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Archaeological Inventory Survey of
TMK:(2)–5–9–005:007 and 081 in Wailau Valley,
Hālawā Ahupua‘a, Ko‘olau District, Island of
Moloka‘i*

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Contents

1	Introduction	3
1.1	Project Area	3
1.2	Environment	3
1.3	Background Research	5
2	Methods	9
3	Field Survey Results	10
4	Test Excavation Results	15
5	Laboratory Results	19
6	Discussion and Conclusions	23
7	Significance Assessments	25
	Glossary	25

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Bibliography	27
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Illustrations

1	Project area location	4
2	Schematic of survey area	5
3	Survey map annotated to show project area	11
4	Survey control point engraved in stone	12
5	Schematic map of survey area	13
6	Section of wall that divides terraces 272-c and 272-e, facing south . .	14
7	Section of stone facing of 'auwai 272-a, facing east	15
8	Test unit 1, east wall	16
9	Test unit 1, east wall profile	17
10	Test unit 2 before excavation, facing north	17
11	Test unit 2 before excavation, facing south	19
12	Test unit 2 during excavation, facing north	20
13	Test unit 2 post-excavation, facing north	21
14	Test unit 2, west wall profile	22
15	Volcanic glass fragment	22
16	Metal nail dating to the nineteenth century	22
17	Posterior probability of the lower wall construction date	23
18	Posterior probability of the upper wall construction date	24
19	Posterior probability of dated wood, Beta-193986	24

Tables

1	Sediment descriptions	18
2	Radiocarbon laboratory results	21
3	Significance determinations	25

Abstract

Archaeological inventory survey was conducted on two small parcels in Wailau Valley, Moloka'i Island located within the Wailau Agricultural Complex, site 50-60-04-272. Part of this *lo'i* system depicted on a 1915 map (Podmore 1915) encompasses both parcels. The terrace walls and 'auwai depicted on the map were relocated and described. Test excavations were carried out on the larger of the two parcels in an area where a small cabin will be constructed. Excavation revealed an earlier phase of *lo'i* construction beneath the terrace facing walls visible on the surface. Charcoal was obtained from beneath the foundation stones of a surface wall, dating its construction to sometime after A.D. 1635. The lower wall was built sometime before A.D. 1724. Inventory survey results support the determinations made during the statewide inventory of historic places in 1974 that site 50-60-04-272 is significant for its research potential and as a good example of a wetland taro system.

1 Introduction

At the request of Linda Dunn, T. S. Dye & Colleagues, Archaeologists, Inc. conducted an archaeological inventory for a proposed undertaking at TMK:(2)-5-9-005:007 and 081 in Wailau Valley, Koʻolau District, Molokaʻi Island. The proposed undertaking will involve the construction of a single-family residence, in the form of a small cabin, with an associated garden and self-composting toilet on Parcel 007. Footings for the cabin will extend approximately 18 in. below the surface. The primary focus of the project was on the discovery and appropriate treatment of historic properties potentially affected by the construction.

undertaking

project

This report is drafted to meet the requirements and standards of state historic preservation law. These include Chapter 6e of the Hawaiʻi Revised Statutes, and the State Historic Preservation Division’s draft *Rules Governing Standards for Archaeological Monitoring Studies and Reports* (§13–279).

The report begins with a description of the project area. The next section presents an historical overview of land use and archaeology in Wailau Valley and Hālawā *ahupuaʻa*. Following this, survey methods are delineated and the results of the archaeological inventory survey are presented. Project results are summarized and significance determinations and recommendations are made in the final section.

Marginal notes call out the first occurrence of words that appear in the glossary.

1.1 Project Area

The project is located in Wailau Valley on the windward side of Molokaʻi Island (fig. 1). The majority of Wailau Valley is part of Wailau *ahupuaʻa*, but a small strip of land on the east side of the valley is part of the neighboring Hālawā *ahupuaʻa*. The project lies within this eastern portion of the valley in Hālawā *ahupuaʻa*. It is unusual for a small strip of land from one *ahupuaʻa* to encroach into the valley of another, as *ahupuaʻa* boundaries tend to follow natural topographic breaks.

ahupuaʻa

The survey area includes Parcel 007, a 0.68 ac. property, and Parcel 081, a 0.01 ac. piece of land, both owned by Linda Dunn. Parcel 081 lies adjacent to Parcel 007 on the south (fig. 2). Parcel 008, owned by the state, lies between the two parcels on the south. Construction will occur only on Parcel 007, but both properties were intensively surveyed. The parcels are located on the east side of the valley, approximately 350 ft. from the coast. The survey area lies within the Wailau Agricultural Complex, State Inventory of Historic Places Site 50–60–04–272, a 2,312 ac. area where *loʻi*, trails, burials, and habitation and religious sites occur. Several *loʻi* terraces are located in the survey area, but the proposed undertaking will be constructed entirely within the *loʻi* walls to minimize adverse effects to the stonework.

1.2 Environment

The surveyed parcels are relatively flat pieces of land bounded by a steep slope on the east and adjacent parcels on the north, south, and west. Kahawaiʻiki Stream cuts through the western portion of Parcel 007, and there is a 6 ft. drop in elevation where the stream occurs. The parcel continues on the other side of the stream in a lowlying former

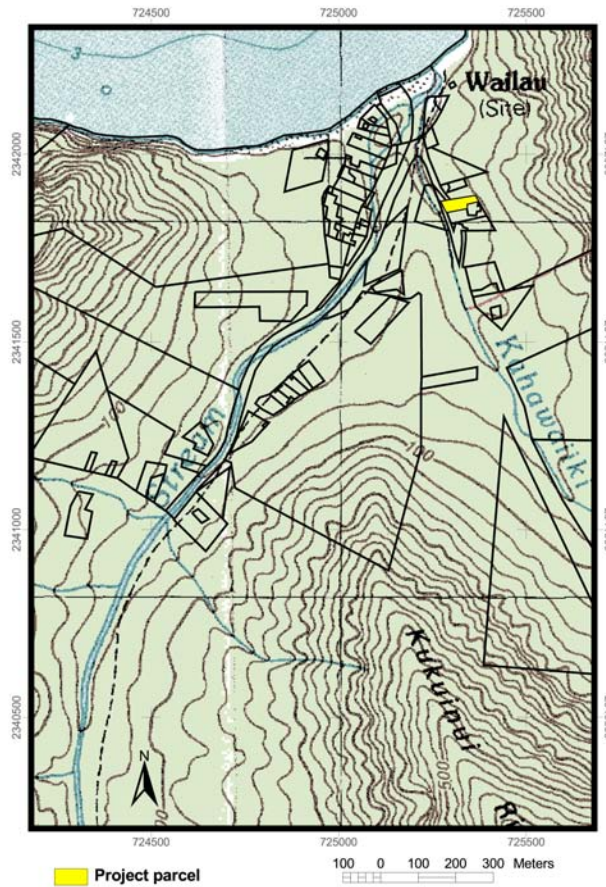


Figure 1. Project area location on a copy of the USGS topographic map.

bamboo
hau
 ginger
 clidemia

stream bed. A dense thicket of bamboo now blankets this area west of the stream. The rest of the survey area is heavily overgrown with *hau*, ginger, and clidemia.

Soils in the area consist of rough mountainous land of the Amalu-Olokui association that includes Kawaihapai Stony Clay Loam near the coast and along Wailau and Kahawai'iki Streams, Colluvial Land along the upper reaches of Wailau and Kahawai'iki Streams and to the west of Wailau Stream, and Rough Mountainous Land on the slopes and ridges bordering the streams (Foote et al. 1972). Rainfall in the valley is generally heavy, ranging from 60–120 in. per year (Juvik and Juvik 1998).

