in the so-called "leeward islands."

William Ellis also described Kailua Bay, the coastal area to the south of the current project area as follows:

The houses which are neat, are generally erected on the sea-shore, shaded with cocoa-nut and kou trees, which greatly enliven the scene. The environs were cultivated to a considerable extent: small gardens were seen among the barren rocks on which the houses were built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places they seemed to be growing literally in the fragments of lava, collected in small heaps around their roots. [Ellis 1979:31]

The mid-nineteenth century brought great changes to North Kona, including private and public land ownership laws known as the *Māhele* (literally, “to divide” or “to section”) and commercial ranching. Ranching, in particular, established the region as a source of market resources (e.g., beef and dairy products) for Honolulu and beyond.

Coulter’s (1931) population density estimates for 1853 (Figure 27) show that a few hundred people lived in the vicinity of the present project area during the mid-1800s. However, many sources of information—including archaeological survey data, historical documentation, and oral-historical information—suggest the main areas of settlement were likely along the coast and upcountry above the present project area. It is likely the present project area was never a location of dense permanent settlement.

Cordy et al. (1991) note the following about Kaloko:

The historical documents suggest that by the 1840s-1850s, the Coastal Zone had been abandoned as a residential area, except probably for a house used by the fishpond’s caretaker. This pattern would have been a stunning change from prehistoric and early historic times, when many coastal residences were present. [Cordy et al. 1991:288]

This pattern likely also held for other *ahupua‘a* in the Kekaha area.

4.4 1848–1852 *Māhele* Data

In the mid-nineteenth century, during the time of Kamehameha III, a series of legal and legislative changes were brought about in the name of “land reform” (see the works of Jon Chinen 1958, 1961 for a thorough and well-written explanation). Prior to the *Māhele*, all land belonged to the *akua* (god), held in trust for them by the paramount chief and managed by subordinate chiefs.

Following the enactment of a series of new laws from the mid-1840s to mid-1850s, Kamehameha III divided the land into four categories: Crown Lands reserved for himself and the royal house; Government Lands set aside for the government; *Konohiki* Lands claimed by *ali‘i* and their *konohiki*; and *kuleana*, small plots claimed by the *maka‘āinana* (commoners) (Chinen 1958:8–15). These claims are described in LCA testimony from the claimant and witnesses. A Royal Patent (R.P.), which quit-claimed the government’s interest in the land, was issued on most LCAs (Chinen 1958:14). In some cases, more than one R.P. number was issued for an LCA, especially in cases where there were several widely separated *‘āpana* (lots), such as an award with agricultural land in one *ahupua‘a* and a house lot in Kailua town.

The chiefs and *konohiki* were required to pay a commutation fee for their lands, usually about one-third of the value any unimproved lands. To pay the fee, the awardees usually “returned” a

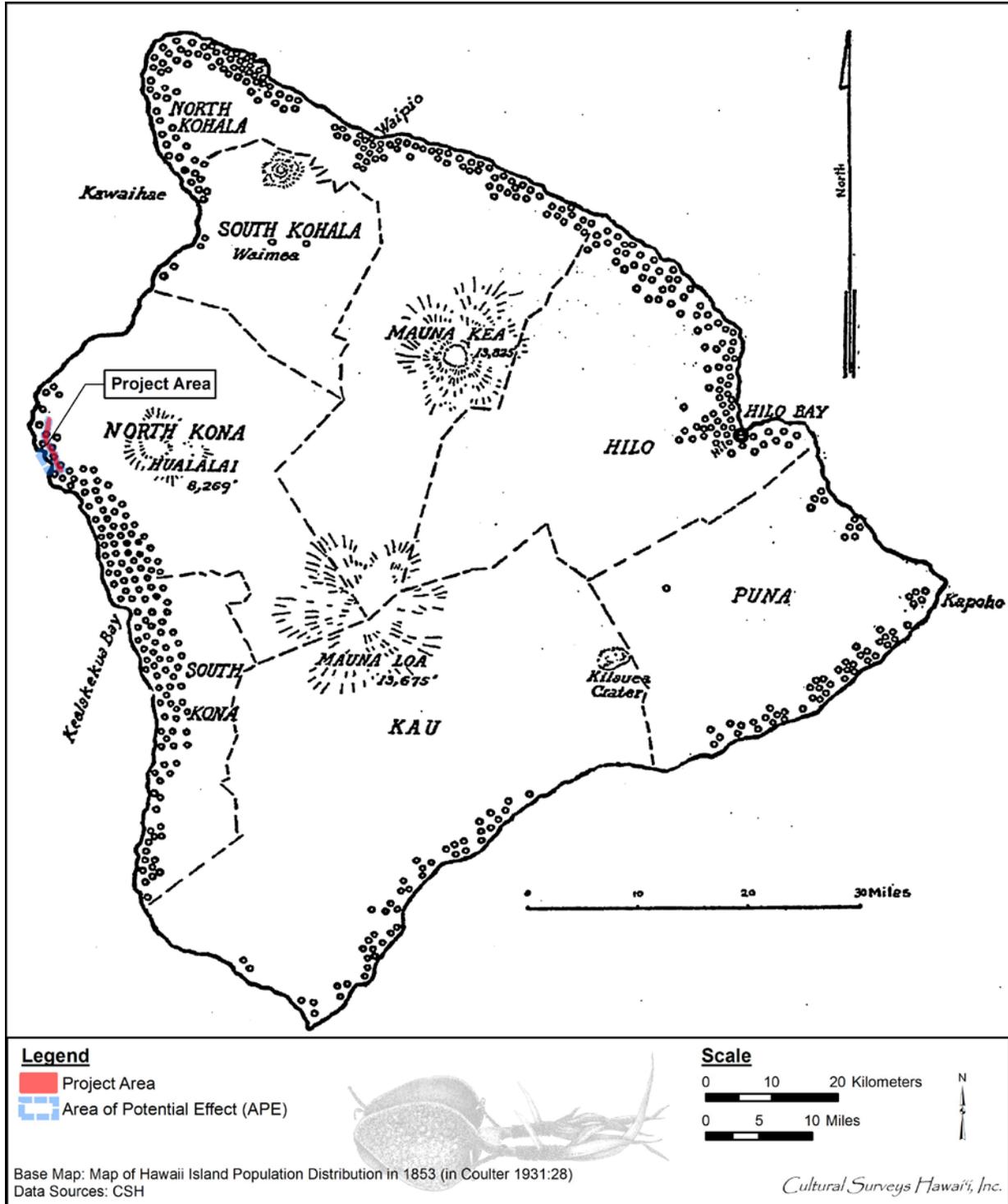


Figure 27. Coulter's (1931) population estimates for 1853 in and around the project area; each symbol represents 50 people

portion of the lands awarded to pay the commutation fee for the lands they decided to retain. The returned lands usually became Government Lands (Chinen 1958:13).

In 1848, four resolutions were passed to protect the rights of the *kama'āina*, the native tenants. The resolutions authorized the Land Commission to award fee simple title to native tenants for habitation and agricultural lands that were part of Crown Lands, Government Lands, or Konohiki Lands. The lands for the common people became known as *kuleana* (tenant) awards (Chinen 1958, 1961). The Kuleana Act of 1850 allowed *maka'āinana*, in principle, to own land parcels at which they were currently and actively cultivating and/or residing. In theory, this set aside hundreds of thousands of acres as potential *kuleana* parcels; however, this ultimately led to about 10,000 claimants obtaining approximately 30,000 acres, while 252 chiefs, for example, divided up about a million acres. Many or most Hawaiians were simply disenfranchised by these acts.

In Kekaha, land claim testimonies indicate there were relatively few native tenants who made land claims, and the majority of lands became the property of the government. Of the few land claims made, it appears the cultivation of traditional crops within the upper elevations (the Upland Zone), including taro and sweet potatoes, was the predominant land use activity. Only one claimant indicated the cultivation of a commercial crop (coffee). Besides a claim made for “salt lands” at Keahuolū and several other claims made for rights to fishpond resources, there is very little indication of land use throughout the intermediate and lower elevations, including an absence of claims made for house lots on the coast.

The Māhele data from each of the subject *ahupua'a* support what Cordy found in his study of land claims made at Kaloko, namely that by the time of the Māhele, “the coast was virtually abandoned [and] the economic focus in this area had shifted to the uplands, which may have been a non-traditional pattern in this area” (Cordy et al. 1991:421). The following are excerpts from previous studies that provide brief summaries of the Māhele data for each of the subject *ahupua'a*. The excerpts are direct quotes compiled from the referenced reports.

4.4.1 Kealakehe – Government Land

Kealakehe was awarded to Kekuapanio, a *hulumanu*, one of a group of young nobles that were the favorites of Kauikeaouli, Kamehameha II. He returned the land to the government. Twenty-three *kuleana* claims were made for Kealakehe, and 11 were awarded. Table 13 gives the LCA number, awardees, the name of the *'ili* in which the award was located (if known), the Royal Patent (R.P.) number, and the acreage. Six *'ili* are mentioned in Māhele testimony, of which all had claims awarded. From the 11 testimonies, it was determined that claimants listed numerous cultivated parcels (*kīhāpai*) planted in taro and sweet potatoes. At least ten houses and a fair sized banana patch were situated in the uplands (Donham 1990b:B-4).

4.4.2 Honokōhau 1-2 – Konohiki Land

Honokōhau 1, composed of 2,653 acres, was awarded to Miriam Kekau'ōnohi (LCA 11216). Honokōhau 2, composed of 480 acres, was awarded to William Pitt Leleiōhoku (LCA 9971). Both of these awards were kept by the claimants. The *'ili* of Papa'akoko and Elepai were also awarded as a *konohiki* award to William Charles Lunalilo (LCA 8559-B), who later became the sixth Hawaiian monarch but ruled for only a year, until his death in 1874. He returned the land to the government in lieu of commutation.

Table 13. Land Commission Awards in Kealakehe

LCA	Awardee	'Ili	R.P.	Acreage
7483	Kulua	Ka'ōhia, Makakiloī'a	4040	2.6
7897	Kahuenui 2	Kukui'ōmino	4002	4.9
8608	Kaahui	Ka'ōhia, Kalihi, Pū'ohē, Kukui'ōmino, 'Ililoa	5228	3.9
9252	Kauhai	Pū'ohē, Ka'ōhia, Kani'ohale	4005	5.78
10070	Mioi	'Ililoa, Kani'ohale, Kukui'ōmino	4003	4.4
10306	Nuole	Kani'ohale	4006	5.25
10322	Nuhi	Makakiloī'a	8054	4.75
10597	Puou	Kukui'ōmino-nui, Kukui'ōmino-iki	6235	4.12
10671	Pepe	'Ililoa, Haleolono, Kukui'ōmino, Kani'ohale	4007	4.96
10692	Paai	Pū'ohu, 'Ililoa, Ka'ōhia	4004	2.8
10950	Waiwaiole	Ka'ōhia, Pū'ohē	5123	2.0

Table 14. Land Commission Awards in Honokōhau 1-2

LCA	Awardee	Ahupua'a	'Ili	R.P.	Acreage
6026	Lanai, Ikaaka	Honokōhau 2	Hanapouli	6787	1.0
7396	Kekipi	Honokōhau 2	Pu'u Kou	5231	3.9
7490	Polapola, Solomona	Honokōhau 1, Honokōhau 2	'Onea, Waipi'o, Pukalani	5247	2.0
7870, 7867	Kamohai	Honokōhau 2	Waipi'o	–	1.0
7890	Kukona	Honokōhau 2	Hanapouli	7766	2.3
8218	Ikiiki	Honokōhau 2	Waipi'o	–	2.3
9061	Kanae	Honokōhau 2	Pukalani	5049	4.8
9236	Kahaulewahine	Honokōhau 1	Kaēo	–	3.2
10319	Nahina	Honokōhau 2	Haleolono	4896	3.5
10521-B	Puhiale	Honokōhau 1	Haleamahuka	7785	6.8
10762	Ahu	Honokōhau 2	Nu'uhiwa	3743	2.2
11064	Apuni	Honokōhau 1		5326	2.5
11216:36	Kekauonohi, Mikahela	Honokōhau 1	Ahupua'a award	7587	26.5
9971	Leleiohoku, William P.	Honokōhau 2	Ahupua'a award	6855	480.0

In addition to the two *konohiki* awards, Hawaiian commoners made an additional 32 claims on Honokōhau lands; 12 were awarded (see Table 14). Lands were claimed in 16 *'ili* but awarded in only nine. These awards—ranging in size from 0.97 to 6.75 acres—are located between 800 and 1,680 ft in elevation. Only two of the testimonies recorded for these awards mentions specific crops grown in the awarded parcels; these include taro and potato *kīhāpai*. A house lot was claimed by only one individual (Robins et al. 1995:25).

4.4.3 Kaloko – Konohiki Land

Kaloko was awarded and kept by Lot Kamehameha (LCA 7715), who later ruled Hawai'i as Kamehameha V. A total of 21 additional claims were made in Kaloko, and 12 were awarded (Table 15). Fifteen *'ili* names are mentioned in Māhele testimony, but lands were awarded in only 12. Kelly (1971) noted all 12 commoner, or *kuleana*, awards were located within the Upland Zone between 1,200 and 1,700 ft elevation. Specific crops grown in the fields are mentioned in only six claims. Taro predominated, although two sweet potato plots and eight mixed taro plots were also claimed. House lots were claimed in only two of the 18 cases, which is extremely unusual. In summary, housing data is extremely poor for this period (Cordy et al. 1991:411, 415).

4.4.4 Kohanaiki – Government Land

Kohanaiki was awarded to Asa Ka'eo, the uncle of Kekau'ōnohi, a granddaughter of Kamehameha I and one of the wives of Kamehameha II. He returned the land to the government. Commoners claimed two LCA parcels in Kohanaiki, but neither was awarded. The entire *ahupua'a* of Kohanaiki was classified as Government Lands (Indices of Awards 1929). Because of this, no testimony can be found on this land by any of the natives wishing to testify for *kuleana* lands. Instead, parcels of the land were later sold by the government to raise money (Lehua Kalima in O'Hare and Goodfellow 1992:A-12).

4.4.5 'O'oma 1-2 – Government Land

Kauikeaouli, the future King Kamehameha III, was born and lived in his early childhood at 'O'oma. He originally claimed the land of 'O'oma as his own land, but returned it to the government for further claims. Kamakau (1961) notes the following:

Ka-iki-o-'ewa became the boy's guardian and took him to rear in an out-of-the-way place at 'O'oma, Kekaha . . . Here at 'O'oma he was brought up until his fifth year, chiefly occupied with his toy boats rigged like warships and with little brass cannon loaded with real powder mounted on [their] decks. [Kamakau 1961:264]

In the Māhele, 'O'oma 1 was awarded as a *konohiki* award to Moses Kekūāiwa, while 'O'oma 2 was awarded to an *ali'i* named Kekaha. Moses Kekūāiwa was the brother of the future Kamehameha IV and Kamehameha V; he died of the measles at the age of 19. Both Kekūāiwa and Kekaha returned these awards to the government to pay the commutation fee for lands they decided to keep. Commoners claimed five *kuleana* awards in 'O'oma, but only three were granted (Table 16).

Table 15. Land Commission Awards in Kaloko

LCA	Awardee	'Ili	Royal Patent	Acreage
7797	Kamohoalii	Kikahala, Ulaiui	3972	5.3
7909	Kamaole	Makaawe, Hale'ape	5377	7.0
9060	Kioku	Ulukukahi	4012	4.0
9160	Kanu	Kanaio	6938	2.5
9237	Kahiona	Oloupe	–	2.8
9238	Kahooahanohano	Pāpua'a	3316	1.8
9241	Kaiama	Kealaehu, Luahine'eku, Haleolono	3772	4.3
9242	Keaweahokina	Kikahala, Kealaehu	3744	2.8
9243	Kaleiko	Kealaehu, Luahine'eku, Haleolono	3786	1.8
10327	Nahuina	Hale'ape	3891	3.5
10694	Puhi	Kiki	3763	3.5
10951	Wahahee	Kealaehu, Kikahala	5095	2.0
7715	Kapuaiwa, Lota	Ahupua'a award	8214	4320.0

Table 16. Land Commission Awards in 'O'oma

LCA	Awardee	'Ili	Royal Patent	Acreage
8245-B	Kiekie	'O'omakaa	–	3.2
8059	Naiwi	'O'omakaa	3950	4.4
11004	Waa	'O'omakaa	5433	4.8

Table 17. Land Commission Awards in Kalaoa

LCA	Awardee	'Ili	Royal Patent	Acreage
7899	Kiekie	Kalaoa 5	–	4.9
7937	Kupuoe	Kalaoa 5	–	5.8

4.4.6 Kalaoa 1-5 – Government Land

Kalaoa was divided into five sections, with Kalaoa 1 awarded to Emilia Keaweamahi, Kalaoa 2 awarded to Kinimaka, Kalaoa 3 awarded to Hapakuka Hewahewa, Kalaoa 4 awarded to William Pitt Leleiōhoku, and Kalaoa 5 designated as Government Land. Emilia Keaweamahi was the wife of Kaikio'ewa, an early supporter of Kamehameha I. He became governor of Kaua'i in 1825 and was succeeded at that post by his wife after his death in 1839. Kinimaka was a high *ali'i*, who became the *makua hānai* (adopted father) of the future King Kalākaua (Barrère 1994:367). Hewahewa was the last high priest of the Hawaiian *kapu* system and had been the *kahuna* of Kamehameha I and Ka'ahumanu before becoming an early Christian convert. Leleiōhoku was the brother of two Hawaiian monarchs, King Kalākaua and Queen Lili'uokalani. The awardees of Kalaoa 1–4 all returned their lands to the government as commutation fees.

Twelve Hawaiians claimed *kuleana* lots in Kalaoa, but only two were awarded, both in Kalaoa 5 (see Table 17). A series of grants were issued in the *ahupua'a* between 1852 and 1864, evidently representing commoners acquiring lands. All the awards were in the upland forest zone from 800–2,200 ft elevations; they appear to be agricultural parcels (Cordy 1985:35).

4.5 Nineteenth and Early Twentieth Centuries

4.5.1 Early Historic Period

By the first decades of the nineteenth century, the inhabitants of Kekaha would have long experienced the social pressures and consequences of western contact. “As early as 1788, Hawaiians began enlisting as seamen on the foreign ships that stopped at Island ports, and their number increased rapidly with the growth of whaling in the Pacific” (Schmitt 1973:16). As harbor facilities were developed at Kailua and Kealahou during the early 1800s, these burgeoning ports became centers of a population drawn from increasingly isolated (economically and socially) areas like Kekaha. Newly introduced diseases decimated the population.

Missionary censuses of the 1830s chart the diminishing population of Kekaha and North Kona. In 1834, the population of Kekaha is recorded as 1,244, comprising 21% of the total North Kona population of 5,957 (Schmitt 1973:31). The North Kona figure represents a population loss of 692 since the previous census of 1831 (during which no figure specific to Kekaha was noted), which recorded 6, 649 persons in the district (Schmitt 1973:9). One factor inducing the diminishing population of Kona was inter-island migration.

By the end of the 1800s, land use in North Kona had undergone significant alterations from the dryland cultivation and fishing practiced during pre-Contact and early historic times. Maly (1994) asserts that the gradual replacement of the Hawaiian lifestyle in this area is the result of two major factors: the 1801 eruption of Hualālai and changing land use patterns over the previous 150 years. The lava flows from Hualālai reclaimed much of the land used for settlement, agriculture, and fishponds, reducing the land to a shadow of its former condition. The introduction of foreign plants and animals brought about additional changes, as once barren lava fields became overgrown with *kiawe* (*Prosopis pallida*) and other weedy shrubs. Goat and cattle raising became a mainstay of local industry. The 1850s saw the development of large-scale commercial ranching and agriculture as a result of the shift to private land ownership brought about by the Māhele and an 1850 law permitting foreigners to own land. Coffee, grazing land,

tobacco, and sugarcane gradually replaced traditional crops such as taro and *'uala* (sweet potato), stripped the land of forests, and caused disruption of the water catchment systems.

Today, the upland and intermediate zones are covered with coffee plantations, housing developments, and light industry. On the coast are the Keāhole Airport and the Natural Energy Laboratory. The coast has not been utilized for permanent human habitation since the 1801 lava flow (Henry et al. 1993:50).

4.5.2 Mid- to Late 1800s

The mid-nineteenth century brought great changes to North Kona, including private and public land ownership laws known as the *Māhele* (literally, to divide or to section; see also Section 4.4) and commercial ranching. Ranching in particular established the region as a source of market resources (e.g., beef and dairy products) for Honolulu and beyond.

Coulter's (1931) population density estimates for 1853 (see Figure 27) show that a few hundred people lived in the area during the mid-1800s. However, many sources of information—including archaeological survey data, historical documentation, and oral-historical information—suggest the main areas of settlement were likely along the coast and upcountry *mauka* of the present project area. It is likely the present project area was never a location of dense permanent settlement.

Oral history interviews (Maly and Maly 2002) relate that in the mid-1800s only a few residences were on the coastal lands, in the uplands above 900 ft elevation, and in the vicinity of Māmalahoa Highway (east of the project area). The land between 900 ft and the coast was used for cattle, donkey, and goat pasturage. *Mauka-makai* trails through Kohanaiki, Kaloko, Kalaoa, and Honokōhau were utilized by upland families to access the coast to fish and gather water during upland droughts (see Section 4.5.8).

Despite these major changes, there were apparently still many people living in the area in the late nineteenth century, as indicated by the following extended testimony of J.W.H.I. Kihe, who was born at Honokōhau in 1854. Kihe talked about the area in 1870:

Now [1924] the majority of those people are all dead. Of those things remembered and thought of by the people who yet remain from that time in 1870; those who are here 53 years later, we cannot forget the many families who lived in the various (*'āpana*) land sections of Kekaha. From the lands of Honokōhau, Kaloko, Kohanaiki, the lands of *'O'oma*, Kalaoa, Haleohiu, Makaula, Kau, Puukala-Ohiki, Awalua, the lands of Kaulana, Mahaiula, Makalawena, Awakee, the lands of Kukio, Kaupulehu, Kiholo, Keawaiki, Kapalaoa, Puuanahulu, and Puuwaawaa. These many lands were filled with people in those days.

There were men, women, and children, the houses were filled with large families. Truly there were many people [in Kekaha]. I would travel around with the young men and women in those days, and we would stay together, travel together, eat together, and spend the nights in homes filled with aloha. The lands of Honokōhau were filled with people in those days, there were many women and children with whom I traveled with joy in the days of my youth. Those families are all gone, and the land is quiet. There are no people, only the rocks remain, and

a few scattered trees growing, and only occasionally does one meet with a man today (1924). One man and his children are all that remain.

Kaloko was the same in those days, but now, it is a land without people. The men, the women, and the children are all gone, they have passed away. Only one man, J.W. Haau, remains. He is the only native child (*keiki kupa*) besides this author, who remains. Now the land is desolate, there are no people, the houses are quiet. Only the houses remain standing, places simply to be counted. [Maly and Maly 2002:341–342]

Another native familiar with the area, J.P. Pu'uokupa, wrote a letter to the Hawaiian language newspaper *Ku Okoa* in 1875. Pu'uokupa was reacting to, and disagreeing with, an earlier letter describing supposed famine-like conditions in the area:

. . . The people who live in the area around Kailua are not bothered by the famine. They all have food. There are sweet potatoes and taro. These are the foods of these lands. There are at this time, breadfruit bearing fruit at Honokōhau on the side of Kailua, and at Kaloko, Kohanaiki, 'O'oma and the Kalaoas where lives J.P. [the author]. All of these lands are cultivated. There is land on which coffee is cultivated, where taro and sweet potatoes are cultivated, and land livestock is raised. All of us living from Kailua to Kalaoa are not in a famine, there is nothing we lack for the well being of our bodies.

Mokuola (a poetic reference to a place of life and well-being) is seen clearly upon the ocean, like the featherless back of the ukeke (shore bird). So it is in the uplands where one may wander gathering what is needed, as far as Kiholo which opens like the mouth of a long house into the wind. It is there that the bow of the boats may safely land upon the shore. The livelihood of the people there is fishing and the raising of livestock. The people in the uplands of Napuu are farmers, and as is the custom of those people of the backlands, they all eat in the morning and then go to work. So it is with all of the native people of these lands, they are a people that are well off . . .

As was said earlier, coffee is the plant of value on this land, and so, is the raising of livestock. From the payments for those products, the people are well off and they have built wooden houses. If you come here you shall see that it is true. Fish are also something which benefits the people. The people who make the pai ai on Maui bring it to Kona and trade it. Some people also trade their poi for the coffee of the natives here . . . [J.P. Puuokupa, in *Ku Okoa*, 27 November 1875; translated by Maly, in Maly and Maly 2002:339]

4.5.3 Kealakehe

As Government Lands, portions of Kealakehe Ahupua'a were subdivided as the Kealakehe Homesteads for purchase by homesteaders for residential development. Following the passage of the Hawaiian Homes Commission Act in 1921, portions of Kealakehe were designated Hawaiian Homelands "for the benefit and use of native Hawaiians, upon which they may live, farm, ranch, and otherwise engage in commercial or industrial or any other activities."

4.5.4 Honokōhau

Clues to the life of the two Honokōhau Ahupua‘a come to light in records of the 1873 Commission of Boundaries (Boundary Commission) proceedings concerning the *ahupua‘a*. J.O. Dominis, agent for Ruth Ke‘elikōlani (widow of William Pitt Leleiōhoku), had petitioned a hearing by the commission “for the settlement of the boundaries of the land of Honokōhauike [i.e., Honokōhau II] situated in North Kona Island of Hawaii.” Three witnesses, all Native Hawaiians familiar with the *ahupua‘a*, gave their testimonies on 12 August 1873. The testimonies contain many place names no longer indicated on modern maps. These place names are associated with land features and constructions that hint at the once thriving traditional Hawaiian life within the *ahupua‘a*. The following testimony of Hoohia suggests how intricately known the land was by its inhabitants:

Commencing at the sea shore the boundary between Honokohaunui and Honokōhauike is at a place called Kuanawai said place is in the water, thence up the sand beach to a place called Pohakuhaiku a heiau on the pāhoehoe, from thence the boundary runs to Pu mau an ai aina or ahua, an old resting place where a koa tree used to stand at a crook on the road thence up the iwi aina to Keauakaluapuaa a cave, thence to Ulukukahi a breadfruit tree thence to an ohia tree called Ohia kaumaia thence up the iwi aina to Kuakahela a lae ohia fruit trees, thence to Mumuku a breadfruit tree on the North Side. From Kuakahela the trail runs mauka along the boundary from Mumuku through Ikuana, an old kulana kauhale, and along the road, mauka to Kapiopio punawai, thence the boundary runs up mauka along the iwi to Kumumanaike a water hole and bathing place. (The Government road is mauka of Mumuku.) From Kumumanaike the boundary runs to ma Laiula, a banana grove in the edge of the ohia woods; where Honokōhauunui and Kealakehe unite thereby cutting Honokōhauike off. There turn makai along Kealakehe to Waiha a punawai at the old kulana kauhale below the woods, thence makai along the iwi aina to Waiopapa, a punawai and ahua above the Government road, where you can look out to sea. Thence makai to Kaneopua an ai aina on the boundary, below the Govt. road, at the junction of . . . [?] boundary of Kealakehe and Honokōhauike. Thence makai to Kukanooonoo, an old kulana kauhale . . . thence makai to Kukuipualoa an ahua pohaku (resting place) coming to the aa. Thence to Kahawai aina, a mahina ai in aa, thence makai to Puunoho on the pāhoehoe, said place is an ahua thence to Pāhoehoea, still on pāhoehoe, thence makai to Maliu a lae. The sea bounds the land makai; and there is a very small fishing right cut off by the sea of Kealakehe and Honokōhauunui.

Noteworthy in these BCTs are the references to the two old “kūlana kauhale” (literally, a plurality of houses; hamlet, village, or residential cluster; Pukui and Elbert 1984:179) named Ikuana and Kukanooonoo, the three *pūnāwai* (water spring), and the “water hole and bathing place” Kumumanaike, all features of the *mauka* portion of the *ahupua‘a*. Also, in the *makai* portion of the *ahupua‘a*, the *heiau* identified as Pohakuhaiku may correspond to the unnamed *heiau* recorded approximately 500 ft inland from the coast in the vicinity of the *ahupua‘a* boundary during an archaeological survey (Emory and Soehren 1971) of the coastal region. Also mentioned is a *heiau* named Halekuo between the Government Road and the sea, which

informant Kamohai described as the wall above the school house and, a few sentences later, as a *heiau*.

Early twentieth century maps and photographs show a village along the coast of Honokōhau comprising frame houses, a chapel, and a schoolhouse. No records were uncovered documenting dates of construction for these structures. Apparently, by the 1920s the village had been abandoned. Most Hawaiians had moved to the uplands, where another schoolhouse had been established by at least 1888, as it appears on the 1888 Emerson map (see Figure 25).

In summary, following the Māhele (ca. 1850s), the Intermediate and Upland Zones of the Honokōhau area were ultimately abandoned, as suggested by Boundary Commission and LCA records. Subsequently, the vacant lands were acquired for cattle ranching, and portions were leased for commercial cultivation of coffee and fruit by Japanese immigrants. By the 1920s–1930s the Coastal Zone of Honokōhau I and II was virtually vacant, with settlement associated with ranching and coffee farming centered primarily along the *mauka* roads, as it is today (Robins et al. 1995:149).

4.5.5 Kaloko

The historical documents suggest that by the 1840s–1850s, the Coastal Zone had been abandoned as a residential area, except possibly for a house used by the fishpond's caretaker. This pattern would have been a stunning change from pre-Contact and early historic times, when many coastal residences were present (Cordy et al. 1991:288).

By the 1870s and 1880s, housing seems to have become focused in the Upland Zone at the Kohanaiki Homesteads, with some scattered houses across Kaloko along the Road to Kailua and the upper Government Road. A Catholic Church is shown on the Emerson map of 1888 (see Figure 25), which would have drawn families to settle nearby. Cultivation may have been shifting to cash crops (e.g., coffee), and small-scale livestock raising may have been taking place.

During the twentieth century, major developments focused on Kaloko Ahupua'a, just north of Honokōhau, with continuing commercial use of the fishpond and increasing animal husbandry. Ranching steadily increased with the development of the *ahupua'a* uplands into the Hu'ehu'e Ranch. Maly and Maly (2003) discussed the acquisition of these lands and the types of ranching that were common:

In 1899, John A. Maguire, founder of Huehue Ranch applied for a Patent Grant on . . . lots in 'O'oma 2nd, but he only secured Grant No. 4536 . . . Maguire's Huehue Ranch did secure General Lease No.'s 1001 and 590 for grazing purposes on the remaining government lands in the Kohanaiki and 'O'oma vicinity. Thus, by the turn of the century, Huehue Ranch, utilized both the upper forest lands and lower kula lands to the shore for ranching purposes. Oral history interviews with elder former ranch hands record that this use extended across the Kapena and Huliko'a grant lands of Kohanaiki, from the fee and leasehold lands of Kaloko and 'O'oma. Nineteenth century goat drives, gave way to formalized cattle drives and round ups on these lands. [Maly and Maly 2003:78]

Until the construction of the Queen Ka'ahumanu Highway in the 1970s, access to the "kula kai (shoreward plains)" was limited to local residents (Maly and Maly 2003:101). The 1924

USGS map shows “the road to the sea” (SIHP # -10714) connecting the Kohanaiki Homesteads with the Kaloko Fishpond. In the first half of the twentieth century, the primary method of travel was “by foot or on horse or donkey, and those who traveled the land were almost always native residents of Kalaoa, ‘O‘oma, Kohanaiki, Kaloko and Honokōhau” (Maly and Maly 2003:99). Huehue Ranch bulldozed a Jeep road to the shore around 1955, during the construction of the Kailua pier; the road was used primarily by the ranch employees for duties or for fishing along the coast.

The Kaloko Fishpond—leased from the Huehue Ranch—continued as a commercial fishing operation until the 1950s. During the 1970s, the pond was incorporated into the newly established Kaloko-Honokōhau National Historical Park.

4.5.6 Kohanaiki, ‘O‘oma, and Kalaoa

Kohanaiki, ‘O‘oma, and Kalaoa were all designated as Government Lands during the Māhele, but the government began to sell this land to native tenants as early as 1852. The 1888 map of the Kona Coast by J.S. Emerson (see Figure 25) shows the dense concentration of land grants purchased near the upper Belt Road (Māmalahoa Highway) in the Kona region. One of these clusters was in Kohanaiki, where a small settlement grew up around a Protestant church built in the 1870s (Kelly 1971:14). The land could also be leased, as was the case with the lower *kula* (pasture, drylands) lands, including the present project area, which were used as grazing lands for goats and cattle. To encourage more native tenants to buy or lease lands, the Hawaiian Kingdom established the Homestead Act in 1884. Government lands from Kohanaiki north to Kūki‘o were set aside for these homesteads, and 20-acre lots were leased, mainly adjacent to Māmalahoa Highway in the uplands. King Kalākaua gave up his lands in Kekaha in 1889 to increase the amount of land available for homesteads. Besides the smaller lots, large tracts were also leased for cattle ranches, such as the Huehue Ranch in Kealakehe.

Ranching has its roots in this early historic period, with the introduction of goats, cattle, and horses by sea captains who sought to develop these resources to replenish their ship holds during long journeys. Captain George Vancouver gave Ke‘eaumoku, an *ali‘i*, a pair of goats in 1792, and the following year, he brought Ke‘eaumoku four sheep. Vancouver also brought the first cattle, California longhorns, to Kamehameha I in 1793. Kamehameha issued a *kapu* (in this case, a prohibition) that carried the death penalty to anyone harming cows or cattle, thus ensuring that the first herds would proliferate. The *kapu* was enforced for ten years. Due to the *kapu*, families constructed walls to protect their sweet potato and taro lands from the cattle. Kamehameha ordered the construction of a wall *mauka* of the project area that ran from north to south Kona, to prevent cattle from destroying populated areas (Bergin 2004:22–23). Historical research suggests both goat and cattle grazing took place within the project area.

In 1803, horses were introduced. They also ran free, although no *kapu* protected them. Horses had difficulties acclimating to local grasses, and herds of feral horses were rare until the 1830s. At that time, Kamehameha III had California *vaqueros*, cowboys of Native Californian, Spanish, and Mexican descent, brought to Hawai‘i to herd the cattle and teach Hawaiians to ride horses and tend the cattle. The *paniolo*, as they were called, were expert horsemen and able to chase down the wild cattle on horseback and capture them with a lasso. The hide and tallow trade proved to be successful, and cattle were shipped from Kailua Bay to slaughterhouses on O‘ahu.

In 1851, it was estimated that Hawai'i Island had 8,000 head of tame cattle and 12,000 head of wild cattle (Kelly 1983:79; Bergin 2004:23, 97).

Historic documents related to the Government Homestead Program of the late 1880s indicate officials deemed goats the only animals adept at grazing within arid, rocky Kaloko and Kohanaiki (Maly and Maly 2003:76, 79). Goats were present in the area prior to the late 1880s and may have been present within the project area. Limited cattle ranching was practiced at the same time, although by 1900 cattle ranching had, for the most part, replaced the goats (Maly and Maly 2003:75).

The development of cattle ranching, as with sugarcane plantations, was most changed by the Māhele (1848), which introduced private land ownership in Hawai'i and allowed for the ownership of land by foreigners. Fences and corrals were built in the vast tracts of formerly open land to contain the captured cattle, and then foreign stock was brought in for breeding. Once the fences and corrals were built, they needed to be maintained; this was one of the many regular tasks of the Hawaiian *paniolo*, in addition to the more occasional cattle round-ups and shipping to slaughter houses (Strazar 1987:xiv–xv).

In the northern section of the project area, in 'O'oma, Kohanaiki, and Kaloko, upland areas were developed into cattle ranches by the turn of the century. In the southern section of the project area, the *mauka* portions of Honokōhau 1 and 2 during the last quarter of the nineteenth century and throughout the twentieth century focused on the activities of the Greenwell family. Henry Nicholas Greenwell, an Englishman, had arrived on Hawai'i Island during the 1850s and soon began purchasing and leasing land. After starting out growing oranges, Greenwell expanded his commercial interests to coffee as well as sheep and cattle raising. The lands of Honokōhau apparently became a part of Greenwell's holdings sometime between the 1870s and his death in 1891. During the twentieth century, the Greenwell Ranch lands of Kona were divided into three units, with the Honokōhau holdings becoming the Frank Greenwell Ranch, named for a son of Henry N. Greenwell who had managed that section. A 1929 publication described the Frank Greenwell Ranch as follows:

This . . . is also known as Honokōhau Ranch and Hualalai Ranch. The total area is about 20,000 acres, one-half of which is suitable for grazing; it stretches from the sea to an elevation of 5400 feet. Four thousand acres of this area are fee simple, the remainder is leased land.

The herd on this ranch is approximately 1500 head. Between 300-350 cattle averaging three to four years of age with an average weight of 525 pounds are marketed annually in Honolulu. In addition ninety head are annually slaughtered locally. The cattle for Honolulu are loaded at Napoopoo. The ranch is well fenced into fifteen paddocks by 20 miles of stone wall and 12 miles of wire fencing.

The ranch now carries 9 Hereford and 3 Shorthorn bulls. Cattle are bred from June to February. From November to April only about one-half of the paddocks are used, the others being too dry over these months. September is perhaps the wettest month in Kona. Only enough horses for use on the ranch are raised. [Henke 1929:26–27]

The Frank Greenwell Ranch subsequently became the Palani Ranch Company. According to information provided by the company, Palani Ranch in modern times has carried over 3,000 head of Angus and Hereford cattle per year.

James M. Greenwell, grandson of H.N. Greenwell and son of Frank Greenwell, provided details of his family's life in Kona and more specifically at Honokōhau (personal communication, 14 September 1992). Mr. Greenwell recalled that dairy cattle ranching on Henry N. Greenwell's Kona lands began in the 1870s, at the time when the first Portuguese immigrants arrived in Hawai'i. Henry N. Greenwell formed partnerships with Portuguese families in which the families would live on Greenwell's land and turn out dairy products. Mr. Greenwell remembered that his father, Frank, planted mango and other introduced trees on portions of the Honokōhau ranch property. Some of these trees were protected by individual surrounding walls.

Mr. Greenwell also noted that, sometime early in this century, a paddock of the ranch below Palani Road within the northeast portion of the present project area was leased to the Kuni and Isomoto families for growing coffee. (During the present interview, Mr. Greenwell pointed out the house sites of these two families and referred to the area as "Kuni paddock"). After the collapse of the coffee market, the families grew avocado and citrus fruit trees. Mr. Greenwell recalled that the families would build protective walls around these trees to protect them from animals.

4.5.7 Coffee

Mr. Greenwell's reference to coffee grown by Japanese families brings to light another commercial activity within Kekaha that paralleled the development of ranching. Thomas Thrum, writing in the 1870s on the history of coffee in the Hawaiian Islands, records that coffee was first introduced "on Hawai'i, in . . . Kona, about . . . 1828 or 9, Rev. Mr. Ruggles planting the first slips in Naole, Kona,—the property now occupied by H.N. Greenwell, Esq." (Thrum 1876:46–47). Thrum notes the coffee industry in Kona was the "center of [coffee] cultivation [on Hawai'i Island which] . . . both from soil and climate produces the choicest article." It expanded despite a scarcity of labor, fluctuating prices, and occasional drought and blight.

Thrum mentions H.N. Greenwell again when he brings his account up to the 1870s and suggests the burgeoning coffee industry in Kona was not based upon large plantation-type operations:

Mr. H.N. Greenwell of Kona, trader, takes great pains in his selections for the market, and any bearing his mark is a sufficient guarantee in Honolulu market of fully ripe, well dried and clean aromatic coffee. There is an idea prevalent that Mr. G. is a grower of this article [i.e., coffee], but that is erroneous. The coffee is almost wholly in the hands of the natives with little patches here and there throughout the district, who gather it in its season and dispose of the same to the stores located near them. [Thrum 1876:51]

With the influx of Japanese immigrants to the Hawaiian Islands during the second half of the nineteenth century, the cultivation of coffee at Kona would no longer be "almost wholly in the hands of the natives," though planting likely continued to be concentrated upon "little patches here and there throughout the district":

Most Japanese immigrants in Kona came from three prefectures of Japan: Kumamoto-ken, Hiroshima-ken, and Yamaguchi-ken. They were mostly sugarcane laborers and coffee farmers, and lived in Kailua, Holualoa, Kainaliu, Kealakekua, Hōnaunau, Captain Cook, and Napoopoo. The majority of these immigrants came directly from Japan during periods of government contract or liberal immigration from 1885 to 1923. [Nakano 1990:45]

Noboru Yamamoto, a *kama'āina* coffee grower of Kona, provides details of life in Kona during the earlier decades of the twentieth century, when Japanese immigrant families were the mainstays of the coffee farming industry (personal communication, 21 February 1993). Mr. Yamamoto remembers most of the coffee farms were on leased land and ranged in size from 5 to 7 acres. The trees were not distributed in any special order but had been planted wherever they would grow. It was only in the late 1930s, Mr. Yamamoto thinks, that he began to see farms with trees planted in straight rows. Mr. Yamamoto also noted that after the coffee beans had been picked in the field, the beans were dried on wooden frames near the house; no drying operation took place in the field.

Mr. Yamamoto remembers both the Kuni and Isomoto families of Honokōhau. He believes all members of the Kuni family who had operated the Honokōhau farm are presently deceased. He believes one member of the Isomoto family survives today.

During the second half of the twentieth century, developments beyond ranching and coffee occurred within Honokōhau. These include the establishment of the Kaloko-Honokōhau National Park at the coast, an industrial park *mauka* of Queen Ka'ahumanu Highway, and residential subdivisions off Māmalahoa Highway and Palani Road. However, the present project area has continued as ranch lands and only since modern times, the *makai* portion is used as a quarry.

4.5.8 Trails

The first improved cross-*ahupua'a* trails through Kekaha (inland of the coastal trail) were the *alaloa* and the *alalele*. The *alaloa* was modified in the 1840s and called the *Alanui Aupuni* (Government Road), the King's Highway, or the Māmalahoa Trail. Cordy et al. (1991:403) believe the curb-lined Māmalahoa Trail was built between 1836 and 1855. Portions of this trail are aligned with the current Queen Ka'ahumanu Highway. The *alalele*, or Kealaehu ("path of Ehu"), extended from Kailua to the uplands of Kekaha; the current Belt Highway, or Māmalahoa Highway, is aligned with portions of this old trail. Each *ahupua'a* also had a *mauka-makai* trail that led from the coast to the uplands. Sometimes these were mere footpaths, marked by cairns across the bare *pāhoehoe* or 'a'ā lava (Clark and Rechtman 2006a:61).

Many of these trails were improved in the mid-nineteenth century for horse or carriage traffic. The government paid for the work or used prisoners working off penalties to construct the roads, which became straighter, back from the coast, and sometimes paved and lined with stones. As the population shifted to the agricultural zone along the inland trail, the Māmalahoa trail on the lower barren shore was abandoned. By the time of J.S. Emerson's survey of homestead lands in Kekaha in 1888, the trail was noted as "Lower Govt. Road – little used" (Cordy et al. 1991:405).

The main means of transport before 1947 were by foot, and on horses and donkeys. Jeeps became available for purchase after the end of World War II, and many old *mauka-makai* trails were improved. Not all trails shown on post-1950s maps are old; for instance, the Huehue Ranch

in Kealakehe blazed a new Jeep trail to the Kaloko shore sometime between 1924 and the 1950s. In 1973, the Queen Ka'ahumanu Highway opened, allowing vehicles to cross Kekaha Ahupua'a at the lower elevations once again (Clark and Rechtman 2006a:66).

The Hawaii Territorial Survey and USGS maps (Figure 28 and Figure 29) depict early trails along the Kekaha Coast. On an 1886 map (see Figure 23) of Hawai'i, only the inland cross-*ahupua'a* Belt Road (now the Māmalahoa Highway) that extends from Kailua to Waimea in Kohala, is depicted. J.S. Emerson depicts a coastal trail immediately adjacent to the beach on an 1891 map (see Figure 24) and a *mauka-makai* trail (SIHP # -10714) from Kaloko Fishpond to the early upper settlements at Kohanaiki near the Belt Road. The same map also depicts two other *mauka-makai* trails: one (SIHP # -18099) within the project area in Honokōhau and another (SIHP # -21588) originating in Honokōhau on the south side of 'Aimakapā Fishpond and connecting with the Māmalahoa Trail in Kealakehe.

During J.S. Emerson's survey of the Kekaha Region of North Kona from ca. 1881–1891, his assistant J. Perryman prepared detailed sketches of the landscape. These sketches show topographic features such as hills, bays, coastal points, fishponds, settlements, and trails that connected the settlements along the coast, as well as between the coast and the uplands. Sketches pertinent to the project area are included in Appendix B of the current volume.

A sketch dated 4 June 1882 (Figure 30) depicts the view looking *mauka* toward Hualalai from Keāhole. Two *mauka-makai* trails are depicted in the sketch converging at "Kohanaiki Village" on the Upper Government Road and running downslope. These trails are labeled "trail to Honokohau" (SIHP # -18099) and "trail to coast" (SIHP # -10714). The two trails end before reaching a final coastal destination, probably due to the sketch being "unfinished on account of bad weather." Segments of SIHP #s -18099 and -10714 are within the current project area.

A sketch dated August 1882 (Figure 31) depicts the view looking *makai* from Kealakehe on the slope of Hualalai. Four trails are visible on this map: the cross-*ahupua'a* coastal foot trail and three *mauka-makai* trails. The *mauka-makai* trails (SIHP #s -21588, -18099, and -10714) are depicted extending from the "Average edge of forest and Conture Line of Mountain Slope," where presumably the forest cover obscures them, to (from left to right) the Kealakehe shore, the 'Aimakapā Fishpond at Honokōhau, and the Kaloko Fishpond in Kaloko.

The trail from 'Aimakapā Fishpond at Honokōhau is better known as the "Trail to Honokohau" (SIHP # -18099). It is a paved, curbed-lined trail that begins at the south side of 'Aimakapā Fishpond, intersects the Māmalahoa Trail (SIHP # -00002), and then runs parallel to a trodden 'a'ā trail (Robins et al. 2000:23). It extends *mauka* of the Māmalahoa Trail for approximately 10,120 ft (nearly 2 miles) reaching 810 ft AMSL.

