

**FINAL—Archaeological Assessment of TMK: (1) 7-1-001:002 (por.) and :005 (por.), Wahiawā Ahupua‘a, Wahiawā District, and TMK: (1) 6-5-002:010 (por.), Kamananui Ahupua‘a, Waialua District, Island of O‘ahu, Hawai‘i**



**Prepared For:**  
Environmental Planning Solutions, LLC  
945 Makaiwa Street  
Honolulu, Hawai‘i, 96816

May 2015

Keala Pono 



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May 2015





## MANAGEMENT SUMMARY

An archaeological inventory survey was conducted for TMK: (1) 7-1-001:002 (por.) and :005 (por.) in Wahiawā Ahupua‘a, Wahiawā District, and TMK: (1) 6-5-002:010 (por.), Kamananui Ahupua‘a, Waialua District, on the island of O‘ahu, Hawai‘i. This was done in preparation for ground disturbance associated with construction of four reservoirs. The archaeological inventory survey consisted of pedestrian survey that covered 100% of the four reservoir project areas, as well as subsurface testing on all four project areas, in the form of eight trench excavations.

No pre- or post-contact surface architecture was found during pedestrian survey of the project areas. All areas were found to be disturbed by previous pineapple cultivation. Likewise, subsurface testing did not yield any evidence of subsurface cultural material or deposits. Evidence of more recent disturbance was noted at Reservoir 3, as the entire area had been bulldozed. A collection of secondarily-deposited glass and ceramic was recovered from the surface and in backdirt piles from Reservoir 3. Given that this material was not found *in situ* and its primary context has been lost, the artifacts were not assigned a site number. A total of 85 ceramic and glass items were collected. They are thought to be trash from pineapple or sugarcane laborers in the early 20<sup>th</sup> century.



## CONTENTS

MANAGEMENT SUMMARY .....	i
FIGURES .....	iv
TABLES .....	iv
INTRODUCTION .....	1
Project Location and Environment .....	1
The Project .....	3
BACKGROUND .....	6
Pre-Contact Wahiawā .....	6
Place Names and Boundaries .....	6
Traditional Land Use .....	7
<i>Mo'olelo</i> and <i>'Ōlelo No'eau</i> .....	8
Historic Wahiawā .....	9
Early Historic Land Use .....	9
Agricultural Interests .....	10
The U.S. Military .....	11
Historic Maps .....	11
Māhele Land Tenure .....	12
Archaeological and Historic Sites .....	19
Previous Archaeological Studies .....	20
Summary and Settlement Patterns .....	24
Anticipated Finds and Research Questions .....	25
METHODS .....	27
RESULTS .....	29
Community Consultation .....	29
Pedestrian Survey .....	29
Subsurface Testing .....	29
Laboratory Analysis .....	37
Bottle Glass .....	37
Ceramics .....	45
Laboratory Analysis Discussion .....	52
Summary of Findings .....	52
CONCLUSION AND RECOMMENDATIONS .....	53
GLOSSARY .....	54
REFERENCES .....	56

## FIGURES

Figure 1. Project area on a 7.5 minute USGS Haleiwa quadrangle map with TMK overlay. ....	2
Figure 2. Soils in the vicinity of the project area. ....	5
Figure 3. Land grant map of Wahiawā (Rowell 1885). ....	13
Figure 4. Government land of Wahiawā (Monsarrat 1899). ....	14
Figure 5. Waialua agricultural land (Wall 1901). ....	15
Figure 6. Portion of a Central O‘ahu map (Wall 1904). ....	16
Figure 7. Portion of an ‘Ewa Forest Reserve map (Marks 1946). ....	17
Figure 8. Territory Survey map of Wahiawā (Awana 1950). ....	18
Figure 9. Location of previous studies in the vicinity of the project area. ....	22
Figure 10. Reservoir 4, facing south, showing vegetation conditions. ....	28
Figure 11. Excavation of TR 4 at Reservoir 2, facing south. ....	28
Figure 12. Reservoir 3, showing the extent of recent disturbance. Orientation is to the northeast. ....	30
Figure 13. Location of Trenches 1–8 on a USGS Schofield Barracks quadrangle. ....	31
Figure 14. TR 1 south face profile drawing (left) and photo (right). ....	33
Figure 15. TR 2 northwest face profile drawing (left) and photo (right). ....	33
Figure 16. TR 3 northwest face profile drawing (left) and photo (right). ....	34
Figure 17. TR 4 southwest face profile drawing (left) and photo (right). ....	34
Figure 18. TR 5 west face profile drawing (left) and photo (right). ....	35
Figure 19. TR 6 north face profile drawing (left) and photo (right). ....	35
Figure 20. TR 7 east face profile drawing (left) and photo (right). ....	36
Figure 21. TR 8 north face profile drawing (left) and photo (right). ....	36
Figure 22. Acc. # 15 (top) and 16 (bottom), found in secondary context. ....	43
Figure 23. Bottles from secondary context. Left to right: Acc. # 17, 19, 18. ....	44
Figure 24. Bottles from secondary context. Left to right: Acc. # 20, 21, 22. ....	45
Figure 25. Ceramics found in secondary context. Left to right: Acc. # 1, 2, 3. ....	50
Figure 26. Ceramics from secondary context. Acc. # 4 (left) and 5 (right). ....	50
Figure 27. Ceramic plate fragment, Acc. # 8, from secondary context. ....	51
Figure 28. Ceramics from secondary context. ....	51