The remains of five or six *lo'i* terraces encompass the entire survey area, and additional terraces occur to the north, south, and west. The terraces tend to be slightly higher in elevation to the south, so that the general impression is that the terraces form steps which get increasingly lower to the north. The terrace located on Parcel 081 is small and elevated; it is unclear whether this terrace is part of the *lo'i* cultivation system

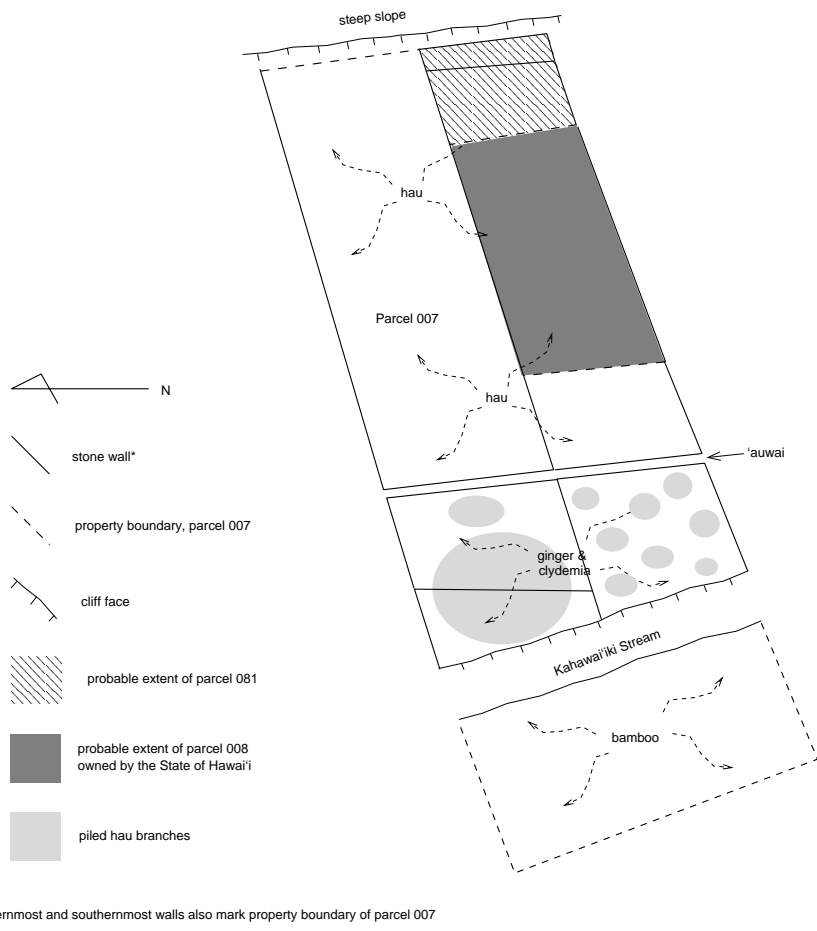


Figure 2. Schematic of survey area, not to scale.

or served another function. The ground surface within each terrace is flat and relatively free of stones. These areas are muddy and prone to flooding. An *'auwai* runs through the middle of the property on the east side of Kahawai'iki Stream.

1.3 Background Research

Wailau Valley was known for its extensive irrigated agriculture system, with taro terraces extending up the valley sides, in the lowlands, and to the backs of the valleys produced by Wailau and Kahawa'iki Streams (Handy and Handy 1972:516). Handy and Handy comment on the exceptional amount of taro produced at Wailau:

Wailau produced far more taro than could be consumed locally, so that quantities of *pa'i 'ai* (hard *poi*) were shipped by boat to Kalaupapa and other localities on Molokai in early post-missionary days. The *pa'i 'ai* was

wrapped in *ti* leaves, and it is said that donkeys used to eat the packages—perhaps the only record of donkeys (“Kona nightingales”) being fed on *poi*! (Handy and Handy 1972:519).

Although *poi* was a staple of the traditional Hawaiian diet, it was also considered a delicacy, thus the feeding of *poi* to donkeys attests to the overabundance of taro that must have been grown at Wailau. For unknown reasons, taro production ceased in 1931, and the *lo‘i* of Wailau were abandoned (Handy and Handy 1972:516).

The valley was also known as an area of *wauke* cultivation (Hitchcock 1836 in Summers 1971:176). Two types of specialized *kapa* were manufactured in Wailau, the *pa‘ikukui* and *mahunali‘i kapa* (Kanepuu 1867 in Summers 1971:176). *Pa‘ikukui kapa* was a pale yellow cloth dyed with liquid from the bark of the *kukui* tree (Brigham 1911 and Pukui and Elbert 1957 in Summers 1971:176). *Mahunali‘i kapa* was a thin, fine-scented cloth dyed with the bark of the *noni* tree (Brigham 1911 and Pukui and Elbert 1957 in Summers 1971:176). It was a *kapu* cloth reserved for *ali‘i* use. The *kapa* was oiled and used in sorcery or was used to cover idols.

More than 60 land claims were awarded in Wailau Valley during the Great Mahele of 1848. The property in the survey area was awarded to Puhili (No. 10869), who states that the land is named Kiaoao and is located in the *‘ili* of Keiu. He mentions *lo‘i*, *kula*, and a house lot, although the *kula* lands were not recognized on the survey.

The *lo‘is* are 52 fathoms long by 15 fathoms wide. I also have a *kula* which is 25 fathoms by 52 fathoms. My house lot is 16 fathoms by 8 fathoms. My *mo‘o* is bounded by Kapaanie on the east and by Kalaikai on the southwest. I have occupied this *mo‘o* for one year. The present Konohiki is Haluku. There are two of us in our *mo‘o*.

PUHILI

HALUKU (Land Board 1851:317).

Due to its inaccessibility, references to Wailau Valley are scarce in the historic literature. In 1854, French biologist Jules Remy traveled by row boat from Hālawā Valley to Pelekunu Valley, passing Wailau on the way. Unfortunately Remy was not able to stop at Wailau because of dangerous surf. He provides a brief description of the coastline:

Have arrived opposite the picturesque valley of Wailau and the village of the same name, where I had planned to disembark, the fury of breakers stopped me and made me go beyond. From there one could see a somewhat large extent of jagged and sinuous shore, along with the plain of Kalaupapa, forming a point detached from the heights, and one could see in the ocean large rocks resembling small islands (Remy 1893:13).

More than a century later, Catherine Summers 1971 compiled all of the archaeological information available for the island of Moloka‘i. Much of this information was obtained from unpublished manuscripts. The locations and descriptions of archaeological sites in Wailau are based largely on the work of J.F.G. Stokes of the B.P. Bishop Museum, who surveyed the island of Moloka‘i in 1909.

wauke

kapa

kukui

noni

kapu

ali‘i

‘ili

kula

mo‘o

Two *pu'uhonua*, a number of *heiau*, and two trails are described for Wailau Valley (Summers 1971:134–136, 175–178). One of the *pu'uhonua* is named Pu'uali'i and is located roughly 2,500 ft. from the coast on the west side of Wailau Stream. It was recorded as a terrace 65 ft. long and 30 ft. wide, including a 6 ft. wide bench. The other *pu'uhonua* is named Oloku'i. It is located on a hill north of Pelekunu and may have also functioned as a fortress. Oloku'i was also an area for capturing 'ua'u birds for *ali'i* consumption.

pu'uhonua

'ua'u

Four *heiau* were described for Wailau. Kanane Heiau is located on the southern slope of the west side of the valley. It was described as a partly demolished platform with a 70 ft. long wall, 8.5 ft. high in places, and 45 ft. wide. Kapala'alaea Heiau is located 4,500 ft. from the coast, on the east side of Wailau Stream. Architecturally, it was only a small terrace, but Hawaiian informants indicated that the site was used as a preparation area for *iwi* of the *ali'i* before burial. Waipulea and Kupukapuakea Heiau were believed to be in Wailau Valley but were never relocated.

iwi

Two ancient foot trails were described for the valley (Summers 1971:134–136, 178). Wailau trail was the only over-land route between Wailau Valley and the Kona side of the island. The trail begins behind 'Ili'iliopae Heiau and continues past numerous springs, up and down steep cliffs, and ends in Wailau Valley. George Kane, a native of Kalalau, Kaua'i traversed the trail in 1912 with guide James Naki. Kane described the treacherous five-and-a-half hour journey to Wailau:

At 9:30 a.m. I left 'Ili'iliopoe [sic] heiau with my guide ... We then reached the top of the hill called Haleone. From this spot you could see clearly the harbor of Mapulehu on the western side of this small hill. The harbor of Puna'ula is on the eastern side and when you look down at Puko'o it is beautiful ... I left there with my patient guide and reached Pu'o'akai, a spring. We drank some water there and found it refreshing and cool because we were climbing straight up the mountain side through 'ie vines and other creeping plants of the forest.