The trail from the Kaloko fishpond in Kaloko is known as the "Road to the Sea Trail" (SIHP # -10714). The trail originates in the vicinity of Kohanaiki Village and is also known by other names such as "Trail to Sea Coast" and "Kohanaiki Road." The trail has been documented *mauka* of the current project area by Wolforth et al. (2005) and more recently by CSH (Bell et al. 2009). This extensive trail system is represented by at least three trail segments identified by CSH during the current investigation, located immediately north of Hina Lani Street (see Volume III for full discussion). The Road to the Sea Trail (SIHP # -10714) can also be seen on a survey station map by J.S. Emerson of the Akahipu'u section of North Kona in 1888 (see Figure 25). The *mauka-makai* trail generally follows the border of Kohanaiki and Kaloko, and is

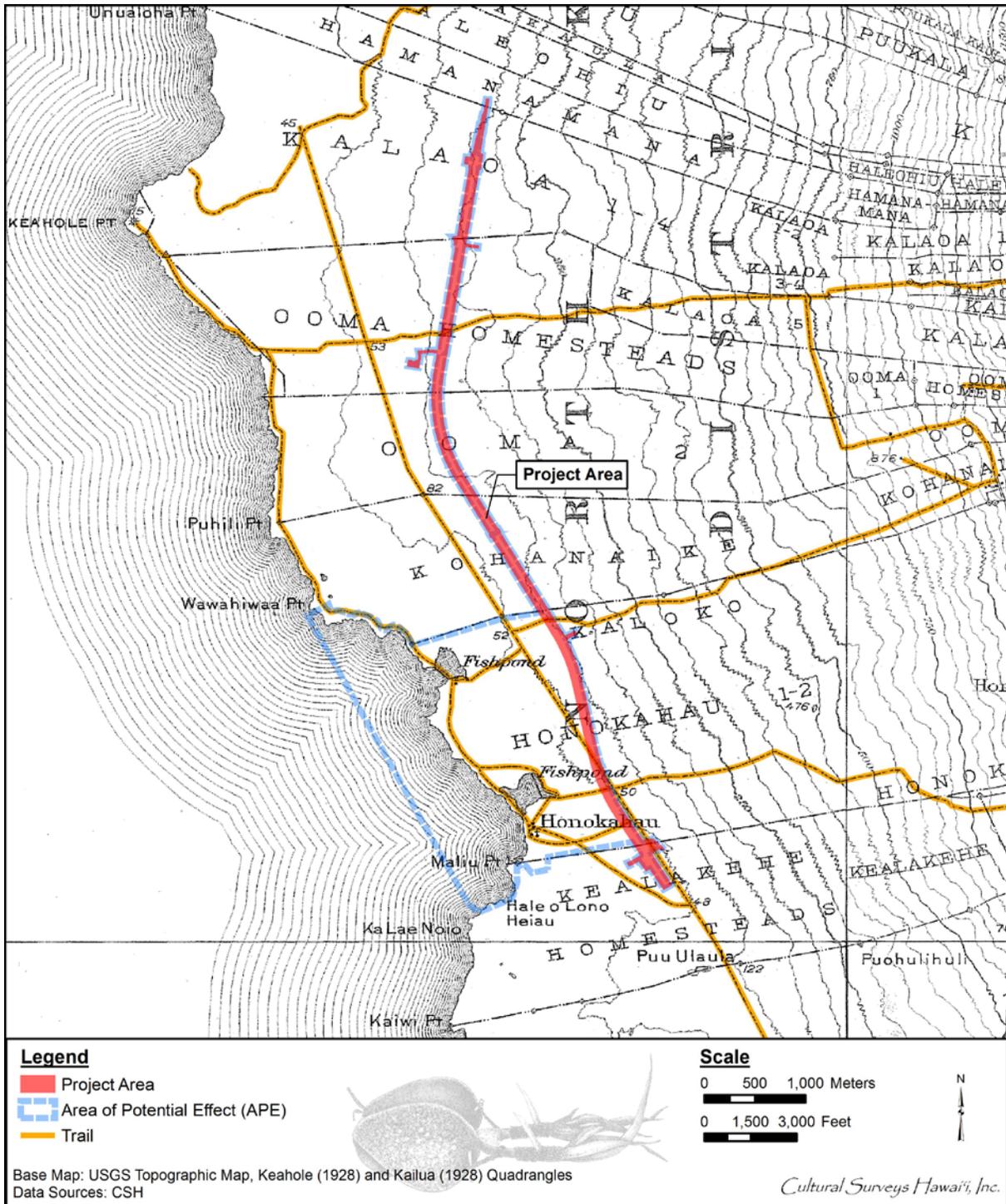


Figure 28. 1928 Keahole and Kailua USGS topographic quadrangles, depicting the project area; note dotted line Māmalahoa Trail (SIHP # -00002) crossing project area in Honokōhau, the Road to the Sea Trail (SIHP # -10714) connecting Māmalahoa Trail with Kaloko Fishpond, and SIHP # -29272 running *mauka-makai* through Ooma Homesteads

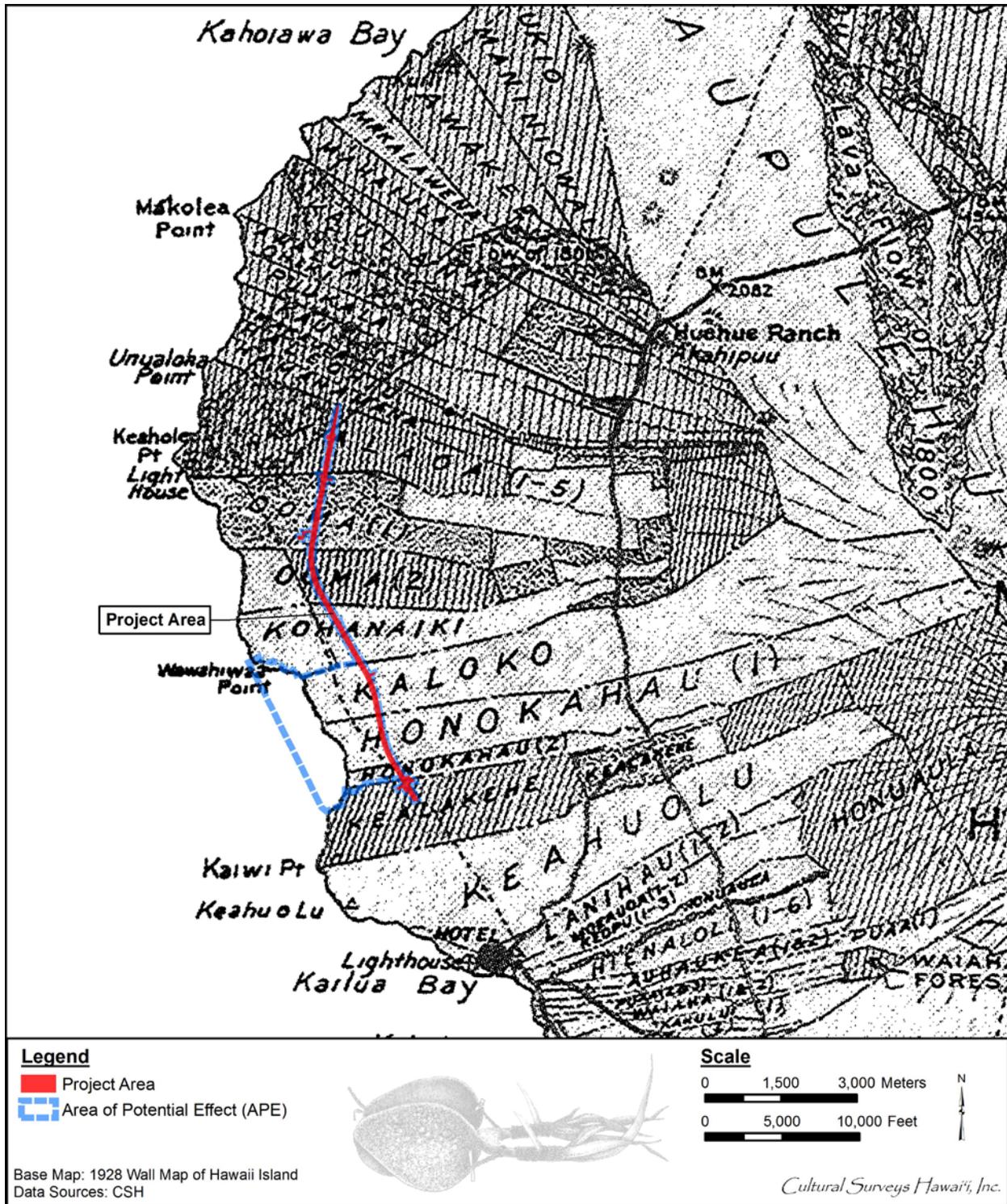


Figure 29. 1928 Hawaii Territorial Survey map of Hawaii (W.E. Wall, surveyor) depicting the approximate boundaries of the project area; note dotted Māmalahoa Trail (SIHP # -00002) adjacent to, and makai of, the highway

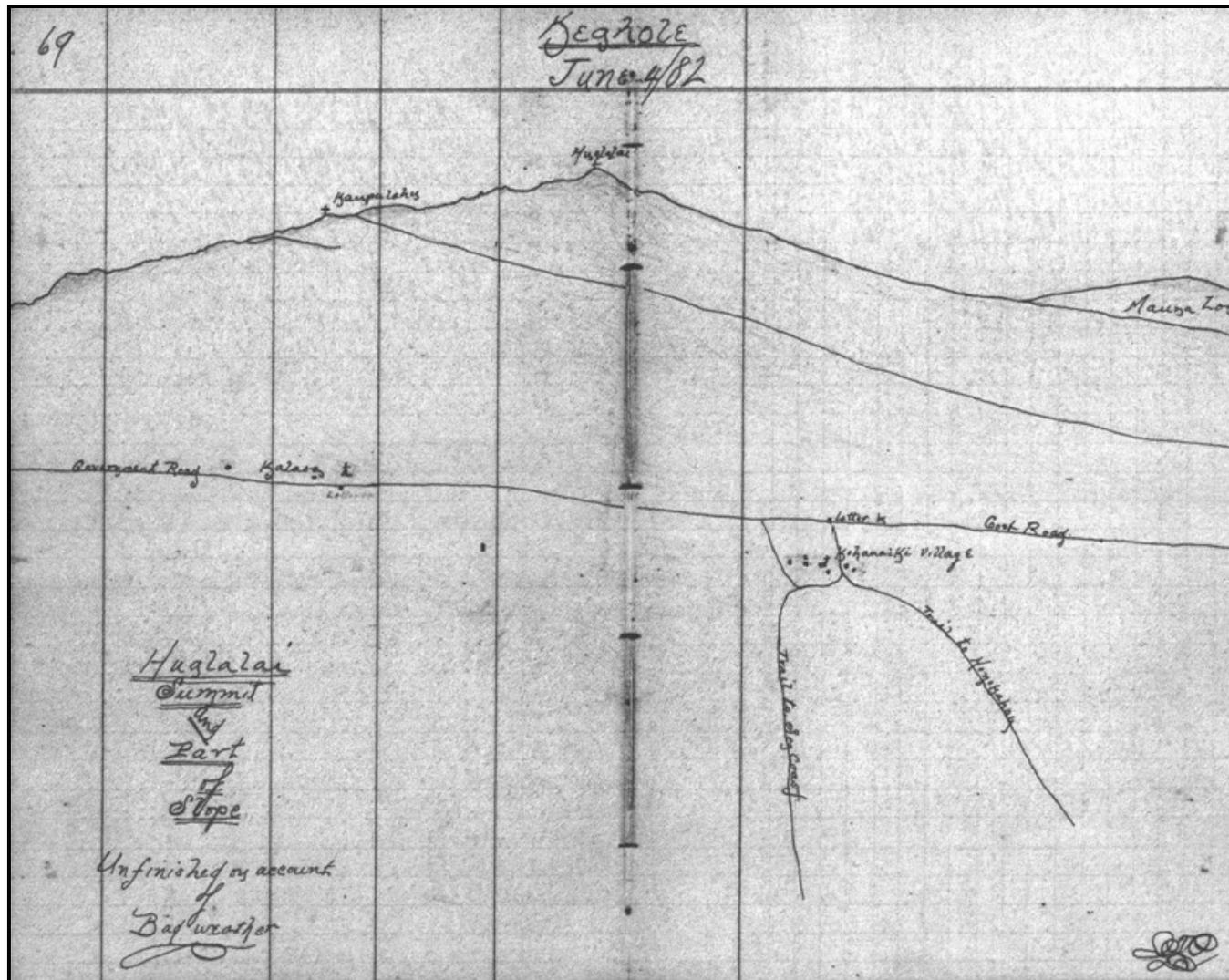


Figure 30. J.S. Emerson Field Notebook Map, Book 253:69, 1882 (Hawai'i Land Survey Division), Kona Coast, view upslope to Hualālai; note *mauka-makai* trails labeled “trail to Honokohau” and “trail to coast” (SIHP #s -18099 and -10714)



Figure 31 J.S. Emerson Field Notebook Map, Book 254:77, 1882 (Hawai'i Land Survey Division), looking *makai* from Kealakehe (left) to 'Aimakapā Fishpond at Honokōhau Ahupua'a to Kaloko Fishpond (center) and to Keāhole Point (right)

depicted between Nawahiahu and Kumuohe stations. Cordy et al. (1991) noted the following:

Emerson's next inland station was called 'Kumuohe,' at 325 elevation (Emerson 1888a:75-78; 1888b). This station was a cairn (ahu) on an 'a'a flow. A mark (+) and cairn were placed here by Emerson (Emerson 1881:75-78). Additionally, a trail, 'road,' was located just south of this station within Kaloko (Emerson 1888b). 'This irregular path is a continuation of the road, located from Na wahi ahu [the next inland station]' (Emerson 1888a:76-78). Emerson's map of the entire Kaloko-Kohanaiki area shows this road leading from the Kohanaiki Homestead, inland at 1,100-1,200 feet and within Kohanaiki ahupuaa, down to Na Wahi Ahu (Nawahiahu), and then into Kaloko by the Kumuohe station and down to Kealiihelepo's house at Kaloko Fishpond in the d13-12 area (Emerson 1888b). [Cordy et al. 1991:404]

It should be noted that a portion of the Road to the Sea trail system (SIHP # - 10714) that is not shown on the 1928 USGS map (see Figure 28) is actually present and recognizable on the ground within the project area. CSH has designated this portion as Feature A of SIHP # -10714. The only cross-*ahupua'a* trail shown on the map is the Māmalahoa Trail (SIHP # - 00002). Within the project area, this trail is *mauka* of, and adjacent to, the present Queen Ka'ahumanu Highway alignment in Kealakehe and in the southern third of Honokōhau, at which point it crosses the highway alignment in Honokōhau, continuing on the highway's *makai* side. The Māmalahoa Trail extends approximately 500 m *makai* of, and parallel to, the alignment in Kaloko, Kohanaiki, and 'O'oma. By Kalaoa, they are no longer parallel, as the highway diverges to the northeast. The relationship of these two alignments is also shown on a 1928 Hawaii Territorial Survey map (see Figure 29).

The 1928 USGS map also shows an additional *mauka-makai* trail north of the three previously mentioned running through Kalaoa 5 Ahupua'a and Ooma Homesteads (see Figure 28). This trail was identified as SIHP # -29272 during the current project's AIS. A more formal section of this trail had been identified by another firm in an adjacent project area to the west (see Rechtman and Clark 2012). At that portion of the trail, Rechtman and Clark (2012:67) identified "a cleared, widened (up to 3.7 meters) and in places cobble paved thoroughfare; low kerbing in spots; and a constructed (10.3 meters long x 3.7 meters wide bridge." Given the effort put into improving the trail, they concluded it was a primary *mauka-makai* transportation route in historic times, and the heavily worn central footpath points to its use in pre-Contact times as well.

On the 1959 USGS map (Figure 32), portions of three *mauka-makai* trails that cross the Queen Ka'ahumanu Highway alignment are shown: a trail (SIHP # -18099) from 'Aimakapā Fishpond in Honokōhau that extends *mauka* to the Māmalahoa Trail; a "jeep trail" (SIHP # -10714) that extends from Kaloko Fishpond to the *mauka* Kohanaiki settlements near the Belt Road; and a "jeep trail" (SIHP # -29272) extending from Wawāloli Beach east to the Kalaoa-Ooma Homesteads in the uplands near the Belt Road. The "jeep trail" in Kaloko refers to a *makai* portion of the current access road to Kaloko Fishpond, a bulldozed connection to Māmalahoa Trail and Huehue Ranch Road found within Kaloko-Honokōhau National Historical Park, and Huehue Ranch Road extending *mauka*.



Figure 32. 1959 Keahole and Kailua USGS topographic quadrangles, depicting the approximate boundaries of the project area; note Mamalahoa Trail (SIHP # -00002) and “jeep trail” (SIHP # -29272) crossing it at Kalaoa-Ooma Homesteads

In Kalaoa, the *mauka-makai* trail was the Alanui Kauhini, or *ka'uhini* (meaning “grasshopper”), which predated the division of the Kalaoa lands into Government Grants in 1852 (Walker and Rosendahl 1990:A-2). After World War II, a Jeep road was bulldozed from Māmalahoa Highway to Keāhole Point along the alignment of the Alanui Kauhini. This Jeep road was abandoned when access to the coastal lands became easier with the 1973 construction of the Queen Ka‘ahumanu Highway (Walker and Rosendahl 1990:A-3). Faint traces of these trails can be seen as thin white lines on a 1977 aerial photograph (Figure 33) of the Kona Coast. This photo also shows the limited development of the project area, with the improvements to the Honokōhau Small Boat Harbor, the construction of an industrial complex on the *mauka* side of the road in Honokōhau, and the development of the Keāhole Airport in Kalaoa.

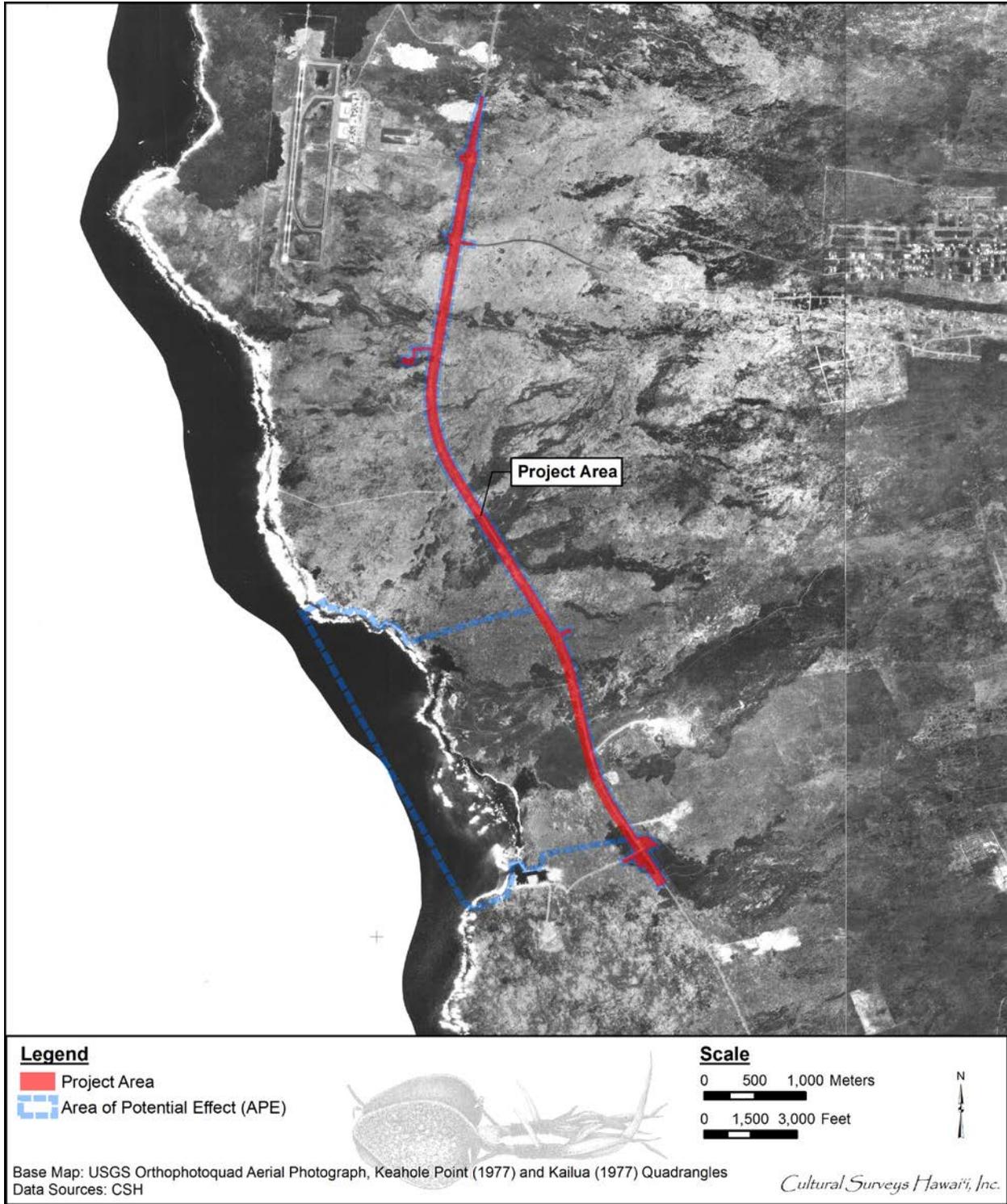


Figure 33. 1977 aerial photograph of the Keāhole Point area (USGS Orthophoto), depicting the approximate boundaries of the project area

Section 5 Previous Archaeological Research

The following is an annotated list of previous archaeological studies conducted within or adjacent to the present project area. They are presented by *ahupua'a* from Kealakehe northward to Kalaoa 1–4. Project areas shown on Figure 34 through Figure 37 are for large survey or data recovery areas, and small projects within these large areas are not labeled on this figure. The background research focused on identifying historic properties previously identified within approximately 91 m (300 ft) of both sides of the present highway (Figure 38, Table 18, and Table 19). Previous studies associated with the current project (i.e., Monahan et al. 2012a, Wilkinson et al. 2017) are depicted on Figure 37 but are not discussed further, as they were already described in detail in Section 2.

5.1 Kealakehe

Summaries of projects adjacent to the Queen Ka'ahumanu Highway are discussed below. Table 20 presents a representative sample of previous archaeological projects conducted in Kealakehe.

5.1.1 Reinecke 1930

In 1930, John Reinecke conducted a survey of Hawaiian sites along the Kona coast. Reinecke (1930) noted the presence of numerous habitation platforms and petroglyphs. Emory (1970:37) indicated Reinecke's Sites 25 through 31 are in Kealakehe, including the Kealakehe settlement ruins, and consist of "13 house platforms, 11 burials, two corrals, one pen, and two *heiau*, Heiau-o-Kāne and Heiau Maka'opio."

5.1.2 Sinoto 1977

This reconnaissance survey was conducted on the eastern, or *mauka*, side of the highway. Four historic properties were identified, only one of which (SIHP # 50-10-27-5011) was within 300 ft of Queen Ka'ahumanu Highway. SIHP # -5011 comprises the *mauka-makai* oriented Kealakehe/Keauhuolū boundary wall, south of the current project area.

5.1.3 Sinoto 1983

This reconnaissance survey of roughly 7 acres is also on the eastern side of the highway. No historic properties were identified. The project areas of the two Sinoto reports (1977 [see above] and 1983) were subsequently subjected to inventory level survey (Donham 1990b; see below for details).

5.1.4 Bonk 1987

This report concerns a walk-through survey over the width of the *ahupua'a*, between the coast and roughly 640 ft AMSL. One historic property, the Māmalahoa Trail (SIHP # -00002), was identified in close proximity to the highway, and another trail, a stepping stone trail previously identified by Soehren (1975; see Honokōhau section below), was mentioned as being just *mauka* of the highway near the northern boundary of the *ahupua'a*.

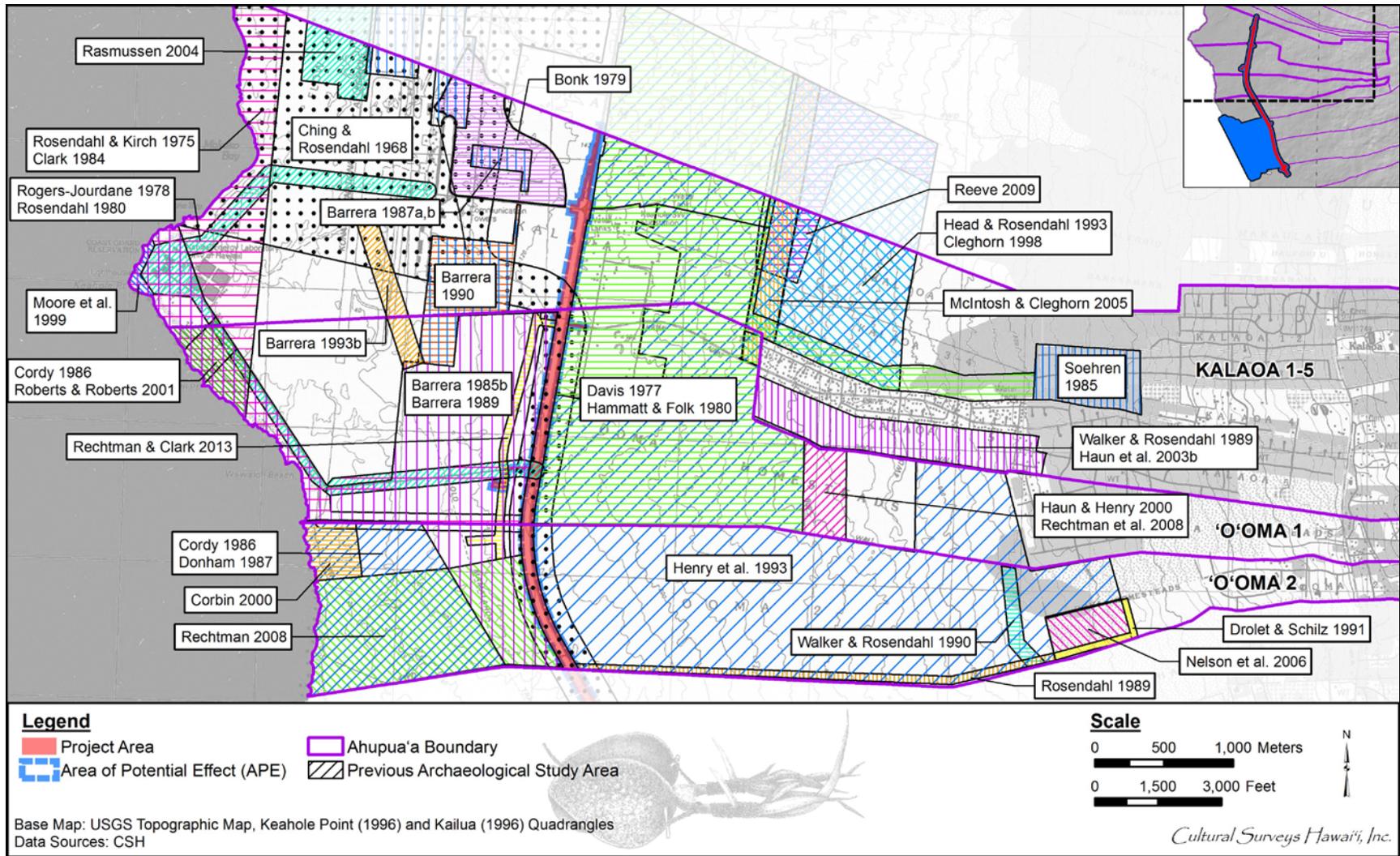


Figure 34. Selected previous archaeological studies in Kalaoa and 'O'oma Ahupua'a (base map: 1996 Keahole Point and Kailua USGS topographic quadrangles)

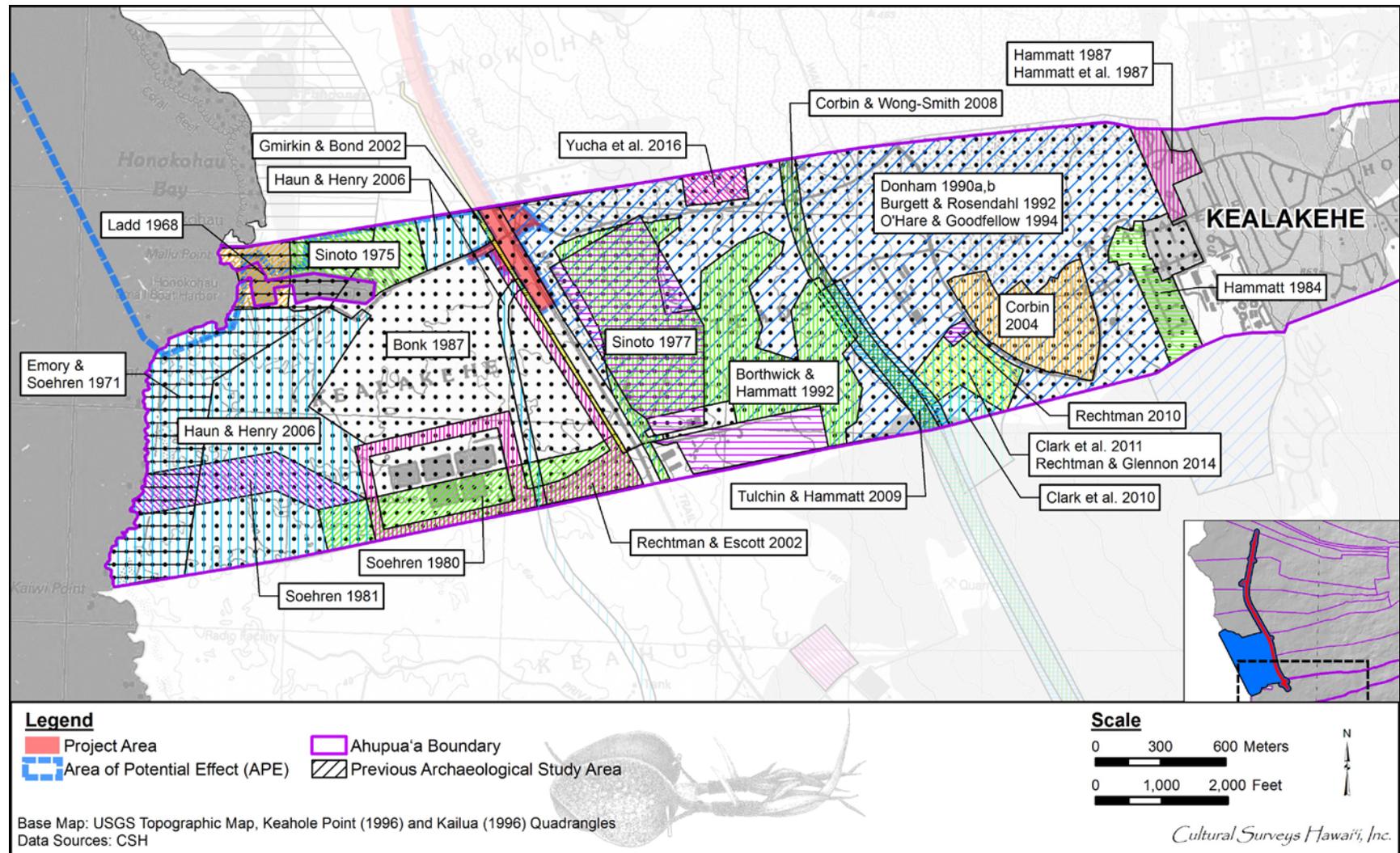


Figure 36. Selected previous archaeological studies in Kealakehe Ahupua‘a (base map: 1996 Keahole Point and Kailua USGS topographic quadrangles)

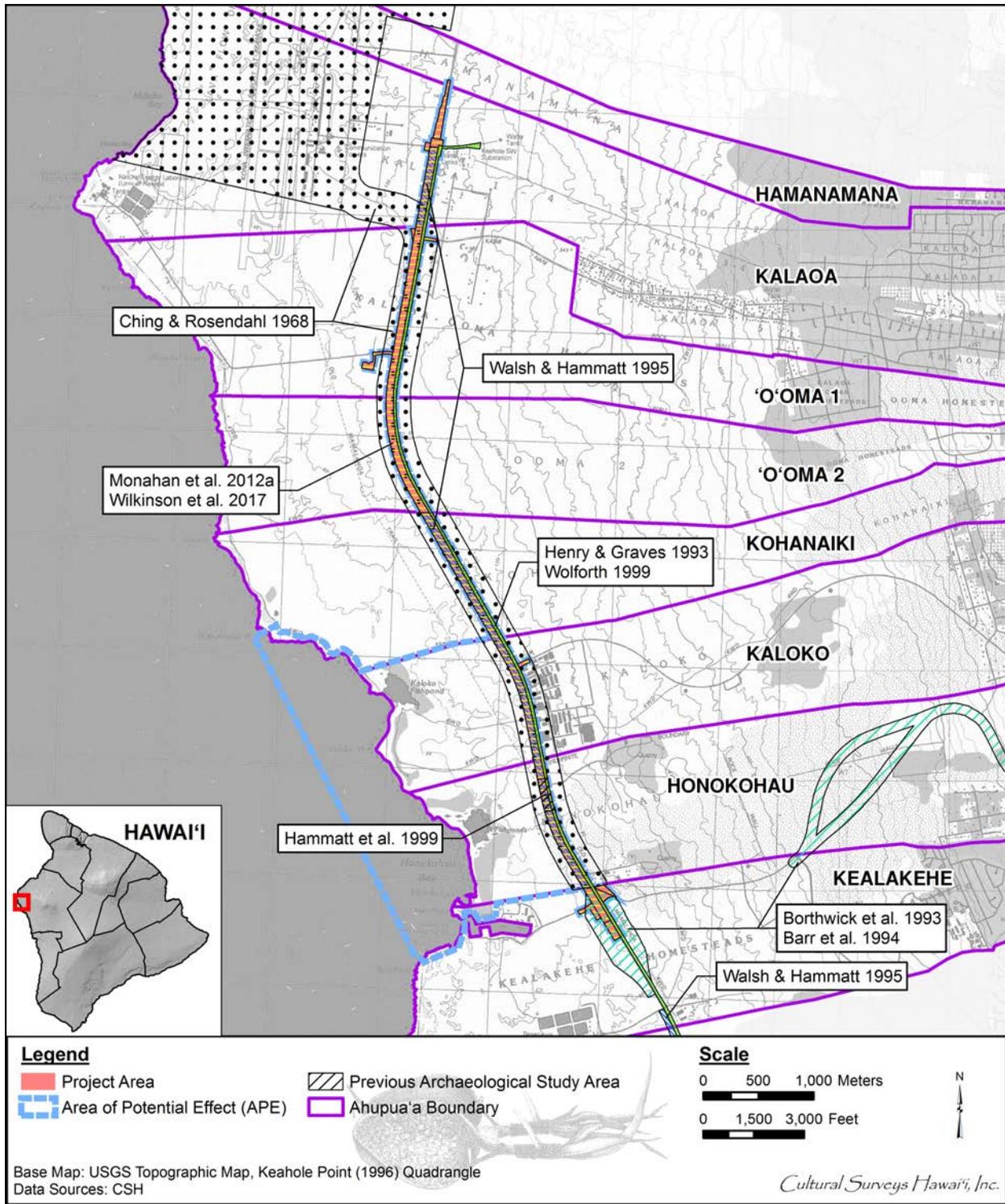


Figure 37. Selected previous archaeological studies along the Queen Ka'ahumanu Highway (base map: 1996 Keahole Point USGS topographic quadrangle)

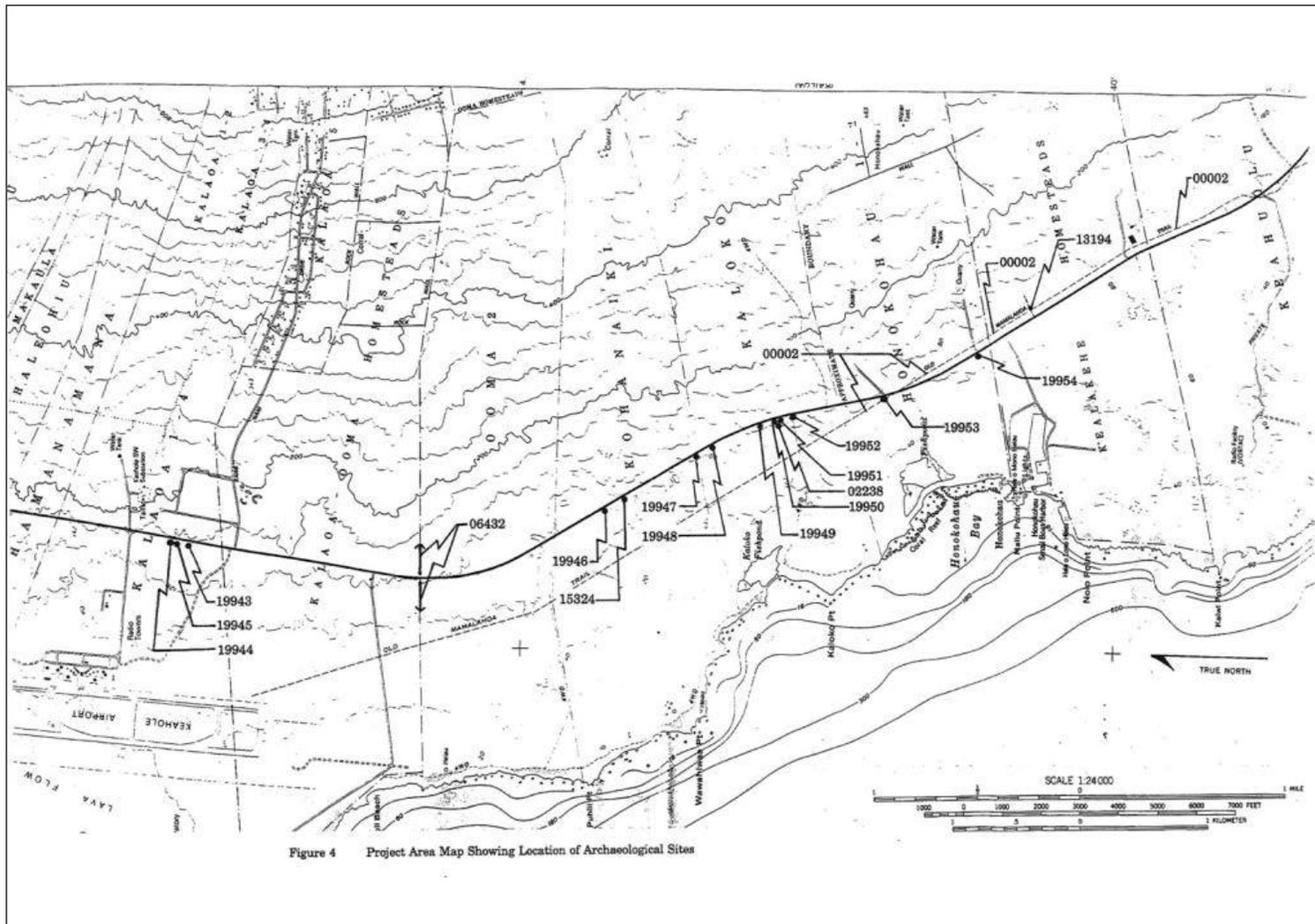


Figure 4 Project Area Map Showing Location of Archaeological Sites

Figure 38. Identified historic properties from Keahuolu to Kalaoa within 300 ft of the Queen Ka‘ahumanu Highway ROW (figure from Walsh and Hammatt 1995)

Table 18. Previously identified historic properties within 300 ft of the Queen Ka'ahumanu Highway (listed by *ahupua'a* from south to north)

SIHP # 50-10-27	Site Type	<i>Ahupua'a</i>	Level	References	Mitigation	Status
-00002*	Māmalahoa Trail	Kealakehe, Honokōhau, Kalaoa	S, AIS	Bonk 1987 and various others	FDC, PID, P, I	M, P, K
-5011	Boundary wall	Kealakehe, Keahuolu	AIS	Sinoto 1977; Donham 1990b	NFW	M
-13194	Trail	Kealakehe	AIS, DR	Donham 1990b+	P, I	P
-13195	<i>Ahu</i>	Kealakehe	AIS	Burgett and Rosendahl 1991	NFW	M
-18081	Petroglyphs	Honokōhau	AIS	Robins et al. 2000	P	K
-18083	Modified outcrop	Honokōhau	AIS	Robins et al. 2000	DR	K
-18084	Rock shelter	Honokōhau	AIS	Robins et al. 2000	DR	K
-18085	Lava tube	Honokōhau	AIS	Robins et al. 2000	DR	K
-18086	Pāhoehoe basin	Honokōhau	AIS	Robins et al. 2000	NFR	K
-18091	Petroglyph	Honokōhau	AIS	Robins et al. 2000	NFR	K
-18099*	Trail	Honokōhau	AIS	Nelson and Gmirkin 2001; Gmirkin and Bond 2002	—	—
-18186	Wall segment	Honokōhau	AIS	Robins et al. 2000	NFR	K
-19953*	Trail	Honokōhau	DR	Hammatt et al. 1999	NFW	P
-22418	Trail	Honokōhau	AIS	Nelson and Gmirkin 2001; Gmirkin and Bond 2002	—	—
-22507*	Trail	Honokōhau	AIS	Nelson and Gmirkin 2001; Gmirkin and Bond 2002	—	—
-02199	Trail	Kaloko	S	Cordy et al. 1991	None	K
BPM 90	Trail	Kaloko	S	Cordy et al. 1991	None	K

SIHP # 50-10-27	Site Type	Ahupua'a	Level	References	Mitigation	Status
-02238	Wall with midden	Kaloko	S	Cordy et al. 1991	None	K
-02233	Trail	Kaloko	S	Cordy et al. 1991	None	K
-02240	Trail	Kaloko	S	Cordy et al. 1991	None	K
-06432	Boundary wall	Kalaoa, 'O'oma	S	Davis 1977	None	K
-10154*	Habitation structure	'O'oma 2	R, DR	Barrera 1985b, 1989	Additional recording only	M
-18524	Pāhoehoe excavation	Kalaoa	R	Henry et al. 1993	FDC	K

Table 19. Abbreviations for Table 18

Abbreviation	Definition
+	Indicates associated addendum reports or revision letters
AIS	Archaeological inventory survey
DR	Data recovery
S	Survey (conducted prior to establishment of current AIS standards)
NFW	No further work
NFR	No further research
FDC	Further data collection
PID	Preservation with interpretive development
PI	Preservation with interpretation
P	Preserved—included in a preservation plan
M	Mitigated—historic property adequately recorded
K	Known—historic property has been identified, but findings and recommended treatment have not been made and/or have not yet been approved by SHPD
*	Historic property included in the current project's AIS (Monahan et al. 2012a)

Table 20. Selected previous archaeological studies in Kealakehe Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Stokes and Dye 1991	Island of Hawai'i	Survey	Identified two <i>heiau</i> , Kawaluna Heiau and Palihilo Heiau, and two <i>ko'a</i> (fishing shrines), Halepa'u Ko'a and Maka'eo Ko'a
Reinecke 1930	West Hawai'i	Survey	Identified seven historic properties: Sites 24 through 35, including house platforms, small complexes encompassing enclosures and platforms, petroglyphs, and a possible fishing <i>heiau</i>
Sekido 1968	A shelter cave Kealakehe D11-1a	Archaeological excavation report (Anthropology 371 UH Hilo paper).	Description of shelter cave
Emory and Soehren 1971	Ka'ū and Kona Districts and 'Anaeho'omalu	Inventory of sites	Confirmed many of Reinecke's (1930) sites, found 27 historic properties in Kealakehe, four in current project area, two <i>heiau</i> , one <i>ko'a</i> , and a cluster of petroglyphs
Sinoto 1975a	A proposed access road corridor at Keahuolū	Archaeological reconnaissance survey	Identified seven historic properties, comprising walls and enclosures
Sinoto 1975b	Honokōhau Small Boat Harbor, Kealakehe	Archaeological reconnaissance survey	Documented no new historic properties but discussed three previously identified
Sinoto 1977	<i>Mauka</i> of hwy	Archaeological Reconnaissance Survey	One historic property within project area
Soehren 1980	Kealakehe Wastewater Site, <i>makai</i> of Queen Ka'ahumanu Hwy, TMK: [3] 7-4-008:003	Archaeological reconnaissance survey	Documented trail (SIHP # -7704), which connected Ainapapa Pond in Honokōhau with a settlement at Pawai Bay in Keahuolū
Soehren 1981	Kealakehe, TMK: [3] 3-7	Archaeological reconnaissance survey	Three previously recorded sites (SIHP #s -1888 through -1890) confirmed

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Sinoto 1983	Kona Public Safety Bldg	Field inspection	No historic properties identified
Hammatt 1984	Kealakehe House lots, TMK: [3] 7-4-008:017	Archaeological reconnaissance survey	No historic properties identified
Schilt 1984	Kuakini Hwy Realignment project, 26 <i>ahupua'a</i> in Kona	Archaeological study	134 historic properties identified in the road corridor; two, a cairn and a modified outcrop, identified in Keahuolū
Bonk 1987	Lower Kealakehe	Archaeological walk-through survey	Noted historic properties in a 1,000-ft wide coastal strip and between 620 ft and 730 ft elevation
Hammatt 1987	15-acre parcel at Kealakehe, TMK: [3] 7-4-017:030, at 700 ft elevation	Archaeological reconnaissance survey	Identified 18 historic properties, including mounds, terraces, overhang shelters, agricultural complexes, and cattle walls
Hammatt et al. 1987	15-acre parcel at Kealakehe, TMK: [3] 7-4-017:030, at 700 ft elevation	Archaeological inventory survey and data recovery	Excavations at 17 historic properties previously identified by Hammatt 1987
Walker and Haun 1987	Kealakehe Reservoir, TMK: [3] 7-4-009:072	Archaeological reconnaissance survey	Recorded one agricultural/habitation complex at an elevation of 900 ft
Donham 1990a, b	Kealakehe Planned Community, TMKs: [3] 7-4-008:012, 017	Archaeological inventory survey	82 historic properties recorded, mainly agricultural and temporary habitation, but also burial features and ranching features
Borthwick and Hammatt 1992	Proposed Kealakehe Golf Center, TMK: [3] 7-1-008:017 (por.)	Archaeological field inspection and interim preservation plan	Identified two additional historic properties (SIHP #s -15537, a cave, and -15538, a terrace)
Borthwick et al. 1993	Proposed Kealakehe Parkway Extension	Archaeological reconnaissance survey	43 newly identified historic properties; preliminary assessments of significance and future treatment made

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Burgett and Rosendahl 1992	Kealakehe Planned Community, TMKs: [3] 7-4-008:012 and 017, <i>mauka</i> of Queen Ka'ahumanu Hwy	Archaeological inventory survey	44 new historic properties with 225 features identified in Donham (1990 a, b) area; 103 new features at previously identified historic properties; most common features modified outcrops, rock mounds, terraces, and 'a'ā excavations
Thompson and Rosendahl 1992a, b	Keāhole Transmission Lines	Archaeological inventory survey (recorded as an archaeological assessment)	Confirmed previously identified historic properties
Barr et al. 1994	Kealakehe Parkway Extension, TMKs: [3] 7-4-008:003, 005, 017, and 034	Archaeological inventory survey	83 historic properties identified; 50 previously recorded; included traditional Hawaiian habitation, huistoric ranching, and Japanese homesteading
Borthwick et al. 1994	Kealakehe Parkway Extension, TMK: [3] 7-4-008:005	Archaeological inventory survey	Additional information for Barr et al. 1994
O'Hare and Goodfellow 1994	Kealakehe Planned Community, TMKs: [3] 7-4-008:012 and 017	Data recovery	Data recovery at selected historic properties previously identified by Donham 1990a, b and Burgett and Rosendahl 1991
Walsh and Hammatt 1995	New Queen Ka'ahumanu ROW	Archaeological inventory survey	Seventeen historic properties identified, with one (Māmalahoa Trail, SIHP # -00002) recorded in Keahuolū Ahupua'a
Wolforth 1999	Māmalahoa Trail, TMKs: [3] 7-3-009, 019, 049, and 051; 7-4-008	Archaeological monitoring	Monitoring to prevent historic property destruction
Haun and Henry 2001	Kealakehe DHHL, TMK: [3] 7-4-008:003, 200 acres	Archaeological inventory survey	Recorded 123 features at 56 historic properties, including two trails, SIHP # -13194, and one recorded by Borthwick et al. (1994a)

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rechtman et al. 2001	Kealakehe, TMK: [3] 7-4-003:007, 21.81 acres	Archaeological inventory survey	Identified six historic properties, comprising four historic walls and two traditional Hawaiian agricultural complexes (SIHP #s 50-10-28-22429, 22430, -22431, -22432, -22433, and -22434)
Rechtman and Dougherty 2002	Kealakehe, TMK: [3] 7-4-03:005, 16 acres	Archaeological reconnaissance survey	One historic property with 79 features identified, historic residence complex (SIHP # 50-10-28-23274)
Rechtman and Escott 2002	Kealakehe Water Treatment, TMK: [3] 7-4-008:003	Archaeological inventory survey	<i>Makai</i> edge of Queen Ka'ahumanu Hwy; recorded five features, including three trail segments
Corbin 2004	Villages of La'i'ōpua Village 4 project, TMK: [3] 7-4-021:012	Data recovery and associated letter report	Data recovery at SIHP # 50-10-28-13209 deemed it a temporary, rather than permanent, habitation
Haun and Henry 2006	Kona Kai Ola project, Kealakehe and Keahuolū Ahupua'a, 370.5 acres	Archaeological inventory survey	127 historic properties comprising 432 features; most common feature type (n=170) was <i>pāhoehoe</i> excavation
Corbin and Wong-Smith 2008	Ane Keohokālole Hwy Corridor, Kealakehe and Keahuolū Ahupua'a	Archaeological survey and cultural impact assessment	Nine previously identified historic properties reidentified; a new feature of a previously identified historic property (SIHP # -6302, Kuakini Wall) also identified
Tulchin and Hammatt 2009	2.3-km long portion of proposed Ane Keohokālole Hwy	Archaeological inventory survey	Identified 12 historic properties, including a wall, lava tubes and blisters, burial caves, terraces, and a trail
Clark et al. 2010	TMKs: [3] 7-4-021:003 and 023	Archaeological inventory survey	Seven historic properties identified within Kealakehe Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rechtman 2010	TMK: [3] 7-4-21:002	Archaeological inventory survey (recorded as an archaeological assessment)	No significant historic properties identified
Rechtman and Glennon 2014	La'i'ōpua 2020 West Hawai'i Community Health Center	Archaeological monitoring	No new historic properties identified
Clark et al. 2011	TMK: [3] 7-4-021:003	Data recovery	Data recovery at SIHP # -13207 (habitation site) suggests it was inhabited on a temporary recurrent or seasonal basis during the late 17th and early 18th centuries
Yucha et al. 2016	Kona Judiciary Complex Candidate Sites C and F, Kealakehe and Keahuolū Ahupua'a	Archaeological inventory survey	Identified ten historic properties, seven newly identified; these included cairns, modified outcrops, excavated pits, and a terrace

5.1.5 Donham 1990a, 1990b

In 1990, Paul H. Rosendahl, Inc. (PHRI) completed an AIS for the Kealakehe Planned Community (Donham 1990b). The approximately 950-acre study area consisted of lands *mauka* of the Queen Ka'ahumanu Highway, including the Kealakehe portion of the current survey area. A total of 840 features were located within the study area. The most common feature types were rock mounds and *pāhoehoe* excavations. Other common features included modified outcrops, terraces, enclosures, and low mounded walls. The author noted the predominance of such features indicates "relatively intensive use of the area for agricultural purposes" (Donham 1990b:ii).