## TABLES

Table 1. Previous Archaeology in Wahiawā. ....	23
Table 2. Sediment Descriptions. ....	32
Table 3. Data for Glass Artifacts. ....	38
Table 4. Data for Ceramic Artifacts. ....	46

## INTRODUCTION

At the request of Environmental Planning Solutions, Keala Pono Archaeological Consulting conducted an archaeological inventory survey (AIS) of TMK: (1) 7-1-001:002 (por.) and :005 (por.) in Wahiawā Ahupua‘a, Wahiawā District, and TMK: (1) 6-5-002:010 (por.), Kamananui Ahupua‘a, Waialua District, on the island of O‘ahu, Hawai‘i. Four reservoirs are proposed for the properties. The archaeological survey was designed to identify any historic properties that may be located in the four reservoir project areas in anticipation of the proposed construction. Due to negative findings the AIS results are reported here as an archaeological assessment.

This report is drafted to meet the requirements and standards of state historic preservation law, as set out in Chapter 6e of the Hawai‘i Revised Statutes and SHPD’s draft *Rules Governing Standards for Archaeological Inventory Surveys and Reports*, §13–276. The report begins with a description of the project areas and a historical overview of land use and archaeology in the region. The next section delineates methods used in the fieldwork, followed by the results of the archaeological survey. Project results are summarized and recommendations are made in the final section. Hawaiian words, flora and fauna, and technical terms are defined in a glossary at the end of the document.

### Project Location and Environment

The project area is located in Wahiawā Ahupua‘a, Wahiawā District, and Kamananui Ahupua‘a, Waialua District, in Central O‘ahu (Figure 1). The district of Wahiawā is a relatively modern construct, created in 1913 (Kamehameha Schools 1987). Before this change, the entire project site was within Kamananui Ahupua‘a in the district of Waialua.

Wahiawā is located on the Schofield Plateau in Central O‘ahu, sandwiched between the Wai‘anae and Ko‘olau Mountain Ranges. Wahiawā District is the only *moku* that does not stretch from the mountains to the sea, but is landlocked by Waialua to the north, Ko‘olauloa to the east, ‘Ewa to the south, and Wai‘anae to the west. MacDonald et al. explain the geology of this region:

Lava flows from the Koolau volcano banked against the already-eroded slope of the Waianae volcano to form the gently sloping surface of the Schofield Plateau. An erosional unconformity between the rocks of the two volcanoes is visible along Kaukonahua Gulch, at the eastern foot of the Waianae Range, where Waianae lavas slope 10° to 15° northeastward and are overlapped by Koolau lavas dipping 5° northwestward. (1983:420)

The four reservoirs are located on three TMK parcels, all of which are owned by the State of Hawai‘i (see The Project section, below). The total acreage surveyed, including all four reservoir project areas is 30.83 acres (12.48 ha). The three TMK parcels and four reservoir survey areas are described below.

TMK: (1) 6-5-002:010 is a 310 acre (125 ha) parcel bounded by Kaukonahua Road to the south, Poamoho Gulch to the north, and farmlands to the east and west. This eastern boundary is also the border between the Waialua and Wahiawā Districts. The Reservoir 1 project area is located near the southwest corner of this parcel. This project area encompasses 3.31 acres (1.34 ha) of the property (see Figure 1).

TMK: (1) 7-1-001:002 is a 302 acre (122 ha) parcel bounded by Kaukonahua Road on the north, Kamananui Road on the east, Wilikina Drive on the south, and farmland to the west. This western boundary is also the border between the Waialua and Wahiawā Districts. The Reservoir 2 project area is situated on the northeast side of this parcel. This project area consists of 10.13 acres (4.10 ha) of the property (see Figure 1).