'ie

We left this place and arrived at the first gate. This is a gate on the trail itself, to go through and out on the other side of the old trail. One has to creep through it. We left there and came to Kaunuakea. There is a watchman there ... We left there and arrived at Kilohana, the summit of the mountain separating Puko'o and Wailau, at 11:20 a.m. At this place I looked about to observe the contour of the land but saw nothing except a deep hollow surrounding me on all sides, and rows of forest trees all about me ... We continued on and arrived at Pohakukuo. This is a stone upon which visitors placed pebbles, and then called down to the natives a mile away and the voice could be heard below. Then the natives knew that there was a visitor. From here I looked at the root-matted trail of Wailau and saw how steep it was when one had looked down and then up. The hillside went straight up and one had to throw back the head to look.

We left Pohakukuo and found we were on the descending trail ... We ... arrived at Kapilipohaku. This is a steep rock like the hillside and one has to pass by it sideways. This is a stone that takes away a wife of a husband,

'ōhi'a

because this is where the natives made the strangers climb from Puko'o or from Wailau. . . . We then continued on to Malama. This is a level place and the trail leads through an 'ōhi'a grove. After leaving Malama we came to Keauhou, a taro growing place. From this place on, I saw taro leaves until I reached the shore. After Keauhou, we arrived at the village of Wailau at 3:00 p.m. (Kane 1912 in Summers 1971:134–136).

lau hala

A secondary trail that splits from Wailau trail is also described (Summers 1971:178). This departed from the Wailau trail at Waiakeakua Stream, continued west to Pulena Stream, crossed Pohakaunoho Ridge, and ended in Pelekunu Valley. A shelter, named Malihini Cave, was located three-quarters of the way from Wailau. The cave functioned as a resting place for travelers, and was outfitted with *lau hala* mats for sleeping and poi pounders and scrapers for travelers to prepare food. In the 1950s it was reported that the bank which supported the cave eroded into the stream, obliterating any remains of the shelter.

Three of the archaeological sites documented by Summers (1971) were relocated by Reeve (1973) on a trail-maintenance expedition sponsored by the Sierra Club. Reeve visited Pu'uali'i Pu'uhonua, Kananae Heiau, and Kapala'alaea Heiau but he was only able to spend time at Pu'uali'i. The site consisted of a 6.5 ft. high terrace associated with multiple small enclosures. Reeve produced a rough field sketch (Reeve 1973:20) but lacked the equipment to clear and map the site in detail. Kananae and Kapala'alaea Heiau were in the same condition as described by John F. G. Stokes in the early twentieth century (Summers 1971). In addition to relocating the three sites, Reeve discovered a bottle cache beneath a *kukui* tree 40 ft. east of the trail and 15 minutes from the beach. Lacking excavation equipment, Reeve used his bare hands and a stick to remove 18 glass bottles from a subsurface deposit. The bottles dated to the late nineteenth century, and most were alcoholic beverage containers. Because of the lack of domestic items in the deposit, the site was interpreted as a traveler's resting place, and not a dump for a historic residence. A thorough archaeological survey of the valley was recommended.

The statewide inventory of historic places recorded the Wailau Agricultural Complex as site 50–60–04–272 in 1974. The Hawaii Register of Historic Places Feature Description Form, filled out by Robert D. Connolly III, describes the site as follows:

The site was named Wailau Agricultural Complex by the Bishop Museum Statewide Inventory Team. The site area includes approximately 936 hectares on the floor and sides of Wailau Valley . . .

The site itself consists of an extensive wet-land taro agricultural system with an associated *heiau*. Also in the valley are signs of what were probably historic housesites, as evidenced by the mango tree, many other exotic plants, and historic wastes, but no structural evidence of a housesite was found near any of these archaeological indicators.

The taro system is quite extensive and impressive. It compares favorably to the systems found in Pelekunu Valley to the W and Halawa Valley to the E on Molokai. The terraces of this system possess the same degree of variety as those of Halawa and Pelekunu, varying from one stone to more than 2 meters in height . . .

The other feature located by the Inventory Team was the Pu'uhonua of Pu'uali'i . . . The Inventory Team did not have time to map and record the numerous individual terraces or the *pu'uhonua*, as that task would take at least a month in the field. Terraces were observed from the mouth of the valley extending continuously back into the valley as far as the team was able to travel during the day used to record this area. Many of the sites recorded by Summers (1971:175–178) could not be relocated because of sketchy location data.

No prehistoric artifacts were found; historic artifacts included bottles and a piece of chain, but they were not found near any recognizable house-site . . .

The most important archaeological aspects of Wailau Valley are its isolation, distance from developed areas, and its consequent undisturbed state—all of the physical aspects of a wet-taro agricultural society, unchanged since the valley was abandoned early in the 20th century . . .

Connolly also evaluated the significance of the site, although the significance categories he used in 1974 differ somewhat from the categories later devised by SHPD. Given the choices “good,” “moderate,” and “poor” in the Register Form field “Importance as Example of Site Type,” Connolly chose “good.” He made a similar choice for “Research Potential.” Thus, in modern terms, the site was evaluated as significant for criteria *c* and *d*.

More archaeological work has been completed in the Hālawā Valley portion of Hālawā *ahupua'a*, which lies to the east of the Wailau Valley portion of Hālawā *ahupua'a*. An extensive archaeological research program was conducted in Hālawā Valley in the 1970s (Riley 1973; Kirch and Kelly 1975). This was a settlement pattern study that focused on the south side of the valley. Excavations were conducted in the *'ili* of Kapana, Kaio, Pua'alaulau, and two sites on the coastal flat. Residential, agricultural, ceremonial, and midden sites were excavated. ¹⁴C and volcanic glass hydration rind dates indicated early nucleated settlement at the coast as early as A.D. 650, with dispersed settlement and cultivation of inland areas occurring later, from ca. A.D. 1250–1750. A wide array of artifacts was recovered, including fishhooks and fishhook manufacturing implements, ornaments, weapons, adzes and other tools, a large assemblage of basalt and volcanic glass flakes, and a variety of food remains. Excavations of irrigated agricultural fields, similar to those found in Wailau Valley indicated two horizons of agricultural use (Kirch and Kelly 1975:113, 114). The most recent horizon was defined by surface remains associated with irrigated taro agriculture. An earlier horizon indicative of shifting cultivation was found below the surface remains. A dissertation provides a detailed report on the excavations of the agricultural complexes (Riley 1973).

2 Methods

Archaeological inventory survey, photography, and test excavations were carried out between 10 and 12 June 2004. Thomas Dye, Ph.D. served as principal investigator, while fieldwork was conducted by archaeologist Windy McElroy, volunteer archaeolo-

gist Mark McCoy, and landowner Linda Dunn. One hundred percent of the survey area was systematically surveyed on foot, with archaeologists spaced 10 m apart, visually inspecting the ground surface for archaeological remains. The survey was hindered by dense vegetation in most of the project area. Bamboo, *hau*, ginger, and clidemia obscured the ground surface and hindered movement throughout the survey. In addition, piles of decaying *hau* were encountered in a strip across the center of the survey area, between the *'auwai* and Kahawai'iki Stream. It was nearly impossible to see the ground surface beneath these piles.