5.1.6 Burgett and Rosendahl 1992

This addendum report (for Donham 1990a, b) documents the inventory survey of an approximately 950-acre project area situated on the east side of the highway. Four historic properties were identified within roughly 91 m (300 ft) of the highway, including the Māmalahoa Trail (SIHP # -00002), a stepping stone trail (SIHP # -13194), several *ahu* (altar; SIHP # -13195), and the *ahupua'a* boundary wall (SIHP # -5011). The stepping stone trail (SIHP # -13253) identified by Soehren (1975) and mentioned again by Bonk (1987) is identified in this survey as being roughly 122 m (400 ft) from the highway, and thus is considered to be outside the present project area.

5.1.7 Borthwick and Hammatt 1992b

This project area lies within the Kealakehe Planned Community project area previously surveyed (see O'Hare and Goodfellow 1994 above), in an area planned for a golf course. No newly identified historic properties were located within 91 m (300 ft) of the highway. Recommended treatment for the three previously identified historic properties (SIHP #s -00002, -13194, and -13195) was the same as cited above.

5.1.8 Borthwick et al. 1993

CSH performed an archaeological reconnaissance survey for the proposed Kealakehe Parkway extension. Forty-three new historic properties were identified. They included habitation sites, burials, lava tubes, and possible *heiau*. Preliminary assessments of significance and future treatment were made.

5.1.9 Barr et al. 1994

A reconnaissance and inventory level survey was conducted of two parcels, one of which is an interchange area of the highway that includes 46 m (150 ft) on either side of an approximately 762-m (2,500-ft) section of the highway. This project area adjoins and partially overlaps with the Kealakehe Planned Community project area previously surveyed (see O'Hare and Goodfellow 1994 and Borthwick and Hammatt 1992b above). The three historic properties identified in prior surveys (SIHP #s -00002, -13194, and -13195) were reidentified in this survey, but no additional historic properties were found within 91 m (300 ft) of the highway; this included virtually the entire length of the highway through Kealakehe, except for a roughly 700-ft section on the *makai* side of the Queen Ka'ahumanu Highway at the southern end of the *ahupua'a*.

5.1.10 O'Hare and Goodfellow 1994

This report is on the data recovery work undertaken within the Kealakehe Planned Community project area. This report includes any final data collection on SIHP #s -00002 (Māmalahoa Trail) and -13194 (stepping stone trail).

5.1.11 Summary of Previous Archaeological Studies in Kealakehe Ahupua'a

The highway extends approximately 1,494 m (4,900 ft) through Kealakehe. The entire *mauka* side of the highway has been subjected to inventory survey and/or data recovery work. Four historic properties have been identified within 91 m (300 ft) of the present highway at Kealakehe. Two, SIHP #s -13195 (*ahu*) and -5011 (wall), have been subjected to data recovery and/or inventory level work, and no further work was recommended (Donham 1990b); two, SIHP #s -00002 (Māmalahoa Trail) and -13194 (stepping stone trail), have been included in preservation plans approved by SHPD.

5.2 Honokōhau

Summaries of projects adjacent to the Queen Ka'ahumanu Highway or pertinent to the current project are discussed below. Table 21 presents a representative sample of previous archaeological projects conducted in Honokōhau.

5.2.1 Cluff 1971

Cluff (1971) conducted a surface survey of the *ahupua'a* west of the highway to the coast. No historic properties were identified within 91 m (300 ft) of the highway.

5.2.2 Soehren 1975, 1976

These reports describe two reconnaissance surveys conducted on adjoining parcels situated within TMK: [3] 7-4-008:026 (por.) on the east side of the highway, along the southern end of the *ahupua'a*. Two historic properties were identified within roughly 91 m (300 ft) of the highway, the Māmalahoa Trail (SIHP # -00002) and a stepping stone trail (SIHP # -13253, also mentioned by Bonk [1987] in his walk-through survey of Kealakehe, as this trail extends into that *ahupua'a*). The northernmost of these two parcels was subsequently included in the inventory survey by Robins et al. (2000; see below).

5.2.3 Jensen and Goodfellow 1993

In 1993, PHRI completed data recovery for the Honokōhau Industrial Park. Research objectives consisted of the following (Jensen and Goodfellow 1993:9–10):

1. Further evaluating the age, duration, and intensity of occupation at individual historic properties and features;
2. Further evaluating and characterizing individual historic properties and features for portable artifact content and assemblages;
3. Further evaluating and characterizing individual historic properties and features for ecofactual content;

Table 21. Selected previous archaeological studies in Honokōhau Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Stokes and Dye 1991	Island of Hawai'i	Survey	Identified two <i>heiau</i> , Kawaluna Heiau and Palihiolo Heiau, and two <i>ko'a</i> , Halepa'u Ko'a and Maka'eo Ko'a
Reinecke 1930	West Hawaii	Survey	Sites 38 through 42 are within Honokōhau I and II, including Pu'uoina Heiau, Makaopi'o Heiau, and a <i>hōlua</i> (slide)
Ching and Rosendahl 1968	Kailua-Kawaihae Rd (Honokōhau-Keāhole Point) and Keāhole Airport	Archaeological surface survey	Two historic properties recorded in the Honokōhau portion; a terrace and a platform and trail
Ladd 1968	Lanihau Corporation Lands, TMK: [3] 7-4-008:010	Data recovery	Excavation at historic properties identified by Emory and Soehren 1971
Cluff 1971	Seaward portion of Honokōhau 1 and 2, TMKs: [3] 7-4-008:010, 025	Archaeological reconnaissance survey	Recorded 61 historic properties, many clustered around 'Aimakapā Fishpond
Emory and Soehren 1971	Honokōhau Area, TMK: [3] 7-3, 7-4	Archaeological reconnaissance survey	Recorded 27 historic properties, including traditional Hawaiian habitation complexes, especially around 'Aimakapā Fishpond at the coast
Sinoto 1975c	Honokōhau 2 Quarry, TMK: [3] 7-4-005	Archaeological reconnaissance survey	Identified 19 historic properties, including portions of a foot trail, the Māmalahoa Trail (SIHP # -00002), and several platforms thought to be burials
Soehren 1975, 1976	Honokōhau 2, TMK: [3] 7-4-008:026 (por.)	Archaeological reconnaissance surveys	Recorded three historic properties: the Māmalahoa trail (SIHP # -00002), a mound, and a stone wall
Rosendahl 1987a	Honokōhau Industrial Park, TMK: [3] 7-4-008:033	Archaeological reconnaissance survey	Recorded two historic properties: a terrace complex (SIHP # -10642) and a single terrace (SIHP # -10643)
Donham 1990c	Honokōhau Industrial Park, TMKs: [3] 7-4-008:026, 049	Archaeological inventory survey	<i>Mauka</i> of the Queen Ka'ahumanu Hwy; six historic properties identified, mainly agricultural and temporary habitation

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Johnson and Somers 1991	Kaloko-Honokōhau Park, TMKs: [3] 7-3; 7-4	Data recovery	Pu'uoina Heiau stabilization
Rosendahl and Walker 1991	Honokōhau Industrial Park, TMKs: [3] 7-4-008:026, 049	Archaeological inventory survey	Identified a trail with two cairns
Fager and Rosendahl 1992	Honokōhau Industrial Park, TMK: [3] 7-3-051:001	Data recovery	Data recovery work for Rosendahl and Walker 1991
Thompson and Rosendahl 1992a, b	Keāhole Transmission Lines	Archaeological inventory survey (recorded as an archaeological assessment)	Confirmed previously identified historic properties
Jensen and Goodfellow 1993	Honokōhau Industrial Park, TMKs: [3] 7-4-008:026, 049	Data recovery	Excavations carried out at 36 historic properties previously identified during Donham 1990c project
Robins et al. 1993	Honokōhau 2, TMK: [3] 7-4-008:034, 82 acres	Archaeological inventory survey	Identified 39 historic properties, mainly dryland agricultural features, temporary habitations, and ranching features
Walsh and Hammatt 1995	Queen Ka'ahumanu Hwy	Archaeological inventory survey	Identified 17 historic properties
Hammatt et al. 1999	Honokōhau, TMKs: [3] 7-3, 7-4, 13 acres, 800-ft elevation area	Data recovery	Historic materials, including a Spanish and a Russian coin, recovered from one rock shelter (SIHP # -18343); indigenous artifacts, including a <i>poi</i> pounder, found at a second rock shelter (SIHP # -18345)
Wolforth 1999	Māmalahoa Trail, TMKs: [3] 7-3-009:019, 049, and 051; 7-4-008	Archaeological monitoring	Monitoring of Māmalahoa Trail (SIHP # -00002)
Rechtman 2000	Honokōhau 2, TMK: [3] 7-4-008:064	Data recovery	Data recovery at a permanent habitation site (SIHP # -18326) and a habitation platform (SIHP # -18327), first identified during the Robins et al. 1993 study

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Robins et al. 2000	Honokōhau 1 and 2, TMKs: [3] 7-4-008:005, 013, 030, and 036, 803 acres	Archaeological inventory survey	Identified 284 historic properties, mainly features for dryland agriculture and temporary habitation; a refuge cave and a <i>heiau</i> also identified
Hammatt et al. 2001	Honokōhau 2, TMK: [3] 7-4-008:034, 9.9 acres	Data recovery	Data recovery at historic properties identified in Robins et al. 1993
Nelson and Gmirkin 2001	Area fronting (<i>mauka</i> side) the National Park	Archaeological inventory survey	In current project area: SIHP #s -21245, -22417, -22418, -18099 and -22507
Gmirkin and Bond 2002	Area fronting (<i>mauka</i> side) the National Park	Addendum to archaeological inventory survey	In current project area: SIHP #s -21245, -22417, -22418, -18099 and -22507
Tuggle 2004	337 acre-parcel, extending inland from Queen Ka'ahumanu Hwy, TMKs: [3] 7-4-009:103, 030	Archaeological data recovery	Data recovery at historic properties first recorded by Robins et al. 2000
Haun and Henry 2005	Honokōhau 1, TMK: [3] 7-4-008:47, 277 acres	Archaeological inventory survey	Identified 167 historic properties with 7,894 component features; 31 historic properties previously identified by Barr et al. 1994, mainly agricultural and temporary habitation
Yucha and McDermott 2008	Keohokālolo Hwy (Henry St Extension), Kaloko and Honokōhau Ahupua'a	Archaeological inventory survey	Identified 33 historic properties comprising 179 features
Tulchin and McDermott 2009	Keohokālolo Hwy (Henry St Extension), Kaloko and Honokōhau Ahupua'a	Addendum archaeological inventory survey	One historic property, SIHP # -18115), historic cattle walls

4. Refining existing assessments, thus far based on inventory-level survey data, of the variety of cultural activities conducted at various historic properties during different pre-Contact time periods;
5. Further evaluating existing interpretations of specific architectural features and presumed associated activities.

Jensen and Goodfellow's (1993:40) investigations confirmed the study area "represented a pattern of recurrent/temporary use of small subsurface and surface habitation features, with subsistence focused on the exploitation of locally available marine resources and limited agriculture." Radiocarbon analysis indicated the area was occupied from as early as AD 980 and continued uninterrupted into the early twentieth century. Artifacts observed during excavations consisted of bone fishhooks and awls, lithic debitage, and coral and basalt abraders. The artifact assemblage indicated a broad range of pre-Contact activities were conducted within the study areas; these activities include fishing gear manufacture, stone tool manufacture, food processing, and domestic activity. Ecofactual analysis of midden indicated the primary source for resources was the ocean.

5.2.4 Robins et al. 2000

This project area is situated on the east side of the highway, between the two parcels surveyed by Soehren (1975, 1976; see above) and the northern *ahupua'a* boundary. Eight historic properties were identified within roughly 91 m (300 ft) of the highway. From south to north, these include SIHP #s -18085, -18086, -18091, -18084, -18186, -18083, -18081, and -00002. Recommended treatment included preservation of SIHP #s -00002 (Māmalahoa Trail) and -18081 (petroglyphs); data recovery for SIHP #s -18083 (modified outcrop), -18084 (rock shelter), and -18085 (lava tube); and no further work for SIHP #s -18086 (pahoe-hoe basin), -18186 (wall segment), and -18091 (historic-era petroglyph).

5.2.5 National Park Service 1975

This document is a report on the cultural and historical resources within Kaloko-Honokōhau National Historical Park. One historic property, SIHP # -00002 (the Māmalahoa Trail), is within 91 m (300 ft) of the highway. The present highway crosses the Māmalahoa Trail in Honokōhau, and therefore the trail is present on both sides of the highway.

Information on additional historic properties located within 91 m (300 ft) of the highway was provided by NPS archaeologist Laura Schuster. In addition to the Māmalahoa Trail, archaeological surveys conducted by NPS archaeologists have identified two *mauka-makai* trails near the highway. Within the park (but not necessarily within the present project area), human burials have been found beneath accretion boulders within the 'a'ā lava flows. The accretion boulders are formed "when a fragment of solidified lava . . . is rolled along and wrapped up in the viscous liquid and range in size up to 10 feet" (MacDonald and Abbott 1970:25–26). These burials had no associated archaeological surface features.

5.2.6 Johnson and Somers 1991

This project included maintenance work at two historic properties within Kaloko-Honokōhau National Historical Park and at the Māmalahoa Trail (SIHP # -00002). A portion of the trail was cleared and restored, but this portion does not lie within 91 m (300 ft) of the highway.

5.2.7 Hammatt et al. 1999

In 1999, CSH completed data recovery for portions of the Māmalahoa Trail (SIHP # -00002) and an intersecting unnamed *mauka-makai* trail, SIHP # -19953, in the *ahupua'a* of Honokōhau 2. The goal of the data recovery was to gather information from the portions of the two trails that would be destroyed by highway widening. The research focused on recording additional information on the two trails through archival quality photographs and test excavations to expose trail cross-sections to document trail construction techniques.

Trail construction at the Māmalahoa Trail involved either the filling or removal of 'a'ā pebbles and cobbles relative to surface topography; low areas were filled and high areas involved removal. Trail construction at SIHP # -19953 involved placing 'a'ā slab boulders atop clinker 'a'ā, with 'a'ā cobbles filling gaps, thus creating a stepping stone trail across an otherwise difficult terrain. SIHP #s -00002 and -19953 are also addressed in the current data recovery report (see Volume III).

5.2.8 Rechtman 2000

In 2000, PHRI completed data recovery at two permanent habitation sites (SIHP # -18326, platforms and terrace, and SIHP # -18327, a platform) in the *ahupua'a* of Honokōhau 2. Six radiocarbon dates were obtained from charcoal samples collected during excavation, with three samples from each historic property. Samples from both historic properties indicated they were occupied by the mid-1400s. Due to similar construction styles and the relative distance between individual features, it was suggested that SIHP #s -18326 and -18327 composed a single permanent habitation complex (Rechtman 2000:23). Additionally, the limited midden diversity and lack of a developed cultural deposit indicated they were occupied for a relatively short duration, likely for a single generation (Rechtman 2000:22).

5.2.9 Hammatt et al. 2001

In 1999, CSH completed data recovery for an approximately 13-acre parcel in the *ahupua'a* of Honokōhau 2. Data recovery was conducted at two permanent habitation sites (SIHP # -18340, an enclosure and terrace, and SIHP # -18349, an enclosure). Research objectives consisted of the following (Hammatt et al. 1999:6):

1. To confirm or disprove the existence of specific activity areas within selected permanent habitation sites;
2. To obtain chronological data (e.g., radiocarbon dates, temporally distinct artifacts) to build a chronology of occupation of permanent habitation sites.

Excavations at SIHP # -18340 yielded both pre- and post-Contact artifacts. Pre-Contact artifacts included abraders, volcanic glass flakes, a hammerstone, a grindstone fragment, and a basalt adze. Post-Contact artifacts included a 1782 Spanish reale, an 1858 Russian kopek, buttons, beads, and equestrian materials. Distribution maps, utilizing point plotting of artifact proveniences, were created in order to identify specific activity areas within the excavated feature. Identified pre-Contact activity areas consisted of a refuse area, a storage area, and a tool manufacture area. A post-Contact writing area was also identified, based on a concentration of slate pencils. Charcoal samples collected from SIHP # -18340 yielded a radiocarbon date range

of AD 1635–1950, reflecting the pre- to post-Contact utilization of this site as indicated by the artifact assemblage collected during excavation.

Excavations at SIHP # -18349 yielded pre-Contact artifacts including a broken *poi* pounder, a hammerstone, and volcanic glass flakes. Due to previous bulldozer disturbance in this area, distribution maps were not generated, since the original positions of many of the documented artifacts were likely disturbed. Charcoal samples collected from SIHP # -18349 yielded radiocarbon date ranges of AD 1305-1645 and AD 1405-1650, reflecting the traditional Hawaiian utilization of this area as indicated by the artifacts.

5.2.10 Nelson and Gmirkin 2001; Gmirkin and Bond 2002

These two studies reported on an AIS of two parcels totaling approximately 17.9 acres along the *mauka* boundary of the Kaloko-Honokōhau National Historical Park. Several historic properties in the current project area, including SIHP #s -22418, -18099, and -22507, were identified.

5.2.11 Yucha and McDermott 2008

In 2008, CSH performed an AIS of the northernmost third of the proposed Ane Keohokālole Highway. Most of the project area had been surveyed previously (see Bell et al. 2008b, Esh et al. 2008, and Robins et al. 2000). The most prevalent types of features observed were mounds (n=66), modified outcrops (n=37), pavements (n=11), enclosures (n=10), platforms (n=10), terraces (n=9), and lava blisters (n=7). Less common feature types included lava tubes, modified depressions, alignments, cleared areas, walls, cairns, trails, petroglyphs/pecking, a *papamū*, a rockshelter, and a cattle trough. The eight functional categories assigned to these features were agriculture, habitation, burial, marker, commemorative, transportation, animal husbandry, and recreation.

5.2.12 Honokōhau Summary

The highway extends approximately 1,280 m (4,200 ft) through Honokōhau Ahupua'a. On the *mauka* side of the road, approximately 1,158 m (3,800 ft) have been subjected to inventory level archaeological survey, while the remaining 122 m (400 ft) have undergone reconnaissance level survey only. The *makai* side of the road has been subjected to reconnaissance level survey only, including that portion of the project area that lies within the Kaloko-Honokōhau National Park.

Thirteen historic properties have been identified within 91 m (300 ft) of the highway, including two sections of the Māmalahoa Trail (SIHP # -00002) on both sides of the highway in Honokōhau. Two additional historic properties, *mauka-makai* oriented trails, have also been noted near the highway, although they have yet to be fully documented (L. Schuster, NPS, personal communication).

5.3 Kaloko and Kohanaiki

Projects adjacent and/or pertinent to the current project area are summarized below. A list of all projects conducted in Kaloko and Kohanaiki is presented in Table 22.

5.3.1 Early Archaeological Surveys

During the mapping of the North Kona area in 1888, Emerson noted two historic properties in Kohanaiki, the cross-*ahupua'a* Māmalahoa Trail (SIHP # -00002), probably built between AD

Table 22. Previous archaeological studies in Kaloko and Kohanaiki Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Reinecke 1930	Kona coastal survey	Cursory survey	Briefly notes numerous historic properties
Emory and Soehren 1971	Kona coastal survey	Cursory survey	Briefly notes numerous historic properties
Kelly 1971	Kaloko and Kuki'o Ahupua'a	Historical survey and background	Background study
Renger 1971	Kaloko, Coastal, TMKs: [3] 7-3-004:005; 7-3-009:002	"Field Notes" of "mauka excavations"	"Field Notes" describe several historic properties
Soehren 1979	Kaloko Access Road corridor (Hina Lani St) TMK: [3] 7-3-009:001	Letter report reconnaissance survey	No finds
Hammatt 1980	Kaloko YO, TMK: [3] 7-3-009:019, 410 acres	Archaeological reconnaissance	Identified two historic properties
Soehren 1980b	Kaloko lowlands	Letter report reconnaissance survey	No finds
Soehren 1980c	Kaloko Access Road corridor	Letter report reconnaissance survey	Discusses three stepping stone trails, two cairns, and a lava tube complex
Barrera 1983	Kaloko, TMK: [3] 7-3-9:019	Archaeological reconnaissance	No finds
Kennedy 1983	Kaloko Golf Course, TMK: [3] 7-3-009:001	Archaeological reconnaissance	Identified 39 historic properties
Kennedy 1984	Kaloko Golf Course, TMK: [3] 7-3-009:001	Intensive archaeological survey	Results of investigations of 39 historic properties
Barrera 1985a	Kaloko and Kohanaiki YO, TMK: [3] 7-3-009:019, 409 acres	Archaeological survey	Identified 58 historic properties

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rosendahl 1985	Kohanaiki Development project, TMKs: [3] 7-3-009:003, 014	Preliminary archaeological reconnaissance survey	Identified 18 historic properties/feature complexes
Donham 1986	Kohanaiki Development project, TMKs: [3] 7-3-009:003, 014	Archaeological reconnaissance survey	Identified 105 historic properties
Rosendahl 1987a	Kaloko and Kohanaiki 3, TMKs: [3] 7-3-009:001, 017, 1-acre parcels	Archaeological reconnaissance survey	One historic property identified
Rosendahl 1987b	Kohanaiki Māmalahoa Trail, TMKs: [3] 7-3-009:003, 016	Field inspection	Inspection of Māmalahoa Trail (SIHP # -00002) in Kohanaiki
Barrera 1988	Kaloko and Kohanaiki YO, TMK: [3] 7-3-009:019, 409 acres	Archaeological excavations	Identified 60 historic properties
Rosendahl 1989a	Kaloko Mauka Parcel 1, TMK: [3] 7-3-024:007	Field inspection	Four historic properties identified
Rosendahl 1989b	Kaloko Mauka Parcel 2, TMK: [3] 7-3-024:008	Field inspection	No finds
Rosendahl 1990	Kohanaiki Resort, TMK: [3] 7-3-009:003	Archaeological inventory survey	Testing of burial features
Rosendahl and Walker 1990	Kaloko Water Tank, TMK: [3] 7-3-010:017	Archaeological inventory survey	One historic property identified
Barrera 1991	Kaloko and Kohanaiki YO, TMK: [3] 7-3-009:019, 409 acres	Archaeological inventory survey and data recovery report	Recorded 140 historic properties, mainly in the Kohanaiki Homestead section; the Kaloko area had been bulldozed

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Cordy et al. 1991	Kaloko-Honokōhau National Park	Ahupua'a Study on the 1971 archaeological work at Kaloko	Identified 94 historic properties
Johnson and Somers 1991	Kaloko-Honokōhau National Park, TMKs: [3] 7-3; 3-7-4	Data recovery	Pu'uoina Heiau stabilization
Kennedy 1991	Kohanaiki Industrial Development, TMK: [3] 7-3-009:015	Surface reconnaissance	No significant finds
O'Hare and Rosendahl 1991	Kohanaiki Resort, TMKs: [3] 7-3-009:003, 014	Data recovery	Seven historic properties comprising 15 features recorded in detail; these included petroglyphs, alignments, filled depressions, burials, caves, cairns, and enclosures
O'Hare et al. 1991	Kohanaiki Resort, TMKs: [3] 7-3-009:003, 014	Burial report	Five features from five historic properties contained burials
Rosendahl and Walker 1991	Industrial crusher site; two adjacent 10-acre parcels within present project area	Archaeological field inspection	Identified a trail with two cairns
O'Hare and Goodfellow 1992	Kohanaiki Resort, TMKs: [3] 7-3-009:003, 014	Data recovery	Data recovery at historic properties identified during Donham (1986)
Barrera 1993a	5.7 acres; 1,450 to 1,630 ft elevation	Archaeological inventory survey	Identified 40 features of Kona Field System
Fager and Graves 1993	Kaloko Industrial Park parcel	Archaeological inventory survey	Identified 17 historic properties with 60 component features
Henry et al. 1993	Transmission line project on <i>mauka</i> side of Queen Ka'ahumanu Hwy	Archaeological inventory survey	Identified 42 historic properties in project area; four historic properties in present project area

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rosendahl 1993	Kaloko Mauka, TMK: [3] 7-3-024:005	Field inspection	Four historic properties discussed
Nees and Williams 1995	Kaloko Mauka Subdivision, TMKs: [3] 7-3-024:010; 7-3-025:016, 110 acres, 2,100 to 2,900 ft elevation	Archaeological investigations	Identified enclosure, lava tube, terrace, wall, and mounds
R.M. Towill 1995	Kaloko-Kohanaiki Trail	Historic property description	Brief historical references to trails
Walsh and Hammatt 1995	Queen Ka'ahumanu Hwy ROW	Archaeological inventory survey	Identified nine historic properties adjacent to <i>makai</i> side of highway in Kohanaiki and Kaloko
Colin et al. 1996	Kaloko and Kohanaiki, TMK: [3] 7-3-009:002, 017, 2,243 acres	Inventory survey and data recovery	Identified 55 historic properties
Rechtman 1998	Kaloko, TMK: [3] 7-3-025:015, 22 acres, 2,400 to 2,500 ft elevation	Archaeological field inspection	No finds
Rechtman and Henry 1999	Kaloko, Morrisson property, TMK: [3] 7-3-008:017, 1,450 to 1,620 ft elevation	Archaeological inventory survey	Identified 15 historic properties
Wolforth 1999	HELCO Keāhole-Kailua transmission line corridor	Archaeological monitoring	Describes one historic property, SIHP # -21258
Haun and Henry 2000a	Kaloko Industrial Park, TMK: [3] 7-3-051:060, 102 acres	Archaeological inventory survey	Identified 45 historic properties with 81 features
Rosendahl and Gothar 2000	Kaloko Mauka, TMK: [3] 7-3-025:013, 2,435 to 2,730 ft elevation	Archaeological inventory survey (recorded as an archaeological assessment)	No finds

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Clark and Rechtman 2002	Kohanaiki, 52 acres, TMK: [3] 7-3-007:027, 1,200 to 1,600 ft elevation	Archaeological inventory survey	Identified five historic properties in area cleared for coffee cultivation
Rechtman and Rivera 2002	Kaloko Mauka, TMK: [3] 7-3-026:004	Archaeological inventory survey (recorded as an archaeological assessment)	No finds
Cobb et al. 2003	Kaloko and Kohanaiki, TMKs: [3] 7-3-09:025, 026 and 028, 400 acres	Archaeological inventory survey (recorded as an archaeological assessment)	Briefly identifies 154 features
Haun 2003	400-acre portion of TMK: [3] 7-3-009:028	Letter report	Re: archaeological assessment
Haun and Henry 2003a	Kaloko, TMK: [3] 7-3-009:028, 400 acres	Archaeological inventory survey (recorded as an archaeological assessment)	Identifies only eight historic properties (63 features), all in 'a'ā
Haun et al. 2003a	Kaloko Industrial Park, TMK: [3] 7-3-051:060, 102 acres	Data recovery report	Data recovery report addresses eight historic properties
Moore and Kennedy 2003	Roadway corridor	Archaeological inventory survey	Identified one historic property, SIHP # -23973 (two mounds)
Puette and Dye 2003	22 acres, 2,100 to 2,400 ft elevation	Archaeological inventory survey	No finds
Rechtman 2003	Kaloko Mauka, TMK: [3] 7-3-026:005, 3,100 ft elevation	Archaeological inventory survey (recorded as an archaeological assessment)	No finds
Shideler and Hammatt 2005	1,200+ acres in Kaloko and Kohanaiki	Archaeological field inspection and literature review	Numerous pre-Contact historic properties, including habitations, agricultural features, petroglyphs, boundary walls, and burials

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Wolforth et al. 2005	TMK: (3) 7-3-09: 032	Archaeological inventory survey	Identified 89 historic properties, consisting of burials, permanent habitations, temporary habitations, religious sites, trails, boundary walls, and agricultural sites
Nelson et al. 2006	TMK: (3) 7-3-009:007	Archaeological inventory survey	Re-recorded SIHP # -16103, which extends into current project area
Bell et al. 2008a	TMK: [3] 7-3-009:017, 224.43 acres	Archaeological inventory survey	Identified 59 historic properties
Bell et al. 2008b	TMK: [3] 7-3-009:025, 360.131 acres	Archaeological inventory survey	Identified 121 historic properties
Esh et al. 2008	TMK: [3] 7-3-009:028, 363.106 acres	Archaeological inventory survey	Identified 41 historic properties
Bell et al. 2009	TMK: [3] 7-3-009:026, 194.324 acres	Archaeological inventory survey	Identified 120 historic properties

1836 and 1855, and a *mauka-makai* trail that extended from the Kohanaiki Homesteads near Māmalahoa Highway toward the coast at Kaloko (Cordy et al. 1991:404; Reinecke 1888:76–78).

During the 1930s, John Reinecke surveyed the coastal areas of North and South Kona for the Bishop Museum. He recorded eight historic properties (later merged into three) in Kohanaiki, which were recorded as SIHP #s 50-10-27-1902, -1905, and -1909 during a Statewide Inventory of Historic Places study in 1971 and 1972. SIHP #s -1902 and -1905 were residential features, while SIHP # -1909 was a possible fishing shrine at Wawahiwaa Point (Reinecke n.d.).

5.3.2 Cordy et al. 1991

Cordy et al.'s (1991) study of Kaloko constructs a generalized model for social structure and environmental adaptation for pre-Contact Kaloko. In 1971, Cordy et al. (1991) attempted to construct a model of how Hawaiians in the Kaloko area were organized socially before western contact (AD 1778), and how this social organization reflected adaptations to the natural and social environments and to internal pressures. A combination of pedestrian survey and subsurface testing was undertaken throughout the Kaloko area in order to collect data for analysis.

Due to a general lack of chronological data, Cordy et al. (1991) were unable to build a picture of local social organization and its adaptation to the environmental field at any single time period, nor could they make any major statements on changes in organization and adaptation. As a result, Cordy et al. (1991) attempted to present a generalized model for social structure and environmental adaptation for the entire pre-Contact period of Kaloko. Cordy et al. (1991) speculated that Kaloko was initially settled between AD 1000 and 1500, and that it may have been an outlier of another community. By historic times, the Kaloko community consisted of four residential groups totaling 60 to 100 individuals. Political power and religious authority were focused in a chief, who apparently before and after AD 1490 to AD 1610 did not reside at Kaloko (Cordy et al. 1991). According to Cordy et al. (1991), adaptation to the natural environment consisted of agriculture, water usage, the collection of raw materials for tool manufacture and dwelling construction, marine resource procurement, and the raising of livestock. Agriculture was determined to be focused within the upland zone (300–490 m elevation) and the lower upland-forest zone (490–550 m elevation). Agricultural structures utilized in this agricultural zone consisted of terraces and low walls for water and soil control, as well as stone piles resulting from the clearing of soil areas for planting. Also noted were enclosures of varying shape, utilized as temporary habitations.

As water was scarce in Kaloko, potable water was thought to have been predominantly acquired at brackish pools near the coastal-middle zone interface. Cultural modification observed at these pools consisted of small, cleared areas or large lava slabs tilted over them for shade. Several short trails leading to the pools were also noted. The middle and upland-forest zones were believed to have been the primary areas for the collection of raw materials such as thatching, wood, and vines for the manufacture of dwellings, weapons, agricultural tools (e.g., digging sticks), fishing gear (e.g., nets and lines), and canoes. Further data and analysis were deemed necessary in order to determine if distinct coastal areas were utilized and partitioned per each residential group, or if Kaloko Fishpond was always reserved for chiefly use. Additionally, further data is necessary to shed light on the extent and nature of animal husbandry in pre-Contact Kaloko.

This report documents the archaeological survey and testing work undertaken in the *makai* portion of Kaloko (i.e., *makai* of the highway) in 1971. Based on the map of the seaward portion of Kaloko included in this study, five historic properties are located within 91 m (300 ft) of the highway; from south to north these include SIHP # -2199 (BPM 46), a *mauka-makai* trail; BPM 90 (no SIHP number assigned), a *mauka-makai* trail; SIHP # -2238 (BPM 86), a wall with midden; SIHP # -2233 (BPM 81), a *mauka-makai* trail; and SIHP # -2240 (BPM 89A–B), a *mauka-makai* trail. Survey work was also performed on the eastern side of the highway, but the information on the locations and descriptions of specific historic properties is missing; therefore, it is unknown if any historic properties were identified within 91 m (300 ft) of the highway.

5.3.3 Haun et al. 2003a

In 2003, Haun & Associates completed data recovery for eight historic properties located in the *ahupua'a* of Kaloko. All eight consisted of temporary habitations in the form of caves and surface midden scatters. Research objectives consisted of the following (Haun et al. 2003a:i):

1. To establish the age of the site/feature
2. To determine the type and variety of activities conducted at each site/feature

Charcoal samples from five of the eight were submitted for radiocarbon analysis (with the remaining three already dated during the inventory survey phase). Three of the historic properties (SIHP #s -21999, -22016, and -22018) were potentially utilized by the mid-1400s. SIHP # -22023 was determined to have multiple occupations spanning from AD 1500–1700. SIHP #s -22014 and -22017 were occupied during the late pre-Contact period into the early post-Contact period.

Observed artifact and midden assemblages, as well as structural modifications, indicated a variety of activities conducted at the temporary habitation features. Activities determined to have been practiced at the data recovery sites included animal husbandry, water collection, fire construction, food preparation and consumption, and stone and bone tool manufacture.

5.3.4 Bell et al. 2008a

This AIS of a 224-acre parcel resulted in the documentation of 59 historic properties, 53 of which were previously identified by Colin et al (1996; see discussion in the following section). The most prevalent types of historic properties observed were modified tumuli (n=26), trails (n=21), enclosures (n=9), terraces (n=7), and lava tubes and blisters (n=11). Based on historic background and previous archaeological studies, the types, functions, and distribution of historic properties matched the anticipated finds for this “intermediate zone” of the Kekaha region.

5.3.5 Late Twentieth Century Surveys in Kohanaiki and Kaloko

Hammatt (1980) conducted a reconnaissance survey of a 410-acre parcel in upland Kohanaiki and Kaloko, recording two historic properties: a walled complex and a habitation cave. In 1985, a full reconnaissance survey was conducted on a portion of the project area (the Y-O project); in this survey (Barrera 1985a), 55 historic properties were recorded within Kohanaiki. Data recovery consisting of limited excavation took place in the Barrera project area in 1987 (Barrera 1988). Barrera (1991) subsequently led a crew for an inventory survey with limited testing in 1991. Most of the features were found in the Kohanaiki section, as the Kaloko area had been extensively bulldozed. Eighty-nine features were identified as agricultural features associated

with the Kona Field System. Sixty-one features were associated with the Kohanaiki Homesteads, a late 1800s historic settlement adjacent to the Māmalahoa Highway. In 2005, the project area, now called Kaloko Heights, was surveyed again by Scientific Consultant Services (Wolforth et al. 2005). Eighty-nine historic properties were identified; the most common were cave shelters (n=37).

Ross Cordy (1985) surveyed a portion of the Kohanaiki coast from 0.25 to 0.5 miles inland in 1975. He recorded 12 historic properties and conducted limited excavations at 11 of them.

Joseph Kennedy (1991) conducted a reconnaissance survey of a 152-m (500-ft) wide strip extending east (*mauka*) from the Queen Ka'ahumanu Highway for 2,213 m (7,260 ft). No historic properties or features were observed; seven caves "were examined to term and were determined to be devoid of cultural materials" (Kennedy 1991:C-1).

A Phase I reconnaissance survey was carried out for the proposed Kohanaiki Development project in 1986 (Donham 1986). The project area covered the coastal area from 'O'oma Ahupua'a on the north to Kaloko Ahupua'a on the south and extended inland approximately 0.5 miles to the Māmalahoa Trail (SIHP # -00002). A total of 105 historic properties were recorded; these consisted of habitation sites (>50%), roads, trails, boundary markers, animal pens, petroglyphs, shrines, and brackish water wells/pools. Three additional historic properties were found in 1987, and in 1990, features identified as possible burials were tested. Only one burial was found (Rosendahl 1990).

Based on the recommendations in the Donham (1986) report, data recovery was conducted at 31 of the previously recorded historic properties; this consisted of relocation and additional recording (O'Hare and Goodfellow 1992). In addition, 15 newly identified historic properties were recorded during the project. A total of 109 test units were excavated at 21 of the 46 historic properties for the data recovery project. Most of the project area is 457 m (1,500 ft) west of the Queen Ka'ahumanu Highway, but an access road extends to the highway. No historic properties were identified within 91 m (300 ft) of the highway or within the access road portion of the project area.

In 1995, CSH conducted an AIS in portions of the current project area (Walsh and Hammatt 1995). Three historic properties were identified in Kohanaiki: two trails and a set of three cairns. The two trails, which converge into one trail inland of the highway, had been previously identified as SIHP # -15324; this historic property is also addressed in the current data recovery report (see Volume III).

In 1996, a 224-acre parcel in Kohanaiki and Kaloko adjacent to the *mauka* side of the Queen Ka'ahumanu Highway was surveyed by CSH (Colin et al. 1996). Fifty-five historic properties were recorded during the project. Thirteen were within Kohanaiki or on the Kaloko-Kohanaiki boundary; these consisted of one cairn, one C-shape, one enclosure, one terrace, two modified excavations, two lava tubes, and portions of five trails.

5.3.6 Summary of Previous Archaeological Studies in Kaloko Ahupua'a

The highway extends for approximately 1,158 m (3,800 ft) through Kaloko. Both sides of the highway have been subjected to some degree of archaeological investigation, but it is likely the archaeological work undertaken within these areas would not be considered adequate as an inventory level survey. Five historic properties were identified within 91 m (300 ft) of the

highway: four *mauka-makai* trails (BPM 90 and SIHP #s -2199, -2233, and -2240) and one historic property described as a wall with midden (SIHP # -2238). The survey in which these historic properties were identified was conducted in 1971, and the survey data was made available in 1991 (see Cordy et al. 1991). The survey report does not include significance assessments or recommendations for future treatment.

5.3.7 Summary of Previous Archaeological Studies in Kohanaiki Ahupua'a

The highway extends approximately 1,311 m (4,300 ft) through Kohanaiki Ahupua'a. One 152-m (500-ft) wide section on the *mauka* side of the highway has been subjected to inventory level archaeological survey, and one approximately 61-m (200-ft) wide section on the *makai* side of the highway has been included in both an inventory level survey and data recovery phase archaeological study. No historic properties were identified in either of these two portions of the present project area within Kohanaiki.

5.4 'O'oma

Previous archaeological projects conducted in 'O'oma are listed in Table 23. Studies pertinent to the current project area are summarized below.

5.4.1 Rosendahl, M. 1989

PHRI conducted an inventory survey of a 61-m (200-ft) wide corridor along the 'O'oma-Kohanaiki border extending east from the highway. No historic properties were identified within 91 m (300 ft) of the highway.

5.4.2 Henry et al. 1993

This is an archaeological assessment of a 1,260-acre parcel on the west side of the highway. Within 'O'oma 2, no historic properties were identified within 91 m (300 ft) of the highway.

5.4.3 Barrera 1985b

This is a reconnaissance survey of a 450-acre project area on the west side of the highway in 'O'oma 2 and Kalaoa-'O'oma (referred to as 'O'oma 1). One historic property (SIHP # -10154, a "habitation structure") was identified within 91 m (300 ft) of the highway.

5.4.4 Barrera 1989

Varying levels of data recovery work were conducted on historic properties identified within a 450-acre project area on the west side of the highway within 'O'oma 2 and Kalaoa-'O'oma (referred to as 'O'oma 1). SIHP # -10154, which is also part of the current data recovery study, is one of the historic properties that "required additional recording only." It is depicted on the project area map and briefly described as a well-constructed shelter with an adjacent short wall section of unknown age and function.

5.4.5 Rechtman and Clark 2012

This reconnaissance level survey encountered the previously identified 'O'oma 1/2 *ahupua'a* boundary wall (SIHP # -6432) and recorded the *mauka-makai* trail, SIHP # -29272. The trail was interpreted originally as a pre-Contact foot path that was later improved in both the early and late historic period. A segment of SIHP # -29272 within the current project area is addressed in the current report (see Volume III).

Table 23. Previous archaeological studies in 'O'oma Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Reinecke 1930	Coastal survey	Cursory survey	Briefly notes numerous historic properties, Sites 66 through 78 are within 'O'oma, mainly habitation sites
Ching et al. 1968–1969	Kailua-Kawaihae Rd corridor extension and parcel near Keāhole Airport	Archaeological reconnaissance survey and excavations	A total of 343 historic properties recorded, 216 features in the coastal portion and 117 in the inland portion from 800 ft to 3 miles from the coast
Ching and Rosendahl 1968	Kailua-Kawaihae Rd corridor, South Kohala to North Kona	Archaeological reconnaissance survey	Identified 665 archaeological features, including three trails (SIHP #s -0500, -0603, and -0630)
Davis 1977	Keāhole Agricultural Park, Kalaoa 1–5 and 'O'oma 1; from Queen Ka'ahumanu Hwy to 400 ft elevation	Archaeological reconnaissance survey	Identified 22 agricultural and habitation historic properties; minimal recording
Rogers-Jourdane 1978	Keāhole Point, NELH, 22.5 acres	Archaeological reconnaissance survey	Identified 11 historic properties
Hammatt and Folk 1980	Keāhole Agricultural Park and 370-acre parcel north of park	Subsurface excavations, reconnaissance survey	Tested 12 site complexes first identified by Davis (1977); 18 new historic properties recorded in 370-acre parcel
Rosendahl 1980	NELH, Keāhole Point, TMK: [3] 7-3-010:036	Inventory survey and data recovery	Follow-up on work of Rogers-Jourdane 1978
Soehren 1980d	'O'oma 1, TMKs: [3] 7-3-007:040, 041	Archaeological reconnaissance survey	Four-page report; no historic property map
Barrera 1985b	'O'oma 2 Resort, 314-acre coastal parcel, TMK: [3] 7-3-009:004	Archaeological reconnaissance survey	Identified 40 historic properties
Cordy 1985	'O'oma and Kalaoa, TMK: [3] 7-3	Historic property inventory	Inventory of previously identified historic properties

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Cordy 1986a	'O'oma 2 Resort, TMK: [3] 7-3-009:004	Field inspection	Re-evaluation of Barrera's survey (Barrera 1985b)
Donham 1987	'O'oma 2 Resort, TMK: [3] 7-3-009:004	Data recovery	Identified 27 new historic properties with 130 features, and 54 features recorded at previously identified historic properties
Barrera 1989	NELH and Host Park, TMKs: [3] 7-3-043:003, 042	Data recovery	Excavation of sites identified by Barrera 1985b
Rosendahl, M. 1989	Kohana-iki Resort Water Development project area, 'O'oma 2, TMK: [3] 7-3-009:005	Archaeological inventory survey	Four historic properties identified along corridor; features included a wall, terraces, a cave, and a <i>papamū</i> (playing) board
Walker and Rosendahl 1990	'O'oma 2 Water System Development project area	Archaeological reconnaissance survey	Identified 13 historic properties with 27 features; majority were agricultural mounds
Drolet and Schilz 1991	'O'oma 2, TMKs: [3] 7-3-007:038; 7-3-009:005, 008	Archaeological inventory survey	Identified 29 historic properties with 41 features identified; majority were agricultural mounds
Yent 1991	Upland 'O'oma, at elevations of 2,600 to 3,200 ft	Archaeological reconnaissance survey	Ten sites found at 2,280 ft elevation; walls and mounds of agricultural fields, probably for sweet potato cultivation
Barrera 1992	'O'oma, TMK: [3] 7-3	Data recovery	Excavations at three historic properties
Dowden and Graves 1992	HELCO Keāhole parcel, Kalaoa 1-4, 15-acre parcel	Archaeological inventory survey	Four historic properties with <i>pāhoehoe</i> excavations recorded
Thompson and Rosendahl 1992a, b	Keāhole transmission lines, TMKs: [3] 6-; 7-; 8-	Archaeological inventory survey (recorded as an archaeological assessment)	Confirmed previously identified historic properties

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Henry et al. 1993	Makaula to Kalaoa to 'O'oma Ahupua'a	Archaeological inventory survey (recorded as an archaeological assessment)	Assessment of a 1,260-acre parcel
Walsh and Hammatt 1995	Queen Ka'ahumanu Hwy, TMKs: [3] 7-, 4-	Archaeological inventory survey	Identified 17 cultural resources
Corbin 2000	NELH, 'O'oma 2, TMK: [3] 7-3-009:004	Data recovery	SIHP #s -1916 and -18028
Haun and Henry 2000b	'O'oma 1, 50-acre parcel, TMK: [3] 7-3-10:03	Archaeological inventory survey	Identified 186 features at 17 historic properties, including a habitation cave and a basalt rock quarry
Haun and Henry 2002	'O'oma, TMK: [3] 7-3-005:004	Data recovery	Data recovery excavation at three caves, SIHP #s -22740, -22741, and -22749
Haun and Henry 2003b	'O'oma, 41-acre parcel, TMK: [3] 7-3-007:040	Archaeological inventory survey	Identified 21 historic properties with 2,046 features, including six habitation caves
Clark and Rechtman 2005	'O'oma 1 and 2, TMKs: [3] 7-3-007:039 and 7-3-046:105	Archaeological inventory survey	Three historic properties previously identified (see Drolet and Schilz 1991) and 12 new historic properties identified, including habitation occupied as late as 1939
Clark and Rechtman 2006a	Holoholo St extension, TMK: [3] 7-3-009:008	Archaeological inventory survey	Four historic properties recorded; two walls, an agricultural complex, and a pre-Contact habitation site
Clark and Rechtman 2006b	'O'oma 2, TMK: [3] 7-3-007:038	Archaeological inventory survey	Identified 18 historic properties, mainly historic walls
Haun et al. 2006	TMKs: [3] 7-3-007:040, 041	Data recovery	SIHP #s -23825, -23831, -23832, -23835, -23836, and -23839; 18 features tested
Nelson et al. 2006	'O'oma 2: 45-acre parcel, TMK: [3] 7-3-009:007	Archaeological inventory survey	Identified 11 historic properties, mainly historic homestead features

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rechtman 2008	'O'oma Beachside Village project area, TMK: [3] 7-3-009:004	Archaeological inventory survey	Reassessed 15 previously identified historic properties, and identified two new historic properties (SIHP #s -25932 and -26678, both lava tubes with human remains)
Rechtman et al. 2008	TMK: [3] 7-3-010:003	Data recovery	Data recovery at five historic properties identified by Haun and Henry (2000b)
Rechtman and Clark 2012, 2013	'O'oma 1 and 2, TMKs: [3] 7-3-043:073, 080, 083, 089, and 091 (por.)	Archaeological inventory survey and update	One previously identified wall, SIHP # -6432, and one recorded trail segment, SIHP # -29272

5.4.6 Summary of Previous Archaeological Studies in 'O'oma 2 Ahupua'a

The highway extends through 'O'oma 2 for approximately 1,158 m (3,800 ft). The *mauka* side of the highway has been subjected to reconnaissance level study. The *makai* side of the road has apparently been adequately surveyed, and data recovery work was carried out on selected historic properties. One historic property has been identified within 300 ft of the highway in 'O'oma 2: SIHP # -10154. This historic property is also included in the current data recovery project.