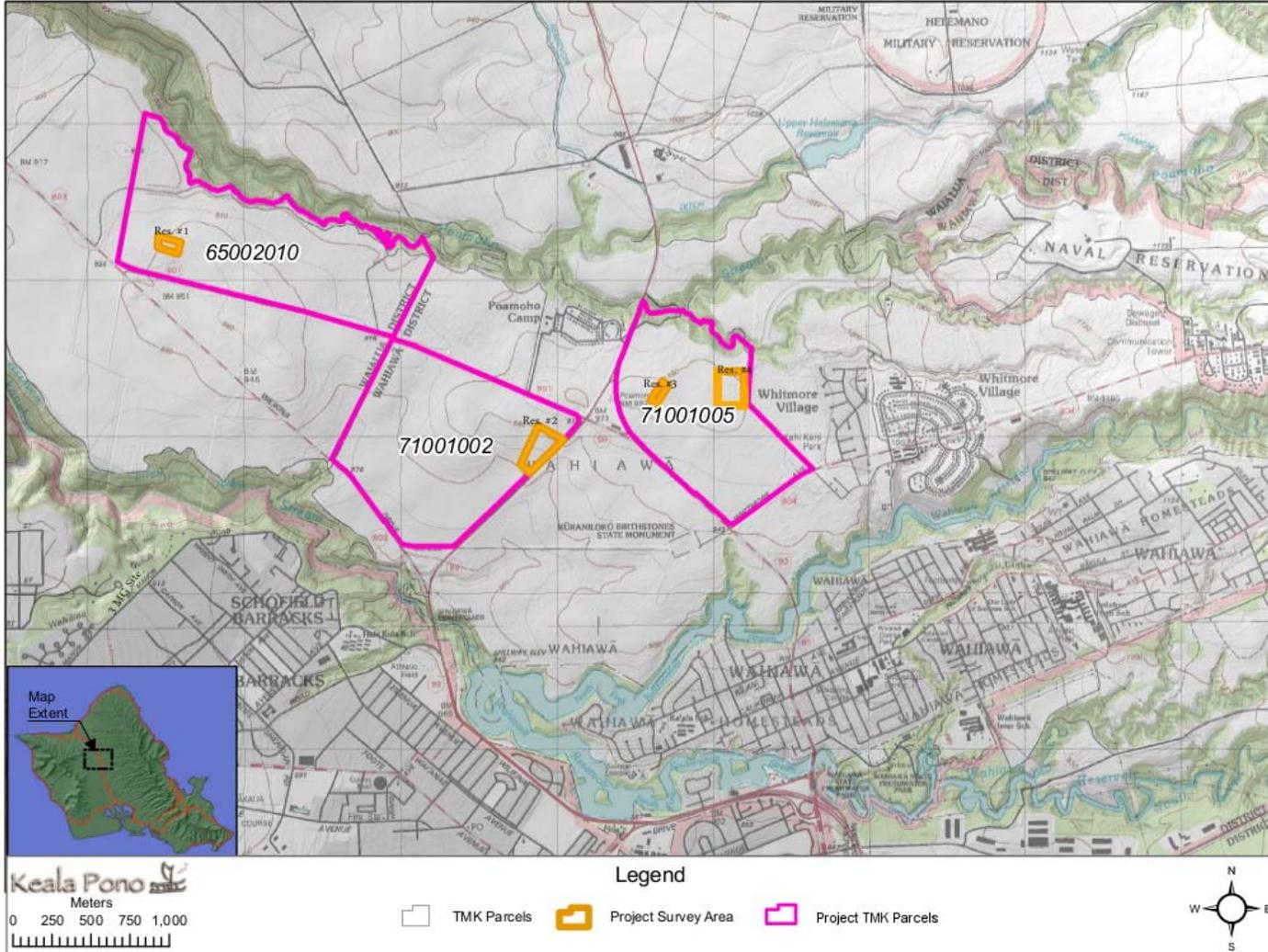


Figure 1. Project area on a 7.5 minute USGS Schofield Barracks quadrangle map with TMK overlay.

TMK: (1) 7-1-001:005 is a 236 acre (96 ha) property adjacent to undeveloped land on the north, Saipan Drive on the east, Whitmore Avenue on the southeast, and Kamehameha Highway on the southwest and west. The Reservoir 3 and 4 project areas are located within this parcel. The Reservoir 3 project area encompasses 2.71 acres (1.10 ha), while the Reservoir 4 project area consists of 14.68 acres (5.94 ha) of the property (see Figure 1).

The parcels lie between 860 and 980 feet (262–299 m) in elevation and are roughly 7 miles (11 km) from the nearest coastline, at Kaiaka Bay in Hale‘iwa. The properties are relatively flat and are currently undeveloped, with traces of former pineapple cultivation evident throughout. Vegetation within the project areas consists mainly of California grass, which was mostly cleared before the survey.

Rainfall is moderate in the Central O‘ahu project area, averaging approximately 40–80 in. (102–203 cm) per year (Juvik and Juvik 1998). The two main watercourses of Wahiawā, Poamoho Stream and Kaukonahua Stream, run north and south of the project area, respectively.