An existing survey map (Podmore 1915) was used in place of the requirement to map the surface architecture. Both cultural and physical features are depicted on the map. These include *lo'i* boundaries, *'auwai*, streams, and hillsides (fig. 3). Field observations indicate that the map is of high quality, thus no additional mapping was conducted. The control points engraved in stones and depicted on the map have been located (fig. 4), and these were used to verify the accuracy of the map. Additional data regarding *lo'i* wall construction were gathered to augment the existing map. Despite the dense vegetation, every wall depicted on the map was located. No additional archaeological sites or features were observed. A similar map was utilized as a basis for field survey for the large-scale settlement pattern study of Hālawā Valley (Kirch and Kelly 1975). The map was produced in the same year and by the same surveyor as the map used here. The map was confirmed to be reasonably accurate for the Hālawā Valley project, although in Hālawā Valley it was noted that many of the smaller archaeological features were not depicted.

Two test units were excavated to detect subsurface deposits or cultural material. One unit was placed in the middle of the *lo'i* in the area proposed for construction of the cabin. Another was placed over one of the *lo'i* walls to obtain datable material from beneath the wall. Both test units were excavated by hand with trowel and whisk broom. All sediment was screened through 0.125 in. mesh and sediment characteristics were described using Munsell soil color charts and a sediment texture flowchart (Thien 1979). Both test units were backfilled after excavation. Cultural material was assigned to contexts in the field according to vertical and horizontal position. Collected materials were sorted in the laboratory by material type and described, weighed, measured, and photographed where appropriate. One sample of charcoal was identified by Gail Murakami of the Wood Identification Laboratory of International Archaeological Research Institute, Inc. and a portion of the same sample was submitted to Beta-Analytic, Inc. for ¹⁴C dating (section 5).

3 Field Survey Results

Archaeological remains within the survey area consist of terrace walls and an *'auwai*. These are part of the Wailau Agricultural Complex, which bears the State Inventory of Historic Places site number 50–60–04–272. New site numbers were not given to the individual components of this site that are documented here. Feature letters *a* through *g* are designated to aid in the description of these structures.

Lo'i are laid out in a stepped pattern, higher on the south and descending toward the north. The steps descend on the north side of each *lo'i* so that the ground surface

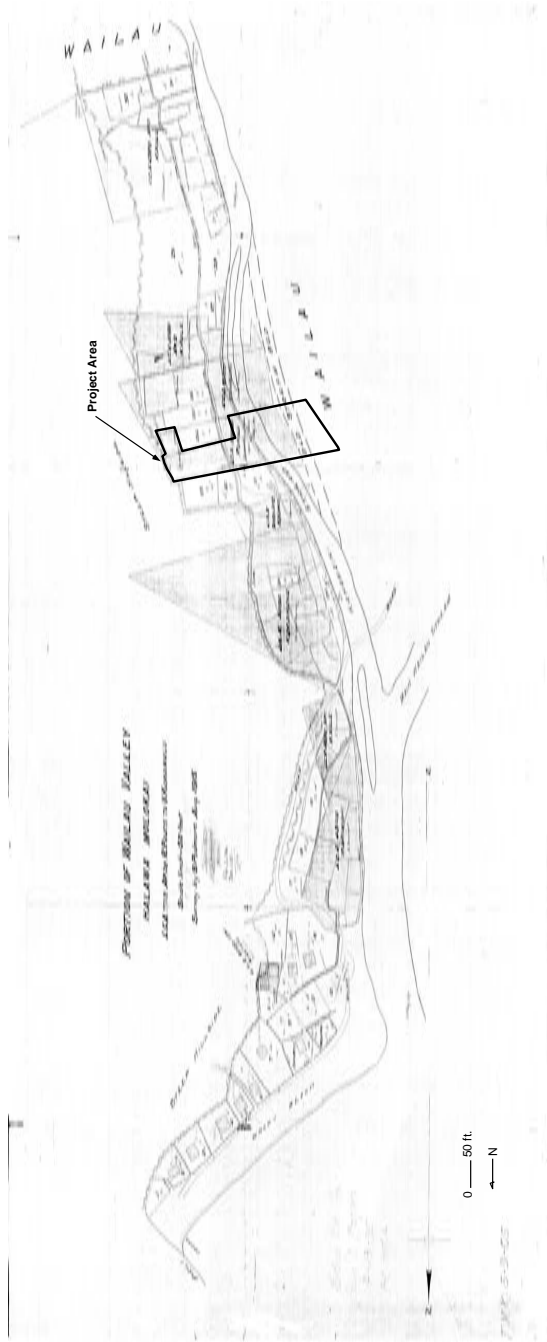


Figure 3. Survey map (Podmore 1915) annotated to show project area.



Figure 4. Survey control point engraved in stone and depicted on map (Podmore 1915). The scale is marked in 10 cm increments.

within an individual terrace is flat. One *'auwai*, designated feature 50-60-04-272-a and six terraces, designated features 50-60-04-272-b through -g occur in the survey area (fig. 5). No archaeological features are present in the survey area to the west of Kahawai'iki Stream. This was expected because the stream once meandered through this area (Podmore 1915).

Terraces 272-b, -c, and -e lie between the stream and the *'auwai*. The land area of terraces 272-b and -e has diminished significantly since the 1915 map was drawn Podmore (1915). The 1915 map depicts the south end of the wall that divides terraces 272-b and 272-c approximately 4 m from the stream cut, but today it lies only 1 m from the stream cut. In addition, a wall and a stone with a reference mark are depicted along the stream cut but have since eroded into the stream. The wall is no longer present in the survey area but can be seen along the bank to the north. The stone bearing the triangular reference mark was discovered in the stream, apparently toppled from the bank above.

The walls of terraces 272-b, -c, and -e are in fair condition. The south wall of terrace 272-e is in the best condition, although all walls are thoroughly overgrown. The wall that divides terraces 272-b and -c is almost completely obscured by decaying piles of cut *hau*. The best preserved wall sections are composed of small stones of basalt stacked 3-4 courses to a height of 60 cm (fig. 6). A single alignment of stones is visible, typically 40 cm in width. In some areas only one course of the wall is visible. The eastern boundary for terraces 272-c and -e is the *'auwai*. An examination of the surface structural remains was insufficient to determine the construction sequence of the terraces and *'auwai*.

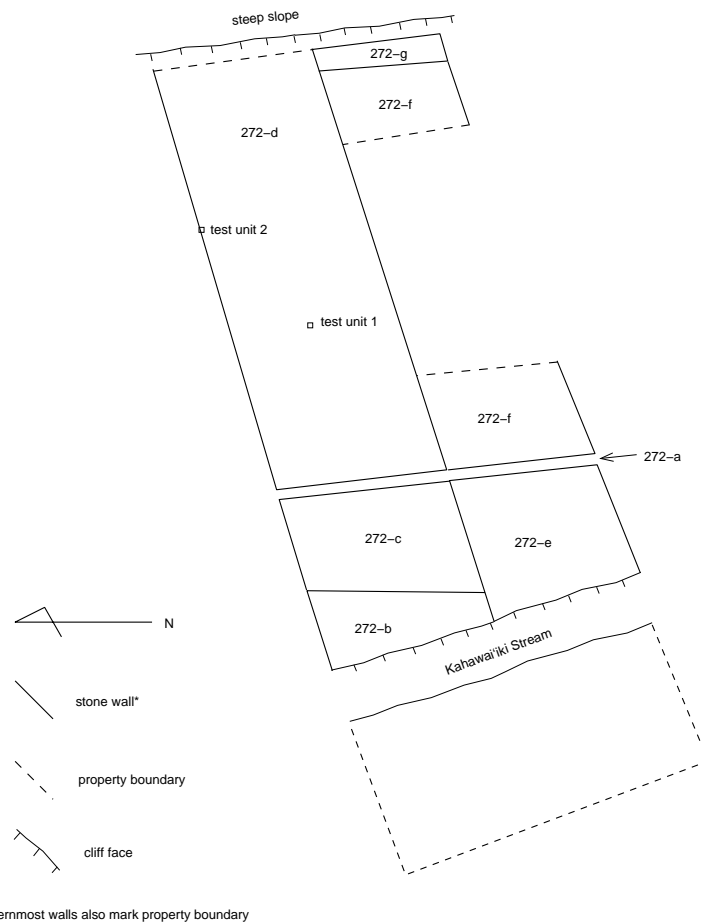


Figure 5. Schematic of survey area, not to scale. Archaeological features and test units are depicted.