5.5 Kalaoa

Previous archaeological studies conducted in Kalaoa are listed in Table 24. Studies pertinent to the current project area are summarized below.

5.5.1 Barrera 1985c, 1989

These reports summarize reconnaissance survey and subsequent data recovery work (see also Barrera 1989 above). No historic properties were identified within 300 ft of the highway at Kalaoa-'O'oma.

5.5.2 Henry et al. 1993

This project area included the western side of the highway at 'O'oma 2 (see description in previous section). One historic property was identified as being within approximately 91 m (300 ft) of the highway: SIHP # -18524, identified as a "pāhoehoe excavation." Recommended treatment was "further data collection." This project continues through Kalaoa 1-4, but no historic properties were identified within 300 ft of the highway there.

5.5.3 Davis 1977; Hammatt and Folk 1980

These two reports record the survey and salvage excavations within the proposed Keāhole Agricultural Park on the east side of the highway. One historic property was identified within 300 ft of the highway: SIHP # -06432, an *ahupua'a* boundary wall. This is described as a historic-era wall that forms the boundary between Kalaoa-'O'oma and 'O'oma 2. Survey and salvage excavations within the proposed Keāhole Agricultural Park also extended into Kalaoa 1-5. No historic properties were identified within 300 ft of the highway there.

5.5.4 Barrera 1987a, b; 1990

These reports record the survey and data recovery work at five areas within Kalaoa 1-5 in the vicinity of the Keāhole Airport. It appears this project area did not include the area within 300 ft of the highway; therefore, no historic properties were identified within 300 ft of the highway.

5.5.5 Summary of Previous Archaeological Studies in Kalaoa-'O'oma Ahupua'a

The highway extends approximately 1,585 m (5,200 ft) through Kalaoa-'O'oma. The *mauka* side of the road through the length of the *ahupua'a* has been subjected to varying degrees of archaeological survey, including salvage excavations in some areas. The length of the *ahupua'a* along the *makai* side of the road was included in the reconnaissance and data recovery work conducted by Barrera (1987a, b; 1990). Two historic properties have been identified within 300 ft of the highway: SIHP # -18524, *pāhoehoe* excavation, and SIHP # -06432, boundary wall.

Table 24. Previous archaeological studies in Kalaoa Ahupua'a

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Stokes and Dye 1991	Island of Hawai'i	Survey	Identified two <i>heiau</i> , Kawaluna Heiau and Paliholo Heiau, and two <i>ko'a</i> , Halepa'u Ko'a and Maka'eo Ko'a
Rosendahl and Kirch 1975	Natural Energy Laboratory Hawai'i (NELH), Keāhole Pt	Reconnaissance survey	Recorded 14 historic properties, all previously identified
Davis 1977	Keāhole Agricultural Park, TMK: [3] 7-3-010:033	Archaeological reconnaissance survey	Identified 22 site complexes in a narrow corridor study
Barrera 1979	Keāhole Airport emergency service roads, TMK: [3] 7-3-043:003	Archaeological reconnaissance survey	Two walled shelters, SIHP #s -06961 and -06962
Bonk 1979	Keāhole Airport, TMK: [3] 7-3-010	Archaeological survey addendum	Borrow pits area, SIHP # -500
Barrera 1980	Keāhole Airport, TMK: [3] 7-3-043:003	Archaeological reconnaissance survey	SIHP # -06987; dismantled two C-shaped structure
Hammatt and Folk 1980	Keāhole Agricultural Park, TMK: [3] 7-3-010:033	Archaeological excavations	Data recovery at 12 historic properties, and identification of 18 historic properties in larger parcel north of park
Rosendahl 1980	NELH, Keāhole Point, TMK: [3] 7-3-010:036	Inventory survey and data recovery	No findings
Soehren 1982	Kalaoa 4, TMK: [3] 7-3-005:013	Archaeological reconnaissance survey	Recorded a house platform and a square enclosure, SIHP #s -10214 and -07266
Clark 1984	NELH, Keāhole Pt, TMK: [3] 7-3-010:036	Archaeological reconnaissance survey	SIHP #s -00185, -00246, -01920, -05601, -10191, -10192, and -10194 through -10201
Barrera 1985c	Keāhole Point, 450-acre parcel, TMK: [3] 7-3	Archaeological reconnaissance survey	Identified 42 historic properties
Cordy 1985	Kalaoa and 'O'oma	Archaeological reconnaissance survey	Settlement pattern study

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Soehren 1985	Alanui Kauhini, Kalaoa 4, TMK: [3] 7-3-010:033	Archaeological survey	Coastal foot trail, SIHP # -21186
Cordy 1986b	NELH, Keāhole Point, TMK: [3] 7-3-010	Field check	SIHP #s -01920 and -10205 through -10214
Barrera 1987a	Keāhole Airport	Archaeological survey	Six historic properties recorded
Barrera 1987b	Keāhole Airport, south ramp and ground transportation expansion, Kalaoa, TMK: [3] 7-3-043:043	Archaeological survey	SIHP #s -00002 and -10306
Cordy 1987	Kalaoa 3 Uplands, TMK: [3] 7-3-028:005	Field inspection	Recorded one platform/terrace
Telea and Rosendahl 1987	Kona Palisades Subdivision, Kalaoa 4, TMK: [3] 7-3-005:086, 6.6 acres	Archaeological reconnaissance survey	Identified 14 features at six historic properties
Walker and Haun 1988	Kona Palisades Subdivision, Kalaoa 4, TMK: [3] 7-3-005:087, 5.6 acres	Limited data recovery	Identified 17 features, including two agricultural complexes part of Kona Field System
Barrera 1989	NELH and Host Park, TMKs: [3] 7-3-043:003, 042	Data recovery	Excavations of historic property identified by Barrera 1985c
Walker and Rosendahl 1989	Pu'uhonua Subdivision, Kalaoa 5, TMK: [3] 7-3-010:027	Archaeological inventory survey	Recorded 34 historic properties with 84 features, composed of SIHP #s -05745 through -05778
Barrera 1990	Keāhole Airport expansion	Archaeological data recovery	Excavations at two caves
Walker and Rosendahl 1990a	Kona Palisades, TMK: [3] 7-3-005:012	Archaeological inventory survey	Identified 12 historic properties, including a refuge cave

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Walker and Rosendahl 1990b	Kona Palisades, TMK: [3] 7-3-005:086	Archaeological inventory survey	Identified 18 additional features, in addition to 14 features found during reconnaissance survey (Telea and Rosendahl 1987)
Dowden and Graves 1992	HELCO Keāhole parcel project area, Kalaoa 1-4, TMK: [3] 7-3-049:036	Archaeological inventory survey	Four quarry sites identified: SIHP #s -18076 through -18079
Thompson and Goodfellow 1992	Kona Palisades Development parcel, Kalaoa 4, TMK: [3] 7-3-005:086	Interim report: background, summary of findings, and recommendations; archaeological data recovery – Phase II	Additional recording at four historic properties (SIHP #s 50-10-28-14135 through -14137 and -14565); 24 test units excavated
Barrera 1993b	Kalaoa, TMK: [3] 7-3-005:088, 5 acres	Data recovery	Further recording of Māmalahoa Trail (SIHP # -00002)
Head and Rosendahl 1993	LUC project, 500-acre university site	Archaeological inventory survey	Identified 43 historic properties, 16 previously identified; included midden deposits, modified outcrops, terraces, enclosures, mounds, walls, <i>pāhoehoe</i> excavations, alignments, petroglyphs, trails, platforms, pavements, modified lava tubes, and cairns
Henry and Graves 1993	Keāhole-Kailua 69kV transmission line project	Archaeological inventory survey	Identified 25 historic properties with 60 component features; two trails, SIHP #s -15324 and -00002, also part of current data recovery
Henry et al. 1993	LUC Project, TMKs: [3] 7-3-009:001; 7-3-010:001	Archaeological inventory survey (recorded as an archaeological assessment)	Identified 25 historic properties
Barrera 1995	Kalaoa Mauka, TMK: [3] 7-3-005:098	Archaeological inventory survey	SIHP #s 50-10-28-19823 through -19831

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Masterson and Hammatt 1997	Kalaoa Reservoir, TMK: [3] 7-3-010:033	Archaeological reconnaissance survey	Upland historic properties
Bonk 1998	Kalaoa, TMK: [3] 7-3-005:112, 5.9 acres	Archaeological survey: papers in ethnic and cultural studies 98-1	Cultural study
Cleghorn 1998	Proposed University Center at West Hawai'i, TMK: [3] 7-3-010:033	Archaeological investigations	SIHP #s 50-10-28-06418, -15263 through -15265, -15268, -15281 through -15288, -15300, and -21361
Moore et al. 1999	Keāhole Point, Kalaoa 4, TMK: [3] 7-3-010:034	Archaeological inventory survey	One significant historic property, SIHP # -21350 (lighthouse)
Wolforth 1999	HELCO Keāhole-Kailua 69kV transmission line, Kalaoa 1-4	Archaeological monitoring	Monitoring of Māmalahoa Trail (SIHP # -00002)
McGerty and Spear 2000	Kalaoa Mauka, TMK: [3] 7-3-05:98, 5.9 acres	Final addendum to archaeological inventory survey	SIHP #s 50-10-28-19823 through -19832, -19839, and -21812
Roberts and Roberts 2001	NELH, Kalaoa 5, TMK: [3] 7-3-043:003	Data recovery	SIHP #s -10211 through -10213
Haun and Henry 2003c	Kalaoa 4, TMK: [3] 7-3-010:029	Archaeological inventory survey	SIHP #s 50-10-28-11271, -21886 and -23640 through -23643
Haun and Henry 2003d	Kalaoa 3, TMK: [3] 7-3-023:088	Archaeological inventory survey	SIHP # 50-10-28-23789
Haun et al. 2003b	Pu'uhonua Subdivision, Kalaoa 5, TMK: [3] 7-3-010:027	Data recovery	SIHP #s -5748, -5749, -5750, -5753, -5755, -5756, -5761, -5762, -5764, -5771, -5773, and -5774; excavation at four historic properties; charred sweet potato found in one feature
Rasmussen 2004	Kona Internatioanl Airport, TMK: [3] 7-3-010	Archaeological inventory survey (recorded as an archaeological assessment)	Nine historic properties documented included cairns, a trail, a <i>pāhoehoe</i> excavation, and petroglyphs

Reference	Project Location	Report Type	Results (SIHP # 50-10-27 unless otherwise noted)
Rosendahl 2004	HELCO Station, Kalaoa 1–4, TMKs: [3] 7-3-049:036, 037	Archaeological inventory survey (recorded as an archaeological assessment)	Four historic properties recorded, all <i>pāhoehoe</i> excavations
McIntosh and Cleghorn 2005	UH Center, Main St Rd, TMKs: [3] 7-3-010:006, 033, 044, and 045	Archaeological inventory survey (recorded as an archaeological assessment)	Confirmed ten historic properties from a previous study and recommended all should be avoided during construction
Reeve 2009	UH Center, Main St Rd, TMK: [3] 7-3-010:033	Data recovery	Excavation of a portion of a roof fall feature within a lava tube yielded no cultural deposit; therefore, preservation not recommended
Rechtman and Clark 2012	Kalaoa 5, TMKs: [3] 7-3-043:073, 080, 083, 089, and 091 (por.)	Archaeological inventory survey	One recorded trail segment, SIHP # -29273, and cairns recorded as SIHP # -29274

5.5.6 Summary of Previous Archaeological Studies in Kalaoa 1–5 Ahupua‘a

The portion of the highway within the present project area extends 732 m (2,400 ft) into Kalaoa 1–5, between the southern boundary of the *ahupua‘a* and the Keāhole Airport entrance road. Along the *mauka* side of this section of the highway, the area has been subjected to both an archaeological survey and salvage excavations. On the *makai* side of the road, survey and data recovery work has been undertaken in the vicinity of the airport, but apparently not within 300 ft of the highway.

5.6 Other Relevant Archaeological Studies

5.6.1 Ching et al. 1968–1969

This report is incomplete and is missing a section called “Kailua-Kawaihae Road Section II Survey and Salvage” (pp. 38–89). The report contains a map of the Keāhole region with historic property locations (SIHP #s -00118 through -00355) but does not provide historic property descriptions.

5.6.2 Ching and Rosendahl 1968

This report records a surface survey of Section II of the highway (likely the same report that was to have been included in the report cited above). The map accompanying this report identifies a small number of historic properties within roughly 300 ft of the (proposed) highway: two historic properties in Honokōhau (T2 and T3), one in ‘O‘oma 2 (T1), one in Kalaoa-‘O‘oma (T1), and one in Kalaoa 1–4 (T1). Minimal descriptions of these historic properties are provided, but the use of this data is highly problematic; see explanation by Cordy (1985:11–12).

5.6.3 Thompson and Rosendahl 1992a, b

This is a study in which the locations of selected existing historic properties along two proposed transmission line routes were identified. The historic properties marked on the map were limited to “sites or features considered to be culturally significant or possibly significant” (Thompson 1992a:4). One of these routes is essentially the same project area as the present highway widening.

5.6.4 Helber et al. 1987

This is a study related to the request for an easement across a portion of the Māmalahoa Trail (SIHP # -00002). Although this report documents the Māmalahoa Trail, it is not considered an acceptable archaeological data recovery report.

5.6.5 Barrera 1993b

This report is an archaeological documentation of a portion of the Māmalahoa Trail (SIHP # -00002) in Kalaoa 1–4.

5.6.6 Henry and Graves 1993

This was an AIS for the Keahole-Kailua 69kV transmission line project. Twenty-five historic properties with 60 component features were identified. These included *ahu*, filled crevices, lava tubes, modified blisters, modified outcrops, mounds, *pāhoehoe* excavations, terraces, trails, and walls. Two of the trails, SIHP #s -15324 and -00002, are also part of the current data recovery project.

Section 6 Cultural Consultation

Consultation was undertaken for the project to comply with HAR §13-275 and 13-276 of Hawai'i State law and Section 106 of the NHPA. To date, project-specific consultation has been conducted with the NPS and the SHPD. CSH anticipates additional consultation will be necessary with the Office of Hawaiian Affairs (OHA) and with the Hawai'i Island Burial Council (HIBC) to address concerns about the burial site (SIHP # -22415) in the project area and other mitigation plans.

On 5 August 2010, CSH (Monahan and Simonson) conducted an initial site visit with NPS staff. The objective of the field inspection with NPS staff was to observe archaeological features believed to have been overlooked during past surveys. During this visit, CSH recorded numerous archaeological features and noted NPS concerns and observations, which have been incorporated into the results of the project's AIS and the current data recovery study.

On 6 October 2010, CSH (Monahan) led a field inspection with the SHPD of two historic properties (SIHP #s -22415 and -28780) suspected of being burials. Present from SHPD at the field inspection were Theresa Donham (archaeologist) and Analu Josephides (cultural specialist). Also present at the request of CSH was Cynthia Nazara (cultural monitor), who is familiar with the descendant families of the project area. The primary objective of the field inspection was to obtain guidance from the SHPD regarding testing of possible burial sites.

On 10 January 2011, CSH (Monahan) and representatives of the project proponent met with Theresa Donham at the SHPD's Hilo office. Topics of discussion included the SHPD's review letter of a previous version of the AIS report.

On 1 February 2011, CSH (Monahan) and representatives of the project proponent met (by teleconference) with representatives of the NPS. Topics of discussion included the NPS's review letter of a previous version of the AIS report.

On 4 February 2011, CSH (Monahan) met with archaeologists from the NPS at its Kona office to discuss specifics of the project's initial AIS (Monahan et al. 2012a).

Additional consultation with the NHOs began on 13 November 2011 specifically to deal with the fieldwork for the supplemental AIS (Wilkinson et al. 2017) regarding possible historic properties identified by NHOs for what was previously called the "North Segment" of the project area (see Figure 7). This consultation continued via emails, phone calls, and meetings. Although less than for the North Segment, some consultation has taken place between CSH and the NHOs for the South Segment work as well.

Additional consultation with the NPS took place in April and May of 2012 specifically dealing with the fieldwork for the supplemental AIS regarding possible historic properties for the South Segment of the project.

Relevant information obtained during consultation efforts is also included in the Results sections of this report (Volumes II and III).

Section 7 Data Recovery Effort

On 5 October 2011, a data recovery plan for the Queen Ka'ahumanu Highway Expansion Phase 2, North Segment (Altizer and Monahan 2011) was accepted by the SHPD in a letter (LOG NO.: 2011.2598, DOC. NO.: 1110TD01; see Appendix A). Excavation was planned (following the Altizer and Monahan [2011:138–139] ADRP) to consist of three excavation units at SIHP # -10154, one at SIHP # -28812, two at SIHP # -28813, and one at SIHP # -28814. However, due to a revision of the project scope, data recovery was halted during this fieldwork effort. While excavation was completed at SIHP #s -28812 through -28814, only one of the three excavation units was completed at SIHP # -10154, which was then recommended for preservation during revision of the data recovery plan. In total, four excavation units comprising approximately 4 sq m of surface area were excavated during this initial data recovery effort, which was performed on 12 October 2011 by Sarah Wilkinson, B.A., Olivier Bautista, B.A., and Trevor Yucha, B.A., assisting project director Chris Monahan, Ph.D. The fieldwork effort required approximately 12 person-days and was conducted under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator).

On 15 October 2012, the revised data recovery and preservation plan (Shideler et al. 2012) was accepted by SHPD (LOG NO.: 2012.3052, DOC. NO.: 1210MV25; see Appendix A); subsequently, on 9 April 2014 an archaeological preservation plan and mitigation plan (Hammatt and Shideler 2014) was accepted by SHPD (LOG NO.: 2014.1379, DOC. NO.: 1404MV06; see Appendix A). This addressed a redesign of the project in which data recovery included controlled excavation (following the Shideler et al. [2012] ADRP) at 12 historic properties (SIHP #s -10154, -28778, -28785, -28786, -28807, -28812 through -28815, -29332, -29335, and -29345); artifact collection at two historic properties (SIHP #s -29348 and -29349); photo documentation of SIHP # -19947; relocation of SIHP #s -29346 and -28808 Features D and E; and characterization of 16 historic trail properties (SIHP #s -00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272) through historical research. Eighty-two excavation units comprising approximately 81.5 sq m of surface area were excavated. CSH completed the data recovery fieldwork in May and June 2015. The field crew included Olivier Bautista, B.A., Scott Belluomini, B.A., Johnny Dudoit, B.A., Angus Raff-Tierney, M.A., Andrew Soltz, B.A., Nifae Hunkin, B.A., Layne Krause, B.A., and Richard Stark, Ph.D., who assisted project director William Folk, B.A. The fieldwork effort required approximately 97 person-days and was completed under the general supervision of Hallett H. Hammatt, Ph.D. (principal investigator). An end of fieldwork letter was submitted to SHPD on 25 June 2015.

The historic properties mitigated herein were identified during an AIS of an approximately 190-acre survey area related to a proposed highway widening project (Monahan et al. 2012a). Project development included grading and filling portions of the highway ROW. Most of the major ground disturbance is on the *makai* side of the existing highway. Data recovery fieldwork focused on collection of data to support Research Objectives 2–4 on temporal analysis, functional analysis, and agricultural analysis (see Section 9). Results of the data recovery fieldwork for both 2011 and 2015 are presented in Volume II of this report and include historic property descriptions, photographs, data recovery excavations, sediment descriptions, feature descriptions, and interpretations. Results of data recovery efforts in regards to the

characterization of 16 historic trail properties (addressing Research Objective 1) through historical research are presented in Volume III of this report.

Section 8 Results of Laboratory Analysis

A variety of laboratory analyses were conducted on materials collected during data recovery fieldwork. Discussions of results by material/analysis type follow.

8.1 Artifact Analysis

Two lithic artifacts were identified and collected during data recovery fieldwork. These included two waterworn basalt manuport bashers (Acc. # 0001 and Acc. # 0002) (Table 25).

Acc. # 0001 (waterworn basalt manuport basher) was collected approximately 12 m southwest of an excavated pit in the surrounding *pāhoehoe* flow. The manuport and the associated excavation pit are both components of SIHP # -29349, originally described during the current project's AIS (Monahan et al. 2012a). Acc. # 0001 is comprised of fine-grained basalt and weighs 1.9 kg. It measures approximately 21 cm by 15 cm by 6.5 cm (Figure 39). It shows signs of use wear on both ends, which suggests the boulder was used for bashing. The parent material is not locally available in the project area; it would have been transported inland from the coast.

Acc. # 0002 (waterworn basalt manuport basher) was collected from within an excavated pit comprising SIHP # -29348, originally described during the current project's AIS (Monahan et al. 2012a). Acc. # 0002 is of highly vesicular basalt and is sizable, weighing 8.4 kg. It measures approximately 33 cm by 23.5 cm by 11.9 cm (Figure 40). Despite lacking clear signs of wear on either end, its heft and portability suggest the boulder intended to be used for bashing. The parent material is not locally available in the project area; it would have been transported inland from the coast.

8.2 Faunal Analysis

This section provides an overview of the faunal material collected during archaeological data recovery. All observed faunal material was recovered and bagged by provenience (excavation unit, strata, and depth) for laboratory analysis. Faunal identifications were conducted by a CSH archaeological field technician and/or an osteologist with experience in identifying Hawai'i's fauna. Skeletal reference collections and resources of Polynesian-introduced and post-Contact species were used. Each specimen was analyzed for evidence of cultural modification and to support a historic or traditional Hawaiian context.

The faunal material recovered during data recovery fieldwork was sorted into two categories: vertebrate and invertebrate. When possible, specimens were identified to class, family, and/or species. The vertebrates include Polynesian-introduced *Sus scrofa* (pig) and *Rattus exulans* (Polynesian rat), although other rat species (e.g., *Rattus norvegicus*) are not definitively excluded. Therefore, all smaller-sized bones of the rat genera are referred to as *Rattus* sp. Two invertebrates were also observed in the project area. These included *Geograpsus severnsi* (extinct land crab) and Amastridae sp. (small land snail). No cultural modifications were identified on any of the faunal remains. With the exception of the pig, faunal assemblages observed throughout the project area are not typically defined as midden utilized during pre-Contact times.

Table 25. Artifacts recovered during the archaeological data recovery

Acc. #	SIHP #	Excavation Unit (EU)	Stratum	Depth (cmbd)	Length (cm)	Width (cm)	Thickness (cm)	Weight (kg)	Material	Comments
0001	-29349	N/a	N/a	Surface	21.0	15.0	6.1	1.9	Basalt	Waterworn manuport basher
0002	-29348	N/a	N/a	Surface	33.0	23.5	11.9	8.4	Basalt	Waterworn manuport basher



Figure 39. Photograph of waterworn basalt basher from SIHP # -29349 (Acc. # 0001)



Figure 40. Photograph of waterworn basalt basher from SIHP # -29348 (Acc. # 0002)

Faunal material was collected from two historic properties (SIHP #s -08785 and -28813) during data recovery fieldwork. These are discussed in detail below.

8.2.1 SIHP # 50-10-27-28785 (Excavation Units 67, 69 through 71, and 75)

SIHP # -28785 is an enclosure 635 m south of the intersection of Hina Lani Street and the Queen Ka'ahumanu Highway within the portion of the project area adjacent to the Kaloko-Honokōhau National Historical Park (see Volume II for a full historic property description). Five of the ten excavation units (EU 67, 69 through 71, and 75) that were excavated during the 2015 data recovery season included the remains of a single mature pig (*S. scrofa*). The skeleton was fully articulated, and no cut marks or other cultural modifications were observed on the bones (Figure 41). Radiocarbon analysis performed on a femoral head of the pig (see also Section 8.3.4) identified the date ranges with the greatest probability (95%) as AD 1670 to 1780 and AD 1800 to post-1950. The results of the analysis show the pig remains could date from a late pre-Contact time frame or could be as recent as modern in age. The presence of the pig within a modified enclosure suggests SIHP # -28785 functioned as a pen utilized for animal husbandry. No other faunal material or cultural materials were observed at SIHP # -28785. The provenience and weight of faunal material collected from SIHP # -28785 is presented in Table 26. A photograph of a sampling of the remains is presented in Figure 41.

8.2.2 SIHP # 50-10-27-28813 (Excavation Units 2, 3, 13, 15, 22, 24, 26, 27, and 42)

SIHP # -28813 consists of six modified lava blisters designated features A through F. It is approximately 437 m north of the intersection of OTEC Road and the Queen Ka'ahumanu Highway. Of the six modified lava blisters, four (Features A, B, C, and E) contained faunal material. A small quantity (i.e., < 1.0 g per feature) of *Rattus* sp. remains observed in Features B, C, and E represents the only vertebrate faunal material observed at SIHP # -28813 (Figure 42). Invertebrate faunal material was also observed in the same four features. This included *G. severnsi* (extinct land crab) and Amastridae sp. (small land snail) (Figure 43 and Figure 44). Concentrations of Amastridae were observed in the four features during both data recovery field seasons, but were only collected during the 2011 field season. The faunal material represented in SIHP # -28813 indicates a low elevation inland area with a low concentration of fauna. None of the faunal material recovered from SIHP # -28813 showed signs of cultural modification, and the context of this historic property does not suggest the faunal remains represent midden. The provenience and weight of faunal material collected from SIHP # -28785 is presented in Table 27 and Table 28.

8.3 Floral Analysis

The project area encompasses an area typified by 'a'ā and pāhoehoe lava flows, with little soil or vegetation cover. The sparse vegetation present is typical of a "Fountain Grass Grassland," as described by Head and Rosendahl (1993:2). Low tufts of grass with scattered shrubs and a few trees grow along this corridor; species observed during fieldwork include *pili* grass (*Heteropogon contortus*), guinea grass (*Panicum maximum*), fountain grass (*Pennisetum* sp.), *wilelaiki* (Christmasberry; *Schinus terebinthifolius*), *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena leucocephala*), *kiawe* (*Prosopis* sp.), and *lantana* (*Lantana camara*).

During data recovery fieldwork, sediment samples were collected from soil areas or beneath stone architectural components of traditional Hawaiian agricultural, habitation, and/or work



Figure 41. Photograph showing a sampling of *S. scrofa* (pig) remains collected from SIHP # -28785

Table 26. Faunal remains recovered from SIHP # -28785

Excavation Unit (EU)	Stratum	Depth (cmbd)	Weight (g)	Description
67	I	140–145	5.4	<i>S. scrofa</i> end tusk fragment
69	I	145–160	1,596.6	<i>S. scrofa</i> jaw bone, axial and appendicular skeleton
70	I	145–155	2,850.6	<i>S. scrofa</i> axial and appendicular skeleton
71	I	146–162	657.2	<i>S. scrofa</i> axial and appendicular skeleton
75	I	135–140	0.2	<i>S. scrofa</i> fragments



Figure 42. Photograph showing a sampling of *Rattus* remains collected from SIHP # -28813



Figure 43. Photograph showing a sampling of *G. severnsi* (extinct land crab) remains collected from SIHP # -28813



Figure 44. Photograph showing a sampling of Amastridae (small land snail) remains collected from SIHP # -28813

Table 27. Vertebrate faunal remains recovered from SIHP # -28813

Feature	Excavation Unit (EU)	Stratum	Depth (cmbd)	Weight (g)	Description
B	15	I	130–140	0.3	<i>Rattus</i> sp.
C	22	I	176–179	0.8	<i>Rattus</i> sp.
E	24	I	102	0.2	<i>Rattus</i> sp.
E	27	I	0–10	0.2	<i>Rattus</i> sp.

Table 28. Invertebrate faunal remains recovered from SIHP # -28813

Feature	Excavation Unit (EU)	Stratum	Depth (cmbd)	Total Weight (g)	Description
A	2	I	0–30	4.6	<i>G. severnsi</i> (2.6 g); Amastridae sp. (2.0 g)
A	3	I	0–30	2.1	<i>G. severnsi</i> (0.2 g); Amastridae sp. (1.9 g)
B	13	I	130–150	2.6	<i>G. severnsi</i> (2.6 g)
B	15	I	130–140	3.2	<i>G. severnsi</i> (3.2 g)
C	22	I	176–179	5.3	<i>G. severnsi</i> (5.3 g)
E	24	I	102	0.7	<i>G. severnsi</i> (0.7 g)
E	26	I	0–10	7.8	<i>G. severnsi</i> (7.8 g)
E	27	I	0–10	1.4	<i>G. severnsi</i> (1.4 g)
E	42	I	0–10	0.1	<i>G. severnsi</i> (0.1 g)

areas. Palynological and starch analysis were performed on six sediment samples from four historic properties (SIHP #s -28778, -28785, -28786, and -28813) in an attempt to identify evidence of cultigens. Macrofloral analysis was also conducted on two samples. The full report produced by PaleoResearch Institute, Inc. (Cummings and Kovacik 2016) is included in Appendix C. In addition, wood taxa analysis was performed by IARII on two charcoal samples; the full report (Huebert and Murakami 2016) is included in Appendix D. All results are described below.

8.3.1 Palynological and Starch Analysis

Palynology is the branch of science concerned with the study of pollen, spores, phytoliths, and other palynomorphs. Palynomorphs are often preserved in sediment samples and, following physical and chemical extraction, can be identified with a microscope. This information leads to the types of plants that made up the local environment, or the local watershed, at the time the sediment was deposited. A large amount of palynological research has been conducted in Hawai'i to examine human impacts on native vegetation. Pollen extraction also retains starch granules, which are a plant's mechanism for storing carbohydrates. Starch is found in numerous seeds, as well as roots and tubers, and can provide evidence of cultigens that produce little or no pollen.

As mentioned above, pollen and starch analyses were performed on six sediment samples (PR-1 through PR-6) collected from four historic properties (SIHP #s -28778, -28785, -28786, and -28813) during data recovery fieldwork. The samples were collected from relatively shallow depths (average depth of 1.2 m) due to the absence of significant sedimentation within the exposed *pāhoehoe* and 'a'ā basaltic lava fields that dominate the project area. The sample locations were generally below modern soil A horizon in order to gain a palynological profile that limits the statistical occurrence of modern invasive plant species found within the project area today. The samples were collected from historic properties interpreted as having a possible agricultural function in order to address Research Objective 2 (see Section 9.2). The analysis was performed in order to identify evidence of cultigens and past human activity, especially that related to agriculture, in the vicinity of these historic properties. Pollen preservation in the samples ranged from good to poor. The results for each historic property are presented in Table 29 and are summarized below.

8.3.1.1 SIHP # 50-10-27-28778

SIHP # -28778, adjacent to Kaloko-Honokōhau National Historical Park, is a *pāhoehoe* excavation consisting of an excavated pit with small piles of angular *pāhoehoe* cobbles and small boulders covering and surrounding the pit. The base of the excavated area contained a thin layer of sediment and organic debris supporting *koa haole* (*L. leucocephala*) and exotic grasses (see Volume II, Section 2.2 for the full historic property description). Pollen and starch analysis on Sample PR-1 (EU-80, Stratum I, 98–104 cmbd) yielded a record dominated by Poaceae pollen, reflecting local growth of grasses, although the grasses cannot be further identified through their pollen grains.

Cheno-am (referring to the genera *Chenopodium* [goosefoot] and *Amaranthus* [pigweed]) pollen was also relatively abundant and likely represents local growth of 'aheahea (*Chenopodium oahuense*), which is a coastal shrub endemic to the Hawaiian Islands. In addition to 'aheahea (*C. oahuense*), other shrubs are represented by small quantities of *Dodonaea*

Table 29. Samples submitted for pollen/starch residue analysis

SIHP # (50-10-27-)	Sample	Excavation Unit (EU)	Stratum	Depth (cmbd)	Description
28778	PR-1	80	I	98–104	<i>Pāhoehoe</i> excavation
28785	PR-2	68	I	150–160	Oval-shaped enclosure
28785	PR-3	73	I	174–179	Oval-shaped enclosure
28786	PR-4	65	I	30–38	Modified depression
28813 (Feature A)	PR-5	2	I	112–116	Modified lava blister
28813 (Feature A)	PR-6	2	I	144–148	Modified lava blister

(representing *a'ali'i* [*Dodonaea viscosa*]), *Euphorbia* (spurge), *Kadua*, *Myrsine* (*kōlea*), *Rhus* (representing *neleau*, also called *neneleau* or Hawaiian Sumac [*Rhus sandwicensis*], and *Sida* (representing *'ilima* [*Sida fallax*]) pollen. *A'ali'i* (*D. viscosa*) is a flowering plant in the soapberry family, while spurge (*Euphorbia*) is a large and diverse genus of flowering plants. *Neleau* (*Rhus sandwicensis*) is a species of flowering plant in the cashew family and is endemic to dry, coastal mesic, mixed mesic, and wet forests of the Hawaiian Islands. *'Ilima* (*S. fallax*) is a species of herbaceous flowering plants in the Hibiscus family and is often found in drier areas with sandy soils, often near the ocean. *Kadua* is a genus of 29 flowering plants restricted to Polynesia; of these, 22 are endemic to the Hawaiian Islands.

Small quantities of Anacardiaceae, *Antidesma*-type, Myrtaceae, and *Rauvolfia* pollen were recovered. Anacardiaceae pollen indicates local growth of a tree in the sumac family such as mango (*Mangifera indica*), which is native to tropical Asia but was introduced to Hawai'i in the early 1800s. *Antidesma*-type pollen likely represents *hame* (*Antidesma platyphyllum*, also called *ha'a*, *mehame*, *hamehame*, *mehamehame*, or *ha'āmaile*), a species of flowering plant endemic to dry to mesic forests of Hawai'i. Myrtaceae pollen indicates a tree in the myrtle family, such as *Eugenia*, *Metrosideros*, *Psidium*, or *Syzygium* (Brazilian or Surinam cherry, *'ōhia*, guava, or Java plum). *Rauvolfia* pollen likely represents *hao* (*Rauvolfia sandwicensis*), which is a shrub or small tree endemic to the coastal mesic and mixed mesic forests of Hawai'i.

Low-spine and high-spine Asteraceae pollen and Liguliflorae pollen represent ragweed (*Ambrosia* family) and similar plants in the sunflower family (Asteraceae), including those in the chicory tribe (*Cichorium* sp.). A few charred Asteraceae tissue fragments suggest burning weeds that include plants in the sunflower family. Small quantities of *Boerhavia*-type and a fragment of a *Geranium* pollen grain reflect local growth of *alena* (*Boerhavia repens*), a succulent herb found in both rocky and sandy coastal areas, and geranium, commonly known as cranesbills, which encompass numerous species of flowering annual, biennial, and perennial plants. The presence of *Leucaena* and *Prosopis* pollen indicate local growth of introduced/invasive tree species, *koa haole* (*L. leucocephala*), which is a small, fast-growing mimosoid tree, and *kiawe* (*Prosopis pallida*), which is an introduced species of mesquite bush/tree bearing spines, spikes of greenish-yellow flowers, and long pods filled with brown seeds. Ferns are represented by monolete and trilete smooth spores.

Recovery of a single, angular starch grain from this sample indicates the deterioration of grass seeds. The angularity of this grain is consistent with grains produced by *Zea mays* (corn). There is no record of corn agriculture being attempted in this area during the historic era; however, picnics may have introduced this species into the sample. While quality control measures in the lab at PaleoResearch Institute, Inc. ensure that starch is not introduced during sample processing, starch grains can be introduced into samples through aerial transport, as well as during the sampling process. A study by Laurence (2013:iii) found that “maize [corn] starch, most likely from ‘powder-free’ [plastic] gloves and air-fall, is a significant source of starch contamination.” Therefore, the presence of corn starch in the sample may represent modern day contamination. Alternatively, Cummings and Kovacik (2016) also note the possibility that other grass seeds produced tightly packed starch, resulting in angularity; *Heteropogon* (a genus of annual and perennial plants in the grass family) seed starch, for example, could not be ruled out as a possibility for this grain, since *Heteropogon* is not included in the PaleoResearch Institute reference collection.

The total pollen concentration for this sample was high, with more than 97,000 pollen grains per cubic centimeter (cc) of sediment. The combination of native and introduced species in the pollen record may reflect the mixing of sediments; alternatively, it may indicate the pit was utilized from the pre- into the post-Contact periods. Although SIHP # -28778 was originally interpreted as a “planting pit feature” (Monahan et al. 2012a:156), no evidence of agricultural use was observed during data recovery fieldwork. Likewise, no starch or pollen grains from common cultigens such as sweet potato and taro were identified within the sample; therefore, palynological analysis concurs with the reinterpretation of SIHP # -28778 as a resource prospecting pit, rather than a planting pit.

8.3.1.2 SIHP # 50-10-27-28785

SIHP # -28785 is an oval-shaped enclosure composed of a C-shaped wall of stacked medium ‘a‘ā and *pāhoehoe* boulders along the edge of a natural depression or collapsed lava blister (see Volume II Section 2.3 for the full historic property description). The east and west ends of the wall connect to the edge of a *pāhoehoe* tumulus; the area enclosed by the wall and tumulus is relatively level and consists of a thick layer of sediment and organic debris supporting the growth of grasses. Pollen samples PR-2 and PR-3 were collected from Stratum I in EU 68 at a depth of 150–160 cmbd and EU 73 at a depth of 174–179 cmbd, respectively. The total pollen concentration was high in both samples, with more than 97,000 and more than 222,000 pollen grains per cc of sediment for Samples PR-2 and PR-3, respectively. Because the contents of the two samples were nearly identical, they are discussed together.

Interestingly, Chenopodiaceae pollen is most abundant, documenting local growth of the shrub ‘aheahea (*C. oahuense*), a coastal shrub endemic to the Hawaiian Islands, either inside or immediately outside the enclosure. Local growth of shrubby and herbaceous plants is further evidenced by small quantities of *Artemisia*, as well as low-spine and high-spine Asteraceae. The *Artemisia* pollen likely represents ‘āhinahina (*Artemisia mauiensis*), which is an endemic, silvery shrub, while Asteraceae represents a variety of plants in the sunflower family. A small quantity of charred Asteraceae tissue fragments suggests burning weeds.

In addition, moderate quantities of Anacardiaceae pollen suggest local growth of mango (*M. indica*) trees or another tree in the family. Evidence of ferns is minimal and includes only monolete spores; barrel-shaped spores observed within the sample likely represent fungus. A few segments of *Sporormiella* dung fungal spores in Sample PR-2 suggest the presence of animal dung as part of the organic debris. *Sporormiella* is a genus of fungi that is obligately coprophilous, growing on the dung of domestic livestock (e.g., cows and horses), as well as wild herbivores; the presence of *Sporormiella* spores may be used as a proxy for the abundance of grazing mammals. Therefore, the recovery of *Sporormiella* spores in Sample PR-2 supports the reinterpretation of SIHP # -28785 as a historic enclosure for animal husbandry, rather than a traditional Hawaiian agricultural enclosure. This reinterpretation is further supported by the lack of pollen or starch from common dryland cultigens such as sweet potato within the two samples. Furthermore, the dominance of Chenopodiaceae pollen in both samples may also reflect the presence of animals eating ‘aheahea (*C. oahuense*) shrubs.

8.3.1.3 SIHP # 50-10-27-28786

SIHP # -28786 is a modified depression originally interpreted as a traditional Hawaiian agricultural feature, which has been reinterpreted as a temporary shelter likely utilized during the

historic era. Pollen and starch analysis of Sample PR-4 (EU 65, Stratum I, 30–38 cmbd) yielded moderately large to large quantities of Anacardiaceae, Chenopodiaceae, and *Kadua* pollen. Anacardiaceae pollen suggests local growth of mango (*M. indica*) trees or another tree in the family. Chenopodiaceae pollen likely indicates local growth of 'aheahea (*C. oahuense*), a coastal shrub endemic to the Hawaiian Islands. *Kadua* is a genus of 29 flowering plants restricted to Polynesia, of which 22 are endemic to the Hawaiian Islands. Total pollen concentration was moderately high, with more than 37,500 pollen grains per cc of sediment.

The sample also included moderately small to small quantities of *Sida*, high-spine Asteraceae, Liguliflorae, Poaceae, and *Prosopis* pollen. *Sida* pollen likely represents 'Ilima (*S. fallax*), which is a species of herbaceous flowering plants in the Hibiscus family and is often found in drier areas with sandy soils, often near the ocean. Asteraceae and Liguliflorae pollen represent ragweed (Asteraceae family) and similar plants in the sunflower family (Asteraceae), including those in the chicory tribe (*Cichorium* sp.). Poaceae pollen reflects local growth of grasses, although the grasses cannot be further identified through their pollen grains. *Prosopis* pollen likely represents *kiawe* (*P. pallida*), which is an introduced species of mesquite bush/tree bearing spines, spikes of greenish-yellow flowers, and long pods filled with brown seeds.

Barrel-shaped spores were moderately abundant in this sample and are similar to those observed in Samples PR-2 and PR-3 from SIHP # -28785 (see above); they likely represent fungus. *Lycopodium cernuum*, monolet bumpy and smooth, and trilete smooth spores represent clubmoss and various ferns growing in the vicinity of SIHP # -28786. This sample also contained a small quantity of *Sporormiella* dung fungal spores, which indicates the presence of grazing animal dung in this probable temporary shelter. The lack of pollen from common dryland cultigens such as sweet potato supports the reinterpretation of SIHP # -28786 as a temporary shelter rather than an agricultural feature. The presence of *Sporormiella* suggests it may have been used for animal husbandry as well.

8.3.1.4 SIHP # 50-10-27-28813

SIHP # -28813 comprises six modified lava blisters designated A through F. Two samples, Samples PR-5 and PR-6, were collected from SIHP # -28813. Both samples were collected from EU 2 in Feature A, which is oval-shaped and exhibits a layer of sediment and organic debris currently supporting grasses. Sample PR-6 was collected from a depth of 144–148 cmbd, and Sample PR-5 was collected from 112–116 cmbd. The total pollen concentration for Sample PR-6 was more than 11,700 pollen grains per cc of sediment, while the concentration for Sample PR-5 was more than 3,300 pollen grains per cc of sediment. However, the abundance of organic debris in Sample PR-5 prevented a count from being obtained; only a single Chenopodiaceae pollen grain was noted amidst the large quantity of debris.

Sample PR-6 yielded mostly large Poaceae pollen, reflecting grasses. A moderately small quantity of Poaceae pollen similar in size to the grains noted in other samples was observed; however, this pollen record is dominated by large grass pollen, which suggests the growth and/or use of *pili* grass (*Heteropogon contortus*). Grasses have been used for a variety of purposes in Hawai'i, including as fibers in cordage, for thatching, and to cover house floors (Handy et al. 1972; Krauss 1993 in Cummings and Kovacik 2016). *Pili* is a perennial grass that grows as a tuft reaching about 3 ft in height, with red-brown bristles and flowers on spikes extending approximately 4 inches in length. It commonly grows in dry, open, and sometimes rocky

landscapes (Krauss 1993 in Cummings and Kovacik 2016). Charcoal from burned *pili* blades was used to produce black dye (*waiho'olu'u*), and the ashes were mixed with the cream of a dark coconut to make medicine for thrush (Handy et al. 1972 in Cummings and Kovacik 2016). Handy et al. (1972 in Cummings and Kovacik 2016) also report *pili* was used in *hana aloha* (love spells).

SIHP # -28786 Feature A was initially interpreted as a traditional Hawaiian agricultural feature. The relatively thick deposit of sediment was interpreted during fieldwork as supporting dryland cultigens such as sweet potato; however, no sweet potato starch was identified within Samples PR-5 or PR-6. Based on the recovered pollen grains, it may have supported the growth of *pili* grass (*H. contortus*).

8.3.2 Macrofloral Analysis

Samples from archaeological sites commonly contain both charred and uncharred floral remains. Many ethnobotanists argue that unless there is a specific reason to believe otherwise, only charred remains should be considered prehistoric. Minnis (1981:147 in Cummings and Kovacik 2016) states it is “improbable that many prehistoric seeds survive uncharred through common archaeological time spans.” In fact, few seeds survive longer than a century, with most surviving for a much shorter period of time (Harrington 1972; Justice and Bass 1978; Quick 1961 in Cummings and Kovacik 2016). This is a result of decomposing organisms working to decay the seeds once the seeds have died. However, archaeological sites with unusual levels of preservation such as caves, waterlogged areas, and very arid areas may yield uncharred prehistoric remains.

Macrofloral analysis was performed on two samples. The first was Sample PR-1 from SIHP # -28778 (EU 80, Stratum I, 98–104 cmbd). The macrofloral portion of Sample PR-1 yielded 13 tiny, unidentified, hardwood charcoal fragments, which were too small for further identification. The results of radiocarbon analysis performed on the charcoal are presented in the following section. Uncharred floral remains included a member of the spurge family, *koa haole*, pricklypear cactus, a member of the purslane family, *'ilima*, and unidentified seeds. In addition to these modern plant remains, uncharred leaves, roots, and rootlets were noted. Non-floral remains included a few insect chitin fragments and moderate quantities of oblong-shaped snail shells.

The second sample was Sample PR-4 from SIHP # -28786 (EU 65, Stratum I, 30–38 cmbd). Uncharred macrofloral remains noted in this sample included moderate quantities of leaf fragments, a few roots, and a moderate quantity of rootlets. Eight hardwood charcoal fragments remained unidentified due to their small size and high level of vitrification. Although charcoal vitrification has been attributed to burning at a high temperature and/or burning green wood, the process of vitrification is not completely understood; experimental studies (McParland et al. 2010 in Cummings and Kovacik 2016) suggest vitrification can also occur at low temperatures. Uncharred non-floral remains included two small fish bone fragments, shells from at least two snail types, a few insect chitin fragments, a single rodent incisor fragment, and abundant rodent fecal pellets. The latter three indicate insect and rodent activity in the vicinity of SIHP # -28786.

8.3.3 Wood Taxa Analysis

Charcoal was collected from 59 of the 80 data recovery excavation units. The charcoal was distributed throughout the project area at various depths and likely represents natural wild fires that have inundated the area over time. Charcoal collection was concentrated in areas below the current exposed surface in order to minimize the statistical occurrence of charcoal from modern brushfires or recent human occupation. No fire pits or other anthropogenic features were associated with any of the charcoal deposits. Two charcoal samples collected from SIHP # -28785 (likely early historic enclosure utilized for animal husbandry) were analyzed for wood taxa identification by IARII (Huebert and Murakami 2016; see Appendix D). The results are presented in Table 30 and are discussed below.

The two charcoal samples were chosen to work in concert with radiocarbon analysis (see the following section for radiocarbon dating results) in order to determine an accurate date range for anthropogenic activities at SIHP # -28785. The samples were collected from 145–160 cmbd in EU 68 and from 70–80 cmbd in EU 70. Wood charcoal from *Euphorbia* sp. (*'akoko*) was identified in the former, while wood charcoal from *Myoporum sandwicense* (*nai*) was identified in the latter. Both of these are shrubs or small trees native to the Hawaiian Islands.

Euphorbia is a genus that includes 15 species endemic to Hawai'i, ranging from coastal environments to upper forest zones on the main islands (Wagner et al. 1990:602–617 in Huebert and Murakami 2016). In addition, eight native species and a number of naturalized introductions are also found on Hawai'i Island in a wide range of habitats. *'Akoko* was valued for firewood by Hawaiians, and the milky sap was once considered a possible source for rubber (Hillebrand 1981:396 and Rock 1974:261 in Huebert and Murakami 2016). According to Huebert and Murakami (2016), it is likely the *Euphorbia* does not have any great inbuilt age (i.e., more than a few decades), as both specimens within the sample appeared to be from stems approximately 1 cm in diameter.