Soils are of the Helemano-Wahiawa association, described as “Deep, nearly level to moderately sloping, well-drained soils that have a fine-textured subsoil; on uplands” (Foote et al. 1972). Specifically, soils in the project area consist of Wahiawa silty clay, 0–3% slopes (WaA) and Wahiawa silty clay, 3–8 % slopes (WaB) (Figure 2).

## **The Project**

The State of Hawai‘i Agribusiness Development Corporation (ADC) is proposing farm land preparation for construction of four reservoirs on fallow pineapple fields often referred to as the former Galbraith Estate Lands. In 2012 the State of Hawai‘i acquired approximately 1,700 acres (688 ha) of land near the town of Wahiawā in Central O‘ahu that were owned by the Estate of George Galbraith (“Galbraith Estate Lands”). As part of the acquisition, approximately 1,207 acres (489 ha) were transferred to ADC and 495 acres (200 ha) to the Office of Hawaiian Affairs. In total the acquisition of Galbraith Estate Lands comprised 12 separate land parcels.

Improvements for this project are proposed on three parcels owned by the State of Hawai‘i and controlled by ADC. Land owned by the Office of Hawaiian Affairs is not part of the proposed action. ADC is also responsible for leasing land under their control to farmers and agricultural ventures. Thus far, ADC has executed licenses with Kalena Farms for 230 acres on TMK: (1) 6-5-002:010 and with Ohana Best Farm for 160 acres of TMK: (1) 7-1-001: 005.

The proposed action is the construction of four water storage reservoirs. ADC proposes to construct two reservoirs and private parties will construct two reservoirs. An environmental assessment is being prepared for the four reservoirs because they are similar actions, serve similar purposes, are located in the same general area, and are on state land.

ADC will construct a 3.0 MG and 10.0 MG reservoir. The private parties each will construct 3.0 MG reservoirs. The reservoirs will be constructed on land under ADC jurisdiction. As shown on Figure 1, the reservoir sites are dispersed over the project area to serve existing and future agricultural users.

Reservoir 1 is a 3.0 MG reservoir to be constructed by Kalena Farms for its use. Reservoir 2 is 3.0 MG reservoir that will be funded and constructed by ADC. Reservoir No. 3 is a 3.0 MG reservoir that will be funded and constructed by Ohana Best Farms. Reservoir No. 4, a 10.0 MG reservoir, will be funded and constructed by ADC.

All reservoirs will be constructed below existing grade. The respective reservoir sites will be graded and excavated to below grade design elevations that can contain the desired storage volume. Typical design criteria for the reservoirs are listed below but may vary by individual reservoir.

- Impounding berm to be engineered at 2:1 slope (Horizontal:Vertical)
- Base and inner slopes to be lined with woven HDPE Polypropylene fabric pond liner
- Erect security and safety fencing
- Provide driveway of adequate width for service and maintenance vehicles

Preliminary design plans for the two private reservoirs show the reservoir basin enclosed by approximately 7-foot (2.1-m) high earth berms for impounding water. Above grade earth berms are not proposed for the ADC reservoirs.

Two wells, located outside the project area, will supply water for the reservoirs. A state-owned well on TMK: (1) 6-5-002:026, located across Kaukonahua Road from Reservoir 1, already is developed and in use. The well, which is identified as Well No. 3-3103-0001 on Commission on Water Resource Management maps, has a pumping capacity of 2,000 gallons per minute. There is no storage reservoir associated with this well.

A second source well is proposed in the vicinity of Reservoir 4. The well will be developed by ADC sometime in the future. Drilling, testing, engineering design, and construction of this well is subject to capital improvements funding from the State of Hawai‘i.

Well construction and water use permits will be sought from the Commission on Water Resources Management, Department of Land and Natural Resources for construction of a new well and water use.

This AIS was conducted of the reservoir sites only and did not include the proposed water distribution system lines or proposed well, because the distribution system will be legislatively funded and commissioned to be designed at a later date. The need for archaeological work at the location of the proposed well and distribution lines will be determined when funding for the well is secured.