Feature 272-a is the *'auwai*. It runs between terraces 272-c and -d and 272-e and -f and continues north and south out of the project area. According to the historic map (Podmore 1915), the *'auwai* continues up the valley to the south and toward the coast to the north to water other *lo'i* in these areas. The *'auwai* ends just south of a church that once sat near the beach. The *'auwai* appears to run off the map to the south, thus its point of origin is unknown. However, the map depicts the entire Wailau Valley section of Hālawā *ahupua'a*, thus it is likely that the *'auwai* starts in Wailau *ahupua'a* to the west. It is unusual for an *'auwai* to begin in one *ahupua'a* and feed the *lo'i* of another, because each *ahupua'a* was directed by a different land manager. This situation suggests close ties between the two *ahupua'a* of Wailau Valley.

In the project area, the *'auwai* does not run a perfectly straight course, but snakes slightly in several places from approximately 150° to 160°. The inner sides of the



Figure 6. Section of wall that divides terraces 272-c and 272-e, facing south. The scale is marked in 10 cm increments.

'*auwai* are stone lined with up to four courses of stacked and piled basalt and the bottom has filled in with mud (fig. 7). The '*auwai* is generally 60 cm deep, 1.3 m wide and exhibits a *U*-shaped cross-section. This feature is in fair condition. It is heavily overgrown and its stone lining has tumbled in places, but the general shape and course of the '*auwai* are prominent. Residents claim that during periods of heavy rain, the '*auwai* of Wailau are still functional (Linda Dunn, pers. com. 2004).

Terrace 272-d is adjacent to the '*auwai* to the east. Its north and south walls extend to the base of a steep slope, where it lacks an east wall. The north and south walls are similar in construction to the walls of the terraces described above. The southern wall is typically in better condition than the northern wall, although well preserved sections of the northern wall exist. A few sections of the northern wall are low and wide from stones that have tumbled, although the feature is generally in fair condition. The undertaking will occur entirely within this terrace. Two test units were placed here, one in the center of the terrace and another against its north wall (section 4).

Terrace 272-f is adjacent to terrace 272-d on the south. The '*auwai* makes up the western boundary of this terrace, and another smaller terrace, feature 272-g, lies to the east. Neighboring parcel TMK:(2)-5-9-005:008 occupies the central portion of the terrace, leaving only the east and west ends within the project area. The property boundary is not marked by walls (fig. 5, pg. 13). The north and south walls of the terrace are generally in good condition, although heavily overgrown in places. The south wall is typically composed of small stones stacked three courses to a height of 45 cm. A single alignment of stones is visible, measuring up to 80 cm in width.

Terrace 272-g lies to the east of terrace 272-f, against a steep slope. This terrace is much smaller than the others in the survey area and may not have served an agricul-



Figure 7. Section of stone facing of 'auwai 272-a, facing east. The scale is marked in 10 cm increments.

tural function. It is possible that this is the house lot referred to by Puhili in his *mahele* claim (pg. 6). The terrace is also atypical because it is raised 50 cm higher than the terrace to the west, defying the typical pattern of terraces stepping down to the north. Its walls are composed of roughly piled stones and boulders, with the junction between its west wall and the south wall of terrace 272-d forming a corner on its northwest side. A rusty metal axe head is wedged beneath a tree near this corner, possibly indicating historic use of the terrace. An examination of the surface structural remains was insufficient to determine which terrace was constructed first. The terrace is generally in poor condition, with one to two courses of piled stones remaining.

4 Test Excavation Results

Two test units were opened within *lo'i* 272-d. Test unit 1 measured 1 m² and was placed in the center of the *lo'i* in the area proposed for construction of the cabin. The unit was placed here to expose any possible subsurface cultural deposits or burials that might be disturbed during construction. Stratigraphy consisted of a dark brown upper layer of runoff deposition overlying a grey pondfield deposit, with a mottled layer of decomposing bedrock below (figs. 8 and 9, table 1). Isolated charcoal fragments were recovered from every layer. Decayed basalt fragments that resembled charcoal in color and texture occurred in layer III but these were not collected. A tiny volcanic glass flake was recovered from layer II (section 5).

Test unit 2 began as a 0.25 m² unit but was later expanded to 0.375 m². It was placed at the north edge of *lo'i* 272-d, above the best preserved facing wall section, and extending beyond the facing wall into the *lo'i*. A single alignment of wall stones



Figure 8. Test unit 1, east wall. The scale is marked in 10 cm increments; the trowel points north.

was visible on the surface before excavation (fig. 10). The wall is stacked two to three courses high in this section (fig. 11). As the unit was excavated, a second, partially buried, alignment was discovered. This second alignment paralleled the first, 20 cm south of the first alignment. The fill between the two alignments was composed of densely packed gravel and cobbles. The parallel alignments with rubble between them are interpreted as a single core-filled stone wall (fig. 12). A metal nail was discovered near the surface above the rubble layer (section 5). Charcoal was collected from the rubble layer, beneath the foundation stones of this wall. This was submitted for wood identification and ^{14}C dating (section 5). The unit was expanded 25 cm to the south because the densely packed rubble impeded further vertical excavation. As excavation continued south of the wall, a third alignment was discovered 14 cm below and 8 cm south of the second alignment (fig. 13). Gravel and cobble fill occupied the space between the second and third alignments. This third alignment is interpreted as an earlier *lo'i* wall that was constructed before and to the south of the first *lo'i* wall. In the interest of time, a shovel was used to expand the unit vertically and horizontally to the south to gain a better understanding of the construction of the wall and the stratigraphy within the *lo'i*. The soil removed by shovel was not screened. A layer of basalt gravel and cobbles was found to the south of the lower wall at 28 cm below surface. This is interpreted as a builder's trench for the lower wall. A layer of decomposing bedrock was encountered beneath the rubble layer. This layer is consistent in color and texture with the basal layer of unit 1. Due to time constraints, the excavation could not be expanded horizontally beyond the rubble of the builder's trench.

Three stratigraphic layers were defined in test unit 2 (fig. 14, table 1). Layer I is a dark brown runoff deposit which is probably continuous with Layer I of test unit 1. Layer Ia is interpreted as the builder's trench for the lower wall. It lies beneath layer I

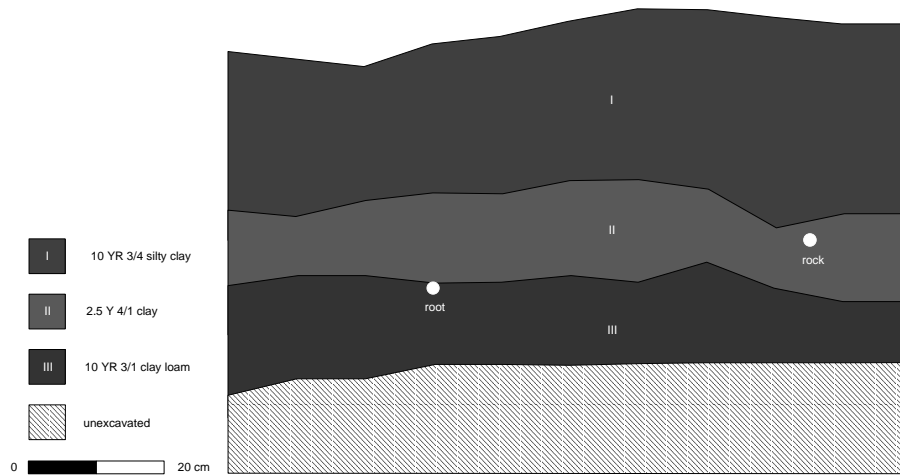


Figure 9. Test unit 1, east wall profile.