Myoporum sandwicense is an indigenous plant that ranges from a shrub 1 m tall in coastal areas to a 15-m tall tree at higher elevation. Its elevational distribution has been documented as 0–2,380 m on all main Hawaiian Islands except Kaho'olawe (Wagner et al. 1990:928–929 in Huebert and Murakami 2016). The fragrant wood was used by Hawaiians for house posts and was harvested during the sandalwood trade with China, when the supply of native sandalwood became low (Buck 1957:83 and Rock 1974:429 in Huebert and Murakami 2016). Because the diameter of the *Myoporum sandwicense* specimen could not be determined, it is possible this specimen contains a moderate amount of inbuilt age.

8.4 Radiocarbon Analysis

Radiocarbon analysis was attempted on a total of four samples and successfully performed on three samples from two historic properties. The results are presented below.

8.4.1 PaleoResearch Institute, Inc.

AMS radiocarbon analysis was attempted on unidentified hardwood charcoal fragments from two sediment samples by PaleoResearch Institute, Inc., but was performed successfully on only one sample. The charcoal fragments from SIHP # -28786 (modified depression likely utilized as a temporary shelter) contained an unspecified brown substance or deposit and were therefore

Table 30. Results of wood taxa identification

SIHP # (50-10-27-)	Provenience	Taxon	Hawaiian Name	Origin	Habit	Part	Weight (g)
28785	EU 68, 145–160 cmbd	<i>Euphorbia</i> sp.	'Akoko	Native	Shrub / tree	Wood	0.26
28785	EU 68, 145–160 cmbd	<i>Euphorbia</i> sp.	'Akoko	Native	Shrub / tree	Wood	0.26
28785	EU 70, 70–80 cmbd	<i>Myoporum sandwicense</i>	Naio	Native	Shrub / tree	Wood	0.44

subjected to chemical pretreatment prior to AMS radiocarbon dating. Although the sample was treated very carefully by PaleoResearch Institute, Inc., it did not survive chemical pretreatment, and several tiny, brown, fibrous-like fragments that remained were too small for AMS radiocarbon dating.

The charcoal fragments (Sample 1; EU 80, Stratum I, 98–104 cmbd) from SIHP # -28778 (*pāhoehoe* excavation interpreted as a resource prospecting pit) yielded a two-sigma calibrated age range of AD 1649 to 1683 (28.5%), AD 1737 to 1756 (5.7%), AD 1761 to 1804 (42.9%), and AD 1936 to present (18.3%). These results indicate the sample could date from a late pre-Contact time frame or be as recent as modern in age. The results are presented in Table 31 and Figure 45.

8.4.2 Beta Analytic Inc.

AMS radiocarbon analysis was performed on two samples (a charcoal fragment and an *S. Scrofa* bone) by Beta Analytic, Inc. The charcoal sample (Sample 2) was collected from EU 68 at SIHP # -28785 (enclosure utilized for animal husbandry) and was identified as *Euphorbia* sp. by IARII (see Section 8.3.3). According to Huebert and Murakami (2016), it is likely the *Euphorbia* does not have any great inbuilt age (i.e., more than a few decades), as the specimen appeared to be from a stem approximately 1 cm in diameter. The sample yielded a two-sigma calibrated age range of AD 1526 to 1557 (5.7%), AD 1632 to 1682 (51.9%), AD 1738 to 1751 (1.3%), AD 1762 to 1903 (29.5%), and AD 1937 to present (7.1%). These results indicate the sample could date from a late pre-Contact time frame or be as recent as modern in age. The results are presented in Table 32 and Figure 46.

Radiocarbon analysis was also conducted on bone collagen (Sample 6) collected from the femoral head of a fully articulated pig skeleton discovered during excavation of EU 70 at SIHP # -28785. The bone sample yielded a two-sigma calibrated age range of AD 1675 to 1778 (38.0%), AD 1799 to 1894 (42.4%), and AD 1905 to post-1942 (14.9%). These results indicate the pig remains could date from a late pre-Contact time frame or be as recent as modern in age. Therefore, the results do not contradict the interpretation of SIHP # -28785 as a historic pen used for animal husbandry. The results are presented in Table 33 and Figure 47.

8.5 Summary of Laboratory Results

Macrofloral analysis of samples from two historic properties (SIHP #s -28778 and -28786) yielded mostly uncharred floral remains that included seeds, leaves, roots, and rootlets from various plants. Uncharred insect chitin fragments in both samples indicate limited insect activity in both deposits, while a rodent tooth and fecal pellets identified in Sample PR-4 from SIHP # -28786 indicate rodent activity. Both samples yielded snail shells, while two uncharred fish bone fragments were noted in Sample PR-1 from SIHP # -28778. Unidentified hardwood charcoal fragments recovered in small quantities from both sediment samples were selected for AMS radiocarbon dating; however, radiocarbon analysis was performed successfully on only one (Sample 1, PR-1, SIHP # -28778), since the small, vitrified charcoal from Sample PR-4 (SIHP # -28786) dissolved during chemical pretreatment.

In addition to the unidentified charcoal fragments from SIHP # -28778, radiocarbon analysis was also performed on an *S. scrofa* bone and a charcoal sample from SIHP # -28785. The charcoal was identified as *Euphorbia* sp., which was unlikely to have any great inbuilt age (i.e.,

Table 31. Radiocarbon analysis for Sample 1 (SIHP # -28778)

Sample Data	Measured 14C Age	13C/12C Ratio	Conventional 14C Age	Two-Sigma Calibration (95.4% Probability)
PRI-5411 SAMPLE 01	100.1 +/- 0.4 pMC	-13.9 o/oo	207 +/- 22 BP	AD 1649 to 1683 (28.5%) AD 1737 to 1756 (5.7%) AD 1761 to 1804 (42.9%) AD 1936 to present (18.3%)

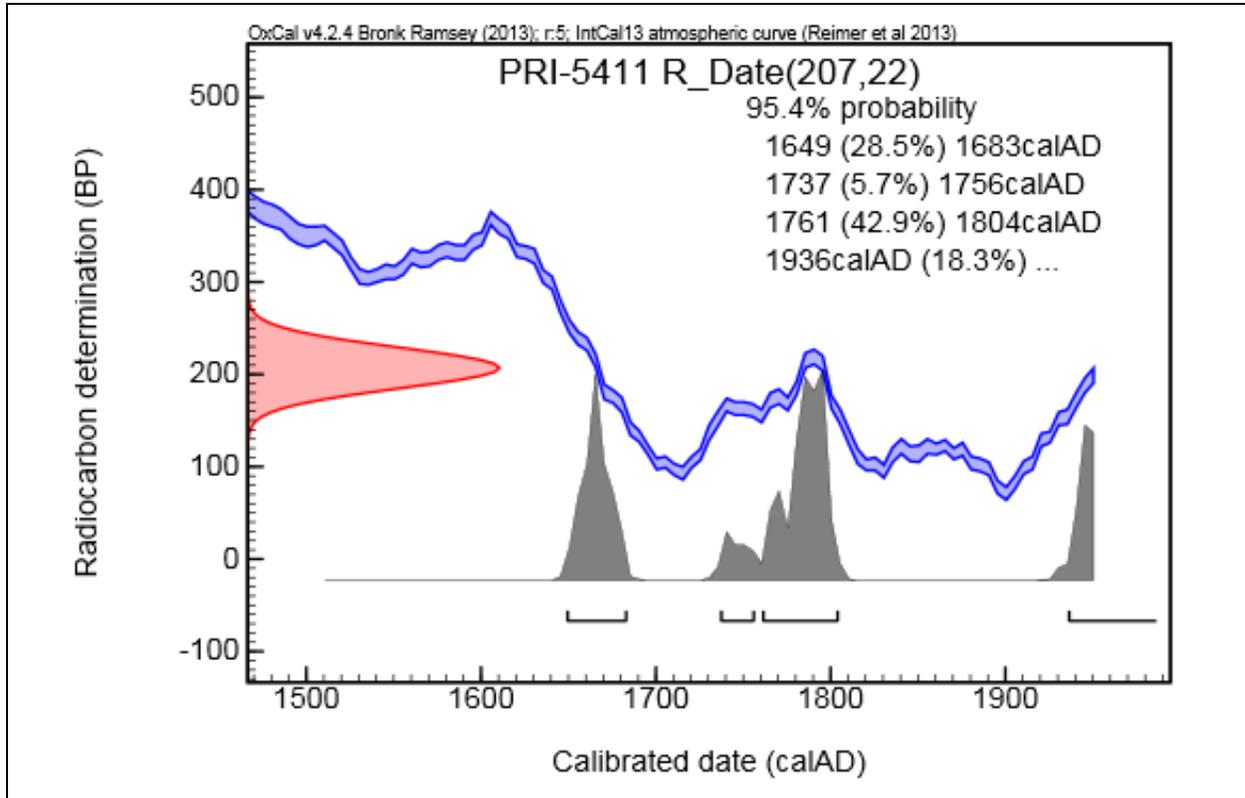


Figure 45. Two-sigma calibration of radiocarbon analysis for Sample 1 in calendar years

Table 32. Radiocarbon analysis for Sample 2 (charcoal, SIHP # -28785)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age	Two-Sigma Calibration (95.4% Probability)
Beta-438424 SAMPLE 02	30 +/- 30 BP	-11.9 o/oo	240 +/- 30 BP	AD 1526 to 1557 (5.7%) AD 1632 to 1682 (51.9%) AD 1738 to 1751 (1.3%) AD 1762 to 1903 (29.5%) AD 1937 to Present (7.1%)

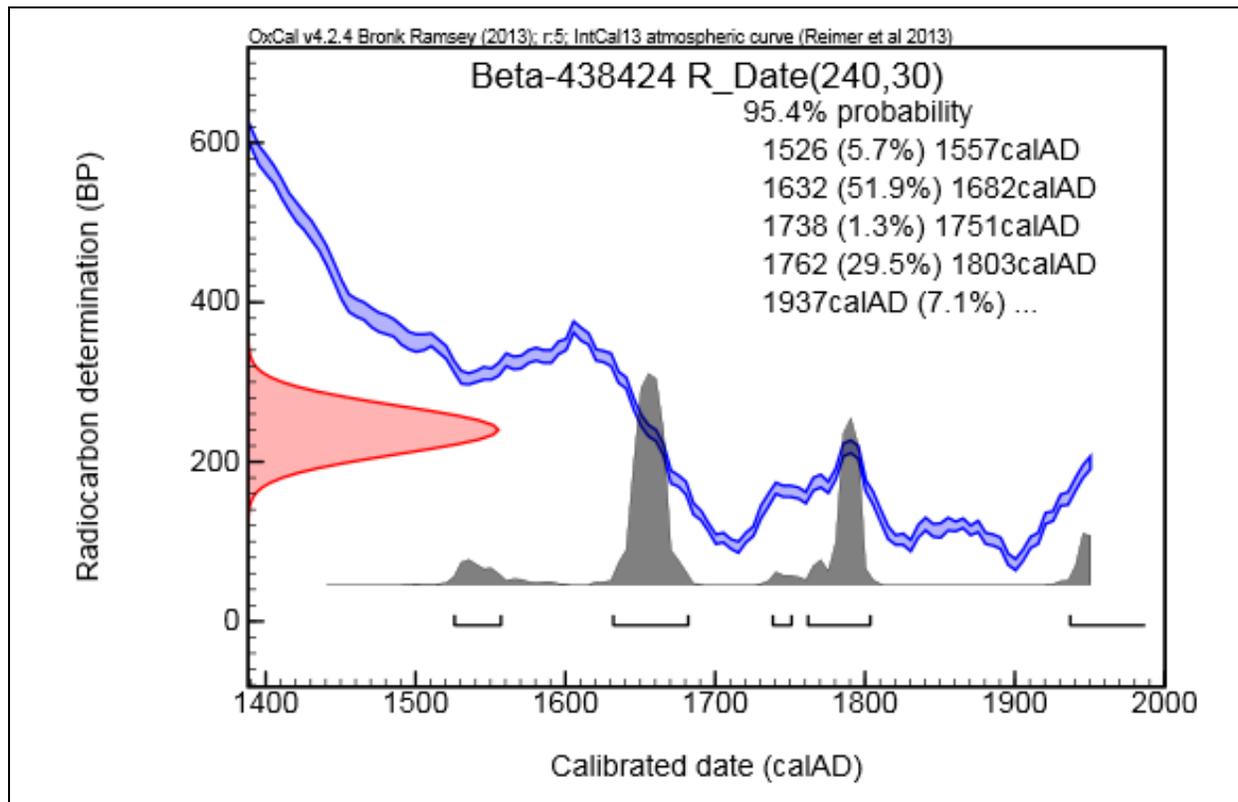


Figure 46. Two-sigma calibration of radiocarbon analysis for Sample 2 in calendar years

Table 33. Radiocarbon analysis for Sample 6 (*S. scrofa* bone, SIHP # -28785)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age	Two-Sigma Calibration (95.4% Probability)
Beta-435909 SAMPLE 06	100.1 +/- 0.4 pMC	-16.2 o/oo	130 +/- 30 BP	AD 1675 to 1778 (38.0%) AD 1799 to 1894 (42.4%) AD 1905 to 1942 (14.9%)

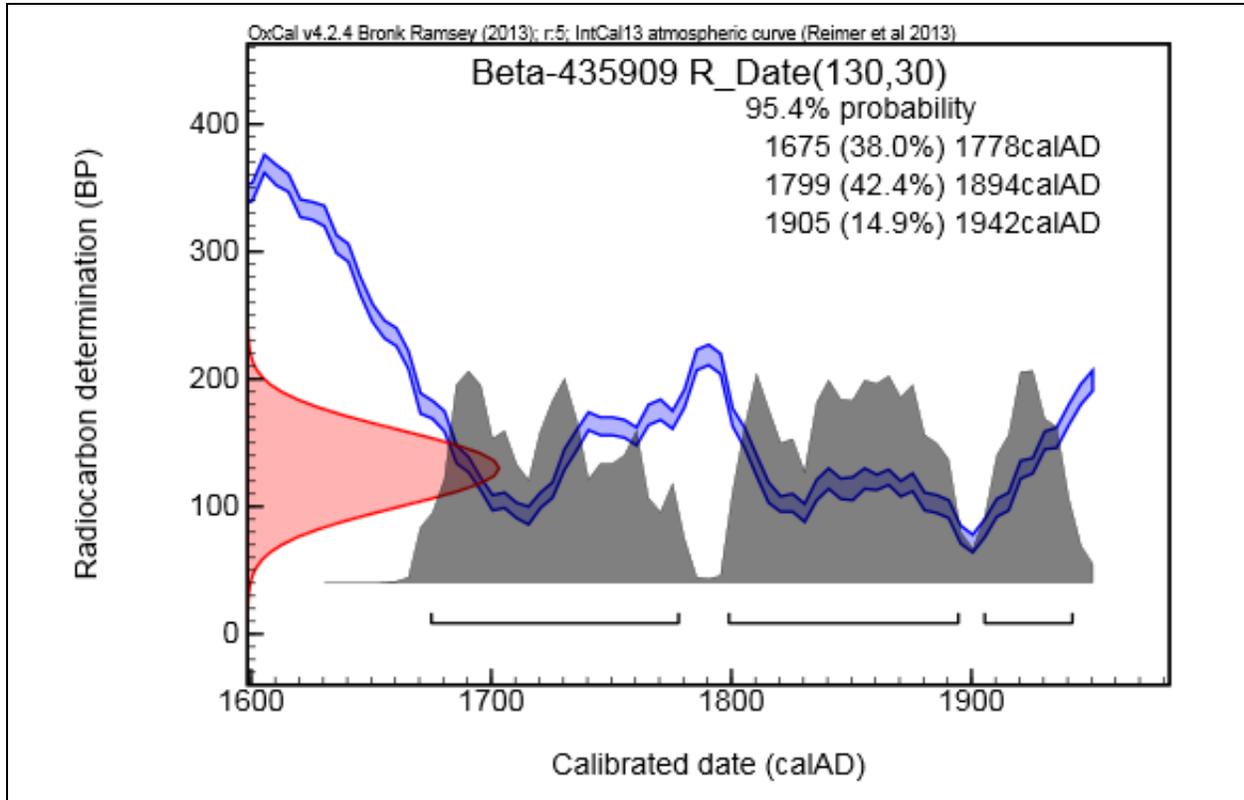


Figure 47. Two-sigma calibration of radiocarbon analysis for Sample 6 in calendar years

more than a few decades) (Huebert and Murakami 2016). All three samples yielded two-sigma calibrated age ranges that indicate anywhere from a late pre-Contact to modern time frame.

Pollen and starch analysis of six sediment samples collected in lava features at four historic properties (SIHP #s -28778, -28785, -28786, and -28813) yielded diverse evidence of local vegetation. SIHP # -28778 yielded the most varied pollen record, which included evidence of both native and alien vegetation; this is consistent with the radiocarbon dating results, which indicate possible activity in the area from the late pre-Contact period into historic or even modern times. All four historic properties were initially interpreted as possible traditional Hawaiian agricultural features; however, the lack of pollen or starch from common dryland cultigens such as sweet potato does not support this interpretation. Rather, the pollen and starch record supports the reinterpretation of these historic properties as follows. SIHP # -28778 is reinterpreted as a resource prospecting pit. SIHP # -28785 is reinterpreted as a historic feature used for animal husbandry; the recovery of *Sporormiella* dung fungal spores in the upper sediment sample further supports this reinterpretation. SIHP # -28786 is reinterpreted as a temporary shelter; the recovery of a small quantity of *Sporormiella* dung fungal spores suggests possible use for animal husbandry as well. The recovery of large Poaceae pollen from SIHP # -28813 suggests the growth and/or collection of *pili* grass, which was commonly used by the Hawaiians for thatching roofs and covering floors.

A modest quantity of vertebrate and invertebrate faunal remains were collected from several excavation units during data recovery fieldwork. Vertebrate remains included pig (*S. scrofa*) and rat (*Rattus* sp.), while invertebrate remains included *G. severnsi* (extinct land crab) and Amastridae sp. (small land snail). The type and quantity of the remains are consistent with natural deposition, and none of the remains showed evidence of cultural modification; therefore, they are not interpreted as midden.

Section 9 Research Objectives

Based on the available historical and archaeological evidence, the largest traditional Hawaiian settlements in the vicinity of the project area were located along the coast, in association with several large *loko* (fishponds), and in the upcountry, in the relatively cooler and misty uplands. The land within and immediately adjacent to the current project area is therefore considered to be an “intermediate” zone between the more productive *kula* coastal settlements and the upland *kalu* gardening areas (Table 34). Previous archaeological work at and near the subject data recovery historic properties suggests traditional habitation features at this elevation (approximately 60–140 ft AMSL) were primarily occupied on a temporary or recurrent, rather than permanent, basis (e.g., Jensen and Goodfellow 1993; Robins et al. 2000). Permanent habitations consisting of stacked stone features located at the ground surface have been documented higher upslope (at approximately 700–800 ft AMSL) by Rechtman (2000) and Hammatt et al. (2001).

Likewise, cultivation of plants in the intermediate zone appears to have been conducted on a relatively small-scale, rather than intensive, basis. Radiocarbon dates from archaeological excavations in the vicinity of the project area demonstrate Hawaiian occupation of this area by at least 1,000 years ago (cf. Cordy et al. 1991:465); however, intensive use of the intermediate zone appears to have occurred somewhat later than this (i.e., starting in the last few centuries before European contact). The following research objectives for the current data recovery project are designed to expand our knowledge of traditional Hawaiian use of this intermediate zone.

9.1 Research Objective 1: Trails

The 16 historic trail properties described during the current project's AIS are as follows: SIHP #s -00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272. The Māmalahoa Trail (SIHP # -00002), which was constructed between 1836 and 1855, extends for miles outside (northwest and southeast of) the project area. SIHP # -10714 is a system of *mauka-makai* oriented trails known as the “Road to Sea Trail,” utilized from pre-Contact times through the historic era. SIHP # -18099 is a pre-Contact *mauka-makai* oriented trail known as the “Trail to Honokōhau.” SIHP # -19953, another *mauka-makai* oriented trail, was interpreted as dating to the pre-Contact or early historic period. The remaining trails (SIHP #s -15324, -19946, -19952, -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272) were described as *mauka-makai* oriented trails of indeterminate age.

Research Objective 1 is to characterize the nature and distribution of trail types (i.e., those with formal features such as curbing and steppingstones versus those without) by developing a predictive model based on known trails in the North Kona region and by integrating this data with documented trails in the project area. Any trail not found to correlate with a historically mapped trail was evaluated for its particular characteristics according to Apple's (1965) criteria and proximity to other historic properties, with the objective of determining relative age, function, and/or regional significance (Table 35). It was likely trails found on historic maps would be of the later Types B, C, or D and possibly the modified Type AB, as the Type A trails are both older and much harder to see in most areas (Apple 1965:10).

Table 34. Emic planting zones of Kona, Hawai'i (after Allen 2004:201)

Zone	Description	Elevation	Primary Crops
<i>Kula</i>	Plain, open country, inland from the coast	Coast–500 ft (0–150 m)	Sweet potato (<i>Ipomoea batatas</i>), paper mulberry (<i>Broussonetia papyrifera</i>)
<i>Kalu</i> or <i>Kalu'ulu</i>	Luxuriant, cultivable zone	500–1000 ft (150–300 m)	Breadfruit (<i>Artocarpus altilis</i>) with paper mulberry (<i>B. papyrifera</i>) understory and sweet potato (<i>I. batatas</i>)
' <i>Apa'a</i>	Dry zone	1000–2500 ft (300–750 m)	Taro (<i>Colocasia esculenta</i>), sweet potato (<i>I. batatas</i>) with sugarcane (<i>Saccharum officinarum</i>), <i>ki</i> (<i>Cordyline fruticosa</i>) and banana (<i>Musa</i> spp.)
' <i>Ama'u</i>	Upland/fern zone	2000–3000 ft (600–900 m)	Banana (<i>Musa</i> spp.) and ' <i>ama'u</i> fern (<i>Sadleria cyatheoides</i>)

Table 35. Trail types (after Apple 1965:65)

TYPE "A"	TYPE "AB"	TYPE "B"	TYPE "C"	TYPE "D"
<p><i>a.</i> Single-file foot trails, characterized by many turnings and one-man width; if on coast, persistently following configurations of shoreline where passable, skirting inland around major land obstacles such as cliffs (thus there was a single beach trail around most of the island)</p> <p><i>b.</i> Coast-inland trails within each <i>ahupua'a</i> of this type</p> <p><i>c.</i> Taboo areas not crossed by such trails</p> <p><i>d.</i> Over soil; a recognizable trace, some places deep</p> <p><i>e.</i> Over "clinker" lava ('<i>a'ā</i>); steppingstones, usually of smooth, waterworn stones ('<i>ala</i>)</p> <p><i>f.</i> Over "billowy" lava (<i>pāhoehoe</i>); usually no trace (followed easiest and shortest route); some cracks filled with small stones; some low spots with causeways of rocks (<i>hipaepae</i>); steppingstones of angular-edged rocks; occasional piles of rocks to mark trail; perhaps petroglyphs also</p>	Modification of Type "A" to accommodate horses; some widening where terrain permitted; usually just the addition of kerbstones, with perhaps some ramping up difficult places	New trails with kerbstones for horses; built in straight line where possible, thus always inland of coastal Types "A" or "AB"; crossed former taboo areas and <i>ahupua'a</i> boundaries; deviated from strict shoreline route; both one- and two- horse width; usually connect with Type "AB" to make a shortcut	New two-horse trails; built as straight as possible between two major points, cutting off many former coastal settlements	Modification and minor realignment of Type "C" to accommodate wheeled vehicles

The treatment of SIHP # -00002 (Māmalahoa Trail) and the intersecting *mauka-makai* trail SIHP # -19953 was codified in the original MOA, in which a combination of preservation and data recovery (for portions that could not be saved) was recommended per Walsh and Hammatt (1995). Data recovery work at SIHP #s -00002 and -19953 was conducted by CSH in 1999 (see Hammatt et al. 1999) and included excavation of four trenches (two at each trail), as well as photo documentation. SIHP #s -00002 and -19953 are the only historic trail properties where data recovery fieldwork was performed; no fieldwork was performed at trails during the 2011 or 2015 data recovery field seasons.

During a revision of the Shideler et al. (2012) ADRP (see Hammatt and Shideler 2014), it was decided to effectively move the *makai* edge of the project *mauka* to secure the support of the Advisory Council on Historic Preservation (ACHP). As a result, ten trails (SIHP #s -15324, -18099, -19946, -19953, -19954, -22418, -22507, -28774, -28782, and -29272) that were going to be partially destroyed would no longer be impacted by the project (see Table 2 and Table 3). Based on consultation with the NPS, all *mauka-makai* trails identified in the project area extend *makai* beyond the project area limits, and many can also be traced *mauka* outside the project area. Physical survey of the full extent of these trails outside the project area boundary (i.e., the State ROW) was beyond the scope of work for the AIS (see Monahan et al. 2012a); however, in response to NPS concerns and review comments, CSH recommended a more comprehensive treatment of trails. Therefore, data recovery for historic trail properties consisted of a comprehensive archival analysis that places the project area trail segments in a context that accurately reflects their cultural and historical significance (see Volume III Figure 3 and Figure 4).

9.1.1 1999 Data Recovery Results

Trenches 1 and 2 were excavated at SIHP # -00002 (see also Volume III Section 2.1.1.1). The section of trail at Trench 1 was 1.9 m wide and built up, particularly on the *makai* (west) side, which is in a natural depression in the 'a'ā field. The surface of the trail, which consisted of crushed 'a'ā pebbles, is most likely the result of a combination of use wear and clearing. Large 'a'ā boulders and cobbles were placed on the flanks of the trail, resulting in a trough-like profile, with the surface lying 30-75 cm below the raised sides. Below the surface, the trail consisted of 2-4 courses of mostly medium-sized cobbles, approximately 25-45 cm in diameter, within 'a'ā pebble fill. The west (*makai*) side of the trail was significantly more built up than the east (*mauka*) side. No cultural materials were observed during excavation.

The section of trail at Trench 2 was also built up in a natural depression of the 'a'ā field and is similar structurally to the portion of the trail at Trench 1. Like Trench 1, Trench 2 had been built up on the flanks with small boulders approximately 25 cm above the trail surface. The surface consisted of an 'a'ā cobble and pebble pavement approximately 5-10 cm thick, with obvious signs of use wear (i.e., dense packing and level surface). The width of the surface was 2.4 m. Underlying the surface was a built-up berm with medium and large cobbles stacked 2-3 courses high within a packed 'a'ā pebble and fine silt matrix. No cultural materials were observed during excavation.

Trenches 3 and 4 were excavated at SIHP # -19953, which crosses the Māmalahoa Trail on the west side of the Queen Ka'ahumanu Highway before extending *makai* onto NPS lands and heading toward 'Aimakapā Fishpond. SIHP # -19953 was considerably less defined than

the Māmalahoa Trail, though obviously used as a path to the coastal area. Trench 3 was placed on a portion of the trail that was approximately 0.9 m wide and moderately built up, about 75 cm. The surface consisted of medium-sized, subangular boulders with small to medium cobbles and pebbles as fill. There was no pavement on this portion of the trail, though discoloration from use helped to define the course of the trail. The trail was built up about 1-3 courses, with no defining surface layer. No cultural materials were observed during excavation.

The section of trail at Trench 4 was on a natural rise with little alteration to the natural surface. The surface was about 1 m in width and consisted of medium-sized 'a'ā pebbles (2-7 cm in diameter). Lying beneath the surface was a thick stratum of weathered 'a'ā pebbles and sparse silt approximately 50 cm thick. One large boulder flanked the north side of the trail, but it appeared to be natural and not deliberately placed. Along this section of the trail, several pieces of fine-grained basalt with embedded (1 mm) olivine crystals was observed. No cultural materials were observed during trenching.

9.1.2 Results of Archival Research

Archival research involved the analysis of all relevant historic Registered Map references and other documents, which could be used as a baseline for a systematic analysis. This analysis would place the project area trail segments in a wider context to more accurately reflect their cultural and historical significance. Additional archival research on 13 historic trail properties (SIHP #s -00002, -10714, -18099, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, and -28791) was performed using data provided by the NPS through research permit # KAHO-2016-SCI-0005 (Appendix E). This data was used to develop narrative descriptions of the trails as they extend into and throughout Kaloko-Honokōhau National Historical Park and to discuss the complexity of the trail system in the area, which connects various locations of interest along the coast. Per the request of the NPS, the precise locations of trails in the National Park that have not previously been disclosed to the public were omitted from this report.

Archival research indicates each *ahupua'a* had a *mauka-makai* trail that led from the coast to the uplands. Sometimes these were mere footpaths marked by cairns across the bare *pāhoehoe* or 'a'ā lava (Clark and Rechtman 2006a:61); these are trails that would be classified as Type "A" according to Apple's (1965) criteria. Such trails were designed in accordance with the *kapu* system, which prohibited residents from travelling beyond their *ahupua'a* boundaries. Only one trail (the coastal trail; see Figure 28), encircling the perimeter of each island, crossed *ahupua'a* boundaries; this trail was used during the *makahiki* festival for tax collection purposes.

Eleven of the *mauka-makai* trails (SIHP #s -10714, -15324, -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272) in the current project area are classified as Type "A," making it the most common type identified. Although they lack formal attributes such as curbing and ramping, they may be characterized by stepping stones or rock piles marking the trail. For instance, two stacked boulders located alongside (just north of) SIHP # -10714 Feature B may have served as a trail marker, while a concentration of weathered coral pebbles and cobbles may have served as a trail marker at SIHP # -28782. Stepping stones consisting of *pāhoehoe* slabs were observed at SIHP #s -19954 and -15324 Feature B. The remaining

Type “A” trails were identified solely through observing subtle wear pattern/color variation on the lava flow.

Type “A” trails typically date to the pre- or early post-Contact period; however, as NPS trail specialists have pointed out, trails lacking formal attributes within the subject project area may exhibit formal features elsewhere (i.e., outside the project area). This is true of at least two Type “A” trails (SIHP #s -10714 and -29272). A more formal section of SIHP # -29272 with curbing and paving was recorded during a study *makai* of the current project area (see Rechtman and Clark 2012). Similarly, a more formal section of SIHP # -10714, the “Road to the Sea,” also served as a major *mauka-makai* route, and an improved section of this trail has been documented *mauka* of the current project area. Both SIHP #s -10714 and -29272 will be described in greater detail during this section’s discussion of the Māmalahoa Trail (SIHP # -00002).

Additional evidence to support the interpretation of several Type “A” trails as traditional Hawaiian foot paths is provided by the proximity of those trails with other likely traditional Hawaiian features. This is the case with SIHP #s -22418, -22507, -28782, and -28784. SIHP # -22418 is approximately 10 m from a likely traditional Hawaiian planting pit (SIHP # -22417), while a probable traditional Hawaiian agricultural complex lies between SIHP #s -28782 and -28784. Although no historic properties were identified in association with SIHP # -22507 within the current project area, traditional-type features including *ahu* (SIHP # -22506), mounds (SIHP #s -22419), and a terrace (SIHP # -22421) have been recorded along both sides of the trail outside the project area, within the National Park.

Another characteristic of Type “A” trails is that they may be associated with petroglyphs. It has been noted by Robins et al. (2000:84) that petroglyphs are often associated with habitation sites and with trails. Robins et al. (2000) propose a possible distinction between personal and public significance for the petroglyphs, suggesting those displayed within a habitation cave may be significant mainly to the individual or family, while images displayed along trails may have been created for the general public, denoting significance to the greater community. At least two trails (SIHP #s -18099 and -28791) within the current project area are associated with petroglyphs. SIHP # -28791 in Kaoloko Ahupua‘a is associated with a likely pre-Contact petroglyph (SIHP # -28792), which has been engraved onto a smooth, level *pāhoehoe* surface (Shideler et al. 2012:167). SIHP # -18099 in Honokōhau Ahupua‘a, immediately south of Kaloko, is actually a Type “AB” trail (discussed in the following paragraph) and is associated with both pre-Contact and historic petroglyphs (containing words). Yucha and McDermott (2008:26) recorded five petroglyphs on outcrops and small portable boulders near SIHP # -18099. One petroglyph, SIHP # -18081, is at the juncture of SIHP # -18099 and the Māmalahoa Trail (SIHP # -00002), just *mauka* of the current project area. Robins et al. (2000:84) propose that such images may have demarcated the trail juncture for travelers, as well as serving as *kapu* markers for non-residents traveling the Māmalahoa Trail, to prevent them trespassing into Honokōhau Ahupua‘a.

Many Type “A” trails were improved in the mid-nineteenth century for horse and/or carriage traffic, transforming them into Type “AB” trails. Type “AB” trails are Type “A” trails that have been widened to accommodate horses and carriages; curbstones and/or ramping were sometimes added as well. Type “AB” trails are the second most common type, with four (SIHP #s -18099, -19946, -19952, and -19953) in the current project area. The government paid for the

improvements or used prisoners working off penalties to construct the roads, which became straighter back from the coast. The main means of transportation on these trails prior to 1947 was by foot, as well as on horses and donkeys. A donkey skeleton was observed at SIHP # -19946 in Kohanaiki Ahupua'a during data recovery fieldwork. Based on the the presence of donkey bones, as well as the trail width and lack of stepping stones, SIHP # -19946 is interpreted as a historic horse/donkey trail, which may have evolved from an earlier, traditional footpath. The transportation of goods by trained donkeys in North Kona has been documented as follows:

During Thanksgiving, Christmas, and New Year's, our kūpuna looked forward to having awa and 'anae in the pā'ina. Old Polto used to catch the fish about ten o'clock in the night, and by two o'clock in the morning, he had it all packed up on the donkey, and they trained a dog and the donkey to transport the fish from Kaloko-Honokōhau to Kailua, at Henry Akona's market. [Maly and Maly 2002:11]

Furthermore, a *pā kēkake*, or donkey corral, is situated on the *mauka* side of the beach at the Kohanaiki Golf Club (see Volume III Figure 43). Its connection to the *mauka-makai* trails of Koahaniki, including possibly SIHP # -19946, is described as follows:

Not far from the ocean, a rustic donkey corral built of lava rock still stands. The donkeys would be loaded up and taken to the trail. They would walk to their destination without riders or guides; they would be unloaded, loaded back up and pointed back to where they came from. [Koahanaiki Press 2015:3]

The use of donkeys and horses on *mauka-makai* trails prior to World War II has also been documented in Kaloko Ahupua'a. Interviews with local informants revealed the following information about SIHP # -10714, the "Road to the Sea":

They would take a trail from 'O'oma over to the homesteads, then go down to the ocean from there. She recalled with some delight how donkeys and horses (they rode donkeys and horses, which she considered the Cadillacs of the day) would 'take their sweet time' going downhill, but moved rapidly uphill on their way home. They would carry fresh water and food down to the ocean, and would fish and drink brackish water down there when the fresh water ran out. [Wolforth et al. 2005:29]

When Jeeps became available for purchase after the end of World War II, many old *mauka-makai* trails were improved for use by wheeled vehicles, and the use of pack animals declined.

The first improved cross-*ahupua'a* trails through Kekaha (inland of the coastal trail) were the *alaloa* and the *alahahele*. The *alahahele*, or Kealaehu ("path of Ehu"), extended from Kailua to the uplands of Kekaha; the current Belt Highway, or Māmalahoa Highway, is aligned with portions of this old trail. The *alaloa* was modified in the 1840s and called the *Alanui Aupuni* (Government Road), the King's Highway, or the Māmalahoa Trail. Cordy et al. (1991:403) believe the curb-lined Māmalahoa Trail was built between 1836 and 1855. Portions of this trail, designated SIHP # -00002, are aligned with the current Queen Ka'ahumanu Highway, and a 149-m segment is within the current project area. SIHP # -00002 is the only trail in the current project area classified as Type "D" based on the criteria presented by Apple (1965; see Table 35). Type "D" trails are generally the width of two horses and have been modified to

accommodate wheeled vehicles. They are built as straight as possible, often cutting off former coastal settlements, and may contain ramping and curbstones.

The Māmalahoa Trail (SIHP # -00002) was used for commerce, troop movements, carrying messages, collecting taxes, and other government activities. The Māmalahoa Trail, inland of the earlier coastal trail, was the main cross-*ahupua'a* trail in the nineteenth century, extending from Kawaihae to Kiholo, upslope to Hu'ehu'e, and down again to Kaloko, Honokōhau, Kealakehe, and Kailua. It was also considered a very safe means of travel, as it fell under the jurisdiction of Kamehameha I's "law of the splintered paddle," which decreed that any traveler could use the trail without fear of being molested (Greene 1993). However, as the population shifted to the agricultural zone along the inland trail, the Māmalahoa Trail on the lower barren shore was abandoned. By the time of J.S. Emerson's survey of homestead lands in Kekaha in 1888, the trail was noted as "Lower Govt. Road—little used" (Cordy et al. 1991:405).

The Māmalahoa Trail (SIHP # -00002) extends both northwest and southeast outside the current project area and is bisected by numerous *mauka-makai* oriented trails, including four (SIHP #s -10714, -18099, -19953, and -29272) within the current project area. Of these, three (SIHP #s -10714, -18099, and -29272) were major *mauka-makai* routes that led from the coast to the uplands and feature prominently on historic maps (e.g., Figure 28). SIHP # -10714 is a trail complex known as the "Road to the Sea," which generally follows the Kaloko/Kohanaiki *ahupua'a* boundary and extends from the Kohanaiki Homesteads (*mauka*) to Kaloko Fishpond at the coast. Within the current project area, CSH has identified three trail segments associated with the "Road to the Sea," designated as SIHP # -10714 Features A–C. All three features continue *makai* into the Kaloko-Honokōhau National Historical Park, although Feature B terminates shortly after crossing the boundary. Features A and C eventually merge with one another and continue toward Kaloko Fishpond, eventually encountering a Jeep trail.

Based on historic maps, SIHP # -10714 dates back to at least 1888; however, archival research indicates this network of trails was likely used by local residents from the pre-Contact period into the twentieth century to move between different resource zones and places of habitation, recreation, ceremony, and agriculture. Prior to ca. 1800, the Road to the Sea would have been on bare lava with sparse vegetation in the vicinity. Stone *ahu* were situated at strategic places along the route to mark the pathway, and people used the trail to move between different resource zones. From ca. 1800–1940, the path was still in use and marked with *ahu*, although fewer people regularly used it; the biggest change at that time was the decline in foot travel and the introduction of pack animals. During World War II, U.S. soldiers were stationed at the church area of the Kohanaiki Homesteads (*mauka* of the current project area), and defensive gun installments were placed at the shoreline below (*makai* of the current project area). Soldiers traveling to and from the coast apparently decided to modify the trail to facilitate vehicular travel. Modifications were made at the soldiers' encampment and continued *makai*, but were abandoned well *mauka* of the current project area. After World War II, vegetation expanded along the trail, and trees grew in and around the Road to the Sea. Pedestrian use of the trail was scanty post-1945, likely because Jeep roads were being created that could facilitate *mauka-makai* travel (Wolforth et al. 2005).

SIHP # -18099, better known as the "Trail to Honokōhau," is a paved, curbed-lined trail that begins at the south side of 'Aimakapā Fishpond, intersects the Māmalahoa Trail (SIHP #

-00002), and then runs parallel to a trodden 'a'ā trail (SIHP # -18122) (Robins et al. 2000:23). It extends *mauka* of the Māmalahoa Trail for approximately 10,120 ft (nearly 2 miles) reaching 810 ft AMSL. Robins et al. (2000:86) note SIHP # -18099 is associated with a network of Type "A" stepping-stone trails, which are likely spur trails that once diverted from a Type "A" trail, superimposed upon by the subsequent curbstone constructions. The Type "A" stepping stone trails in this area were likely associated with localized travel between habitation, animal pen, and agricultural sites.

Furthermore, a number of permanent habitation sites, as well recurrent/temporary habitations, have been identified adjacent to, or in close proximity to, SIHP # -18099. For example, Yucha and McDermott (2008:165) noted the presence of permanent habitations in the "intermediate" zone of Honokōhau Ahupua'a. Although permanent habitation is usually associated with the coastal and upland zones, the presence of habitation features in the intermediate zone suggests pre-Contact populations were living there year-round—something that may have been facilitated by the presence of SIHP # -18099, which provided access to coastal and *mauka* resources. Based on historic maps, SIHP # -18099 was used until at least 1928; as mentioned previously, the likely use of SIHP # -18099 from the pre-Contact period into the historic period is evidenced by the presence of both pre-Contact and historic petroglyphs in the vicinity.

The third and northernmost major *mauka-makai* route, SIHP # -29272, consists of two features. Feature A is a level area of rounded but "fresh" looking basalt cobbles and small boulders with some rounded coral pieces in a low area at the edge of a *pāhoehoe* outcrop, which may have been used as a resting place. Feature B is a relatively faint trail oriented *mauka-makai* leading into the area of Feature A from the west. As mentioned previously, a more formal section of this trail has been identified in an adjacent project area to the west by Rechtman and Clark (2012), who concluded it was a primary *mauka-makai* transportation route in historic times, with likely use during the pre-Contact period as well. Historic maps (see Figure 28) depict SIHP # -29272 running through Kalaoa 5 and 'O'oma Homesteads and intersecting with the Māmalahoa Trail (SIHP # -00002) west (*makai*) of the current project area. By 1959, it had become a "Jeep trail" (see Figure 32).

SIHP # -29272 is the only trail identified within roughly the northern half of the current project area; this is consistent with the findings of previous archaeological studies in the vicinity. Transportation features (i.e., trail segments) were the least common functional type observed during a study by Henry et al. (1993) on the *mauka* side of the highway in that area (see Figure 36). Although three *pāhoehoe*-lined trails crossing 'a'ā flows (SIHP #s -18449, -18458, and -18469) were recorded during that study, none appear to connect with SIHP # -29272. The fact that transportation features were the least common functional type was contrary to expectations, and Henry et al. (1993:85) asserted that these findings "support Hammatt's [1987] contention that coastal-upland interaction patterns in North Kona and South Kohala were fairly irregular and informal in nature." However, given the numerous *mauka-makai* trails recorded in Kaloko and Honokōhau Ahupua'a to the south, Henry et al. (1993) acknowledge transportation features may have been under-represented in their study; specifically, they point to the difficulty in detecting trails over *pāhoehoe* flows. Similarly, Bell et al. (2008a:259) concluded in their study of a 224.43-acre parcel in Kohanaiki and Kaloko Ahupua'a to the south that the "location of trails only on 'a'ā suggests less modified, braided trails crossed the *pāhoehoe*." Based on these findings, one would expect the majority of trails in the current study to have been identified

within 'a'ā, rather than *pahoehoe*, but interestingly, this is not the case. Seven trails (SIHP #s -10714, -18099, -22418, -22507, -28774, -28791, and -29272) were identified on *pāhoehoe*, seven (SIHP #s -00002, -19946, -19953, -19954, -28782, -28784, and -28787) were identified on 'a'ā, and two (SIHP #s -15324 and 19952) were identified on both types of lava. However, it is worth noting that some of the trails were relatively faint and difficult to discern; several were pointed out to CSH by NPS trail specialists.

The fourth trail to intersect the Māmaloa Trail is SIHP # -19953, which was not depicted on any of the historic maps reviewed; likewise, no trail segments identified during previous archaeological studies were found to connect with SIHP # -19953 *mauka* of the current project area. SIHP # -19953 does extend onto NPS property, after crossing the Māmaloa Trail, and continues toward 'Aimakapā Fishpond. The portion within the National Park has previously been designated as SIHP # -21021 and intersects with SIHP # -22507, which is also part of the current data recovery investigation. As described in the previous section, SIHP # -19953 is older than the Māmaloa Trail and therefore dates to the pre- or early post-Contact period. Data recovery excavation performed at SIHP # -19953 in 1999 yielded no cultural materials.

SIHP # -19953 is one of 13 data recovery trails that extend onto National Parks land. Four of these (SIHP #s -00002, -10714, -18099, and 19953) have already been described in some detail. Of the rest, five (SIHP #s -22418, -28782, -28784, -28787, and -28791) extend *makai* for only a short distance onto NPS property and do not intersect or connect with any other trails in the National Park. Of these, only SIHP # -22418 appears to connect with another trail *mauka* of the current project area, where it merges with SIHP # -18099 (Trail to Honokōhau).

SIHPs # -22507 and -19954, near the southern extent of the project area, both cross an unnamed trail (no SIHP #) within the National Park that runs just *makai* of, and roughly parallel with, the NPS boundary. SIHP # -19954 terminates shortly thereafter, but SIHP # -22507 extends west toward 'Aimakapā Fishpond, before turning north/northwest to run parallel with the coast. It crosses several *mauka-makai* trail segments before terminating just north of Hu'ehu'e Ranch Road. The portion of SIHP # -22507 within the National Park was formerly known as Site D13-94 and was mapped, but not formally described, by Cluff (1971). It was subsequently described by Nelson and Gmirkin (2001:32) as a "foot/hoof worn trail on the pahoehoe."

Between SIHP #s -22507 and -19954 is SIHP # -28774, which appears to connect/merge with SIHP # -23353 just *mauka* of the NPS boundary. According to Gmirkin and Bond (2002:16), SIHP # -23353 "originate[s] at the coast between 'Ai'ōpio Fishtrap and 'Aimakapā Fishpond, intersects with State Site 50-10-27-21588, within Kaloko-Honokōhau N.P., crosses present day Māmaloa Highway." The trail also continues *mauka* of the highway, extending into Lanihau, where it passes a historic petroglyph, SIHP # -23353. SIHP #s -23353 and -21588 (not part of the current data recovery project) are both depicted on the 1928 USGS map of Keahole and Kailua quadrangles (see Figure 28).

In addition, a trail segment identified *mauka* of the current project area (see Donham 1990, Robins et al. 2000), designated as SIHP # -13006, may once have been connected to SIHP # -28774/-23353. Donham (1990:14) identified SIHP # -13006 between 300 and 330 ft AMSL and described it as a curbstone trail, oriented *mauka-makai*, which "probably intersected with Māmaloa Trail, and . . . may have continued to the coast." Donham (1990:A-22) describes the age of SIHP # -13006 as "Prehistoric/Historic." Similarly, it was subsequently described by

Robins et al. (2000:86) as a Type “AB” trail “conform[ing] to the spatial distribution of presumably prehistoric or early historic habitation sites.” According to Robins et al. (2000:88), SIHP #s -13006 and -18099 (the Road to Honokōhau, already discussed in some detail) were the two primary *mauka-makai* routes in Honokōhau. Along with the various spur trails in the area, these trails reveal the residents “had a significant network of travel routes that provided access to resources and exchange of resources between the coast and upland regions.” Like SIHP # -18099, SIHP # -13066 is in a state of disrepair and is no longer contiguous with portions that may exist at lower elevation; therefore, SIHP #-28774 may represent a short, unimproved section of a much longer *mauka-makai* route that once stretched from the uplands to the coast.

Two of the data recovery trails that extend into the National Park, SIHP #s -19952 and -28787, are located extremely close together (approximately 12 m apart) and roughly parallel to one another. Although initially it seemed unusual to have two roughly parallel trails positioned so close to one another, this phenomenon has been documented in a previous study within the same *ahupua'a* of Kaloko. During an AIS of a 224.3-acre parcel in Kaloko and Kohanaiki Ahupua'a, Bell et al. (2008a) documented 21 historic trail properties and noted the following:

Among these transportation routes, something peculiar appears to be going on with the numerous short trails crossing a small 'a'ā flow near the southern border of the project area ([SIHP #s] 13493, 20722, 20726, 20744, 20745). Here there appears to have been great need for crossing the 'a'ā quickly without regard to the increased labor needed to build so many parallel trails. One explanation for this is that a larger *mauka-makai* route was nearby and that these trails converged upon it shortly after leaving the rugged flow. It may be that this hints at a route older than Kohanaiki Road, which could be either north or south of Hina Lani. [Bell et al. 2008a:259]

Bell et al. (2008a:202) also point out that the “closely spaced and approximately parallel trails . . . [suggest] a relatively high degree of traffic in the area.” The “high degree of traffic” in Kaloko and Honokōhau Ahupua'a has been documented during the current data recovery study as well, with 13 of the 16 trails identified within those two *ahupua'a*. All 13 of the trails extend *makai* into the National Park, at least for a short distance, and many also connect or intersect with other trails within the Park. The cultural significance of the trail network within the National Park has been described as follows:

In Kaloko-Honokohau the residents built a system of *mauka-makai* trails to travel and communicate with extended family members and friends. Other routes traversed the coast laterally to transport food and other goods to neighboring *ahupua'a*. Several trails are found in the Kaloko-Honokohau area, mostly short footpaths comprising a local trail system, used both in the prehistoric and early historic (pre-1840) periods. Some prehistoric trails modified with curbs have been identified here, as well as new, probably post-1840, straight curbed trails...