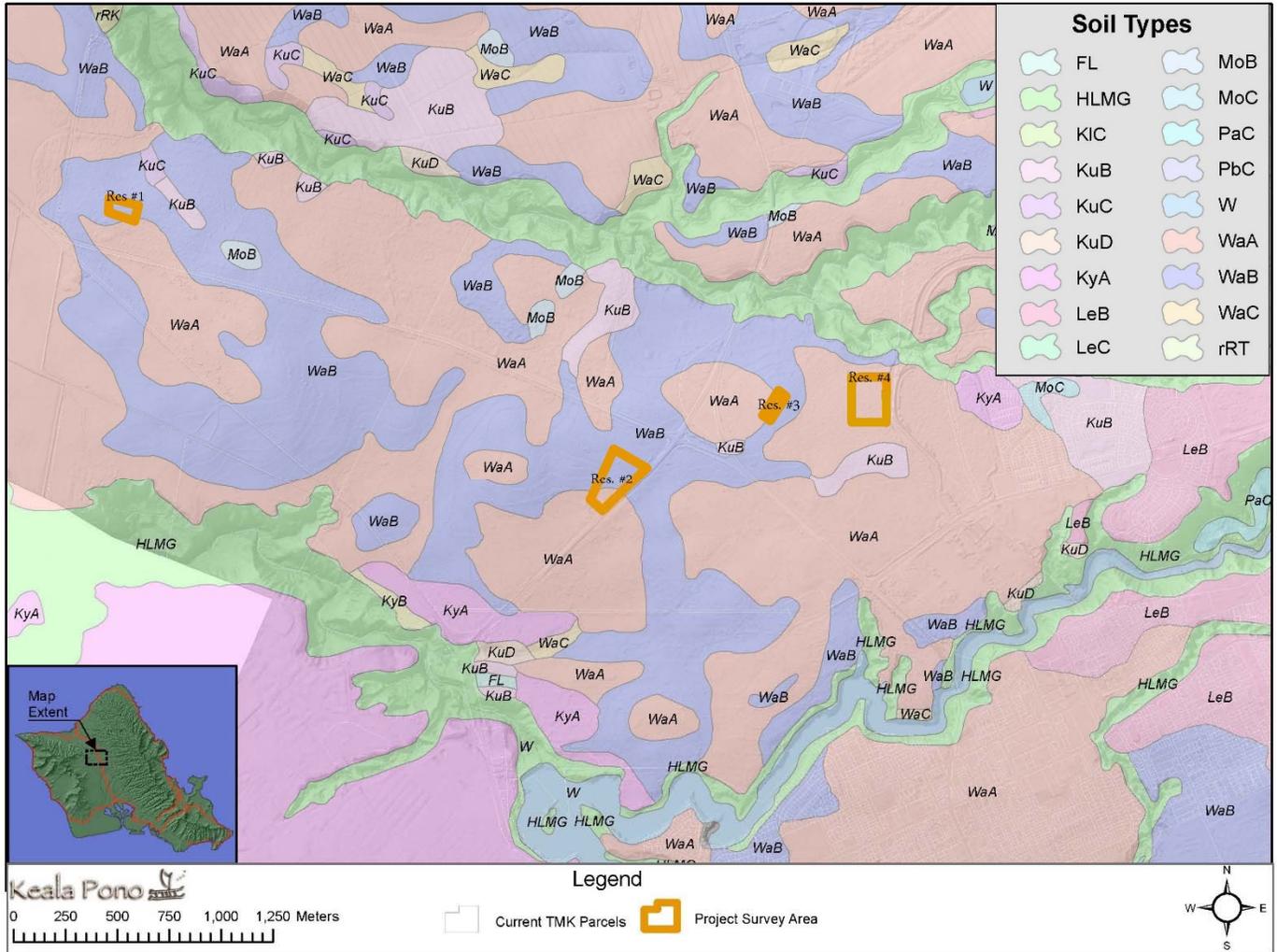


Figure 2. Soils in the vicinity of the project area.

## BACKGROUND

This section of the report presents background information as a means to provide a context through which one can examine the cultural and historical significance of the project lands. In the attempt to record and preserve both the tangible (i.e., traditional and historic archaeological sites) and intangible (i.e., *mo'olelo*, *'ōlelo no'eau*) culture, this research assists in the discussion of anticipated finds. Research was conducted at the Hawai'i State Library, the University of Hawai'i at Mānoa libraries, the SHPD library, and online on the Papakilo database, Ulukau database, and the State of Hawai'i Department of Accounting and General Services (DAGS) website. Historical maps, archaeological reports, and historical reference books were among the materials examined.

### Pre-Contact Wahiawā

In pre-contact times, before the arrival of Westerners in 1778, the Wahiawā region constituted the sacred center of O'ahu known as Līhu'e. Numerous *heiau* and the Kūkaniloko *ali'i* birthing stones were located here. There were agricultural areas as well, with *kalo* and *'uala* grown in the *lo'i* and *kula* lands, respectively.

### Place Names and Boundaries

Before the establishment of Wahiawā District in 1913, the project area was located in the traditional *moku* of Waialua. Several conflicting accounts inform on the naming of Waialua District. Thrum (in Sterling and Summers 1978:88) states that “Waialua” translates to “two waters,” thus many believe that the name derived from Waialua's two streams. However, he believes that the district was named after a taro patch, and a common saying was that if you traveled to Waialua and did not see this taro patch, then you did not really see Waialua. Pukui (in Sterling and Summers 1978:88) asserts that the district was named for the cruel chief Waia, grandson of Wakea. Waia carried out his evil deeds at Waialua, and there was so much suffering there that the district was named Waialua, or “doubly disgraceful.” Another source attributes the name to Waialua Pool at Kemo'o (Awai in Sterling and Summers 1978:88).