Figure 10. Test unit 2 before excavation, facing north. The *lo'i* wall runs horizontally along the top of the photo. The scale is marked in 10 cm increments; the trowel points north.

in the southern portion of the unit. The soil of layer Ia is the same color and texture as the soil of layer I, but this layer is differentiated because it contained densely packed basalt gravel and cobbles. Layer II corresponds with layer III of test unit 1, consisting

Table 1. Sediment descriptions

Unit	Layer	Depth*	Color [†]	Description	Interpretation
1	I	0–31	10YR 3/4	Dark yellowish brown silty clay, few large roots, many fine roots, no rocks, few isolated charcoal flecks; wavy, clear boundary.	Runoff deposition after pondfield abandonment
1	II	20–41	2.5 Y 4/1	Dark gray clay, few fine and medium roots, some basalt gravel, isolated charcoal flecks throughout; wavy, clear boundary.	Pondfield deposit
1	III	37–52	10 YR 3/1	Very dark gray clay loam, very mottled, few fine and medium roots, weathered basalt gravel, few isolated charcoal flecks; base of excavation.	Natural decomposing bedrock
2	I	0–28	10YR 3/2	Very dark grayish brown clay loam, many large and medium roots, few isolated charcoal flecks, some basalt gravel and cobbles; smooth, abrupt boundary.	Runoff deposition after wall construction
2	Ia	28–42	10YR 3/2	Very dark grayish brown clay loam, many large and medium roots, few isolated charcoal flecks, densely packed basalt gravel and cobbles; smooth, abrupt boundary.	Fill from builder's trench
2	II	42+	10 YR 3/1	Very dark gray clay loam, very mottled, few fine and medium roots, weathered basalt gravel and cobbles, few isolated charcoal flecks; base of excavation.	Natural decomposing bedrock

* Centimeters below surface.

[†] Colors determined from wet sediment.

of a mottled layer of decomposing bedrock. The pondfield deposit layer II observed in test unit 1 did not occur in test unit 2.

In sum, a chronological sequence for the stratigraphy, features and artifacts exposed during excavation of the two test units can be outlined as follows:

1. The natural bedrock layer is deposited and begins to decompose (layer II of test unit 2 and layer III of test unit 1).
2. A trench for the lower wall in test unit 2 is excavated and the foundation stones for this wall are laid.
3. Gravel and cobbles are placed within the trench to support the foundation stones (layer Ia of test unit 2). This rubble may have been a product of clearing the land within the *lo'i*, as the pondfield deposit of test unit 1 was relatively free of basalt.
4. Use of the *lo'i* for pondfield cultivation begins. Evidence for this is absent from test unit 2, but can be inferred by the position of the pondfield deposit exposed



Figure 11. Test unit 2 before excavation, facing south. The *lo'i* wall runs horizontally across the bottom of the photo. The scale is marked in 10 cm increments; the trowel points north.

in test unit 1 (layer II of test unit 1). The volcanic glass flake found in test unit 1 made its way into the archaeological record at this time.

5. A trench for the upper wall of test unit 2 is excavated and foundation stones for the two alignments of this wall are laid. The dated sample of charcoal came from beneath the foundation stones, predating the construction of this wall.
6. Gravel and cobbles that make up the rubble for this upper wall are placed within and around the foundation stones.
7. The pondfield is abandoned and runoff deposition occurs (layer I of both test units), completely covering the lower wall and partially covering the upper wall in test unit 2. The metal nail of test unit 2 was deposited during this time.

5 Laboratory Results

A tiny volcanic glass fragment, a rusty metal nail, and isolated charcoal fragments were recovered from the test excavations. The fragment of volcanic glass was found in layer II of test unit 1 at 23–32 cm below the surface (fig. 15). The fragment is 0.35 cm long, 0.3 cm wide, and weighs less than 1 g. The metal nail was found near the surface of test unit 2. The nail measures 1.8 cm long, 0.7 cm wide at the head, and weighs 1.2 g (fig. 16). Historic archaeologist, Susan Lebo determined that the nail was machine cut and manufactured during the nineteenth century.



Figure 12. Test unit 2 during excavation, facing north. Stones *A* and *B* are part of the alignment identified before excavation. Stones *1* through *5* are part of a second alignment, identified during excavation. White text indicates a stone visible above the surface, while black text indicates a subsurface stone. Note the cobble fill between the two alignments. The scale is marked in 10 cm increments.

Isolated charcoal fragments were recovered from every layer of test unit 1 and from layer I of test unit 2, although a single specimen from test unit 2 can be regarded as suitable dating material. The specimen was recovered directly beneath the base of a boulder in the upper wall, thus the age of the specimen represents a *terminus post quem* for construction of the upper wall. The specimen was identified by Gail Murakami of International Archaeological Research Institute, Inc. Wood Identification Laboratory as cf. *Chamaesyce* sp. It strongly resembles 'akoko, but Murakami was not able to rule out the possibility that it is from a different species of the genus. There are 15 endemic shrubs and small trees in the genus *Chamaesyce*, all of which can be reasonably assumed to be short-lived for the purposes of ^{14}C dating. The identified specimen was sent to Beta-Analytic, Inc. in Miami, Florida for accelerator mass spectrometry dating. The specimen, which was assigned the laboratory number Beta-193986, provided ample amounts of carbon for an accurate measurement and the analysis went normally. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. Beta-193986 yielded a conventional radiocarbon age (Stuiver and Polach 1977) of 330 ± 30 (table 2).

The results returned by the dating laboratory were calibrated using Bayesian statistics (Buck et al. 1996). Bayesian statistics were used because the goal of the dating program was to provide an estimate of when the upper wall was built; the age of the dated sample was of secondary interest. Bayesian calibration can yield a posterior

suitable dating material
terminus post quem

'akoko



Figure 13. Test unit 2 post-excavation, facing north. Stones A, B, 2, and 3 are part of the alignments that make up the upper wall and are labeled as in fig. 12. Stones I and II are the foundation stones of the alignment that comprises the lower wall. The scale is marked in 10 cm increments.

Table 2. Radiocarbon laboratory results

Sample	Lab. No.	Material	$^{13}\delta$ per mil	CRA*
04607	Beta-193986	<i>Chamaesyce</i> sp.	-10.8	330 \pm 30

* Conventional radiocarbon age. (Stuiver and Polach 1977).

probability for an archaeological event that cannot be directly dated, given a model that includes its temporal relationship to one or more events that are dated. The model used for the calibration can be represented by inequalities (1) and (2), where w_u is the construction date of the upper wall, w_l is the construction date of the lower wall, α_1 and β_1 are the beginning and end of the period of sediment deposition in the builder's trench for the upper wall, and A.D. 1915 is the date of a map (Podmore 1915) that shows the system of walls represented in the excavation by the upper wall. Events w_l and w_u were assigned uninformative prior probabilities, modeled as uniform distributions over the period from initial Polynesian settlement to the drawing of the map, A.D.

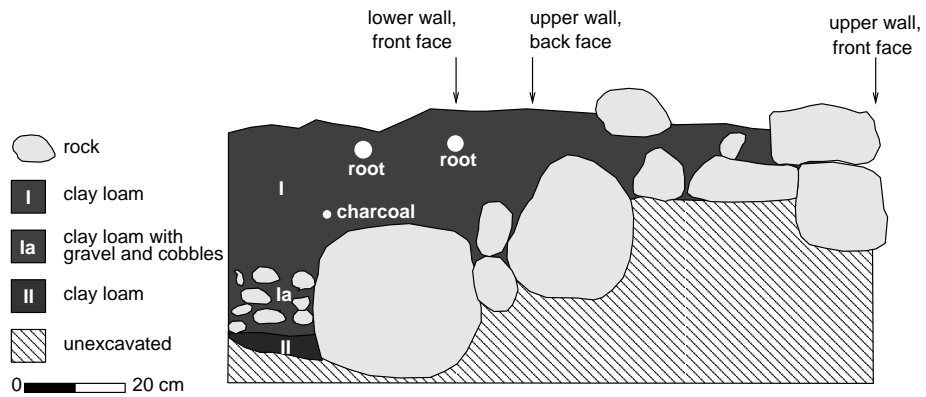


Figure 14. Test unit 2, west wall profile.