These trails are an important component of the park's cultural landscape, providing data on the linkages between communities. sometimes include associated features such as small cairns placed as markers along the routes or petroglyphs (especially where smooth lava is found) that serve as pictorial

signatures of people who passed by. Often caves or small walled shelters are found that served as resting places along longer trails. The Māmalahoa Trail is one of the most significant resources in the park, but all the trails are important in illustrating early communication, transportation, and commercial networks. Their importance to the prehistoric Hawaiian subsistence economy cannot be overlooked, because they were the lifelines for food exchange. They were a direct result of the belief that everyone had access rights to the products of the land and ocean for their sustenance. [Greene 1993:Chapter VIII]

9.1.3 Trails Summary

Data recovery fieldwork at the Māmalahoa Trail (SIHP # -00002) and an intersecting *mauka-makai* trail (SIHP # -19953) was conducted by CSH in 1999 (see Hammatt et al. 1999) and included the excavation of four trenches (two at each trail), as well as photo documentation. No cultural materials were observed in any of the trenches. SIHP # -19953 was considerably less defined than the Māmalahoa Trail, though obviously used as a path to the coastal area. According to SHPD, SIHP # -19953 predates SIHP # -00002 and therefore likely dates to the pre-Contact or early historic period. SIHP #s -00002 and -19953 are the only historic trail properties where data recovery fieldwork was performed; no fieldwork was performed at trails during the 2011 or 2015 data recovery field seasons.

In association with the 2015 data recovery effort, archival research was performed on the 16 historic trail properties within the project area. Fifteen of the trails are oriented *mauka-makai*, while one (SIHP # -00002, the Māmalahoa Trail) is a cross-*ahupua'a* trail. Trails were also analyzed according to Apple's (1965) criteria of classification (see Table 35), with the result that the majority of trails in the project area (n=11) are classified as Type "A" trails, which are *mauka-makai* trails designed to conform with the *kapu* system. The second most common trail type (n=4) is Type "AB," which are Type "A" trails that have been modified to accommodate horses. The main means of transportation prior to 1947 was by foot, as well as on horses and donkeys; after World War II, Jeeps became available for purchase.

Only one trail in the current project area, the Māmalahoa Trail (SIHP # -00002), is classified as Type "D" based on the criteria presented by Apple (1965). Type "D" trails are generally the width of two horses and have been modified to accommodate wheeled vehicles. SIHP # -00002 was one of the first improved cross-*ahupua'a* trails (inland of the coastal trail) and extended from Kawaihae to Kiholo, upslope to Hu'ehu'e, and down again to Kaloko, Honokōhau, Kealakehe, and Kailua. Archival research indicates the Māmalahoa Trail (SIHP # -00002) was used for commerce, troop movements, carrying messages, collecting taxes, and other government activities. It was also considered a very safe means of travel, as it fell under the jurisdiction of Kamehameha I's "law of the splintered paddle," which decreed that any traveler could use the trail without fear of being molested (Greene 1993). However, as the population shifted to the agricultural zone along the inland trail, the Māmalahoa Trail on the lower barren shore was abandoned (Cordy et al. 1991:405).

The Māmalahoa Trail (SIHP # -00002) extends both northwest and southeast outside the current project area and is bisected by numerous *mauka-makai* oriented trails, including four (SIHP #s -10714, -18099, -19953, and -29272) in the current data recovery project. Of these, three (SIHP #s -10714 [Road to the Sea], -18099 [Trail to Honokōhau], and -29272) were major

mauka-makai routes that led from the coast to the uplands, allowing residents to move between different resource zones and places of habitation, recreation, ceremony, and agriculture. SIHP # -29272 is also notable as the only trail identified within roughly the northern half of the current project area. This dearth of transportation features is consistent with the findings of previous studies in the vicinity (e.g., Henry et al. 1993) and may support Hammatt's (1987) contention that coastal-upland interaction patterns in North Kona and South Kohala were fairly irregular and informal in nature; however, given the numerous *mauka-makai* trails recorded in Kaloko and Honokōhau Ahupua'a to the south, it may be that transportation features are underrepresented in some areas due to the difficulty in discerning less modified, braided trails on *pāhoehoe* (see also Bell et al. 2008a).

The relatively high degree of traffic in Kaloko and Honokōhau Ahupua'a evidenced by the proliferation of trails there has been noted in previous studies (e.g., Bell et al. 2008a, Robins et al. 2000), as well as in the current study. It is further evidenced by the extensive network of trails within Kaloko-Honokōhau National Historical Park on the *makai* side of the current project area. Thirteen of the 16 data recovery trails extend into NPS land, and most connect/intersect with other trails within the National Park. Archival research indicates the residents of Kaloko-Honokōhau built a system of *mauka-makai* trails to travel and communicate with extended family members and friends, while other routes traversed the coast laterally to transport food and other goods to neighboring *ahupua'a*. This proliferation of trails attests that these *ahupua'a* were commonly traversed during both pre-Contact and historic times.

9.2 Research Objective 2 – Cultivation

Research Objective 2 is to understand the nature and intensity of cultivation in the project area in the context of predictive models for North Kona based on variations in elevation and rainfall. Though very near to the *'apa'a* zone (see Table 34) with its extensive Kona Field System, which has been studied in detail by a number of researchers (e.g., Allen 2004; Cordy 2000; Horrocks and Rechtman 2009), the entire project area falls within the less-productive *kula* zone of cultivation. This makes it marginal at best and not agriculturally productive without intensive human effort.

The expected cultivant for this arid zone is the sweet potato (*Ipomoea batatas*), since it requires less water than other common cultigens (Allen 2004; Cordy 2000; Horrocks and Rechtman 2009) and is documented historically to have been grown on the lava fields in small man-made plots using various techniques. In similar ecozones, soil was sometimes imported to the area and placed in prepared plots, which were sometimes mulched with cut grass and vines to prevent evaporation (Cordy 2000:134) and may also have employed rock mulching. "Rock mulching involves planting crops in piles of stones, or covering the field's surface with stones . . . rock mulch conserves moisture and can have other benefits such as protecting the roots from rodent predation" (Barker and Gilbertson 2000:269). One alternative hypothesis for the function of at least some of the agricultural features in the current project area, as suggested to CSH (Monahan) by Mr. Fred Cachola (NHO), is that they were used to grow fish food for the *loko* at the coast (e.g., 'Aimakapā and Kaloko) rather than *'uala* (sweet potato) for human consumption.

Horrocks and Rechtman (2009) conducted a study in a portion of the Kona Field System, South Kona, looking for evidence of both sweet potato and banana (*Musa* spp.) microfossils (pollen, phytoliths, and starch residue) in soil samples from traditional Hawaiian archaeological

features. Their starch residue analysis (which included starch grains, raphides [calcium oxalate crystals], and xylem cells) found evidence of sweet potato in every sample. They concluded their study demonstrates an intensive focus on bananas and sweet potatoes in a relatively “mono-specific,” rather than diversified, approach to cultivation (Horrocks and Rechtman 2009:1125). Therefore, agricultural features within the current project area in North Kona may be associated with sweet potato and/or banana cultivation.

The sample of probable/possible agricultural historic properties included in the current data recovery study are SIHP #s -28778, -28785, -28786, and -28813. The results are discussed in detail below.

9.2.1 Cultivation Results

9.2.1.1 SIHP # 50-10-27-28778

SIHP # -28778 is a *pāhoehoe* excavation adjacent to the Kaloko-Honokōhau National Historical Park, approximately 120 m south of the park’s visitor center entrance. It consists of an excavated pit with small piles of angular *pāhoehoe* cobbles and small boulders (the excavated material) both covering and surrounding the pit. The base of the excavated area consists of a thin layer of sediment and organic debris supporting the growth of *koa haole* (*L. leucocephala*) and exotic grasses.

Data recovery fieldwork at SIHP # -28778 involved 100% areal excavation. Excavation consisted of four 1.0 m by 1.0 m excavation units (EU 76 through 79) placed into a 2.0 m by 2.0 m areal excavation, along with another 1.0 by 1.0 m excavation unit (EU 80) adjacent to the north. Depositional stratigraphy for SIHP # -28778 consisted of an aeolian silt deposit with many fine roots, likely associated with the aforementioned *koa haole* (*L. leucocephala*) in the center of the feature, overlying the natural *pāhoehoe* bedrock.

Irregular, scalloped edges observed on the margins of the pit made it clear it was anthropogenically modified; however, no other cultural indicators or materials were observed during data recovery fieldwork. While originally interpreted as a “planting pit feature” during the project’s AIS (Monahan et al. 2012a:156), no evidence of agricultural use was observed at SIHP # -28778 during data recovery efforts. Likewise, pollen and starch analysis on a sediment sample collected from 98–104 cmbd within EU 80 failed to yield evidence of common cultigens such as banana or sweet potato (see Section 8.3.1.1). The discovery of a small lava tube at the north end of SIHP # -28778 and the presence of most, if not all, of the original excavated material suggest that SIHP # -28778 is associated with prospecting for subterranean openings in the lava (Monahan et al. 2013:25). Therefore, SIHP # -28778 has been reinterpreted as a resource prospecting pit, rather than an agricultural feature.

9.2.1.2 SIHP # 50-10-27-28785

SIHP # -28785 is an enclosure 635 m south of the intersection of Hina Lani Street and the Queen Ka‘ahumanu Highway, within the portion of the project area adjacent to the Kaloko-Honokōhau National Historical Park. It consists of an oval-shaped enclosure composed of a C-shaped wall to the south along the edge of a natural depression or collapsed lava blister. The east and west ends of the C-shaped wall connect to the edge of a *pāhoehoe* tumulus to the north. The area enclosed by the wall and tumulus is relatively level and consists of a thick layer of sediment and organic debris supporting the growth of grasses (Monahan et al. 2012a:217).

Data recovery fieldwork at SIHP # -28785 followed recommendations from the ADRP, wherein Shideler et al. (2012:143) proposed excavation of “an 8-m long and 1-m wide trench down the central long axis (east/west) of the enclosure.” They also proposed an option for two additional 1.0 m by 1.0 m excavations should there be “significant finds.” Due to the discovery of pig (*S. scrofa*) remains, the optional excavation units (EU 74 and 75) were included, for a total of ten excavation units (EU 66 through 75).

Depositional stratigraphy consisted of an A horizon overlying the *pāhoehoe* bedrock. The A horizon consisted of an organic rich, gravelly silt loam most likely enriched by manure. Overlying the A horizon was grass and leaf litter mostly derived from a thick *koa haole* (*L. leucocephala*) stand. Within the leaf litter were the nearly complete, articulated remains of a mature pig (*S. scrofa*); additional pig remains were identified in five of the test excavations (EU 67, 69 through 71, and 75). None of the remains were butchered or showed any evidence of cultural modification.

During the project's AIS, SIHP # -28785 was interpreted as an agricultural enclosure, likely dating to the pre-Contact period. This interpretation was based on the presence of a thick sediment layer within the enclosure, which could have supported various dryland cultivars (Monahan et al. 2012a:217). However, during data recovery fieldwork no evidence of an agricultural function was observed. Likewise, pollen and starch analysis on two sediment samples collected from 150–160 cmbd within EU 68 and 174–179 cmbd within EU 73 failed to yield evidence of common cultigens such as banana or sweet potato (see Section 8.3.1.2). However, one of the samples contained *Sporormiella* dung fungal spores. *Sporormiella* is a genus of fungi that is obligately coprophilous, growing on the dung of domestic livestock (e.g., cows and horses), as well as wild herbivores; therefore, the presence of *Sporormiella* spores may be used as a proxy for the abundance of grazing mammals. Based on the presence of *Sporormiella* spores and unmodified pig bones, as well as the lack of evidence for common cultigens, SIHP # -28785 has been reinterpreted as a pen utilized for animal husbandry, rather than an agricultural feature.

9.2.1.3 SIHP # 50-10-27-28786

SIHP # -28786 is a modified depression along the northern edge of Kaloko Road within the portion of the project area adjacent to the Kaloko-Honokōhau National Historical Park. There are three to four courses of informally stacked 'a'ā cobbles and small boulders along the south, east, and northeast edges of the depression, within which there is a thin layer of sediment and organic debris supporting the growth of a Christmasberry (*Schinus terebinthifolia*) tree. Modern trash, including discarded coconut husks, was also present within the depression (Monahan et al. 2012a:222).

Data recovery fieldwork at SIHP # -28786 followed recommendations set forth in the ADRP, wherein Shideler et al. (2012:146) proposed a 1.0 m by 1.0 m excavation (EU 65) at the location with the most potential to yield data (i.e., the location with the deepest sedimentary deposit). Depositional stratigraphy consisted of naturally deposited, very gravelly silt loam sediment, overlying the *pāhoehoe* bedrock. No evidence of anthropogenic/cultural modifications at SIHP # -28786 was discovered during data recovery fieldwork.

According to the NPS, SIHP # -28786 is consistent with, and likely associated with, an agricultural complex of enclosures extending more than 600 m into Kaloko-Honokōhau National

Historical Park and may therefore be part of the larger cultural landscape of the park. During the project's AIS, SIHP # -28786 was interpreted as an agricultural locality likely dating to the pre-Contact period, based on this information from the NPS as well as the presence of shallow sediment within the modified depression, which could have supported dryland cultigens (e.g., sweet potato). However, no evidence of agricultural use was observed during data recovery efforts. In addition, pollen analysis on a sediment sample from 30–38 cmbd in EU 65 yielded no evidence of common cultigens. The sample did contain a small quantity of *Sporormiella* dung fungal spores, which indicates the presence of grazing animals in the vicinity.

SIHP # -28786 is adjacent to a pull-off area along Kaloko Road. The eastern margin of the site contained the highest concentration of constructed rock stacking, which may have acted as a wind break or early morning sun shade for temporary habitation. As a result, SIHP # -28786 has been reassessed as a historic to modern temporary shelter, rather than a traditional Hawaiian agricultural feature. Additionally, the presence of *Sporormiella* in a sediment sample suggests it may also have been used for animal husbandry.

9.2.1.4 SIHP # 50-10-27-28813

SIHP # -28813 consists of six modified lava blisters designated features A through F. It is approximately 437 m north of the intersection of OTEC Road and the Queen Ka'ahumanu Highway. Data recovery fieldwork at SIHP # -28813 occurred during both the 2011 and 2015 field seasons, with the former following the 2011 ADRP (Altizer and Monahan 2011). At the time of that report, Altizer and Monahan (2011:153) considered SIHP # -28813 to consist only of Feature A, for which they recommended two 1.0 by 1.0 m excavation units (EU 2 and EU 3) within the feature's interior. During the 2015 season, data recovery fieldwork involved the excavation of 53 1.0 by 1.0 m excavation units (EU 12 through 64) designed to encompass all the sediment within the historic property, as the revised ADRP called for "100% areal excavation of Features B through E" (Shideler et al. 2012:203).

Depositional stratigraphy generally consisted of an aeolian silt deposit mixed with varying amounts of decomposing bedrock in the form of angular cobbles and pebbles, overlying the *pāhoehoe* bedrock. Several excavation units contained modest quantities of land snail shells and/or crustacean fragments, although their deposition was interpreted as natural (i.e., not midden). Feature A contained both the thickest fine sediment deposit and the densest concentration of land snail shells and crab claw fragments. No evidence of anthropogenic/cultural modification was found in any of the test units.

SIHP # -28813 was originally interpreted by Monahan et al. (2012a) as an agricultural locality dating to the pre-Contact period. This interpretation applies only to what is now considered Feature A and was based on the relatively thick deposit of sediment inside the blister, which was interpreted as potentially supporting dryland cultigens. However, pollen analysis performed on two samples from EU 2 at Feature A failed to yield evidence of such cultigens. An abundance of organic debris prevented a pollen count in the upper sample, while the lower sample yielded mostly large Poaceae pollen, reflecting large grasses. This suggests the growth and/or use of *pili* grass (*H. contortus*), which has been used for a variety of purposes in Hawai'i, including for thatching and to cover house floors (Handy et al. 1972; Krauss 1993 in Cummings and Kovacik 2016).

Data recovery was conducted on Features B through F in order to satisfy the recommendations of SHPD and address NHO concerns. The results of data recovery support the archaeologists' initial interpretation of the additional features identified by Isaac Harp as natural basalt formations with no cultural indicators.

9.2.2 Cultivation Summary

In association with Research Objective 2 (cultivation), pollen and starch analysis was performed on six sediment samples collected in lava features at four historic properties (SIHP #s -28778, -28785, -28786, and -28813), all of which were initially interpreted as traditional Hawaiian agricultural features. The results of this analysis yielded diverse evidence of local flora and fauna and supported the reinterpretation of all four historic properties. SIHP # -28778 yielded the most varied pollen record, which included evidence of both native and alien vegetation, suggesting traditional as well as historic use and sediment accumulation. The discovery of a small lava tube at the north end of SIHP # -28778, the presence of most, if not all, of the original excavated material, and the lack of pollen or starch from common dryland cultigens supports the reinterpretation of SIHP # -28778 as a prospecting pit rather than an agricultural feature.

SIHP # -28785 (enclosure) has been reinterpreted as a historic feature used for animal husbandry. This reinterpretation is supported by the presence of unmodified pig bones, the recovery of *Sporormiella* dung fungal spores in a sediment sample, and the lack of pollen or starch from common dryland cultigens. *Sporormiella* spores were also recovered from SIHP # -28786, suggesting possible use of this depression for animal husbandry as well. Although NPS archaeologists believe SIHP # -28786 is consistent with, and likely associated with, an agricultural complex of enclosures extending more than 600 m into Kaloko-Honokōhau National Historical Park, no evidence of agriculture was found during fieldwork or through pollen/starch analysis of sediment samples. The recovery of large Poaceae pollen from one of the samples suggests the growth and/or use of *pili* grass, which was commonly used by Native Hawaiians for thatching roofs and floors. Additionally, constructed rock stacking along the eastern margin of the site may have acted as a wind break or early morning sun shade for temporary habitation; hence, the reinterpretation of SIHP # -28786 as a historic to modern temporary shelter.

9.3 Research Objective 3 – Function

Based on the results of the project's AIS (Monahan et al. 2012a), several historic properties were indeterminate as to function, since the available evidence was ambiguous or inconclusive. In large part, this is due to the inherent nature of the archaeological evidence in the project area such as the difficulty in interpreting relatively informal, stacked rock constructions, filled crevices, mounds and *ahu*, excavated pits, and similar features on relatively barren lava flows. Resolution of function for these historic properties is critical to a more accurate understanding of traditional and early historic land use. The most effective way of resolving these uncertainties is to conduct data recovery excavation and/or dismantling at historic properties where the function could not be determined. The sample of indeterminate historic properties included in data recovery excavation/dismantling are SIHP #s -28807, -28812, -28814, -28815, -29332, -29335, and -29345.

9.3.1 Function Results

9.3.1.1 SIHP # 50-10-27-28807

SIHP # -28807 is a filled crevice approximately 420 m northwest of the intersection of Hulikoa Drive and the Queen Ka'ahumanu Highway and 100 m east of the highway. It consists of a prominent *pāhoehoe* tumulus with a natural crevice running roughly north-south through the central apex of the tumulus. Within the crevice is a concentration of large, water-rounded and weathered coral cobbles and several small boulder-sized *pāhoehoe* slabs. Data recovery fieldwork at SIHP # -28807 involved dismantling and clearing out stones from 100% of the site, following the recommendations in the ADRP (Shideler et al. 2012:185). This required the excavation of eight 1.0 m by 1.0 m excavation units (EU 55 through 62).

Excavations at SIHP # -28807 removed 161 massive rounded coral cobbles and pebbles (approximately 136 liters) from within the *pāhoehoe* crevice. Cultural materials encountered consisted of massive (i.e., not branched) coral manuports and a modern modified stick. During data recovery efforts, modern artifacts observed 5 m north of the crevice consisted of nails and circular metal arranged in the shape of a cross. These may have been used to anchor a highway memorial; their proximity to SIHP # -28807 suggests they are related. A wooden stake with deteriorated orange flagging tape tied to one end, first observed during the project's AIS (see Monahan et al. 2012a), was also relocated beneath the central coral concentration.

SIHP # -28807 is on a prominent *pāhoehoe* tumulus easily visible from the highway. At the base of the tumulus, many additional massive coral cobbles match the type found within the crevice. The presence of a modern wooden stake beneath the coral fill of the crevice suggests SIHP # -28807 is either of modern construction or was highly disturbed during modern times. The proximity of SIHP # -28807 to modern artifacts, as well as its visibility from the modern highway, indicate the artifacts are likely associated with SIHP # -28807. Therefore, the results of data recovery suggest SIHP # -28807 represents a modern placement of corals, likely associated with commonly observed "Kona graffiti." Kona graffiti refers to the placement of white coral pieces on Kona's dark lava fields by locals, tourists, and artists to spell out names and other words. SIHP # -28807 is therefore interpreted as a modern activity area.

9.3.1.2 SIHP # 50-10-27-28812

SIHP # -28812 is approximately 390 m north of the intersection of OTEC Road and the Queen Ka'ahumanu Highway and was described during the project's AIS (see Monahan et al. 2012a) as a possible filled crevice. The crevice, which was identified by the presence of a small stand of *kī* (*Cordyline fruticosa*) immediately to the north, contained a loose pile of *pāhoehoe* boulders and cobbles. Data recovery fieldwork at SIHP # -28812 occurred during both the 2011 and 2015 field seasons.

Data recovery during the 2011 field season followed the 2011 ADRP (Altizer and Monahan 2011:153), which recommended a single 1.0 by 1.0 m excavation unit (EU 4) placed within the possible filled crevice. During the 2015 season, data recovery fieldwork at SIHP # -28812 involved 100% areal excavation, as recommended by the 2012 ADRP (Shideler et al. 2012:200). This required the excavation of two 1.0 by 1.0 m excavation units (EU 50 and 51).

All three test excavations yielded a culturally sterile matrix composed of a naturally deposited sediment overlying the undulating *pāhoehoe* bedrock. The *pāhoehoe* boulders and cobbles within

the crevice appeared to be unmodified rubble or collapse. The presence of *kī* plants, which were commonly used by Hawaiians for a variety of applications, suggests the area may have been planted; however, it is possible the *kī* could have been transported by animal, as the plants did not appear to be older than five years in age. Given the lack of evidence for anthropogenic modifications to the natural outcrop and the modern age of the *kī* plants, the results of data recovery suggest SIHP # -28812 is a natural rock formation with no cultural function.

9.3.1.3 SIHP # 50-10-27-28814

SIHP # -28814 is a lava tube approximately 105 m north of the intersection of Ka'iminani Drive and the Queen Ka'ahumanu Highway. There are two main chambers within the lava tube connected by a linear passageway. Off the two main chambers are several small, tapering offshoots that quickly become impassable. Potential modification to the lava tube consists of two *pāhoehoe* boulders (potential water catchment cradles), placed just inside the entrance by the northern wall and within the light zone. Data recovery fieldwork at SIHP # -28814 occurred during both the 2011 and 2015 seasons.

Data recovery during the 2011 field season followed the 2011 ADRP by Altizer and Monahan (2011:153), and the sediment deposit was excavated as a single, irregularly shaped unit (EU 1). During the 2015 field season, data recovery fieldwork at SIHP # -28814 followed the 2012 ADRP by Shideler et al. and involved the excavation of eight 1.0 m by 1.0 m excavation units (EU 4 through 11). Depositional stratigraphy at SIHP # -28814 consisted of two surfaces: the ground surface above the lava tube and the lava tube floor. A thin (less than 5 cm) layer of natural aeolian sediment was observed on the ground surface of three units (EU 8, 10, and 11). Although the ADRP stipulated the collection of bulk sediment samples for pollen analysis and/or radiocarbon dating, the paucity of sediment accrual precluded that effort. No cultural material was observed during excavation.

In other studies, boulders similar to the two observed at SIHP # -28814 have been identified as cradles for gourds or '*opihī* (*Cellana exarata*) shells to trap water dripping from the ceiling during rain events (Martin 1991). Water catchment locations were an important resource in arid regions like the North Kona coast, where dependable water sources were rare. While data recovery fieldwork yielded no additional cultural materials, the possible function of the lava tube as a traditional Hawaiian water catchment cannot be ruled out. Therefore, the function of the lava tube has been reassessed as "potential subterranean resource."

9.3.1.4 SIHP # 50-10-27-28815

SIHP # -28815 is a *pāhoehoe* excavation approximately 185 m northeast of the intersection of Ka'iminani Drive and the Queen Ka'ahumanu Highway. Data recovery fieldwork at SIHP # -28815 followed the Shideler et al. (2012:215) ADRP recommendations involving "100% areal excavation" of the *pāhoehoe* excavation floor; this required the excavation of two 1.0 m by 1.0 m excavation units (EU 2 and 3). Depositional stratigraphy consisted of a thin aeolian silt deposit overlying the natural *pāhoehoe* bedrock. Angular *pāhoehoe* cobbles and boulders covering the unit showed wear consistent with having been excavated; no cultural materials other than quarried *pāhoehoe* cobbles and boulders were observed.

During the project's AIS, SIHP # -28815 was interpreted as a possible raw material quarrying locality, likely dating to the pre-Contact period (Monahan et al. 2012a:156). Irregular, scalloped

edges along the margins of the pit, as well as angular breaks on the excavated material, make it clear SIHP # -28815 has been anthropogenically modified. During data recovery, a narrow lava tube was found to connect to the excavated pit; however, the opening is too small for a person to enter. No evidence of agricultural use or habitation was observed during data recovery efforts, and SIHP # -28815 is not located near any other constructed historic properties. The lack of compelling evidence for use and the presence of a narrow lava tube contacting the excavated pit suggest SIHP # -28815 may be associated with prospecting for subterranean openings in the lava (Monahan et al. 2013:25). Therefore, SIHP # -28815 is reinterpreted as a resource prospecting pit.

9.3.1.5 SIHP # 50-10-27-29332

SIHP # -29332 is a mound/paved area within a naturally formed *pāhoehoe* depression approximately 15 m east of the National Park service road. Although it is not located within the project grading or construction limits, SIHP # -29332 was slated for excavation through a program of data recovery following consultation with the SHPD. Data recovery fieldwork involved the excavation of one 1.0 m by 1.0 m excavation unit (EU 1) in the southeastern portion of SIHP # -29332. Depositional stratigraphy consisted of decomposing *pāhoehoe* bedrock cobbles and pebbles mixed with less than 2% aeolian fine silt, overlying irregular *pāhoehoe* bedrock. EU 1 yielded a culturally sterile matrix, with no evidence of anthropogenic/cultural modification.

SIHP # -29332 was identified by NPS archaeologist Tyler Paikuli-Campbell and was originally interpreted as “Indeterminate/Possible Burial” (Monahan et al. 2012a:132). Since no human remains were discovered during data recovery fieldwork, the function of SIHP # -29332 remains indeterminate; however, the lack of evidence for cultural modifications or materials indicates it is most likely a natural formation.

9.3.1.6 SIHP # 50-10-27-29335

SIHP # -29335 is a segment of dry-stacked rock wall on a *pāhoehoe* bedrock outcrop, approximately 15 m east of the Kaloko-Honokōhau National Historical Park boundary and east-adjacent to a National Park access road. It was identified by NPS archaeologists during the supplemental survey of the southern segment of the current project area (see Monahan and Yucha 2012). Data recovery fieldwork at SIHP # -29335 followed recommendations in the ADRP (Shideler et al. 2012:232) to place cross-section trenches in locations with the most potential to yield data (i.e., across the most intact portions of the rock wall). Therefore, two excavation units (EU 81 and 82) measuring 0.5 m north/south by 1.5 m east/west each were placed parallel with one another across the southern portion of the rock wall. Depositional stratigraphy at SIHP # -29335 consisted of placed *pāhoehoe* cobbles and pebbles, overlying a billowing *pāhoehoe* bedrock; however, no smaller grained sediment was present. Other than the rock wall, no cultural materials were encountered.

During the project's AIS, SIHP # -29335 was interpreted as older than 50 years based on appearance, although neither its precise age (i.e., historic or pre-Contact) nor function could be determined. In consultation with the SHPD, it was proposed that SIHP # -29335 may have had an agricultural function (Monahan et al. 2012:143); however, dismantling of the rock wall during data recovery yielded no additional cultural materials, nor was there sufficient sediment to collect a bulk sample. Therefore, no new evidence was collected during data recovery fieldwork

that could dispute or confirm the interpretation of SIHP # -29335 as “Indeterminate/Possibly Agricultural,” as documented in the AIS (Monahan et al. 2012a:390).

9.3.1.7 SIHP # 50-10-27-29345

SIHP # -29345 consists of three discrete concentrations of coral fill inside natural crevices/fissures along a *pāhoehoe* tumulus, approximately 1 km south of OTEC Road and 60 m *makai* of the Queen Ka'ahumanu Highway. Data recovery fieldwork at SIHP # -29345 involved the excavation of three 1.0 m by 1.0 m excavation units (EU 52 through 54) to cover the largest coral concentration. Excavated material consisted entirely of manuport coral cobbles resting on the *pāhoehoe* crevice. No sediment was encountered within the crevice, and no cultural materials or modifications were observed other than the coral cobble manuports.

The function of SIHP # -29345 was originally interpreted as “indeterminate” (Monahan et. al. 2012a:327). Removal of the coral cobbles during data recovery yielded no additional cultural materials beneath or in association with the coral. Additionally, a few other modern placements of coral, including “Kona graffiti,” were observed within the immediate vicinity. Therefore, SIHP # -29345 has been reassessed as a modern activity area.

9.3.2 Function Summary

Research Objective 3 (function) addresses historic properties that were indeterminate in function, due to the available evidence being ambiguous or inconclusive. In large part, this is a result of the difficulty in interpreting relatively informal, stacked rock constructions, filled crevices, mounds and *ahu*, excavated pits, and similar features on relatively barren lava flows. Because resolution of function is critical to a more accurate understanding of traditional and early historic land use, an attempt at resolving these uncertainties was made through excavation and/or dismantling at historic properties where the function could not be determined. The indeterminate historic properties included in data recovery excavation/dismantling are SIHP #s -28807, -28812, -28814, -28815, -29332, -29335, and -29345. Excavation and/or dismantling during data recovery fieldwork yielded new evidence for the function, or possible function, of six of the seven historic properties; only SIHP # -29335 failed to yield useful data, since no smaller grained sediment was present, and no cultural materials were observed.

Based on the results of data recovery, SIHP #s -28807 and -29345 (filled crevices) were both determined to be modern activity areas, likely associated with commonly observed “Kona graffiti.” SIHP #s -28812 and -29332 were determined to be natural rock formations with no cultural function. SIHP # -28814 has been reassessed as a “potential subterranean resource,” based on the presence of two *pāhoehoe* boulders, which may have been used as cradles for gourds or ‘*opihi* (*C. exarata*) shells to trap water dripping from the ceiling during rain events (Martin 1991). Finally, the presence of a narrow lava tube contacting the excavated pit at SIHP # -28815 suggests its possible use as a resource prospecting pit.

9.4 Research Objective 4 – Temporal Analysis

Research Objective 4 is to determine the absolute dates of occupation of the project area as may be available from data recovery sites at which excavation/dismantling is proposed. Radiocarbon dates from data recovery will add to the existing archive of previously documented episodes of occupation within the region. Based on available archaeological evidence from the

vicinity of the project area, it is anticipated that radiocarbon dates will cluster around the last few centuries before European (late eighteenth century) contact, when either agricultural intensification, population pressure, and/or other factors forced population movement to relatively marginal areas (Cordy 2000:46). Radiocarbon dating results that do not conform to this expectation would represent an unexpected finding that would have to be explained in a broader regional context.

The sample of historic properties from which radiocarbon dating samples could be obtained depended on whether discrete, subsurface features could be identified, as well as the availability of dateable organic material, in excavation/dismantling of the historic properties listed for Research Objectives 2 and 3 (see above).

9.4.1 Temporal Analysis Results

AMS radiocarbon analysis was performed on three samples from two historic properties: SIHP #s -28778 and -28785. Radiocarbon analysis was also attempted on unidentified hardwood charcoal fragments from SIHP # -28786 (Sediment Sample PR-4; EU 65, Stratum I, 30–38 cmbd); however, the fragments did not survive chemical pretreatment. In addition, sample collection for radiocarbon analysis was also planned at a number of other historic properties (e.g., SIHP #s -28814, -28815, -29332, -29335, -29345); however, this effort was precluded by the lack of dateable organic material. The radiocarbon results for SIHP #s -28778 and -28785 are discussed below.

9.4.1.1 SIHP # 50-10-27-28778

SIHP # -28778 is a *pāhoehoe* excavation adjacent to the Kaloko-Honokōhau National Historical Park. While originally interpreted as a “planting pit feature” during the project’s AIS (Monahan et al. 2012a:156), no evidence of agricultural use was observed during data recovery fieldwork, nor through pollen and starch analysis on a sediment sample (see Section 9.2.1.1 discussion). The lack of evidence for dryland cultigens, the discovery of a small lava tube at the north end of the site, and the presence of most or all of the original excavated material led to the reinterpretation of SIHP # -28778 as a resource prospecting pit. Unidentified hardwood charcoal fragments from a sediment sample (Sample PR-1; EU 80, Stratum I, 98–104 cmbd) yielded a two-sigma calibrated age range of AD 1649 to 1683 (28.5%), AD 1737 to 1756 (5.7%), AD 1761 to 1804 (42.9%), and AD 1936 to present (18.3%), indicating sediment deposition within the last approximately 350 years. Therefore, SIHP # -28778 may have been utilized as early as the late pre-Contact period.

9.4.1.2 SIHP # 50-10-27-28785

SIHP # -28785 is an enclosure 635 m south of the intersection of Hina Lani Street and the Queen Ka‘ahumanu Highway, within the portion of the project area adjacent to the Kaloko-Honokōhau National Historical Park. During the project’s AIS, SIHP # -28785 was interpreted as an agricultural enclosure, likely dating to the pre-Contact period. This interpretation was based on the presence of a thick sediment layer within the enclosure, which could have supported various dryland cultivars (Monahan et al. 2012a:217). However, during data recovery fieldwork no evidence of an agricultural function was observed. Likewise, pollen and starch analysis on two sediment samples failed to yield evidence of common dryland cultigens such as banana or sweet potato. Based on the presence of *Sporormiella* spores and unmodified pig bones, as well as

the lack of evidence for common cultigens, SIHP # -28785 was reinterpreted as a pen utilized for animal husbandry.

Radiocarbon analysis was performed on two samples (a charcoal fragment and an *S. Scrofa* bone) from SIHP # -28785. The charcoal sample (Sample 2) was collected from EU 68 and was identified as *Euphorbia* sp. According to Huebert and Murakami (2016), it is likely the *Euphorbia* does not have any great inbuilt age (i.e., more than a few decades) as the specimen appeared to be from a stem approximately 1 cm in diameter. The sample yielded a two-sigma calibrated age range of AD 1526 to 1557 (5.7%), AD 1632 to 1682 (51.9%), AD 1738 to 1751 (1.3%), AD 1762 to 1903 (29.5%), and AD 1937 to present (7.1%). These results indicate SIHP # -28785 may have been utilized as early as the late pre-Contact period.

The *S. scrofa* sample (Sample 6) was collected from the femoral head of a fully articulated pig skeleton discovered during excavation of EU 70. The bone sample yielded a two-sigma calibrated age range of AD 1675 to 1778 (38.0%), AD 1799 to 1894 (42.4%), and AD 1905 to post 1942 (14.9%). These results indicate the pig remains could date from as early as the late pre-Contact period, but may be as recent as modern in age.

9.4.2 Temporal Analysis Summary

Radiocarbon analysis was performed on three samples from two historic properties, SIHP #s -28778 and -28785. All three samples yielded two-sigma calibrated date ranges indicating possible utilization of these historic properties as early as the late pre-Contact period, with continued use into the historic and perhaps modern period. These results conform with prior expectations that radiocarbon dates would cluster around the last few centuries before European (late eighteenth century) contact, when either agricultural intensification, population pressure, and/or other factors forced population movement to relatively marginal areas (Cordy 2000:46).

9.5 Data Requirements

Data requirements for addressing Research Objective 1 involved obtaining access to archival materials at several research repositories, including the SHPD library, Hamilton Library of the University of Hawai'i-Mānoa, Hawai'i State Archives, Mission Houses Museum Library, the NPS, Hawai'i Public Library, Archives and Library of the Bishop Museum, and Land Survey Office of the DLNR. CSH also maintains a database of Registered Maps that was systematically evaluated for historic and pre-Contact trails to be integrated into a GIS layer for presentation and analysis purposes. This comprehensive archival analysis placed the project area trail segments in a wider context that more accurately reflects their cultural and historical significance.

Data requirements for addressing Research Objectives 2–4 involved obtaining in situ samples of charcoal, ash deposits, and/or organically enriched sediment for radiocarbon and palynological/starch residue analysis. Four samples were submitted for radiocarbon analysis. Prior to radiocarbon analysis, CSH submitted two charcoal samples to the Wood Identification Laboratory at IARII in Honolulu for taxonomic identification, to provide important data regarding the age and depositional history of sediments recovered from archaeological features. Wood charcoal identification is also a necessary component of radiocarbon dating, should wood charcoal be used for such a purpose, in order to avoid the “old wood” problem (see Dye 2000). Six bulk soil samples were also sent to Paleo Research Institute (Golden, Colorado) for palynological/starch residue analysis.

Section 10 Summary

At the request of R.M. Towill Corporation, on behalf of HDOT, CSH conducted archaeological data recovery and prepared this ADR for the proposed Queen Ka'ahumanu Highway Widening Phase 2 project, Kalaoa, Kalaoa-'O'oma, 'O'oma 2, Kohanaiki, Kaloko, Honokōhau 1–2, and Kealakehe, North Kona District, Island of Hawai'i, TMKs: [3] 7-3-009, 7-3-043, and 7-4-008 (LaChance et al. 2017). The 2011 data recovery was conducted in accordance with the Altizer and Monahan (2011) ADRP, and the 2015 data recovery was conducted in accordance with the Shideler et al. (2012) ADRP and the Hammatt and Shideler (2014) APMP. All historic properties addressed in the current data recovery project were identified in the project's AIS by Monahan et al. (2012a).

In 2011, data recovery consisted of controlled excavations at four historic properties (SIHP #s -10154 and -28812 through -28814). In 2015, data recovery included controlled excavation at 12 historic properties (SIHP #s -10154, -28778, -28785, -28786, -28807, -28812, -28813 through -28815, -29332, 29335, and -29345); artifact collection at two historic properties (SIHP #s -29348 and -29349); photo documentation of SIHP # -19947; relocation of SIHP #s -29346 and -28808 Features D and E; and characterization of 16 historic trail properties (SIHP #s -00002, -10714, -15324, -18099, -19946, -19952 through -19954, -22418, -22507, -28774, -28782, -28784, -28787, -28791, and -29272) through archival research. Data recovery fieldwork focused on the collection of data to support the project's research objectives for cultivation, function, and temporal analysis (Research Objectives 2–4), while archival research addressed Research Objective 1 (trails).

Based on the available historical and archaeological evidence, the largest traditional Hawaiian settlements in the vicinity of the project area were located along the coast, in association with several large *loko* (fishponds), and in the upcountry, in the relatively cooler and misty uplands. The land within and immediately adjacent to the current project area is therefore considered to be an “intermediate” zone between the more productive *kula* coastal settlements and the upland *kalu* gardening areas (see Table 34). Previous archaeological work at and near the subject data recovery historic properties suggests traditional habitation features at this elevation (approximately 60–140 ft AMSL) were primarily occupied on a temporary or recurrent, rather than permanent, basis (e.g., Jensen and Goodfellow 1993; Robins et al. 2000). Likewise, cultivation of plants in the intermediate zone appears to have been conducted on a relatively small-scale, rather than intensive, basis. Radiocarbon dates from archaeological excavations in the vicinity of the project area demonstrate Hawaiian occupation of this area by at least 1,000 years ago (cf. Cordy et al. 1991:465); however, intensive use of the intermediate zone appears to have occurred somewhat later than this (i.e., starting in the last few centuries before European contact). The research objectives for the current data recovery project were therefore designed to expand our knowledge of traditional Hawaiian use of this intermediate zone.

The purpose of Research Objective 1 was to characterize the nature and distribution of trail types (i.e., those with formal features such as curbing and stepping stones versus those without) by developing a predictive model based on known trails in the North Kona region and by integrating this data with documented trails in the project area. Any trail not found to correlate with a historically mapped trail was evaluated for its particular characteristics according to

Apple's (1965) criteria (see Table 35) and proximity to other historic properties, with the objective of determining relative age, function, and/or regional significance. Based on Apple's (1965) criteria, the majority of trails in the project area (n=11) are classified as Type "A." Type "A" trails typically date to the pre- or early post-Contact period; however, as NPS trail specialists have pointed out, trails lacking formal attributes within the subject project area may exhibit formal features elsewhere (i.e., outside the project area). In some instances, additional evidence for the interpretation of these trails as traditional Hawaiian footpaths is provided by the proximity of likely pre-Contact features, including agricultural features (e.g., SIHP #s -22418, -28782 and -28784) and petroglyphs (SIHP # -28791).

The second most common trail type (n=4) in the project area is Type "AB," which are generally historic trails developed from earlier, traditional footpaths (e.g., SIHP #s -18099 and -19946). The main means of transportation along the trails prior to 1947 was by foot, as well as on horses and donkeys; after World War II, Jeeps became available for purchase. Only one trail in the current project area, the Māmalahoa Trail (SIHP # -00002), is classified as Type "D" based on the criteria presented by Apple (1965). Type "D" trails are generally the width of two horses and have been modified to accommodate wheeled vehicles. SIHP # -00002 was one of the first improved cross-*ahupua'a* trails (inland of the coastal trail). It was used for commerce, troop movements, carrying messages, collecting taxes, and other government activities; however, as the population shifted to the agricultural zone along the inland trail, the Māmalahoa Trail on the lower barren shore was abandoned (Cordy et al. 1991:405).

The Māmalahoa Trail (SIHP # -00002) extends both northwest and southeast outside the current project area and is bisected by numerous *mauka-makai* oriented trails, including four (SIHP #s -10714, -18099, -19953, and -29272) within the current project area. Of these, three (SIHP #s -10714 [The Road to the Sea], -18099 [Trail to Honokōhau], and -29272) were major *mauka-makai* routes that led from the coast to the uplands, allowing residents to move between different resource zones. SIHP # -29272 is notable as the only trail identified within roughly the northern half of the current project area. This dearth of transportation features is consistent with the findings of previous studies in the vicinity (e.g., Henry et al. 1993). In contrast, the "relatively high degree of traffic" in Kaloko and Honokōhau Ahupua'a to the south is evidenced by the proliferation of trails (Bell et al. 2008a:202), which have been identified during previous studies *mauka* of the current project area as well as in the current study. It is further evidenced by the extensive network of trails within Kaloko-Honokōhau National Historical Park on the *makai* side of the current project area.

The purpose of Research Objective 2 was to understand the nature and intensity of cultivation in the project area in the context of predictive models for North Kona based on variations in elevation and rainfall. The expected cultivant for this arid zone is the sweet potato (*I. batatas*), since it requires less water than other common cultigens (Allen 2004; Cordy 2000; Horrocks and Rechtman 2009) and is documented historically to have been grown on the lava fields in small, man-made plots. In association with Research Objective 2, pollen and starch analysis was performed on sediment samples collected in lava features at four historic properties (SIHP #s -28778, -28785, -28786, and -28813), all of which were initially interpreted as traditional Hawaiian agricultural features. The results of this analysis yielded diverse evidence of local flora and fauna but failed to produce evidence of common dryland cultigens, leading to the reinterpretation of the function of these historic properties.

Research Objective 3 addressed historic properties that were indeterminate in function, due to the available evidence (during the project's AIS; see Monahan et al. 2012a) being ambiguous or inconclusive. In large part, this is a result of the difficulty in interpreting relatively informal, stacked rock constructions, filled crevices, mounds and *ahu*, excavated pits, and similar features on relatively barren lava flows. Because resolution of function is critical to a more accurate understanding of traditional and early historic land use, an attempt at resolving these uncertainties was made through excavation and/or dismantling at the seven historic properties where the function could not be determined during the AIS. Data recovery fieldwork yielded new evidence for the function, or possible function, of six of the seven historic properties; only SIHP # -29335 failed to yield useful data, since no smaller-grained sediment was present, and no cultural materials were observed. Of the remaining six, two (SIHP #s -28807 and -29345) were determined to be modern activity areas, and two (SIHP #s -28812 and -29332) were determined to be natural rock formations with no cultural function.

Research Objective 4 was to determine the absolute dates of occupation of the project area as may be available from data recovery sites at which excavation/dismantling was proposed. Based on available archaeological evidence from the vicinity of the project area, dates were expected to cluster around the last few centuries before European (late eighteenth century) Contact, when either agricultural intensification, population pressure, and/or other factors forced population movement to relatively marginal areas (Cordy 2000:46). In conjunction with Research Objective 4, radiocarbon analysis was performed on charcoal and faunal samples from two historic properties, SIHP #s -28778 (resource prospecting pit) and -28785 (pen used for animal husbandry). All samples yielded two-sigma calibrated date ranges indicating utilization of these historic properties no earlier than the late pre-Contact period. These results are consistent with prior expectations that radiocarbon dates would cluster around the last few centuries before European contact.

It should be noted that very little cultural material was observed or collected during data recovery fieldwork, and that fine-grained sedimentary deposits were typically either non-existent or very shallow. A modest quantity of vertebrate (*S. scrofa* [pig], *Rattus* sp.) and invertebrate (*G. severnsi* [extinct land crab] and Amastridae sp. [small land snail]) faunal remains were collected from several excavation units during data recovery fieldwork. However, the type and quantity of the remains are consistent with natural deposition, and none of the remains showed evidence of cultural modification; therefore, they are not interpreted as midden. The lack of midden and other cultural materials, the dearth of evidence for cultivation, the relatively recent radiocarbon dates (no earlier than late pre-Contact), and the reinterpretation of several historic properties as modern or natural in origin supports the available historical and archaeological evidence—namely, that the land within and immediately adjacent to the current project area is an “intermediate” zone between the more productive *kula* coastal settlements and the upland *kalu* gardening areas, with habitation at this elevation (approximately 60–140 ft AMSL) on a temporary or recurrent, rather than permanent, basis (see also Jensen and Goodfellow 1993; Robins et al. 2000). In roughly the southern half of the project area, in Kaloko and Honokōhau Ahupua‘a, there seems to have been a relatively high degree of traffic at least passing through this intermediate zone, as evidenced by the majority (13 of 16) of data recovery trails being identified in those two *ahupua‘a*. Most of these trails represent *mauka-makai* routes, which allowed residents to move between different resource zones and places of habitation, recreation, ceremony, and agriculture.