The Wahiawā District boundary has a complicated history (Sterling and Summers 1978:134). At the turn of the 20<sup>th</sup> century, Wahiawā Ahupua'a fell within the Waialua District. By 1913, the community had grown apart from Waialua District, and the new district of Wahiawā was established. Thus, in 1913, the *ahupua'a* of Wahiawā and Wai'anae Uka were moved from Waialua District to the new district of Wahiawā. In 1925 the size of Waialua District was reduced as large plots of land were transferred to Wahiawā. However, in 1932 the original 1913 land boundaries were reinstated, with some small parcels added to the Schofield Barracks Military Reservation. Today the western parcel of the project area (TMK: [1] 6-5-002:010) lies within the *ahupua'a* of Kamananui, while the eastern parcels (TMK: [1] 7-1-001:002 and :005) are in Wahiawā.

Kamananui translates to “the large branch,” and a grove of trees in the *ahupua'a* was named Pōloa, or “the long night” (Pukui et al. 1974:80). Wahiawā on O'ahu should not be confused with Wahiawa on Kaua'i, a stream and *heiau* located in Kōloa. Wahiawā can be translated as “place of noise,” as rough seas were said to be heard there (Pukui et al. 1974:218). In ancient times, Hi'iaka, sister of Pele, heard the bellowing seas and composed a chant about Wahiawā and Waialua and the sound of the sea (Emerson in Handy and Handy 1991:465).

Līhu'e translates to “cold chill” (Pukui et al. 1974:132). The place name Līhu'e may pre-date the formation of *ahupua'a* on O'ahu and “seems to exist independently of the *ahupua'a* in which it falls” (Desilets et al. 2009:43). Desilets et al. help to define the boundaries of the Līhu'e region:

Judging from traditional usage, Līhu‘e appears to be an ancient place-name that refers, minimally, to the entire region west of Wahiawā and east of the Wai‘anae range. As a traditional place, its boundaries are necessarily imprecise, but it is clear that the region encompasses most of western Wai‘anae Uka and all of Schofield Barracks. Līhu‘e also appears to be used more generally to refer to the entire Central Plateau, encompassing such sacred sites as Kūkaniloko. Although it is difficult to determine with any certainty, it seems probable that Līhu‘e had broader boundaries prior to the institutionalization of the *moku* and *ahupua‘a* land divisions we know today. Līhu‘e is most often referred to as the “uplands,” although that could well mean the whole Central Plateau, which relative to coastal areas is upland. (2009:39)

### Traditional Land Use

Traditionally, Kamananui was one of the three *ahupua‘a* (along with Pa‘ala‘a and Kawailoa) in the fertile heartland of Waialua Moku. The *makai* areas of Waialua once contained many *lo‘i*, while the *mauka* slopes were covered with *kula* of red soil, an environment very good for growing sweet potato (Handy and Handy 1991:466; Kirch and Sahlins 1992:1:20). Sterling and Summers (1978:103) note that “there were large terrace areas along the flatlands between the junction of Helemano and Poamoho Streams and the flatland west of Poamoho,” as well as small terraces in the lower flats of Poamoho and Kaukonahua Valleys. It is probable that sweet potato and bananas were grown around house sites along the ridges of the gulches. The upland areas of Kamananui/Wahiawā were one of the few places on the island where sweet potato agriculture was irrigated, with water brought in from Helemano Stream and Wahiawā Stream, both of which had many terraces along the stream banks (Handy and Handy 1991:464–5).

The population was most densely settled in the lower floodplains of the *ahupua‘a*, irrigated in large part by a two mile-long waterway that at the time was the longest on the island. The *lo‘i* and fishponds of the lower areas, as well as the rainfall agriculture of the *kula* supported a pre-contact community estimated at 6,000 to 8,000, which was probably the majority of the population in Waialua. In this pre-contact period (pre-Western arrival in 1778), “Kamananui was the ritual and political center of Waialua,” although the seat of power moved to the neighboring *ahupua‘a* of Kawailoa by the early 1800s (Kirch and Sahlins 1992:1:20).

Līhu‘e was home to the highest class of chiefs, the *lō ali‘i*. The *lō ali‘i* lived in the uplands of O‘ahu, including Wahiawā, and were under strict *kapu* because of their sacredness:

The chiefs of Līhu‘e, Wahiawā, and Halemano on O‘ahu were called *lō ali‘i*. Because the chiefs at these places lived there continually and guarded their *kapu*, they were called *lō ali‘i* [from whom a “guaranteed” chief might be obtained, *loa‘a*]. They were like gods, unseen, resembling men. (Kamakau 1991:40)