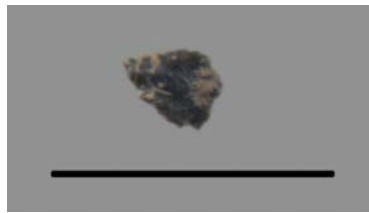


Figure 15. Volcanic glass fragment from layer II of test unit 1. The scale bar is 1 cm long.



Figure 16. Metal nail dating to the nineteenth century. The scale bar is 1 cm long.

750–1915. The calibration was run on the BCal server in Sheffield (Buck et al. 1999), where the results converged after 50,000 iterations.

$$\alpha_1 > \beta_1 > w_u > \text{A.D.1915} \quad (1)$$

$$w_l > w_u \quad (2)$$

The calibration yielded posterior probabilities for the construction of the lower and upper walls, and the age of the *Chamaesyce* sp. specimen. The dated specimen provided little information on the construction date of the lower wall, and the age of this event was constrained only by the uninformative prior and the stratigraphic information that it was older than the upper wall. Thus, it is only possible to say that the wall was built sometime prior to A.D. 1724, the upper bound of the 95% highest posterior density region for the event (fig. 17). The dated specimen does constrain the estimate for the construction date of the upper wall, which was built sometime in the interval A.D. 1635–1914, the 95% highest posterior density region for the event (fig. 18). Finally, the specimen of *Chamaesyce* sp. grew, probably somewhere in Wailau Valley, between A.D. 1476 and A.D. 1641.

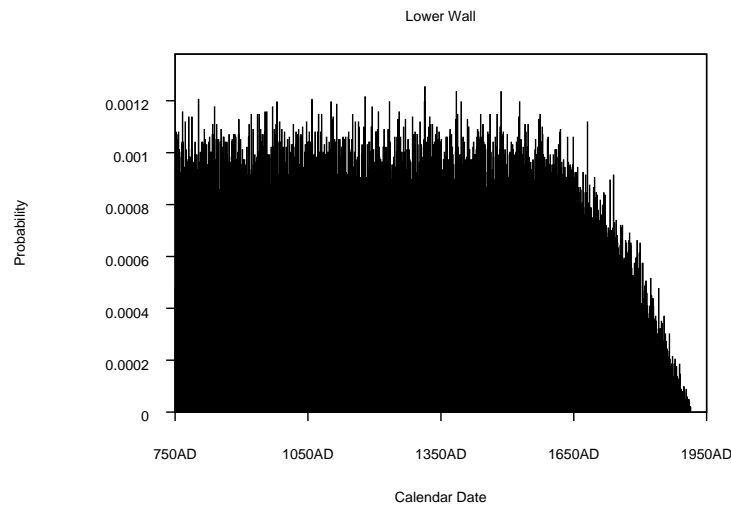


Figure 17. Posterior probability of the lower wall construction date.

6 Discussion and Conclusions

The work reported here represents the first detailed archaeological survey and the first archaeological excavation in the valley of Wailau. Seven architectural components were found on parcels (2)–5–9–005:007 and 081 in Wailau Valley. They consist of an 'auwai, five agricultural terraces, and a possible habitation terrace. All were depicted on a survey map of a portion of the valley (Podmore 1915). Test excavations in one of the agricultural terraces revealed an intact pondfield deposit, portions of the upper *lo'i* wall not visible on the surface, and a lower *lo'i* wall that lay entirely buried. Bayesian

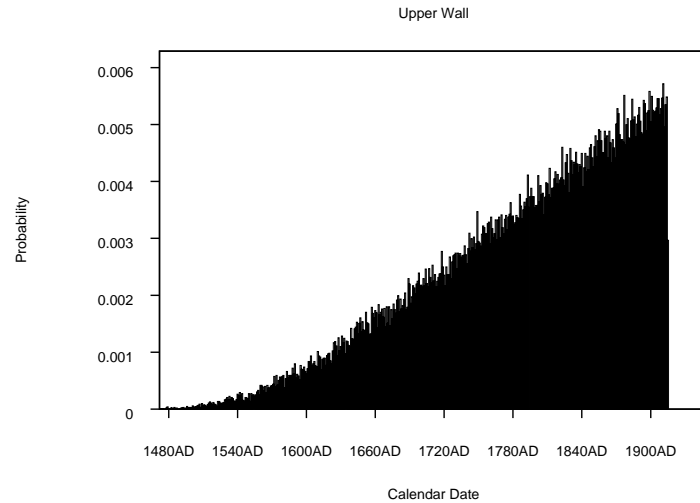


Figure 18. Posterior probability of the upper wall construction date.

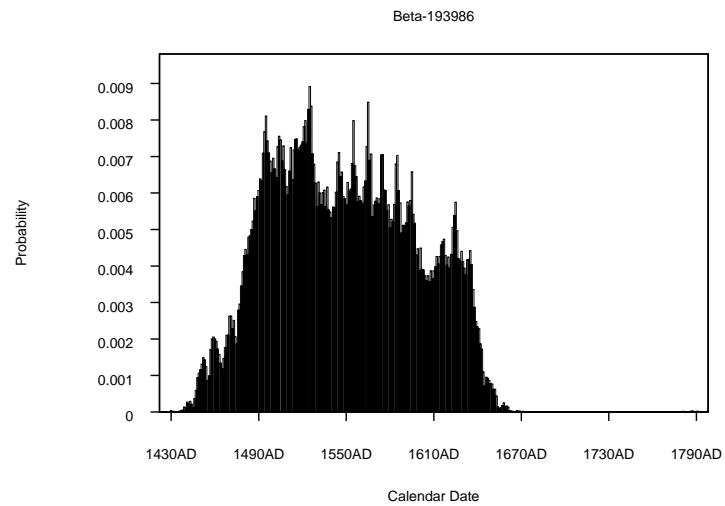


Figure 19. Posterior probability of dated *Chamaesyce* sp. wood sample, Beta-193986.

calibration of a dated fragment of charred *Chamaesyce* sp. wood indicated a construction date of A.D. 1635–1914 for the upper wall, and sometime before A.D. 1724 for the lower wall. Thus, the lower wall was clearly constructed in the pre-contact era. It is possible that the upper wall was built in pre-contact times as well, though it is

more likely to have been constructed in the historic era; the probability that it was constructed before A.D. 1778, given the current dating evidence, is approximately 0.39. The metal nail, *mahele* documents, and the Podmore map all indicate that use of the *lo'i* continued into the historic era, and it is reasonable to conclude that the most recent modifications of the excavated *lo'i* wall were made in the historic period, building on a plan laid out in the pre-Contact era.

7 Significance Assessments

The Wailau Agricultural Complex, site 50-60-04-272, has been evaluated as significant under criteria *c* and *d* because the system may be representative of a pre-contact irrigated agricultural complex and might yield information on Hawaiian history and prehistory (see pg. 9). The seven architectural components that occur in the project area are elements of site 50-60-04-272 and contribute to its significance.

Table 3. Significance determinations

Site	Description	Criterion	Justification
50-60-04-272	Wailau Agricultural Complex	c and d	Representative of a traditional irrigated agricultural system and may yield information on Hawaiian history and prehistory.