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Appendix A SHPD Correspondence

 <p>NEIL ABERCROMBIE GOVERNOR OF HAWAII</p>		<p>WILLIAM J. AHL, JR. CHAIRPERSON BOARD OF LAND AND NATURAL RESOURCES COMMISSION ON WATER RESOURCE MANAGEMENT</p> <p>PAUL J. CONRY INTERIM FIRST DEPUTY</p> <p>WILLIAM M. TAM DEPUTY DIRECTOR - WATER</p> <p>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 KAIHOOLAWE ISLAND RESERVE COMMISSION LAND STATE PARKS</p>
<p>STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES</p> <p>POST OFFICE BOX 621 HONOLULU, HAWAII 96809</p>		
<p>August 21, 2012</p>		
<p>Chris Monahan, Ph.D. Cultural Surveys Hawaii PO Box 1114 Kailua, Hawaii 96734</p>	<p>LOG NO: 2012.1443 DOC NO: 1208MV01</p>	
<p>Subject: Chapter 6E-8 & National Historic Preservation Act Section 106 Review - Archaeological Inventory Survey, Proposed Queen Ka'ahumanu Highway Widening, Phase 2 Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a North Kona District, Island of Hawai'i <u>TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)</u></p>		
<p>Thank you for submitting the report titled <i>Archaeological Inventory Survey for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a, North Kona District, Island of Hawai'i</i> TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (C. Monahan, T. Yucha, and C. O'Hare), July 2012. This report was received by our office on July 20, 2012. The report presents the findings of multiple phases of archaeological survey work conducted along a 5.2 mile section of the proposed Queen Ka'ahumanu Highway Widening Project, Phase II. A previous draft of this archaeological inventory survey (AIS) report was reviewed by SHPD (<i>Log 2011.1140 Doc 1104TD12</i>). This previous draft was accepted under the condition that comments and concerns from other consulting parties, including the National Park Service (NPS) and native Hawaiian organizations (NHO), would be addressed. Because the concerns of the consulting parties were not adequately addressed, additional field work was undertaken in the project area and a revised draft report was submitted to our office for review. The results of all the field work in this project area to date are presented in this revised report. The survey identifies 75 historic properties in the proposed project area; twenty of the historic properties are previously described in existing archaeological reports. The remaining 55 historic properties are newly identified in this report. Of the 55 newly identified historic properties, 35 were recorded in the initial draft of this report (Monahan et. al. 2011), and the remaining 20 historic properties were recorded during the supplemental fieldwork involving consulting parties (NHO's NPS, and SHPD).</p>		
<p>The changes that were made to this report are the result of the SHPD review of a previous draft (<i>Log 2012.1443, Doc. 1206MV26</i>). We believe the revisions and explanations have adequately addressed our concerns relating to inadequate levels of recording at multiple sites, the assessment of site functions, and treatment recommendations. We are pleased that the 'Big Cave' site (50-10-28-29725) has been identified and recoded in this AIS, and we are pleased that the FHWA will proceed with the proposed mitigation commitment of creating a Burial Treatment Plan to be presented to the Hawaii Island Burial Council, in consultation with the appropriate land owner.</p>		
<p>All 75 historic properties identified during this survey are assessed as significant under the National Register of Historic places (NRHP) criterion D for their ability to yield information on historic and prehistory. As a result of consultation with Native Hawaiian organizations (NHOs), Criterion "e" of the Hawaii Register of Historic Places (HRHP) has been added to all 75 sites, because the NHOs believe these properties are of cultural value to the Native Hawaiian people. In addition, Sites 19954, 28774, 22507, 22418, 19953, 28782, 28784, 28787, 19952, 15324, 19946, 28791, and 29272 are assessed as significant under NRHP criteria C and D; and HRHP Criterion "e". Two trails, (Sites 18099 and 10714) are assessed as significant under NRHP criteria A, C, and D; and HRHP Criterion "e". Finally, the Mamalahoa Trail (Site 00002) is assessed as significant under NRHP criteria A, B, C, and D; and HRHP Criterion "e". We concur with the significance assessments presented in this report for all sites assessed as significant under NRHP criteria A, B, C, and D.</p>		

Dr. Monahan
August 21, 2012
Page 2

The application of HRHP significance Criterion "e" to all sites has been reviewed by the SHPD History and Culture Branch. The results of that review are as follows:

The History and Culture Branch concurs with the Archaeological Inventory Survey that all 75 historic properties in the project area be assessed as significant under Criterion E, as having important value to the *native Hawaiian people...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 history accounts—these associations being important to the group's *history and cultural identity*. Due to changes in Hawai'i that occurred subsequent to contact with the western world (1778), the unique cultural identity of the native Hawaiian people progressively eroded. Thus with respect to that cultural identity, aside from personal DNA that each native Hawaiian possesses, all that is left today are those physical manifestations (archaeological sites and features) that identifies and defines the native Hawaiian culture. From a cultural perspective then, all sites and features are significant to the native Hawaiian.

The History and Culture Branch also concurs with the project effect and mitigation recommendations as discussed in Section 7, as well as summarized in Table 27 (Summary of Proposed Mitigation) and Table 28 (Project Effect and Mitigation Recommendations for Historic Properties in the Project Areas). The Branch would also like emphasize the importance of care and sensitivity as it relates to the proposed data recovery at those sites identified as possible burials.

This report meets the requirements of HAR §13-276 and *Secretary of the Interior's Standards for Documentation and Evaluation*, and is accepted by SHPD. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office.

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,



Theresa K. Donham
Deputy State Historic Preservation Officer
Archaeology Branch Chief
Historic Preservation Division

cc: Hinano Rodrigues, Acting Branch Chief
History and Culture Branch
Historic Preservation Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
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

October 25, 2012

Chris Monahan, Ph.D.
Cultural Surveys Hawaii
PO Box 1114
Kailua, Hawaii 96734

LOG NO: 2012.3052
DOC NO: 1210MV25

Dear Dr. Monahan,

Subject: **Chapter 6E-8 & National Historic Preservation Act Section 106 Review - Revised Archaeological Data Recovery and Preservation Plan for the Proposed Queen Ka'ahumanu Highway Widening, Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a North Kona District, Island of Hawai'i**
TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)

Thank you for submitting the revised plan titled *Archaeological Data Recovery and Preservation Plan for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a, North Kona District, Island of Hawai'i TMK: (3) 7-4-008, 7-3-009 & 7-3-043* (D. Shideler, T. Yucha, C. O'Hare and C. Monahan), August 2012. This plan was received by our office on October 9, 2012. The plan outlines the proposed site specific mitigation commitments for 75 historic properties discovered during the identification phase of this proposed undertaking. These 75 historic properties are documented in the archaeological inventory survey report for the project area (Monahan et. al. 2012) that was approved by SHPD in August 2012 (Log No 2012.1443, Doc No 1208MV01).

The site specific mitigation commitments for the 75 sites are described on page iv of the management summary and in table 3, which stretches from page 26 to page 28. According to these tables: two sites will be subjected to separate burial treatment plans (Sites 22415 and 29275); 15 sites will be preserved with no additional field work (Sites 10154, 19943, 19950, 19951, 28780, 28781, 28788, 28789, 28790, 28792, 28797, 28799, 28802, 28806, and 28810); one site will receive a combination of no further work and preservation (19945); 11 sites will be avoided during construction and therefore subject to short term protection measures (28794, 28801, 28803, 28804, 28805, 28809, 29337, 29341, 29342, 29343, and 29347); two sites will receive no further work, but impacts will be monitored by an archaeologist (6432 and 29338); two sites will be relocated (19947 and 29346); one site will receive a combination of relocation and preservation (28808); 20 sites will receive data recovery excavation with no additional mitigation (19949, 22417, 28778, 28785, 28786, 28800, 28807, 28811, 28812, 28814, 28815, 29332, 29333, 29334, 29335, 9336, 29339, 29340, 29344, and 29345); 14 sites will be subjected to a combination of archival data recovery and partial preservation (00002, 10714, 15324, 18099, 19946, 19952, 19953, 19954, 22507, 28774, 28782, 28784, 28787, and 28791); one site will be subjected to a combination of archival data recovery, data recovery excavation and partial preservation (29272); one site will be subjected to archival data recovery only (22418); two sites will have data recovery through the collection and curation of portable artifacts (29348 and 29349); and three sites will be subjected to a combination of data recovery excavation and preservation (19948, 28783, and 28813).

Changes were made to this plan in response to the SHPD review of a previous draft (Log No. 2012.2546, Doc. No. 1209MV06). We believe the revisions and explanations have adequately addressed our concerns. We believe that this mitigation plan will now serve as the overall site-specific mitigation document for the undertaking. This plan meets the requirements of HAR §13-277, HAR §13-278 and the *Secretary of the Interior's Standards*, and is accepted by SHPD. Please send one hardcopy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office.

Dr. Monahan
October 25, 2012
Page 2

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

A handwritten signature in black ink, appearing to read 'Theresa Donham', with a long horizontal flourish extending to the right.

Theresa Donham
Archaeology Branch Chief and
Deputy State Historic Preservation Officer
Historic Preservation Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
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AQUATIC RESOURCES
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

July 23, 2013

David Shideler.
Cultural Surveys Hawaii
PO Box 1114
Kailua, Hawaii 96734

LOG NO: 2013.4167
DOC NO: 1307MV17
Archaeology

Subject: **Chapter 6E-8 and National Historic Preservation Act Section 106 Review - Proposed Queen Ka'ahumanu Highway Widening, Phase 2 Redesign and Mitigation Revisions Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a North Kona District, Island of Hawai'i**
TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)

Thank you for submitting the consultation letter that was received by our office on July 9, 2013. According to the letter, the Federal Highways Administration (FHWA) has initiated a redesign of the Phase 2 widening project in order to minimize the effects of this undertaking on historic properties. The treatment recommendations for the 55 historic properties in the project area were finalized following an archaeological inventory survey conducted by Monahan et. al. (2012) and accepted by SHPD (Log 2012.1443, Doc 1208MV01). As a result of the redesign, 20 sites that were proposed to be directly impacted will now be avoided by construction activities. Nine of these sites are trails that were previously proposed to be partially destroyed, with mitigation in the form of archival research, and the undisturbed portion of the trail preserved (SIHP Sites 20-10-27-15324, 18099, 19946, 19954, 22418, 22507, 28774, 28782, and 29272). The remaining 11 sites were previously proposed to be all or partially destroyed by the highway widening, with data recovery excavation for 10 sites (SIHP Sites 19947, 19948, 19949, 22417, 28783, 28800, 28811, 29333, 29334, 29336, and 29344); and relocation for one site (SIHP 19947). As a result of the redesign, all 20 of these sites will be avoided by this undertaking.

FHWA is proposing to revise the proposed mitigation commitments for these sites in order to avoid the potential adverse effects associated with data recovery excavation. For the 9 trail sites, FHWA now proposes to preserve the entire site within the project area, and continue with the data recovery work in the form of non-invasive archival research. SHPD agrees with this recommendation. In addition, the remaining 11 sites, which were previously recommended for relocation or data recovery excavation, will retain these original treatment recommendations. These sites will be preserved during the implementation of the current undertaking through the implementation of interim protection measures. Because these sites will retain their original treatment recommendations, it is possible for these 11 sites to be impacted by future undertakings, provided the agreed upon mitigation commitments are carried out. SHPD also agrees with this recommendation, and we look forward to the opportunity to review an amended mitigation plan that will outline the preservation measures that will be carried out for these sites during this undertaking.

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Theresa K. Donham
Deputy State Historic Preservation Officer
Historic Preservation Division

NEIL ABERCROMBIE GOVERNOR OF HAWAII		WILLIAM J. AILA, JR. CHAIRPERSON BOARD OF LAND AND NATURAL RESOURCES COMMISSION ON WATER RESOURCE MANAGEMENT
	STATE OF HAWAII DEPARTMENT OF LAND AND NATURAL RESOURCES	ESTHER KIA'AINA FIRST DEPUTY
	POST OFFICE BOX 621 HONOLULU, HAWAII 96809	WILLIAM M. TAM 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

October 28, 2013

David Shideler.
Cultural Surveys Hawaii
PO Box 1114
Kailua, Hawaii 96734

LOG NO: 2013.4267
DOC NO: 1310MV12
Archaeology

Subject: Chapter 6E-8 & National Historic Preservation Act Section 106 Review - Amended Archaeological Data Recovery and Preservation Plan for the Proposed Queen Ka'ahumanu Highway Widening, Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a North Kona District, Island of Hawai'i
TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)

Thank you for submitting the plan titled *Amended Archaeological Data Recovery and Preservation Plan for the Proposed Queen Ka'ahumanu Highway Widening Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a, North Kona District, Island of Hawai'i* TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (D. Shideler, T. Yucha, C. O'Hare and C. Monahan), September 2013. This plan was received by our office on September 9, 2013. The plan outlines amended site specific mitigation commitments for 76 historic properties that were previously proposed for mitigation through an earlier version of this plan that was accepted by SHPD via LOG NO: 2012.3052, DOC NO: 1210MV25. These 76 historic properties were documented in the archaeological inventory survey report for the project area (Monahan et. al. 2012) that was approved by SHPD in August 2012 (Log No 2012.1443, Doc No 1208MV01). The mitigation commitments described in the original version of this plan are the result of treatment recommendations for the individual sites that were presented in the accepted AIS of this project area (Monahan et. al. 2012). The mitigation commitments were as follows:

Two sites will be subjected to separate burial treatment plans (Sites 22415 and 29275); 15 sites will be preserved with no additional field work (Sites 10154, 19943, 19950, 19951, 28780, 28781, 28788, 28789, 28790, 28792, 28797, 28799, 28802, 28806, and 28810); one site will receive a combination of no further work and preservation (19945); 11 sites will be avoided during construction and therefore subject to short term protection measures (28794, 28801, 28803, 28804, 28805, 28809, 29337, 29341, 29342, 29343, and 29347); two sites will receive no further work, but impacts will be monitored by an archaeologist (6432 and 29338); two sites will be relocated (19947 and 29346); one site will receive a combination of relocation and preservation (28808); 20 sites will receive data recovery excavation with no additional mitigation (19949, 22417, 28778, 28785, 28786, 28800, 28807, 28811, 28812, 28814, 28815, 29332, 29333, 29334, 29335, 9336, 29339, 29340, 29344, and 29345); 14 sites will be subjected to a combination of archival data recovery and partial preservation (00002, 10714, 15324, 18099, 19946, 19952, 19953, 19954, 22507, 28774, 28782, 28784, 28787, and 28791); one site will be subjected to a combination of archival data recovery, data recovery excavation and partial preservation (29272); one site will be subjected to archival data recovery only (22418); two sites will have data recovery through the collection and curation of portable artifacts (29348 and 29349); and three sites will be subjected to a combination of data recovery excavation and preservation (19948, 28783, and 28813).

The Federal Highways Administration (FHWA) has initiated a redesign of the Phase 2 widening project in order to minimize the effects of this undertaking on historic properties. As a result of the redesign, 20 sites that were previously proposed to be directly impacted will now be avoided by construction activities. Nine of these sites are trails that were proposed to be partially destroyed, with mitigation in the form of archival research, and the undisturbed portion of the trail preserved (SIHP Sites 20-10-27-15324, 18099, 19946, 19954, 22418, 22507, 28774, 28782, and 29272). The remaining 11 sites were previously proposed to be all or partially destroyed by the highway widening, with data recovery excavation for 10 sites (SIHP Sites 19947, 19948, 19949, 22417, 28783, 28800, 28811, 29333, 29334, 29336, and 29344); and relocation for one site (SIHP 19947). As a result of the redesign, all 20 of these sites will be avoided by this undertaking.

Mr. Shideler
 October 28, 2013
 Page 2

The agreement to avoid these sites was established via SHPD correspondence (Log 2013.4267, Doc 1307MV17). This agreement indicated that the treatment recommendations established in the Monahan et. al. (2012) AIS would be maintained, however the mitigation measures would be changed in order to preserve these sites from any impact during project activities. We believe that the amended archaeological data recovery and preservation plan has overstepped the limits of this agreement, as sites that were not included in the agreement have been changed from a proposed mitigation of data recovery to "Avoidance During Construction" or "ADC." In addition, this plan does not outline sufficient preservation measures for the sites that will now be preserved. Our specific concerns are presented below:

1. The summary of proposed mitigation table on Page 20 indicates that SIHP 29339 and 29340 are recommended for "avoidance during construction." However, these sites were recommended for Data Recovery in the Monahan et. al. (2012) AIS and included in the D. Shideler, T, Yucha, C. O'Hare and C. Monahan (2012) mitigation plan. In addition, SIHP 29339 and 29340 are not included in the 20 sites whose treatment recommendations were revised as a result of SHPD correspondence (Log 2013.4267, Doc 1307MV17). We believe that these sites should not change from data recovery to "avoidance during construction." Instead we believe that these sites should be treated in a similar fashion as the other sites whose treatment recommendations have changed to preservation. This change would not rule out the possibility of Data Recovery in the near future.
2. The summary of proposed mitigation table on Page 20 also indicates that SIHP 28796 has been added to the treatment category of "avoidance during construction." Our records indicate that this site was determined to be a feature of SIHP 10714 during the SHPD review of the AIS (Log 2012.1443, Doc 1206MV26). Subsequently, this feature was recommended for preservation as part of SIHP 10714 in the D. Shideler, T, Yucha, C. O'Hare and C. Monahan (2012) mitigation plan. There is no mention of Site 28796 in the mitigation plan. We believe that this feature should be preserved as part of SIHP 10714.
3. The summary of proposed mitigation table on Page 20 does not indicate the change in mitigation that occurred with SIHP 22418. This site is one of the trail sites that will be preserved as part of the redesign as reflected in SHPD correspondence (Log 2013.4267, Doc 1307MV17). However, this site is still listed as having mitigation in the form of archival data recovery research only. The new treatment of preservation should be identified.
4. Page 109, short and long term preservation measures should be identified for SIHP 22418, which should include all relevant provisions of HAR 13-277 including a map of the proposed buffer zone.
5. There are no preservation buffers presented for SIHP 15324 and 22418.
6. Page 312 - The preservation buffer for SIHP 18099 does not adequately protect the site.
7. Page 315 - The preservation buffer for SIHP 19953 does not adequately protect the site.
8. Page 316 - The preservation buffer for SIHP 19954 does not adequately protect the site.
9. Page 319 - The preservation buffer for SIHP 28782 does not adequately protect the site.

In order to clearly and concisely correct these and any other oversights in the draft, SHPD recommends that the amended data recovery and preservation plan be abandoned, and instead, an independent preservation/mitigation plan be prepared only for the sites whose mitigation commitments will change as a result of the redesign. This preservation plan should be an amendment to the previously accepted D. Shideler, T, Yucha, C. O'Hare and C. Monahan (2012) mitigation plan. This plan should provide preservation measures for the 20 sites that were changed to preservation via Log 2013.4267, Doc 1307MV17. If additional sites, such as SIHP 29339 and 29340 are to be added to preservation this could be accomplished in this plan. The preservation measures should provide all relevant provisions of HAR 13-277 and should meet the *Secretary of the Interior's Standards* for the treatment of historic properties. We look forward to the opportunity to review the addendum preservation plan, and we look forward to bringing the historic preservation review of this project to completion. Finally we believe that the terms of the addendum preservation plan should be incorporated into the Memorandum of Agreement for this undertaking.

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,



Theresa K. Donham
 Deputy State Historic Preservation Officer
 Historic Preservation Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

April 9, 2014

David Shideler.
Cultural Surveys Hawaii
PO Box 1114
Kailua, Hawaii 96734

LOG NO: 2014.1379
DOC NO: 1404MV06
Archaeology

Subject: **Chapter 6E-8 and National Historic Preservation Act Section 106 Review -
Archaeological Preservation Plan and Mitigation Plan Addressing 23 Historic Properties
Queen Ka'ahumanu Highway Widening, Phase 2
Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a
North Kona District, Island of Hawai'i
TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)**

Thank you for submitting the plan titled *An Archaeological Preservation Plan and Mitigation Plan Addressing 23 Sites for the Proposed Queen Ka'ahumanu Highway Widening, Phase 2 Project Kalaoa, O'oma, Kohanaiki, Kaloko, Honokohau 1-2 and Kealakehe Ahupua'a North Kona District, Island of Hawai'i TMK: (3) 7-4-008, 7-3-009 & 7-3-043 (portion)* (H. Hammatt and D. Shideler), March, 2014. This plan was received by our office on March 28, 2014. The plan outlines amended site specific preservation measures for 23 historic properties located within the Queen Ka'ahumanu Highway corridor. An archaeological inventory survey report for the project area documented a total of 76 historic properties and provided treatment recommendations (Monahan et. al. 2012). This inventory survey and treatment recommendations were approved by SHPD in August 2012 (Log No 2012.1443, Doc No 1208MV01). The mitigation commitments were as follows:

Two sites will be subjected to separate burial treatment plans (Sites 22415 and 29275); 15 sites will be preserved with no additional field work (Sites 10154, 19943, 19950, 19951, 28780, 28781, 28788, 28789, 28790, 28792, 28797, 28799, 28802, 28806, and 28810); one site will receive a combination of no further work and preservation (19945); 11 sites will be avoided during construction and therefore subject to short term protection measures (28794, 28801, 28803, 28804, 28805, 28809, 29337, 29341, 29342, 29343, and 29347); two sites will receive no further work, but impacts will be monitored by an archaeologist (6432 and 29338); two sites will be relocated (19947 and 29346); one site will receive a combination of relocation and preservation (28808); 20 sites will receive data recovery excavation with no additional mitigation (19949, 22417, 28778, 28785, 28786, 28800, 28807, 28811, 28812, 28814, 28815, 29332, 29333, 29334, 29335, 9336, 29339, 29340, 29344, and 29345); 14 sites will be subjected to a combination of archival data recovery and partial preservation (00002, 10714, 15324, 18099, 19946, 19952, 19953, 19954, 22507, 28774, 28782, 28784, 28787, and 28791); one site will be subjected to a combination of archival data recovery, data recovery excavation and partial preservation (29272); one site will be subjected to archival data recovery only (22418); two sites will have data recovery through the collection and curation of portable artifacts (29348 and 29349); and three sites will be subjected to a combination of data recovery excavation and preservation (19948, 28783, and 28813).

Subsequently a mitigation plan was prepared to address the recommended treatments presented in the AIS (Shideler et. al. 2012), and this plan was accepted by SHPD (Log No. 2012.3052, Doc No. 1210MV25). However, the Federal Highways Administration (FHWA) initiated a redesign of the Phase 2 widening project in order to minimize the effects of this undertaking on historic properties. As a result of the redesign, 21 sites that were previously proposed to be directly impacted will now be avoided by construction activities. Nine of these sites are trails that were proposed to be partially destroyed, with mitigation in the form of archival research, and the undisturbed portion of the trail preserved (SIHP Sites 20-10-27-15324, 18099, 19946, 19954, 22418, 22507, 28774, 28782, and 29272). Eleven (11) sites were previously proposed to be all or partially destroyed by the highway widening, with data recovery excavation for 10 sites (SIHP Sites 19947, 19948, 19949, 22417, 28783, 28800, 28811, 29333, 29334, 29336, and 29344); and relocation for one site (SIHP 19947). As a result of the redesign, all 21 of these sites will be avoided by this undertaking. In addition, two sites that were outside of the project area and previously recommended for data recovery (SIHP 29339 and 29340) are now subject to interim protection measures.

Mr. Shideler
April 9, 2014
Page 2

The agreement to avoid these sites was established via SHPD correspondence (Log No. 2013.4167, Doc No. 1307MV17). This agreement indicated that the treatment recommendations established in the Monahan et. al. (2012) AIS would be maintained, however the mitigation measures would be changed in order to preserve these 23 sites from any impact during project activities.

SHPD previously reviewed an amended preservation and data recovery plan that dealt with all 76 historic properties identified in the Monahan et. al. (2012) AIS. We requested that that the amended data recovery and preservation plan be abandoned and an addendum preservation/mitigation plan be prepared only for the sites whose mitigation commitments will change as a result of the redesign (Log No. 2013.4267, Doc No. 1310MV12). SHPD reviewed a second draft of the plan on January 21, 2014 and outlined several revisions that were needed in order to meet the standards of HAR 13-277 and the *Secretary of the Interior's Standards* for the treatment of historic properties (Log 2013.6921, Doc 1401MV05). Changes were subsequently made to this plan in response to the SHPD reviews of the previous drafts. SHPD now believes that the preservation plan will adequately protect the historic properties that it is intended to during construction. We also believe that the plan now makes reference to a reasonable and good faith effort to consult with Native Hawaiian Organizations.

This revised plan meets the standards of HAR 13-277 as well as the *Secretary of the Interior's Standards* for the treatment of historic properties and is accepted by SHPD. Please send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office. We look forward to the opportunity to review the revised Memorandum of Agreement for this undertaking that that incorporates the terms of the addendum preservation plan.

Please contact Mike Vitousek at (808) 652-1510 or Michael.Vitousek@Hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,



Theresa K. Donham
Deputy State Historic Preservation Officer
Historic Preservation Division

Appendix B J.S. Emerson Survey Maps

John Emerson made a series of maps of the Kona Coast from ca. 1881 to 1891. His assistant, J. Perryman, made detailed sketches of the features mapped by Emerson. The 1882 maps pertinent to the project area are presented in Figure A through E. These sketches show topographic features, such as hills, bays, coastal points, and fishponds, but also show areas of mid- to late nineteenth century settlements, as well as the trails that connected the settlements along the coast and between the coast and the uplands.

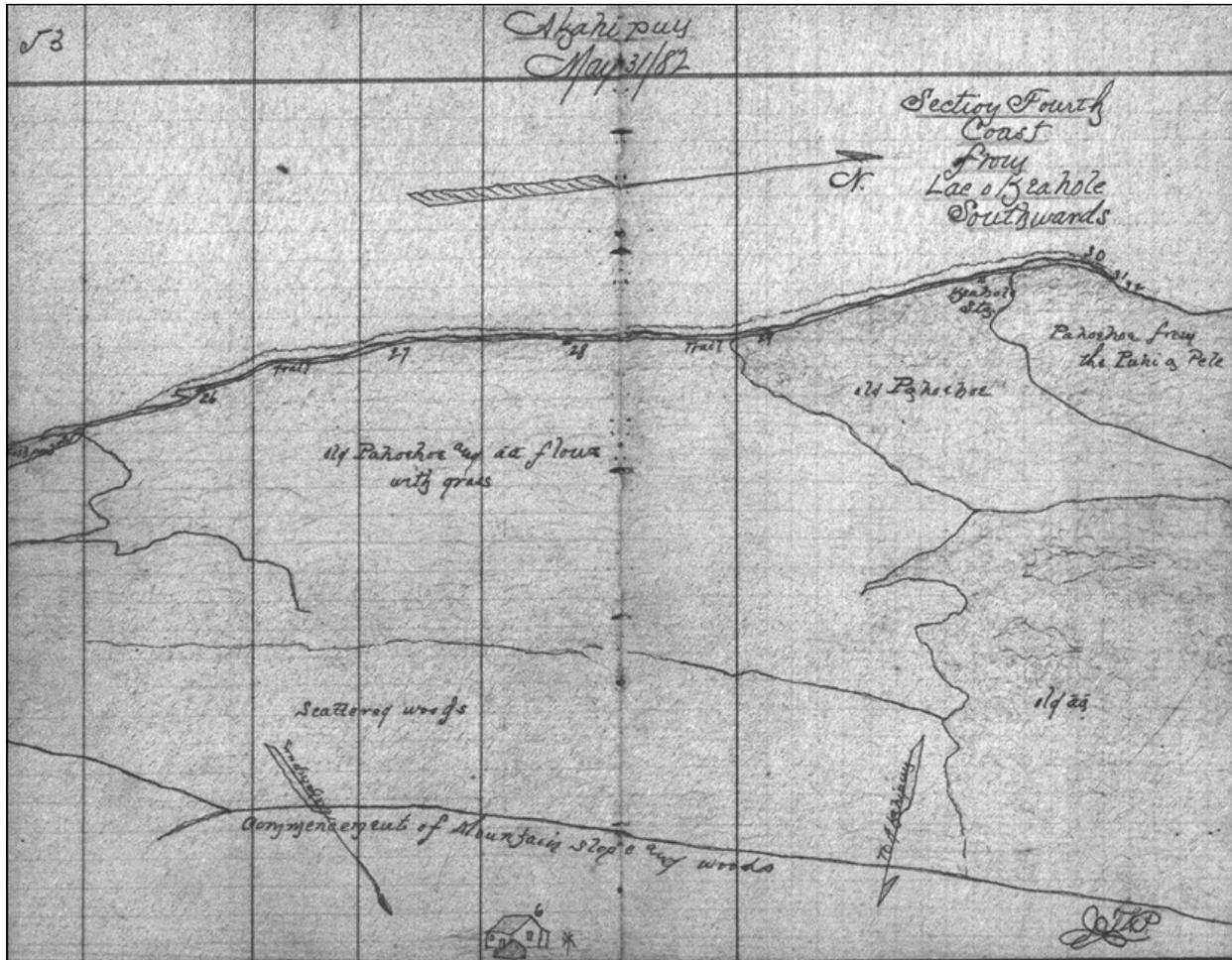


Figure A. J. S. Emerson Field Notebook Map, Book 253:53, 1882 (Hawai'i Land Survey Division), from Kohanaiki Ahupua'a (left) to Keāhole Point at Kalaoa (right); the coastal foot trail is labeled

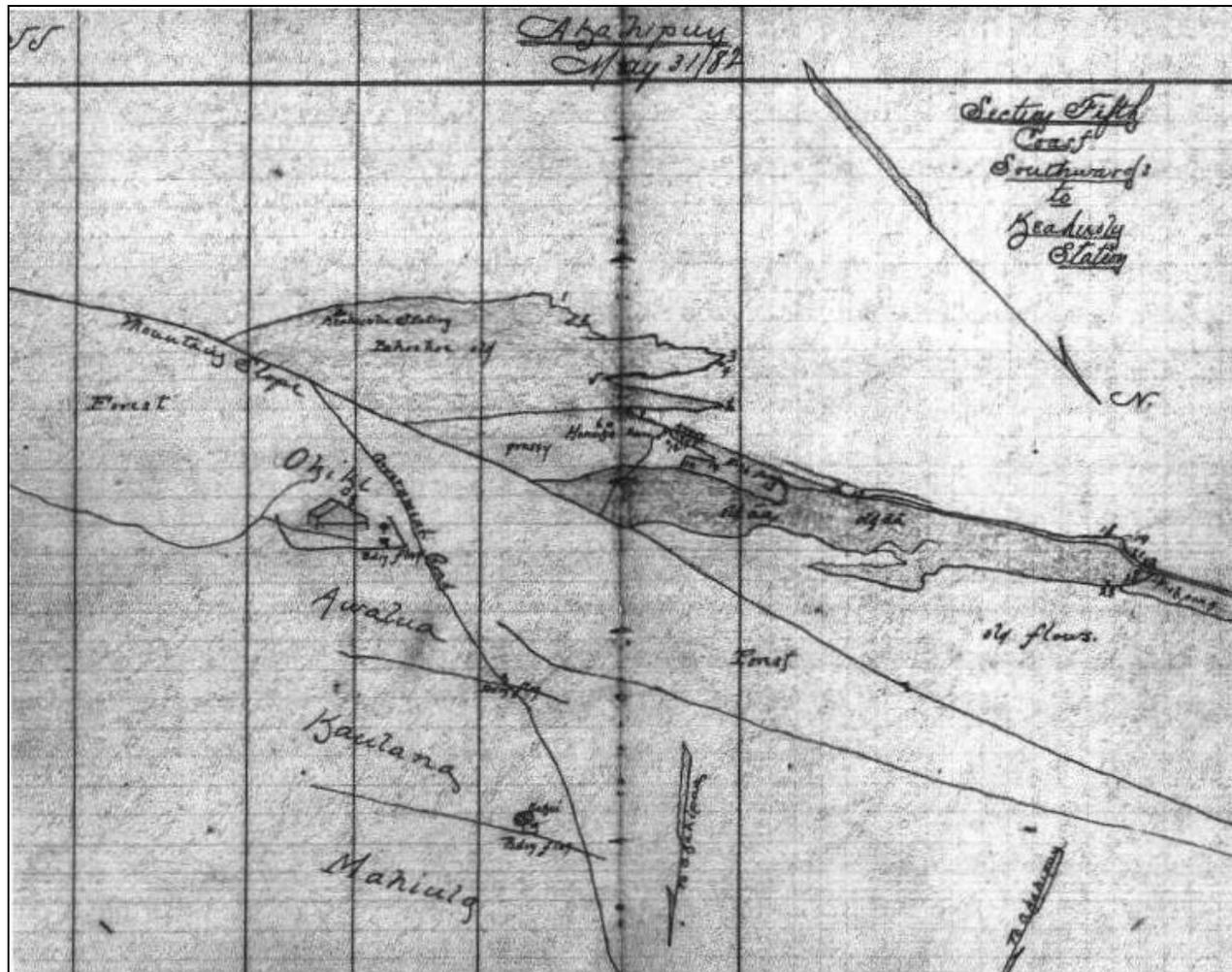


Figure B. J. S. Emerson Field Notebook Map, Book 253:55, 1882 (Hawai'i Land Survey Division), from Keahulū Station (left) south to 'O'oma shore (right), showing Honōkohau Bay and Kaloko Fishpond in central section; map depicts the upper Government Road (now the Māmalahoa Highway)

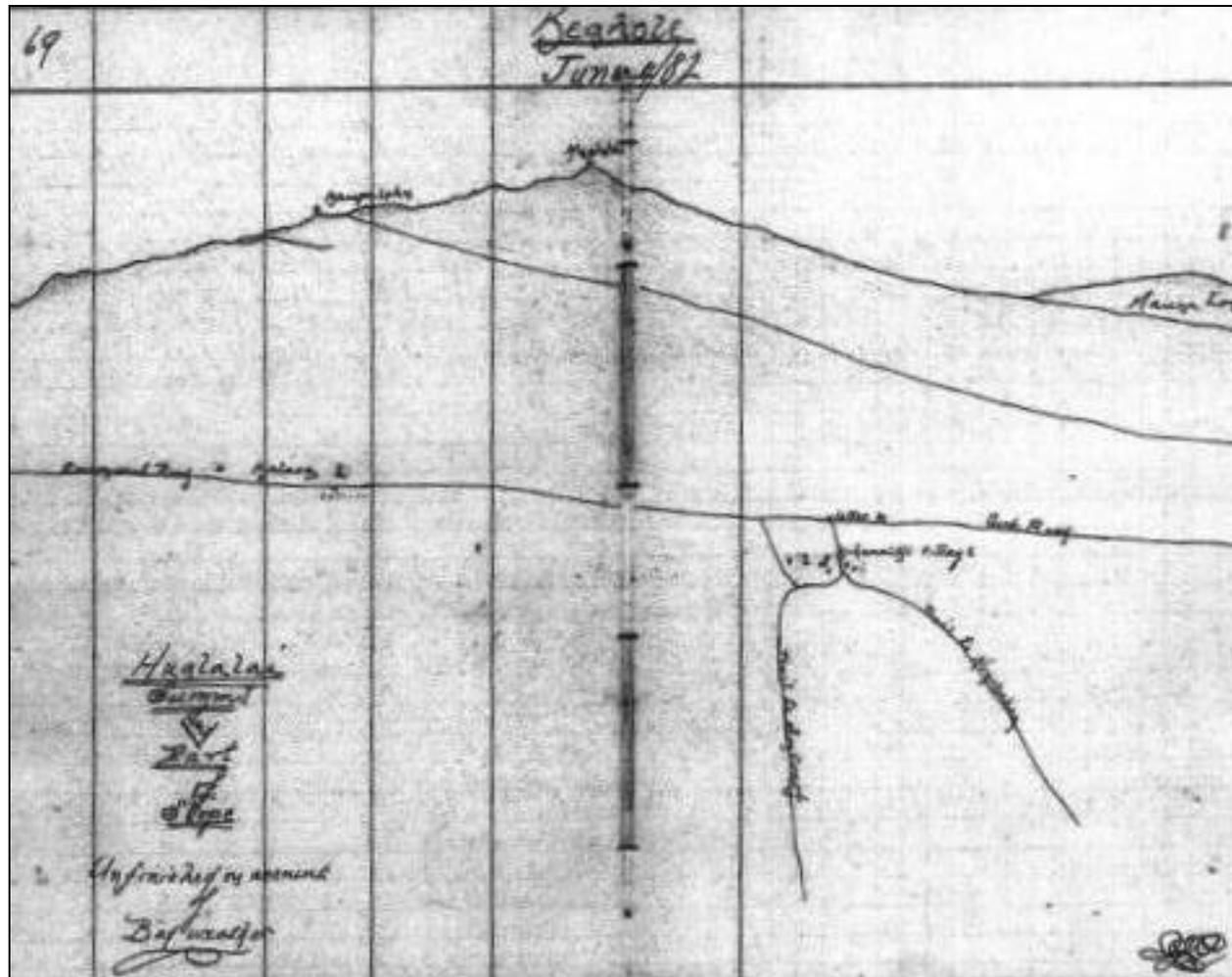


Figure C. J. S. Emerson Field Notebook Map, Book 253:69, 1882 (Hawai'i Land Survey Division), Kona Coast, view upslope to Hualālai. Note *mauka-makai* trails (“trail to Honokohau” at right and “trail to coast” at left) to Kohanaiki Village. “Kalaoa Church” is labeled on the Upper Government Road (now Māmalahoa Highway) at the left

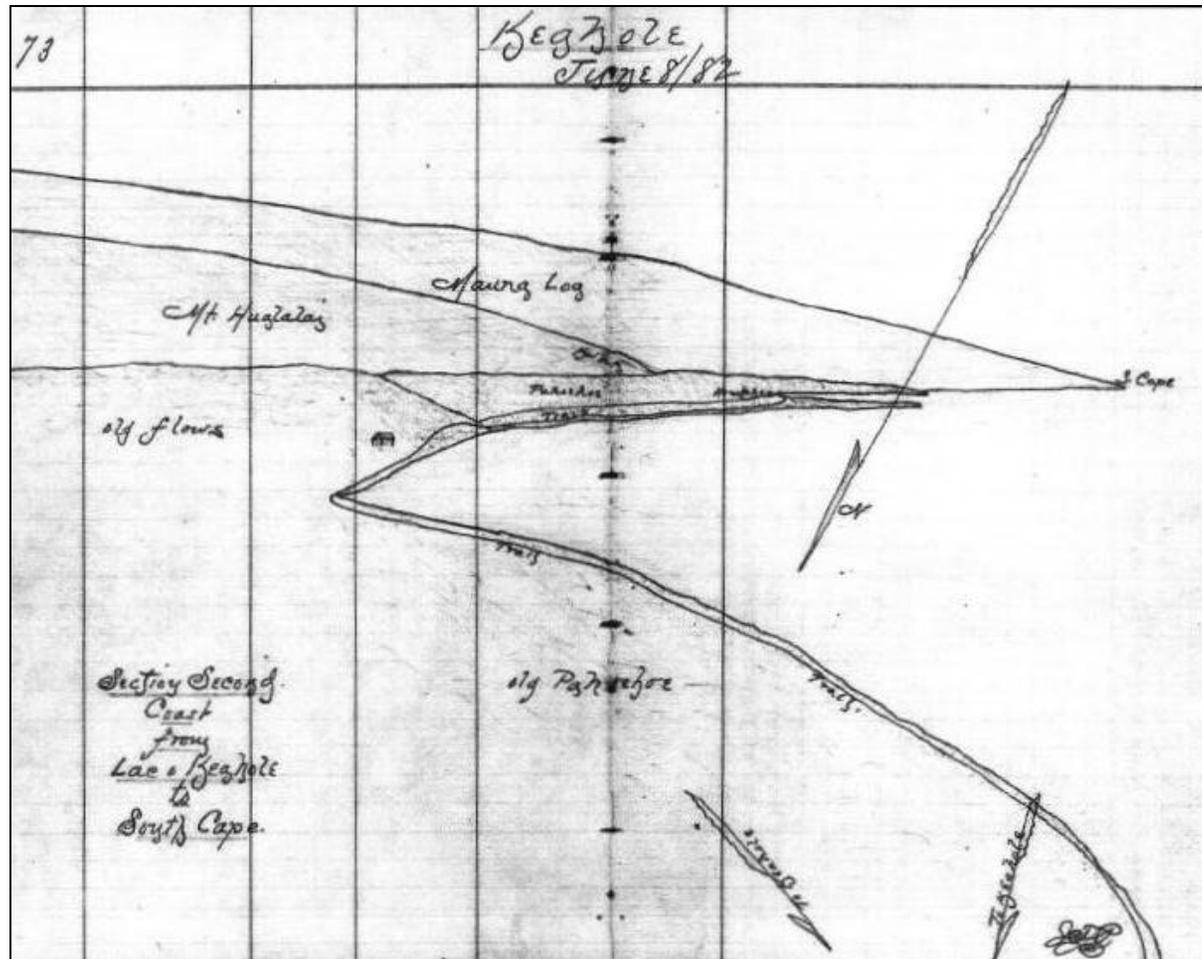


Figure D. J. S. Emerson Field Notebook Map, Book 253:73, 1882 (Hawai'i Land Survey Division), showing coast from Keāhole Point in Kalaoa south to beyond Keahuolu; house in the central area is within 'O'oma ahupua'a; two trails are shown in this section; the coastal trail (which extended to Keāhole Point) and a second parallel, but inland, cross *ahupua'a* trail, probably the Māmalahoa Trail

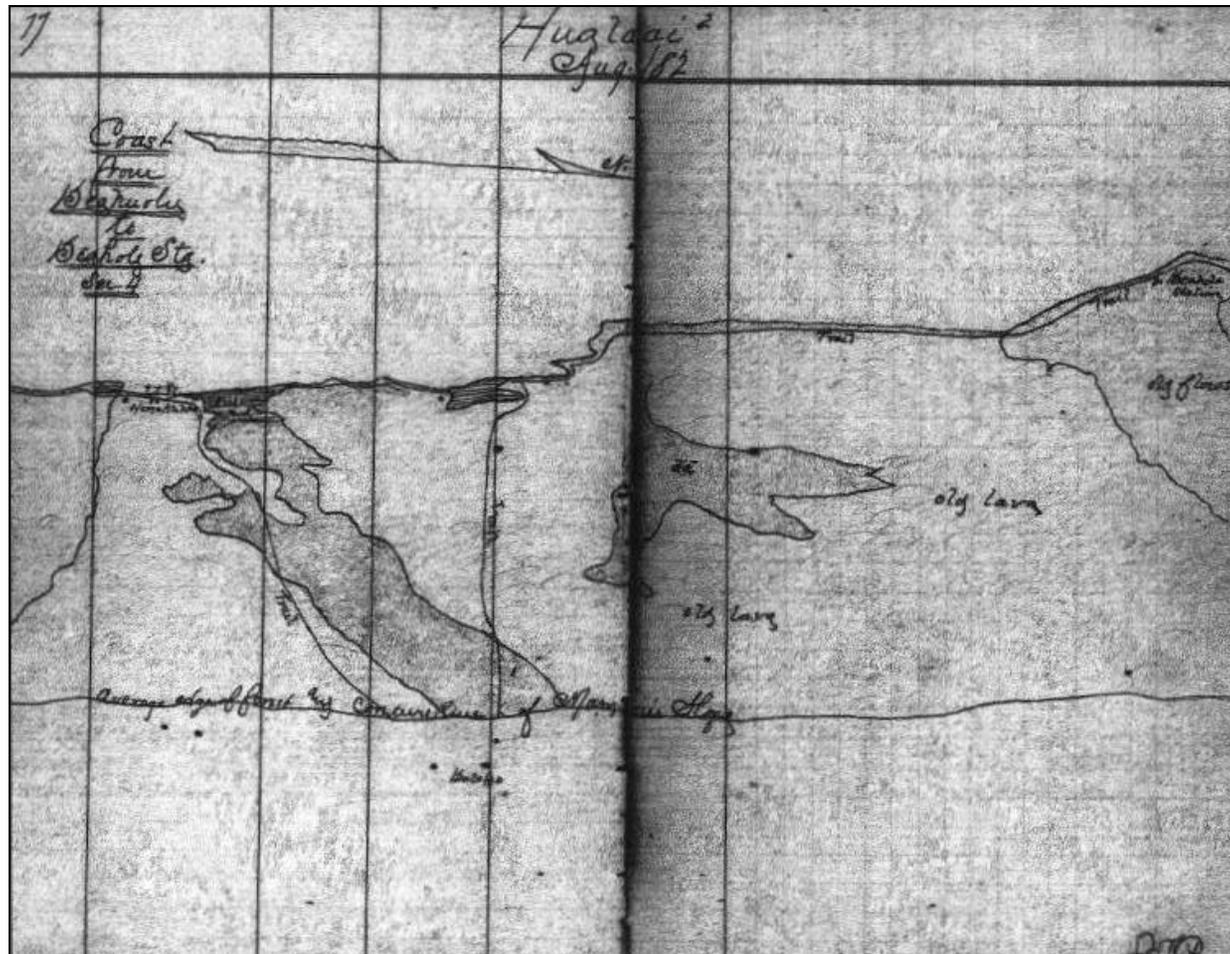


Figure E. J. S. Emerson Field Notebook Map, Book 254:77, 1882 (Hawai'i Land Survey Division), looking *makai*, from Kealakehe (left) to 'Aimakapā Fishpond at Honokōhau Ahupua'a to Kaloko Fishpond (center) and to Keāhole Point on the right; note the three *mauka-makai* trails from Kealakehe to the uplands, from Honokōhau Village to the Upper Government Road (Māmalahoa Highway), and from Kaloko Fishpond to the Upper Government Road

Appendix C Pollen, Starch, Macrofloral Analysis, and AMS Radiocarbon Dating (Cummings and Kovacik 2016)

POLLEN, STARCH, AND MACROFLORAL ANALYSIS
AND AMS RADIOCARBON AGE DETERMINATION OF SAMPLES FROM
SIHP # 50-10-27-28778, SIHP # 50-10-27-28785, SIHP # 50-10-27-28786,
AND SIHP # 50-10-27-28813, KALAOA AHUPUA'A, HAWAII

By

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August 2016

INTRODUCTION

Sediment samples were collected from soil areas or beneath stone architectural components of prehistoric agricultural, habitation, and/or work areas within a 5.2-mile corridor of North Kona. Elevation and distance from the coast vary from 60 ft above mean sea level (AMSL) and 0.5 miles from the coast to 140 ft AMSL and 1.25 miles from the coast at the north end. Land surface comprises primarily un-dissected *'a'ā* and *pāhoehoe* lava flows with little or no soil and vegetation cover. Vegetation typically includes mosses, lichens, ferns, and a few small *ohia* trees. Pollen and starch analysis were performed on six sediment samples collected from four sites along this corridor in an effort to identify evidence of cultigens. Macrofloral analysis and AMS radiocarbon analysis were conducted on two samples.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for recovering pollen grains from sediments. This particular process was developed for extracting pollen from soils where the preservation has been less than ideal and the pollen density is lower than in peat. It is important to recognize that it is not the repetition of specific and individual steps in the laboratory but rather mastery of the concepts of extraction and how the desired result is best achieved, given different sediment matrices, that results in successful recovery of pollen for analysis.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the sediment samples, after which, they were screened through 250-micron mesh. The samples were rinsed with reverse osmosis deionized (RODI) water and centrifuged to recover the sediments, pollen, and starch, then freeze-dried under vacuum. Once dry, the samples were mixed with sodium polytungstate (SPT), at a density of 1.8 g/ml, and centrifuged to separate the organic material including pollen and starch, which float, from the inorganic remains and silica, which will not. The supernatant containing pollen and organic remains was decanted. Sodium polytungstate was added a second time to the inorganic fraction to repeat the separation process. The supernatant was decanted into the same tube as the supernatant from the first separation. This supernatant then was centrifuged at 1,500 rpm for 10 minutes to allow any remaining silica to be separated from the organics. Following this, the supernatant was decanted into a 50-ml conical tube and diluted with RODI water. These samples were centrifuged at 3,000 rpm to concentrate the organic fraction in the bottom of the tube. This pollen-rich organic fraction was rinsed, then all samples received a short (25 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were acetylated for 10 minutes to remove extraneous organic matter. The samples were rinsed with RODI water to neutral. Following this a few drops of potassium hydroxide (KOH) were added to each sample which was then stained lightly with safranin.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. An extensive comparative reference housed at PaleoResearch Institute aided pollen identification to the family, genus, and species level, where possible.

Pollen aggregates were recorded during pollen identification. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. An "A" next to the pollen frequency on the percentage pollen diagram notes the presence of aggregates. A plus sign (+) on the pollen diagram indicates that pollen was observed, in spite of the fact that pollen was not present in a sufficient concentration to obtain a full count. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

"Indeterminate" pollen includes pollen grains that are folded, mutilated, or otherwise distorted beyond recognition. These grains were included in the total pollen count since they are part of the pollen record. The microscopic charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains.