The chiefs of Lihue, Wahiawa, and Halemano on Oahu were called Lo chiefs, Po‘e Lo Ali‘i [“people from whom to obtain a chief”], because they preserved their chiefly *kapus*. The men had *kapus*, and the women had *kapus*, and when they joined their *kapus* and children were born, the children preserved their *kapus*. They lived in the mountains (*i kuahiwi*); and if the kingdom was without a chief, there in the mountains could be found a high chief (*ali‘i nui*) for the kingdom. Or if a chief was without a wife, there one could be found—one from chiefly ancestors. Kauakahi‘ailani, Ma‘ilikukahi, Kalona, Piliwale, Kukaniloko, Pa‘akakanilea [Pa‘akanilea], Ka‘akauualani, Ka‘au, Lale, Paoakalani, Pakapakaua, Nononui, Kokoloea, and a great many others were *Lo* chiefs. (Kamakau 1964:5)

Kamananui was very much the ceremonial center of the island. The *ahupua‘a* contains numerous *heiau*, including two presided over by Kū, which were also *heiau luakini* associated with human

sacrifice (Kirch and Sahlins 1992:1:21). In Wahiawā is also located one of the most sacred sites on the island, Kūkaniloko (“the sound or resonance rises from within”), birthing stones situated near where Kamehameha Highway intersects with Whitmore Road (Yent 1999:15; Yent 1995) (also see Archaeological and Historic Sites section).

The establishment of Kūkaniloko as a sacred birthplace goes back to the time of the earliest chiefs of O‘ahu. Nanakāoko was the chief, Kahihiokalani was the chiefess, and they made Kūkaniloko as a birthplace for their son, Kapawa. Kapawa’s birth and the birth of later chiefs at Kūkaniloko was accompanied by prescribed ceremony. The historian Samuel Kamakau describes the first royal birth there:

Kūkaniloko was made by Nanakāoko and his wife Ka-hihi-o-ka-lani as a place for the birth of their child Kapawa... When the child was born, it was immediately taken into the *waihau heiau* Ho‘olono-pahu. There forty-eight chiefs ministered to the child and cut the navel cord. Ho‘olono-pahu was a furlong and a half south of Kūkaniloko. Two furlongs to the east of Kūkaniloko was where the sacred drum Hāwea was beaten; it indicated the birth of a chief. On the east of the stream on that side of Kua‘ikua were the *maka ‘āinana* --- a great many of them --- and to the south, three furlongs distant, were the *kauwā*. (Kamakau 1991:38)

Kamakau points out that long after Kapawa, the sacredness of Kūkaniloko continued and that all of the “chiefs born at Kūkaniloko were the *akua* of the land and were *ali‘i kapu* as well” (Kamakau 1991:53).

The historian John Papa Ii adds that besides being a sacred birthplace, Kūkaniloko was also a designated place of refuge:

The Hale o Keawe was called Kaikaialealea and was a *pu‘uhonua*, or place of refuge. Similarly, Kukaniloko in Wahiawa, Oahu; and Holoholoku in Wailua, Kauai, were places to which one who had killed could run swiftly and be saved. (Ii 1959:138)

As a place of refuge, Kūkaniloko fits in the story of the newborn twin chiefesses Laielohelohe and Laiekawai. Their mother Malaekahana feared that her newborns would be harmed, so she sent one of them to the safe haven of Kūkaniloko to be raised by Kapukaihaoa (Beckwith 1970).

Even after the arrival of Westerners, Kūkaniloko remained to be a place of great significance among the Hawaiian population. Ii reminds us that this important place was situated along one of the major trails that traversed O‘ahu Island:

From the stream of Anahulu and from Kamani, above the houses and taro patches, a trail stretched along in front of Kuokoa’s house lot and the church. This trail went on to meet the creeks of Opaepala and Halemano, the sources of the stream of Paalaa, on down to the stream of Poo a Moho, and on to the junction where the Mokuleia trail branched off to Kamananui and Keawawahie, to Kukaniloko, the birthplace of chiefs. (Ii 1959:98)

### ***Mo‘olelo and ‘Ōlelo No‘eau***

The Līhu‘e chiefs are memorialized in *mo‘olelo*, with the story of Lō Kaholi-a-Lale (Kamakau 1991:50–51). Lō Kaholi-a-Lale was born and raised in the Līhu‘e uplands, where he learned the arts of war, including throwing of the spear, for which the Līhu‘e chiefs were particularly renowned. However, the *mō‘ī* of ‘Ewa, named Piliwale, was also highly skilled at spear throwing and offered his daughter’s hand in marriage to any man who could throw as well as his own instructor, ‘Awa. It was said that ‘Awa “could grasp ten spears in his right hand and ten in his left...he could throw ten spears from the shoulder, two backwards, and two directly to the navel” (Kamakau 1991:50–51). Lō