Construction of a single-family residence, garden, and self-composting toilet will take place entirely within agricultural terrace 272-d. Undertaking activities will be restricted to the center portion of the *lo'i* to avoid disturbing the terrace walls. Excavation of test unit 1 in the center of the *lo'i* did not expose any buried walls or cultural features. However, an intact pondfield deposit is buried about 20 cm below surface in the area that will be affected by the undertaking. This deposit was well documented with the excavation of test unit 1. Cultural material was sparse in the grey pondfield deposit, consisting of isolated charcoal fragments and a tiny piece of volcanic glass. No further work is recommended because the undertaking will not disturb the *lo'i* walls and the pondfield deposit was well-documented in test unit 1.

The possibility that isolated human burial remains will be discovered during construction activities should be noted, even though no evidence of human burials was discovered during archaeological survey. This caveat is based on the fact that the test units excavated during the survey were not large or numerous enough to have exposed isolated cultural features in every part of the property. However, because of the dynamic nature of irrigated agriculture, it is highly unlikely that human burials will be found in the deposits within the *lo'i*. If human burial remains are discovered during construction activities, work in the vicinity of the remains should cease and the Maui Island Archaeologist should be contacted.

Glossary

Entries for Hawaiian words are excerpted or paraphrased, where possible, from the *Hawaiian Dictionary* (Pukui and Elbert 1971), or from Lucas (1995). Geological and geographical terms are from American Geological Institute (1976) and Clark (1998). Archaeological terms are from Bray and Trump (1982) and Mignon (1993).

‘akoko A member of the genus *Chamaecyse* spp., which includes 15 endemic shrubs and small trees.

‘auwai Ditch.

‘ili A land section, next in importance to *ahupua‘a* and usually a subdivision of an *ahupua‘a*.

‘ōhi‘a Two kinds of forest trees. See also *‘ōhi‘a ‘ai* and *‘ōhi‘a lehua*.

‘ōhi‘a ‘ai The mountain apple tree, *Eugenia malaccensis*, a forest tree to 50 ft. high.

‘ōhi‘a lehua An endemic species, *Metrosideros polymorpha*, that ranges in habit from prostrate shrubs to tall trees and is distributed from sea level to 2,200 m elevation on all the main Hawaiian Islands.

‘ua‘u The endangered seabird *Pterodroma phaeopygia*, or dark-rumped petrel.

ahupua‘a Traditional Hawaiian land division usually extending from the uplands to the sea.

ali‘i Chief, chiefess, officer, ruler, monarch, peer, head man, noble, aristocrat, king, queen, commander.

bamboo A shrub or tree including *Dendrocalamus*, *Phyllostachys*, *Schizostachyum*, and *bambusa* with various uses. Some species provide edible seeds and young shoots. Bamboo is also a common building material in Asia.

clidemia The tropical American weed *Clidemia hirta*. Also known as Koster’s curse, the shrub tends to take over where it is introduced.

ginger The flowering plant *Zingiber* common to Hawaiian forests.

hau An indigenous tree, *Hibiscus tiliaceus*.

‘ie Vine of the *‘ie‘ie*, or *Freycinetia arborea*, an endemic, woody branching climber that grows at altitudes of 300–600m. In ancient Hawai‘i, vines were considered sacred and used in basketry and for ceremonial purposes.

iwi Bone.

kapa Tapa cloth.

kapu Taboo, prohibition; special privilege or exemption from ordinary taboo; sacredness; prohibited, forbidden; sacred, holy, consecrated; no trespassing, keep out.

kukui The candlenut, *Aleurites moluccana*.

kula Plain, field, open country, pasture. Land with no water rights.

lau hala Pandanus leaf, especially as used in plaiting.

lo'i A single irrigated taro patch. Irrigated terrace, especially for taro.

mo'o Narrow strip of land, smaller than an 'ili. See also *ahupua'a*.

noni The Indian mulberry (*Morinda citrifolia*), a small tree or shrub in the coffee family, native to Asia, Australia, and the Pacific Islands. In Hawai'i, *noni* was used for medicines and dyes.

project The inventory survey.

pu'uhonua Place of refuge, sanctuary, asylum, place of peace and safety.

suitable dating material An identified sample of wood charcoal, selected to include short-lived species, twigs, or sapwood collected from a context that is in a clearly defined association with a confidently identified traditional Hawaiian cultural feature.

terminus post quem A date earlier than an archaeological event of interest.

undertaking Construction of a single-family dwelling within an abandoned taro *lo'i*.

wauke A small tree or shrub, *Broussonetia papyrifera*, whose bark was made into tapa cloth used for clothing.

Bibliography

American Geological Institute (1976). *Dictionary of Geological Terms* (Revised ed.). Garden City, N.Y.: Anchor Press.

Bray, W. and D. Trump (1982). *The Penguin Dictionary of Archaeology* (Second ed.). New York: Penguin Books.

Buck, C. E., W. G. Cavanagh, and C. D. Litton (1996). *Bayesian Approach to Interpreting Archaeological Data*. Statistics in Practice. Chichester: John Wiley & Sons.

Buck, C. E., J. A. Christen, and G. James (1999, July). BCal: an on-line Bayesian Radiocarbon Calibration Tool. <http://bcal.sheffield.ac.uk>.

- Clark, A. N. (1998). *The Penguin Dictionary of Geography* (Second ed.). London: Penguin Books.
- Foote, D. E., E. L. Hill, S. Nakamura, and F. Stephens (1972). *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*. Washington, D.C.: United States Department of Agriculture, Soil Conservation Service. Published in cooperation with the University of Hawaii Agricultural Experiment Station.
- Handy, E. S. C. and E. G. Handy (1972). *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Number 233 in Bernice P. Bishop Museum Bulletin. Honolulu: Bishop Museum Press. With the collaboration of Mary Kawena Pukui.
- Juvik, S. P. and J. O. Juvik (Eds.) (1998). *Atlas of Hawai'i* (Third ed.). Honolulu: University of Hawaii Press.
- Kirch, P. V. and M. Kelly (Eds.) (1975). *Prehistory and Ecology in a Windward Hawaiian Valley: Halawa Valley, Molokai*. Number 24 in Pacific Anthropological Records. Honolulu: Anthropology Department, B. P. Bishop Museum.
- Land Board (1846–1851). Native register. Archives of Hawaii.
- Lucas, P. F. N. (1995). *A Dictionary of Hawaiian Legal Land-Terms*. Honolulu: Native Hawaiian Legal Corporation and University of Hawai'i Committee for the Preservation and Study of Hawaiian Language, Art and Culture.
- Mignon, M. R. (1993). *Dictionary of Concepts in Archaeology*. Number 13 in Reference Sources for the Social Sciences and Humanities. Westport, Conn.: Greenwood Press.
- Podmore, G. (1915, August). Portion of Wailau Valley, Halawa, Molokai. Bishop Estate Survey Map. Scale 1:600.
- Pukui, M. K. and S. H. Elbert (1971). *Hawaiian Dictionary* (Third ed.). Honolulu: University of Hawaii Press.
- Reeve, R. (1973, August). *Wailau: An Archaeological Site Survey of Wailau Valley Molokai*. Honolulu: Anthropology Department, B. P. Bishop Museum. Ms. Anthropology Department 122873.
- Remy, J. (1893). *The Island of Molokai Before Leprosy*. Arcis-sur-Aube. Translated by Mildred M. Knowlton, Oct. 1975.
- Riley, T. J. (1973, May). *Wet and Dry in a Hawaiian Valley: The Archaeology of an Agricultural System*. Honolulu: University of Hawai'i. Ph.D. Dissertation.
- Stuiver, M. and H. Polach (1977). Discussion: Reporting of ¹⁴C data. *Radiocarbon* 19, 355–363.
- Summers, C. C. (1971). *Molokai: A Site Survey*. Pacific Anthropological Records Number 14. Honolulu: Anthropology Department, B. P. Bishop Museum.
- Thien, S. (1979). A flow diagram for teaching texture-by-feel analysis. *Journal of Agronomic Education* 8, 54–55.