Pollen extraction retains starch granules. Since starch analysis was requested for these samples, not only were starches recorded as part of the pollen count, an additional search for starches was conducted. Starch granules are a plant's mechanism for storing carbohydrates. Starches are found in numerous seeds, as well as in starchy roots and tubers. The primary categories of starches include the following: with or without visible hila, hilum centric or eccentric, hila patterns (dot, cracked, elongated), and shape of starch (angular, ellipse, circular, or lenticular). Some of these starch categories are typical of specific plants, while others are more common and tend to occur in many different types of plants.

Macrofloral

Bulk samples were floated using a modification of procedures outlined by Matthews (1979). Each sample was added to approximately three gallons of water, then stirred until a strong vortex formed. The floating material (light fraction) was poured through a 250-micron mesh sieve. All material that passed through the screen was retained for possible microcharcoal, particulate soil organics, and/or humate extraction. Additional water was added and the process repeated until all floating material was removed from the samples (a minimum of five times). The material remaining in the bottom (heavy fraction) was poured through a 0.5-mm mesh screen. The floated portions were allowed to dry.

The light fractions were weighed, then passed through a series of graduated screens (US Standard Sieves with 4-mm, 2-mm, 1-mm, 0.5-mm, and 0.25-mm openings) to separate charcoal debris and to initially sort the remains. Contents of each screen then were examined. Charcoal pieces larger than 0.5 mm in diameter were separated from the rest of the light fraction, and the total charcoal was weighed. Charcoal pieces in a representative sample were broken to expose fresh cross, radial, and tangential sections, then examined under a binocular microscope at a magnification of 70x and under a Nikon Optiphot 66 microscope at magnifications of 320–800x. Weights of each charcoal type within the representative sample were recorded. Material that remained in the 4-mm, 2-mm, 1-mm, 0.5-mm, and 0.25-mm sieves

was scanned under a binocular stereo microscope at a magnification of 10x, with some identifications requiring magnifications of up to 70x. Material that passed through the 0.25-mm screen was not examined. Heavy fractions were scanned at a magnification of 2x for the presence of botanic remains. The term "seed" is used to represent seeds, achenes, caryopses, and other disseminules. Remains from the light and heavy fractions were recorded as charred and/or uncharred, whole and/or fragments. Macrofloral remains, including charcoal, were identified using manuals (Carlquist 2001; Hoadley 1990; Martin and Barkley 1961; Musil 1963; Schopmeyer 1974; Schweingruber, et al. 2011, 2013) and by comparison with modern and archaeological references. Clean laboratory conditions were used during flotation and identification to avoid contamination of charcoal and botanic remains to be submitted for radiocarbon dating. All instruments were washed between samples, and the samples were protected from contact with modern charcoal.

Samples from archaeological sites commonly contain both charred and uncharred remains. Many ethnobotanists argue that unless there is a specific reason to believe otherwise, only charred remains are considered prehistoric (Minnis 1981:147). Minnis (1981:147) states that it is "improbable that many prehistoric seeds survive uncharred through common archaeological time spans." Few seeds survive longer than a century, and most survive for a much shorter period of time (Harrington 1972; Justice and Bass 1978; Quick 1961). It is presumed that once seeds have died, decomposing organisms work to decay the seeds. However, sites with unusual levels of preservation, such as caves, waterlogged areas, and very arid areas can contain uncharred prehistoric remains. Interpretation of uncharred remains as part of the prehistoric record relies on these unusual conditions for preservation.

AMS Radiocarbon Dating - Charcoal

Charcoal samples submitted for radiocarbon dating were identified and weighed prior to selecting subsamples for pre-treatment. The remainder of each subsample that proceeds to pre-treatment, if any, is curated permanently at PaleoResearch Institute. Selected subsamples were vacuum freeze-dried, freezing out all moisture at -107 °C and < 10 millitorr. Then samples were treated with cold pH 2 hydrochloric acid (HCl), followed by cold 6N HCl. Samples then were heated to approximately 110 °C while in 6N HCl. This step was repeated until the supernatant was clear. This step removes iron compounds and calcium carbonates that hamper humate compound removal. Next, the samples were subjected to 5% potassium hydroxide (KOH) to remove humates using both cold solutions and solutions that were heated. Once again, the samples were rinsed to neutral and re-acidified with pH 2 HCl between each KOH step. This step was repeated until the supernatant was clear, signaling removal of all humates, then was rinsed to neutral. After humate removal, samples were made slightly acidic with pH2 HCl. Fibrous inorganic material remaining in Sample PR-4 appears to be fine sediment deposited in the vessels of charcoal. Unfortunately that charcoal could not be radiocarbon dated. The sample was freeze-dried, then combined in a quartz tube with a specific ratio of cupric oxide (CuO) and elemental silver (Ag) in quantities based on the mass of carbon in the sample. The tube was hydrogen flame-sealed under vacuum.

Standards and laboratory background wood samples were treated to the same acid and base processing as wood and charcoal samples of unknown age. A radiocarbon "dead" wood blank from the Grey Fossil site in Washington County, Tennessee, dated to the Hemphillian stage of the late Miocene, 4.5-7 MYA (currently beyond the detection capabilities of AMS) was

used to calibrate the laboratory correction factor. In addition, standards of known age, such as the Third International Radiocarbon Inter-comparison (TIRI) Sample "B" (Belfast Pine) with a consensus age of 4503 ± 6 , and TIRI Sample "J" (Bulston Crannog wood) with a consensus age of 1605 ± 8 (Gulliksen and Scott 1995), are used to help establish the laboratory correction factor. After the requisite pre-treatment, a quantity similar to submitted samples of each wood standard was sealed in a quartz tube. Once all the wood standards, blanks, and submitted samples of unknown age were prepared and sealed in their individual quartz tubes, they were combusted at 820°C , soaked for an extended period of time at that temperature, and allowed to cool slowly, enabling the chemical reaction that extracts carbon dioxide (CO_2) gas.

Following this last step, the sample of unknown age, the wood standards, and the laboratory backgrounds were sent to The Center for Applied Isotope Studies in Athens, Georgia, where the CO_2 gas was processed into graphite. The graphitized samples were placed in the target and run through the accelerator, generating numbers that are subsequently converted into radiocarbon dates. Data presented in the Discussion section are displayed as conventional radiocarbon ages and calibrated ages using IntCal13 curves on OxCal version 4.2.4 (Bronk Ramsey and Lee 2013; Bronk Ramsey 2009; Reimer, et al. 2013). This probability-based method for determining conventional ages provides a calibrated date reflecting the probability of its occurrence within a given distribution (signaled by the amplitude [height] of the curve). This method is different from the intercept-based method of individual point estimates that provides no information concerning probabilities. As a result, the probability-based method offers more stability to the calibrated values than those derived from intercept-based methods, which are subject to adjustments in the calibration curve (Telford, et al. 2004).

RADIOCARBON REVIEW

Radiocarbon dates from non-annuals, such as trees and shrubs, reflect the age of that portion of the tree/shrub when it stopped exchanging carbon with the atmosphere, not necessarily the date the tree/shrub died or was burned. Trees and shrubs grow each year by adding new layers or rings of cells to the cambium. During photosynthesis, new cells take in atmospheric carbon dioxide, which includes carbon-14 (^{14}C) or radiocarbon. The radiocarbon absorbed is consistent with atmospheric ^{14}C levels during that growth season. Metabolic processes stop for the inner sapwood once it is converted into heartwood. At this point, no new carbon atoms are acquired, and the radiocarbon that is present starts to decay. Studies show there is little to no movement of carbon-bearing material between rings (Berger 1970, 1972 in Taylor and Bar-Yosef 2014:67). As a result, wood from different parts of the tree yields different radiocarbon dates (Puseman 2007). The outer rings exhibit an age close to the cutting or death date of the tree, while the inner rings reflect an early stage of tree growth. Because the younger, outer rings burn to ash first, usually it is the older, inner rings that are remaining in a charcoal assemblage (Puseman, et al. 2009; Taylor 1987).

Radiocarbon age calibrations are based on comparisons between measured ^{14}C and calendar dates determined by dendrochronology and other techniques. The relationship between measured ^{14}C ages and calendar dates is not a straight line, but instead includes fluctuations. A "squiggly" line from the upper left toward the lower right portion of the calibration figure depicts these fluctuations, which have their basis in variability in the ratio of ^{14}C present in the atmosphere through time, among other things. The elongated bell-shaped curve at the left

margin of the calibration window depicts the two-sigma probability range (\pm values) around a central point (radiocarbon date in RCYBP) (Taylor and Bar-Yosef 2014:156-157). The solid black peaks at the bottom of the graph represent the intersection of the bell-shaped curve and the "squiggly" line of the calibration curve. Their amplitude and area of coverage indicate the probability that the radiocarbon date falls within any given year range. Brackets along the bottom edge of these peaks indicate the one-sigma and two-sigma ranges. These probabilities also are presented at the right side of the figure. The probability does not provide a value judgment or measure of the appropriateness for any point on the calibration curve. In contrast, an intercept date represents the central point between the two extremes of the calibrated age range. This intercept point or mathematical central point may fall in a zero probability portion of the calibration curve. Additional information from samples' proveniences and their contexts relative to architectural features, such as collapsed walls or capped features, facilitates evaluation and interpretation of which calibrated date range portions most accurately represent occupation or the activity of interest.

Calibrations that fall within the recent era are now reported during calibration with a "... " as the concluding or most recent portion of the date. Because the fraction Modern (percent carbon) for all of the dates in this project is reported as less than that for AD 1950, the terminal or most recent portion of each of the dates can be assumed to be prior to AD 1950 even though the calibration program lists "...". Therefore, the text discusses the terminal portion of the calibration for these dates as "recent" for BP calibrations and AD 1950 for AD calibrations.

DISCUSSION

This corridor, located in North Kona, encompasses an area typified by 'a'ā and *pāhoehoe* lava and little sediment. Four archaeological sites were sampled (Table 1) seeking information concerning agricultural activity and recovery of radiocarbon dateable materials to establish chronology. Vegetation in the project area is typical of a "Fountain Grass Grassland", described by Head and Rosendahl (1993:2 in LaChance, personal communication April 7, 2016). Along this corridor low tufts of grass grow with scattered shrubs and a few trees. *Pili* grass (*Heteropogon contortus*), Guinea grass (*Panicum maximum*), fountain grass (*Pennisetum setaceum*), *wilelaiki* or Christmas berry (*Schinus terebinthifolius*), *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena glauca*), *kiawe* (*Prosopis*), and *lantana* (*Lantana camara*) were reported (LaChance, personal communication April 7, 2016). Results are discussed by site below.

SIHP # 50-10-27-28778

SIHP # 50-10-27-28778, situated adjacent to the Kalaoko-Honokōhau National Historical Park, is a *pāhoehoe* excavation consisting of an excavated pit with small piles of angular *pāhoehoe* cobbles and small boulders covering and surrounding the pit. The irregular-shaped excavated area has scalloped edges and measures approximately 3.0 m N/S by 2.0 m E/W. The exposed lava tube measures approximately 5.0 m N/S by 5.0 m E/W with a maximum ceiling height of 0.45 m. A shallow overhang along the perimeter of the excavated area provides a maximum ceiling height of 0.22 m and a maximum width of 1.1 m. The base of the excavated area displays a thin layer of sediment and organic debris supporting *koa haole*

(*Leucaena glauca*) and exotic grasses (Monahan, et al. 2012:156 in LaChance, personal communication April 15, 2016). Archaeological evidence points to prehistoric use of this pit.

The macrofloral portion of Sample PR-1 (Unit EU-80, Level I, 98–104 cmbd) yielded thirteen tiny unidentified hardwood charcoal fragments (0.0165 g), too small for further identification (Tables 2 and 3). Uncharred floral remains include Euphorbiaceae, *Leucaena leucocephala*, *Opuntia*, probable Portulacaceae, *Sida*, and unidentified seeds, reflecting a member of the spurge family, *koa haole*, pricklypear cactus, a member of the purslane family, *'Ilima*, and other unidentified seeds. In addition to these modern plant remains, uncharred leaves, roots, and rootlets were noted. Non-floral remains include a few insect chitin fragments and moderate quantities of oblong-shaped snail shells. Unidentified hardwood charcoal fragments yielded a date of 207 ± 22 RCYBP (PRI-5411) with two-sigma calibrated age range of 310–260, 220–140, and 20–recent CAL yr. BP or AD 1640–1690, AD 1730–1810, and AD 1930–1950 (Figures 1 and 2, Table 4), indicating deposition within the last ~ 300 years. This pit has been interpreted as a prehistoric pit. Archaeological evidence suggests this calibrated range can be narrowed to exclude the historic interval, while recovery of *koa haole* seeds suggests it was used during the historic interval.

Pollen and starch analysis of Sample PR-1 yielded a record dominated by Poaceae pollen (Figure 3, Table 5), reflecting local growth of grasses. Chenopod pollen is moderately abundant, likely representing local growth of *'aheahea* shrubs. Recovery of small quantities of Anacardiaceae, *Antidesma*-type, Myrtaceae, and *Rauvolfia* pollen indicates local growth of a tree in the sumac family such as mango; native *hame*; a tree in the myrtle family such as *Eugenia*, *Metrosideros*, *Psidium*, or *Syzygium* (Brazilian or Surinam cherry, *'ohia*, guava, or Java plum; and *hao*. Shrubs in addition to *'aheahea* are represented by small quantities of *Dodonaea*, *Euphorbia*, *Kadua*, *Myrsine*, *Rhus*, and *Sida*, representing *a'ali'i*, spurge, *au*, *kōlea*, *neleau* or *neneleau*, and *ilima*. Recovery of small quantities of Low-spine Asteraceae, High-spine Asteraceae, and Liguliflorae represents ragweed and similar plants, various other plants in the sunflower family, and plants in the chicory tribe of the sunflower family. Small quantities of *Boerhavia*-type and a fragment of *Geranium* pollen reflect local growth of *alena* and geranium. The Poaceae pollen frequency is elevated, reflecting local growth of grasses not further identified. Recovery of both *Leucaena* and *Prosopis* pollen indicate local growth of alien trees *koa haole* and *kiawe*. Recovery of a single angular starch in this sample indicates deterioration of grass seeds. Angularity of this starch is consistent with that produced by *Zea mays*. Maize agriculture might have been attempted in this area during the historic era or picnics might have introduced maize/corn flour. Few vectors for introducing starch into sediment samples include aerial transport and introduction during sampling. Quality control measures in the lab at PaleoResearch Institute ensure that starch is not introduced during sample processing. We regularly test purchased supplies such as toothpicks used to stir the samples when microscope slides are made, and both microscope slides and coverslips and this testing have not revealed maize starch. Ferns are represented by monolete and trilete smooth sores. A few charred Asteraceae tissue fragments suggest burning weeds that included plants in the sunflower family. Total pollen concentration was high at more than 97,000 pollen per cubic centimeter (cc) of sediment. The pollen record is a combination of prehistoric and historic signals, suggesting mixing of sediments.

SIHP # 50-10-27-28785

Site # 50-10-27-2875 comprises a *pāhoehoe* tumulus and undulating *pāhoehoe* flow located at an elevation of 85 ft AMSL. This oval-shaped enclosure includes a C-shaped wall constructed of stacked 'a'ā and *pāhoehoe* boulders enclosing a natural depression or collapsed lava blister apparently used during the early historic period. A thick layer of sediment and organic debris currently support a growth of grasses. Pollen samples PR-2 and PR-3 were collected from Level I in Unit EU-68 at a depth of 150–160 and from Unit EU-73 at a depth of 174–179 cm, respectively. The content of these two samples is so similar they are discussed together. Interestingly, Chenopodiaceae pollen is most abundant, documenting local growth of shrubby 'aheahea, either inside or immediately outside the enclosure. In addition, moderate quantities of Anacardiaceae pollen suggest local growth of mango trees or another tree in the family. Recovery of small quantities of *Artemisia*, representing shrubby 'āhinahina, and Low-spine Asteraceae and High-spine Asteraceae, representing a variety of plants in the sunflower family indicates local growth of shrubby and herbaceous plants.

Evidence of ferns is minimal and includes only monolete spores. Barrel-shaped spores probably represent fungus. A small quantity of charred Asteraceae tissue fragments suggest burning weeds, while recovery of a few segments of *Sporormiella* dung fungal spores in Sample PR-2 suggests presence of animal dung as part of the organic debris. Recovery of *Sporormiella* dung fungal spores is consistent with reinterpretation of use of this enclosure for animal husbandry. No evidence of agriculture was noted in either sample. Given the animal husbandry interpretation of this enclosure and recovery of *Sporormiella*, dominance of the pollen record in both samples by Chenopodiaceae pollen might reflect presence of animal dung from animals that eat shrubby 'aheahea. *Sporormiella* is an ascomycete fungus found only on the dung of herbivores. This genus is widespread in sub-boreal and temperate regions of the world. *Sporormiella* spores are borne in ascospores on the surface of drying dung and are spread passively to nearby vegetation, with which they are ingested (Davis and Shafer 2006). Many coprophilous fungi, such as *Sporormiella*, rely on a cyclic process involving herbivore ingestion of spores with foliage, germination of spores following passage through the gut, mycelial growth within, and eventual sporulation on dung (Wicklow, et al. 1980). While grazing, herbivores also can inadvertently ingest ascospores, the fruiting bodies on dung that contain millions of individual spores, especially in areas where dense herbivore populations exist (Aptroot and Geel 2006). *Sporormiella* fungal spores are found on the dung of introduced herbivores such as cows and horses, as well as on dung from local grazing animals.

Total pollen concentration was high in both samples and is calculated at more than 97,000 and more than 222,000 pollen per cc of sediment for Samples PR-2 and PR-3, respectively.

SIHP # 50-10-27-28786

A single sample was collected from a modified depression interpreted to have been used as a temporary shelter during the historic era. Uncharred macrofloral remains noted in Sample PR-4 include moderate quantities of leaf fragments, a few roots, and moderate quantities of rootlets. Eight hardwood charcoal fragments (0.0088 g) remained unidentified due to their small size and high level of vitrification. Vitrified charcoal has a shiny, glassy appearance that can range from still recognizable in structure "to a dense mass, completely 'molten' and non-

determinable" (Marguerie and Hunot 2007; McParland, et al. 2010). Although charcoal vitrification has been attributed to burning at high temperature and/or burning green wood, the process of vitrification is not completely understood. Experimental studies and reflectance measurements on archaeological charcoal suggest that vitrification can occur at low temperatures (McParland, et al. 2010). Kaelin et al. (2006:1-12) associate vitrification with changes in the lignin structure of wood. Specifically, they implicate changes resulting from "reactions involving and altering the nature of the C3 side-chain unit, reducing the number of β -O-4 linked lignin units" (Kaelin, et al. 2006:10). Experiments examining wood composition changes during heating at low and high temperatures (Rutherford, et al. 2005) indicate transformation of lignin, identified using Fourier Transform Infrared (FTIR) analysis. In addition to being vitrified, the vessels of these charcoal fragments contained an unspecified brown substance or deposit. These tiny unidentified charcoal fragments were subjected to chemical pretreatment prior to AMS radiocarbon age determination. Although the sample was treated very carefully, it did not survive chemical pretreatment. Several tiny, brown, fibrous-like fragments that remained were too small for AMS radiocarbon age determination. Examination under a binocular microscope indicates they most likely represent inorganic material, such as fine sediment, representing secondary deposits in the charcoal vessels. Uncharred non-floral remains include two small fish bone fragments (0.0142 g) and shells from at least two snail types. A few insect chitin fragments, a single rodent incisor tooth fragment (0.0119 g), and numerous quantities of rodent fecal pellets indicate insect and rodent activity.

Pollen and starch analysis of Sample PR-4, collected from a modified depression interpreted as a temporary shelter in Unit EU-65, Level I at a depth of 30–38 cmbd, yielded moderately large to large quantities of Anacardiaceae, Chenopodiaceae, and *Kadua* pollen representing trees in the mango family, 'aheahea, and *au* or *pilo*. Moderately small to small quantities of *Sida*, High-spine Asteraceae, Liguliflorae, Poaceae, and *Prosopis* pollen, representing *ilima*, plants in the sunflower family, plants in the chicory tribe of the sunflower family, grasses, and introduced *kiawe*, were observed. Barrel-shaped spores were moderately abundant in this sample and are similar to those observed at Site 28785 in Samples PR-2 and PR-3. *Lycopodium cernuum*, monolet bumpy and smooth, and trilete smooth spores represent clubmoss and various ferns growing in the vicinity of the site. This sample contained a small quantity of *Sporormiella* dung fungal spores, indicating presence of grazing animal dung in this probable temporary shelter. Total pollen concentration was moderately high at more than 37,500 pollen per cc of sediment.

SIHP # 50-10-27-28813

This site contains modified lava blisters interpreted to have had an agricultural use pre-contact. Feature A was oval-shaped and exhibited a layer of sediment and organic debris currently supporting grasses. Pollen and starch Sample PR-6, collected from aeolian sediments at a depth of 144–148 cmbd in EU-2, yielded mostly large Poaceae pollen, reflecting grasses. A moderately small quantity of Poaceae pollen that was a similar size to that noted in the other samples from this site was observed. Small quantities of *Antidesma* and High-spine Asteraceae pollen, representing *hame* and plants in the sunflower family also were observed. Total pollen concentration was more than 11,700 pollen per cc of sediment. Domination of this pollen record by large grass pollen suggests growing or using pili grass. *Heteropogon* pollen has a mean diameter of 49 μ (APSA Members 2007), which is consistent with the size of the large Poaceae pollen recorded in this sample. Although description of this feature as containing grasses would

normally suggest the possibility that the pollen record might reflect modern vegetation, this sample was collected at a depth of nearly 1.5 m below the surface, indicating this pollen does not represent modern vegetation.

Grasses have been used for a variety of purposes in Hawaii, including as fibers in cordage, for thatching, and to cover house floors (Handy, et al. 1972, 238; Krauss 1993:27, 58, 59). *Pili* is a perennial grass that grows as a tuft reaching about three feet in height with flowers and red-brown bristles on spikes extending approximately four inches in length. This grass commonly grows in open, dry, and sometimes rocky landscapes (Krauss 1993:286; Neal 1965:80). *Pili* was most commonly used for thatching (Neal 1965:80). Charcoal from burned *pili* blades was used to produce black dye (*waiho'olu'u*) (Krauss 1993:67), and the ashes were mixed with the cream of a dark coconut to make a medicine for thrush (Handy, et al. 1972, 239). *Pili* was also used in *hana aloha* (love spells) (Handy, et al. 1972, 241).

Sample PR-5, collected from Unite EU-02, Level 1 at a depth of 112–116 cmbd, yielded only a single Cheno-am pollen mixed with a large quantity of organic debris. Although total pollen concentration was calculated at more than 3300 pollen per cc of sediment, the abundance of organic debris prevented obtaining a count.

SUMMARY AND CONCLUSIONS

Macrofloral analysis of samples from two sites yielded mostly uncharred floral remains, including seeds, leaves, roots, and rootlets from various plants. Uncharred insect chitin fragments in both samples (PR-1 and PR-4) indicate limited insect activity in both deposits (SIHP # 50-10-27-28778 and SIHP # 50-10-27-28786). A single rodent tooth and rodent fecal pellets were identified in Sample PR-4 (SIHP # 50-10-27-28786). Both samples also yielded snail shells, while two uncharred fish bone fragments were noted in Sample PR-1. Unidentified hardwood charcoal fragments, recovered in small quantities from both samples, were selected for AMS radiocarbon age determination. However, only charcoal from Sample PR-1 (SIHP # 50-10-27-28778) yielded a date, while the small, vitrified charcoal from Sample PR-4 (SIHP # 50-10-27-28786) dissolved during the chemistry. A date of 207 ± 22 RCYBP (PRI-5411) was obtained for charcoal from Sample PR-1 suggesting deposition at SIHP # 50-10-27-28778 within the range of 310–recent CAL yr. BP (AD 1640–1950).

Pollen and starch analysis of six sediment samples collected in *pāhoehoe* or *a'a* lava features at four archaeological sites near Kona yielded diverse evidence of local vegetation. A probable resource prospecting pit at SIHP # 50-10-27-28778 yielded the most varied pollen record that included pollen evidence of both native and alien vegetation, which is consistent with the radiocarbon date for this feature of AD 1640–1950. Local vegetation included trees, shrubs, herbs, and grasses. Both *kiawe* and *koa haole* grew in the vicinity of this pit, suggesting historic use and sediment accumulation. Grasses likely grew inside the pit. Recovery of an angular centric starch suggests the possibility that corn was prepared in this pit. Although angular starch is usually attributed to corn, it is possible that other grass seeds produced tightly packed starch, which results in angularity. *Heteropogon* seed starch cannot be ruled out as a possibility for this identification because we do not have it in our reference collection.

SIHP #50-10-27-28785, an early historic site, was postulated to have been used for animal husbandry. Recovery of *Sporormiella* dung fungal spores in the upper sample support this interpretation. Local vegetation appears to have been dominated by 'aheahea.

SIHP #50-10-27-28786, a modified depression interpreted to have been used as a temporary shelter, also was occupied during the historic era. A limited quantity of *Prosopis* pollen mixed with pollen indicating local growth of mango, 'aheahea, au, neleau, various members of the sunflower family, and grasses indicates local vegetation. Recovery of a small quantity of *Sporormiella* dung fungal spores suggests use of this depression for animal husbandry.

SIHP 503-10-27-28813, a pre-contact site, contained modified lava blisters interpreted to have been used for agriculture. Recovery of large Poaceae pollen suggests use of this pit for growing pili grass, which is useful for thatching.

TABLE 1
 PROVENIENCE DATA FOR AEOLIAN SOIL DEPOSITS
 FROM SITES IN KALAOA AHUPUA'A, HAWAII

Sample No.	Cat. No.	PRI No. (AMS)	Unit	Level	Depth (cmbd)	Provenience/ Description	Analysis
SIHP # 50-10-27-28778: Prehistoric							
PR-1	S-01	5411	EU-80	I	98-104	Resource prospecting pit	Pollen Starch Macrofloral AMS C ¹⁴ Date
SIHP # 50-10-27-28785: Early Historic							
PR-2	S-04		EU-68	I	150-160	Enclosure used for animal husbandry	Pollen Starch
PR-3	S-05		EU-73	I	174-179		Pollen Starch
SIHP # 50-10-27-28786: Historic							
PR-4	S-07	5412	EU-65	I	30-38	Modified depression, used as a temporary shelter	Pollen Starch Macrofloral
SIHP # 50-10-27-28813: Pre-Contact							
PR-5	S-08		EU-02	I	112-116	Modified lava blisters, pre-contact agriculture	Pollen Starch
PR-6	S-09				144-148		Pollen Starch

TABLE 2
MACROFLORAL REMAINS FROM SITES IN KALAOA AHUPUA'A, HAWAII

Sample No.	Identification	Part	Charred		Uncharred		Weights/Comments
			W	F	W	F	
SIHP # 50-10-27-28778							
PR-1	Volume Floated						200.00 ml
EU-80	Light Fraction Weight						10.465 g
~ 98-104 cmbd	FLORAL REMAINS:						
	Euphorbiaceae	Seed			2		
	<i>Leucaena leucocephala</i>	Seed			6		
	<i>Opuntia</i>	Seed				4	
	cf. PORTULACACEAE	Seed			11	1	
	<i>Sida</i>	Seed			2		
	Leaf					X	Moderate
	Unidentified	Seed			X	X	Numerous
	Roots					X	Few
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal \geq 0.5 mm						0.0165 g
	Unidentified hardwood - small **	Charcoal		13			0.0165 g
	NON-FLORAL REMAINS:						
	Insect	Chitin				X	Few
	Rock					X	Few
	Snail shell - oblong				X	X	Moderate
SIHP # 50-10-27-28786							
PR-4	Volume Floated						350.00 ml
EU-65	Light Fraction Weight						20.748 g
~ 30-38 cmbd	FLORAL REMAINS:						
	Leaf					X	Moderate
	Roots					X	Few
	Rootlets					X	Moderate
	CHARCOAL/WOOD:						
	Total charcoal \geq 0.5 mm						0.0088 g
	Unidentified hardwood - vitrified **	Charcoal		8			0.0088 g

TABLE 2 (Continued)

Sample No.	Identification	Part	Charred		Uncharred		Weights/Comments
			W	F	W	F	
PR-4	NON-FLORAL REMAINS:						
EU-65	Bone					2	0.0142 g
~ 30-38	Rodent incisor tooth					1	0.0119 g
cmbd	Insect	Chitin				X	Few
	Rock					X	Few
	Rodent fecal pellet				X	X	Numerous
	Snail shell - depressed				X	X	Few
	Snail shell - oblong				X	X	Numerous

W = Whole
 F = Fragment
 X = Presence noted in sample
 ml = milliliter
 g = grams
 mm = millimeters
 **= Submitted for AMS ¹⁴C Dating
 ***= Submitted for AMS ¹⁴C Dating, failed

TABLE 3
 INDEX OF MACROFLORAL REMAINS RECOVERED FROM SITES IN KALAOA AHUPUA'A, HAWAII'I

Scientific Name	Common Name
FLORAL REMAINS:	
Euphorbiaceae	Spurge family
<i>Leucaena leucocephala</i> syn. <i>glauca</i>	<i>Koa haole</i>
<i>Opuntia</i>	Prickly pear cactus
Portulacaceae	Purslane family
<i>Sida</i>	<i>'Ilima</i>
CHARCOAL/WOOD:	
Unidentified hardwood - small	Wood from a broad-leaved flowering tree or shrub, fragments too small for further identification
Unidentified hardwood - vitrified	Wood from a broad-leaved flowering tree or shrub, exhibiting a shiny, glassy appearance
NON-FLORAL REMAINS:	
Chitin	A natural polymer found in insect and crustacean exoskeleton
Snail shell - depressed	Snail shell with a depressed (flat) shape where the width is much bigger than the height
Snail shell - oblong	Snail shell with an oblong shape where the height is much bigger than the width

TABLE 4
 RADIOCARBON RESULTS FOR SAMPLES FROM SITES IN KALAOA AHUPUA'A, HAWAII

PRI AMS No. & Sample No.	Sample Identification	AMS ¹⁴ C Date*	1-sigma Calibrated Date (68.2%)	2-sigma Calibrated Date (95.4%)	δ ¹³ C (‰)
PRI-5411 PR-1	Unidentified hardwood charcoal	207 ± 22 RCYBP	300–270; 180–150; 10–... CAL yr. BP	310–260; 220–140; 20–... CAL yr. BP	-13.9
			AD 1650–1680; AD 1770–1800; AD 1940–...	AD 1640–1690; AD 1730–1810; AD 1930–...	

* Reported in radiocarbon years at 1 standard deviation measurement precision (68.2%), corrected for δ¹³C.

TABLE 5
 POLLEN TYPES OBSERVED IN AEOLIAN SOIL DEPOSITS
 FROM SITES IN KALAOA AHUPUA'A, HAWAII

Scientific Name	Common Name	Nat	Pol	End	Ind
TREES:					
Anacardiaceae	Mango family	x		x	
<i>Antidesma</i> -type	<i>Hame, ha'a, ha'amaile, hamehame, mehame, mehamehame, bignay</i>			x	
Myrtaceae	Myrtle family	x	x	x	x
<i>Rauvolfia</i>	<i>Hao</i>			x	
SHRUBS:					
Cheno-am	<i>Achyranthes, Chenopodium oahuense, Amaranthus, Charpentiera, etc.</i>	x		x	
<i>Dodonaea</i>	<i>A'ali'i, ('a'ali'i kū makani, 'a'ali'i kū ma kua, kūmakani)</i>				x
<i>Euphorbia</i> (shrub or herb)	<i>Kaliko, spurge, Mexican fireplant (wild poinsettia)</i>	x		x	
<i>Kadua</i>	<i>Au, pilo, 'Awiwi, kio'ele, etc.</i>	x		x	
<i>Myrsine</i>	<i>Kōlea, 'Ōiiko, Kōlea lau nui, Kōlea lau li'i</i>			x	
<i>Rhus</i>	Sumac		x		
<i>Sida</i>	<i>'Ilima, Prickly sida</i>	x			x
HERBS:					
Asteraceae	Sunflower family	x		x	x
Low-spine Asteraceae	Sunflower family; Includes ragweed and others	x		x	x
High-spine Asteraceae	Sunflower family; Includes <i>Bidens</i>	x		x	x
Liguliflorae	Sunflower family, chicory tribe	x			
<i>Boerhavia</i> -type	<i>Alena, anena, nena</i>	x			x
<i>Geranium</i>	Geranium	x		x	
GRASSES, etc.:					
Poaceae	Grass family	x		x	x
Poaceae large	Grass family, probably <i>pili</i> -grass		?		?

TABLE 5 (Continued)

Scientific Name	Common Name	Nat	Pol	End	Ind
ALIENS:					
<i>Leucaena</i>	<i>Kao-haole ('ekoa, lilikoa)</i>	x			
<i>Prosopis</i>	<i>Kiawe, mesquite</i>	x			
Indeterminate	Too badly deteriorated to identify				
SPORES:					
<i>Lycopodium cernuum</i>	Club moss (<i>Wawae'iole</i>)			x	
Monolete bumpy	Ferns				
Monolete smooth	Ferns				
Trilete smooth	Ferns				
OTHER:					
Charred Asteraceae Tissue	Charred tissue fragment from a member of the sunflower family				
Scolecodont	Worm jaw				
Sporormiella	Dung fungal spore				
Total Pollen Concentration	Quantity of pollen per cubic centimeter (cc) of sediment				

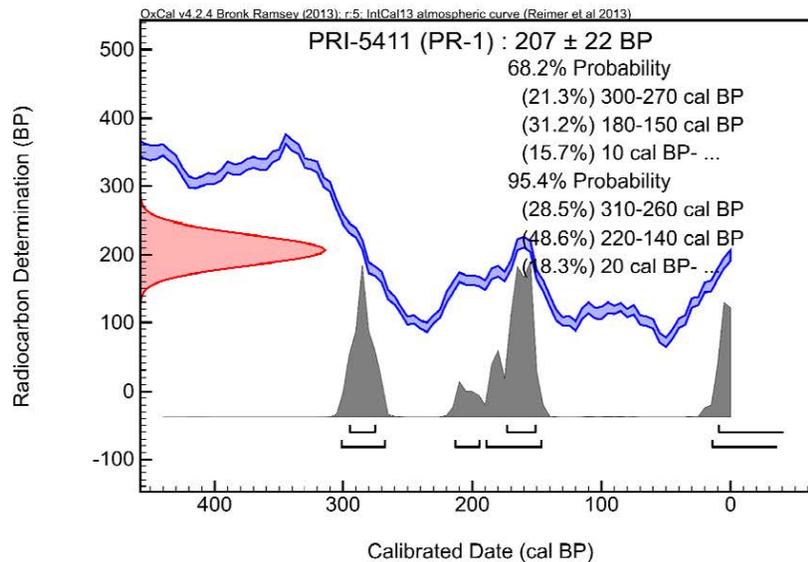
Plant names and information derived from (Wagner, et al. 1990)
 Fern (spore) names derived from (Selling 1946)

Nat = Naturalized
 Pol = Polynesian introduction
 End = Endemic
 Ind = Indigenous

Pollen identifications to species were made based on the fact that only 1 species is reported by (Wagner, et al. 1990). Species identification was not made based on morphologic characteristics observed under the microscope.

**FIGURE 1. PRI-5411 (PR-1) CALIBRATION BP.**

Laboratory Number (Sample Number): PRI-5411 (PR-1)
 Sample Identification: Unidentified hardwood charcoal
 Conventional AMS ^{14}C Date: 207 ± 22 RCYBP
 1-sigma Calibrated Age Range (68.2%): 300–270; 180–150; 10–... CAL yr. BP
 2-sigma Calibrated Age Range (95.4%): 310–260; 220–140; 20–... CAL yr. BP
 $\delta^{13}\text{C}$ ($^{\circ}/_{\text{PDB}}$): -13.9



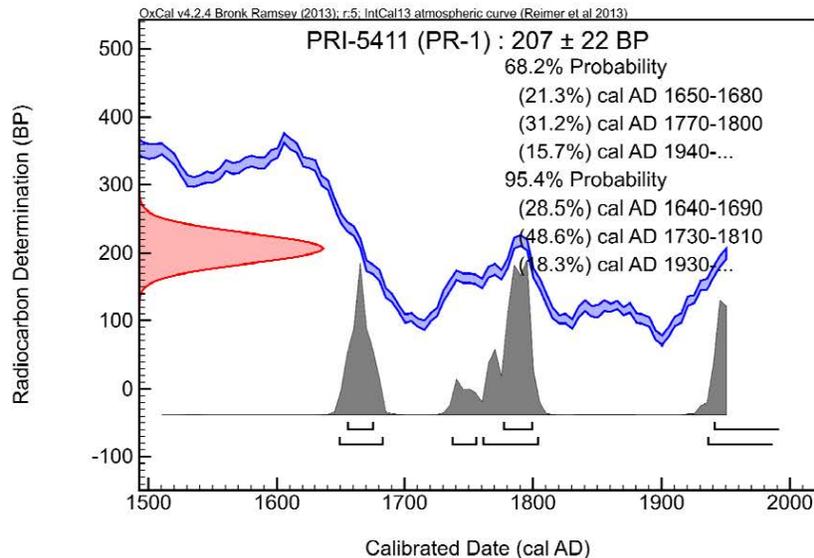
Intercept Statement. For radiocarbon calibration, PRI uses OxCal4.2.4 (Bronk Ramsey 2009; Bronk Ramsey and Lee 2013), which is a probability-based method for converting ages in radiocarbon years (RCYBP) into calibrated dates (CAL yr BP). This method is preferred over the intercept-based alternative because instead of providing individual point estimates, it reflects the probability of the date's occurrence within a given range (reflected by the amplitude [height] of the curve). As a result, the probability-based method produces more stable calibrated values than do intercept-based methods (Telford 2004). Ongoing refinements and adjustments to the calibration curve have a greater apparent effect on individual points than on ranges.

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- Telford, R. J., E. Heegaard, and H. J. B. Birks, 2004. The intercept is a poor estimate of a calibrated radiocarbon age. *The Holocene* 14(2):296-298.

**FIGURE 2. PRI-5411 (PR-1) CALIBRATION AD.**

Laboratory Number (Sample Number): PRI-5411 (PR-1)
 Sample Identification: Unidentified hardwood charcoal
 Conventional AMS ^{14}C Date: 207 ± 22 RCYBP
 1-sigma Calibrated Age Range (68.2%): AD 1650–1680; AD 1770–1800; AD 1940–...
 2-sigma Calibrated Age Range (95.4%): AD 1640–1690; AD 1730–1810; AD 1930–...
 $\delta^{13}\text{C}$ ($^{\circ}/_{\text{PDB}}$): -13.9



Intercept Statement. For radiocarbon calibration, PRI uses OxCal4.2.4 (Bronk Ramsey 2009; Bronk Ramsey and Lee 2013), which is a probability-based method for converting ages in radiocarbon years (RCYBP) into calibrated dates (CAL yr BP). This method is preferred over the intercept-based alternative because instead of providing individual point estimates, it reflects the probability of the date's occurrence within a given range (reflected by the amplitude [height] of the curve). As a result, the probability-based method produces more stable calibrated values than do intercept-based methods (Telford 2004). Ongoing refinements and adjustments to the calibration curve have a greater apparent effect on individual points than on ranges.

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- Bronk Ramsey, C., 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51(1):337-360.
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Appendix D Taxa Identification of Wood Charcoal (Huebert and Murakami 2016)

WIDL 1618

TAXA IDENTIFICATION OF WOOD CHARCOAL FROM KALAOA 19, KALAOA AHUPUA'A, HAWAI'I ISLAND

Jennifer Huebert
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May 5, 2016

INTRODUCTION

Two samples collected from excavations at the Kalaoa 19 site in the Kalaoa Ahupua'a, Hawai'i Island, were analyzed for taxa identification. These materials were recovered from TU-68 and TU-70. The freshly fractured transverse, tangential longitudinal and radial facets of each charcoal piece were viewed with an epi-illuminated microscope at magnifications of 50–500X. Some material was also examined with a dissecting microscope. Taxa identifications were made by comparing the anatomical characteristics seen during examination against those of woods in the IARII Pacific Islands Wood Collection. Vouchers associated with these specimens have been verified and archived at the Department of Botany, University of Hawai'i, Mānoa. Published references, including books, journal articles, technical documents, and wood atlases, were also consulted.

RESULTS

Wood charcoal from three taxa were identified. Some of these materials are from relatively short-lived plants, which are preferred for radiocarbon dating. It is likely that the *Euphorbia* ('akoko) do not have any great inbuilt age (i.e., more than a few decades), as many plants of this genus are shrubs or small trees in Hawai'i and both specimens appear to be from stems that were approximately 1 cm diameter. *Myoporum* (naio) are also shrubs and small trees, but the diameter of the specimens could not be determined and these materials could contain a moderate amount of inbuilt age. Results are detailed in Table 1. A systematic review of the identified taxa and anatomical descriptions of the wood are presented in the sections that follow.

WIDL 1618

Table 1. Results from Kalaoa 19, Kalaoa Ahupua'a, Hawai'i Island.

WIDL No.	Site Number	Provenience Details	Taxon*	Common/Hawaiian Name	Origin	Habit	Part	Weight (g)
1618-1	Kalaoa 19, 10-15-277-19-0205	TU-68, 145-160 cmbd	<i>Euphorbia</i> sp. A	'Akoko	Native	Shrub-Tree	Wood	0.26
1618-2	Kalaoa 19, 10-15-277-19-0205	TU-68, 145-160 cmbd	<i>Euphorbia</i> sp. B	'Akoko	Native	Shrub-Tree	Wood	0.26
1618-3	Kalaoa 19, 10-15-277-19-0214	TU-70, 70-80 cmbd, in situ	<i>Myoporum sandwicense</i>	Naio	Native	Shrub-Tree	Wood	0.44

* When fragments compared well with a particular taxon in our reference collection but some uncertainty remained, they were assigned the designation "cf." (confer or compare to).

TAXA REVIEW

Euphorbia spp. ('Akoko)

Distribution of the 15 endemic Hawaiian shrubs and small trees in this genus range from coastal environments to upper forest zones on the main islands (Wagner et al. 1990:602-617). Eight native species, and a number of naturalized introductions, are found on Hawai'i Island today in a wide range of habitats. 'Akoko was once valued for firewood by the Hawaiians (Hillebrand 1981:396) and the milky sap was once considered a possible source for rubber (Rock 1974:261). Some members of this genus were once known as *Chamaesyce* but research has shown affinity with the genus *Euphorbia* (Govearts et al. 2000).

Myoporum sandwicense A. Gray (Naio)

The habit of this indigenous tree ranges from a shrub 1 m tall in coastal areas to a 15 m tall tree at higher elevation. Its elevational distribution has been documented as 0 to 2,380 m on all the main Hawaiian Islands except Kaho'olawe (Wagner et al. 1990:928-929). The fragrant wood was once used by Hawaiians for house posts (Buck 1957:83) and was harvested during the sandalwood trade with China when the supply of native sandalwood became low (Rock 1974:429).

WIDL 1618

ANATOMICAL FEATURES

Euphorbia sp. A Vessels small, ~25 μm diameter, in radial chains of 3 or more, occasionally solitary or in clusters; few axial parenchyma, mainly associated with vessels; fiber walls medium thickness; rays frequent, thin, tall, many uniseriate but occasionally wider (2-3 cells); intervessel pits small (~3-4 μm), oval. Fragment ~1 cm diameter by 2 cm long, curved surface, appears to be half of a small-diameter stem.

Euphorbia sp. B Vessels 50-60 μm diameter, round, in radial rows (2)3-4, and clusters, TS has overall smooth and reflective appearance; rays thin, uniseriate and 2-3 seriate, can be very tall, mostly procumbent cells with one or more rows of square or upright cells at ends, uniseriate rays all square and upright cells, one radial canal or laticifer noted; fibers pitted in both TLS and RS; intervessel pits small, oval, ~4 μm ; vessel-ray pits similar, very oval, may be slightly enlarged. Fragment ~8 mm diameter by 2.5 cm long, also appears to be half of a small-diameter stem.

Myoporum sandwicense Vessels (45)50-80 μm diameter, solitary or in groups, sometimes very round; axial parenchyma in irregular paratracheal bands (subtle); rays (1)2(3) cells wide, medium height, occasionally with enlarged cells; intervessel pits ~3-5 μm , flattened oval shape, occasionally arranged in channels containing 2-3 pits; fibers have abundant small pits in both TLS and RS.

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Appendix E KAHO Research Permit

 <p>SCIENTIFIC RESEARCH AND COLLECTING PERMIT Grants permission in accordance with the attached general and special conditions United States Department of the Interior National Park Service Kaloko-Honokohau</p>	<p>Study#: KAHO-00097 Permit#: KAHO-2016-SCI-0005 Start Date: Mar 15, 2017 Expiration Date: Mar 15, 2018 Coop Agreement#: Optional Park Code:</p>
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<p>Name of principal investigator: Name: Christeen Okada Phone: (808)262-9972 Email: ckokada@culturalsurveys.com</p>
<p>Name of institution represented: Cultural Surveys Hawaii</p>
<p>Co-Investigators: Name: <i>Gina Farley</i> Phone: 808-965-6478 Email: <i>gfarley</i> @culturalsurveys.com Name: Sarah Phone: 808-965-6478 Email: swilkinson@culturalsurveys.com</p>
<p>Study Title: Archival Research for the for the Queen Ka'ahumanu Highway Widening Phase 2 Project Archaeological Data Recovery Report</p>
<p>Purpose of study: CSH wishes to perform archival research on nine trail sites (SIHP #'s -00002, -10714, -18099, -19952, -19953, -19954 -28774, -28782, and -28791) in the current project area that continue makai into NPS lands. As part of the requirements set forth in the Data Recovery and Preservation Plan for this project (Hammat and Shidolor 2014), CSH is obligated to conduct additional archival research on the trail sites including collecting any information the NPS may have on the sites.</p>
<p>Subject/Discipline: Archeology</p>
<p>Locations authorized: Archival research at park headquarters on nine trail sites (SIHP #'s -00002, -10714, -18099, -19952, -19953, -19954 -28774, -28782, and -28791).</p>
<p>Transportation method to research site(s): N/A</p>
<p>Collection of the following specimens or materials, quantities, and any limitations on collecting: CSH may perform archival research using data provided by NPS on the nine trail sites in their current project area that continue makai into NPS lands. The trail sites are all undergoing preservation and will not be affected or damaged by the project.</p>
<p>Name of repository for specimens or sample materials if applicable:</p>
<p>Specific conditions or restrictions (also see attached conditions): Data provided to Cultural Surveys Hawaii as part of this archival research request will only be used for the sole purpose of their obligation to complete the Data Recovery and Preservation Reports for the Queen Kaahumanu Highway Widening Project. Data provided to Cultural Surveys Hawaii will only be used to develop narrative descriptions of the trails as they extend into and throughout Kaloko-Honokohau National Historical Park. Data provided to Cultural Surveys Hawaii will not be used to develop or depict maps showing location of such trails. Data provided to Cultural Surveys Hawaii will not be used to reveal locations of any archeological, cultural resources and/or historical properties within National Park properties in any publicly released products. Data provided to Cultural Surveys Hawaii can be used to better understand and generally discuss the complexity of the trail system in the area, connecting various locations of interest along this coastline.</p>
<p>GENERAL: Please acknowledge NPS permit number in final reports and publications. Final reports will be provided directly to Resource Management.</p>

Recommended by park staff(name and title):

R. TYLER PAIKULI-CAMPBELL

Reviewed by Collections Manager:

Yes No

Approved by park official:

[Signature]

Date Approved:

3/15/17

Title:

Superintendent

I Agree To All Conditions And Restrictions Of this Permit As Specified
(Not valid unless signed and dated by the principal investigator)

[Signature]
(principal investigator's signature)

3/15/17
(Date)

THIS PERMIT AND ATTACHED CONDITIONS AND RESTRICTIONS MUST BE CARRIED AT ALL TIMES WHILE CONDUCTING RESEARCH ACTIVITIES IN THE DESIGNATED PARK(S)