Kaholi-a-Lale studied the moves of ‘Awa as other suitors unsuccessfully battled him. He challenged ‘Awa at Hālaulani, and his feats are memorialized as place names of ‘Ewa and Waipi‘o. These include Kūpahu, which means “to hurl,” and Hanapouli, or “make dark” (Kamakau 1991: 50–51). Lō Kaholi-a-Lale’s success earned him the hand of Piliwale’s daughter, Kohe-palaoa, and the significance of this is as follows:

That was the beginning of the combining of the *lō* and the *wohi*, the ranks of Kaholi-a-Lale. As for Kohe-palaoa, her rank was that of a Kumuhonua chief of Kūkaniloko; she was a *nī‘aupi‘o*. They had a son named Kānehōalani who became the chief of Ko‘olau. (Kamakau 1991:51)

Pukui (1983:291) notes a saying: “*Pili pono ka lā i Kamananui*,” meaning “the sun is very close to Kamananui.” Although the *‘ōlelo no‘eau* is supposed to refer to a person in power who becomes very angry and scorches people like the hot sun, the indication that the sun is very close to Kamananui in particular very likely references both Kamananui’s association with the *lō ali‘i*, as well as the solar calendar function of Kamananui’s most sacred site, Kūkaniloko. The *‘ōlelo no‘eau* for the sun’s relationship to Kamananui is in stark contrast to that of nearby Wai‘anae in the saying, “*Kapakahi ka lā ma Wai‘ane*,” meaning “lopsided is the sun at Wai‘anae” (Pukui 1983:164).

In addition to power, Kamananui is also associated with violence in a number of *mo‘olelo*. Within Kamananui, Keawawaihi (*mauka* of Hale‘iwa) was known as “The Valley of the Spears,” named for the brigands of robbers who went rogue after being trained for war using spears or a shark’s tooth tied to the hand with *olonā* fiber, and by using the warrior art of *lua*, “the art of dislocating the joints and rendering an opponent helpless” (Sterling and Summers 1978:107). Pohakukae in Keawawaihi Gulch is the location of another tale of bloodshed. The large rock on the north ridge of the gulch was named after an event in which a man named Kalaimoku stood on the rock and called out to the people below: “*E na kanaka o Keawawaihi ea ka ai he kukae*,” or “Men of Keawawaihi here is the food, excrement” (Sterling and Summers 1978:107). The people became enraged and tore Kalaimoku and his attendants to pieces.

A few miles southeast of Kūkaniloko, near the south fork of Kaukonahua Stream, was a place later called O‘ahunui (named after the last resident chief), the former residence of the ruling *ali‘i* of O‘ahu. A *mo‘olelo* associated with the site indicates that O‘ahunui practiced cannibalism, and his most horrific act involved eating his two plump nephews (his older sister’s sons), for which he and his sister were decapitated in retribution by the boys’ father. Their bodies turned to stone, and O‘ahunui is said to resemble the shape of O‘ahu. The site was considered desecrated by the act, and the residence of the ruling chief was moved from Kamananui to Waikīkī (Kawaharada 1999:52–53; Sterling and Summers 1978:137).

### **Historic Waihiawā**

In historic times (post-1778), the Waihiawā region has been used for harvesting sandalwood, sugarcane and pineapple cultivation, and for military interests.

#### **Early Historic Land Use**

When Kamehameha I conquered O‘ahu in 1795, Waialua was given to his ally, Chief Ke‘eaumoku, and for the next 70 years, the land was controlled by his descendants, primarily his daughter, Queen Ka‘ahumanu. In the early 19<sup>th</sup> century, Waialua was a source of food, sandalwood for trade, and building lumber for the royalty (Office of State Planning 1995:1).

The sandalwood trade in Hawai‘i began in 1791, with most of the wood shipped to China, where it was valued for its fine grain and pleasant scent. The peak trade years were 1810–1840, and this was

also a period in which there was an increased desire for Western goods, which led to debts held by Hawaiian monarchs who paid these by urging or even forcing the *maka'āinana* to cut down large numbers of trees in the upper regions (Harrington 2013:33). This effort to collect sandalwood for trade placed great strain on the people of Waialua because the trees were located up in the mountains, “far from the people’s homes and gardens,” the collection of which necessitated “sustained operations of days, weeks, or sometimes months on end” (Kirch and Sahlins 1992:1:83). While away, they were then not tending to the gardens and animals needed for their own sustenance.

As the sandalwood trade died down, whaling would become an important element in the economic, political, and social structure in Waialua. The height of the whaling period was approximately 1830–1860, which was also an era in which Waialua lost roughly half of its people to disease and emigration. At the same time, the ruling *ali'i*, *konohiki*, and other officials taxed the commoners more heavily in order to pay for the Western goods and customs they had come to covet. Most income to the *ali'i* came from sales of supplies to the whaling ships, with supplies of food (e.g. cattle, taro, sweet potato), salt, and other materials generated by the *maka'āinana*. The commoners of Waialua were additionally burdened by collateral issues tied to supplying the ships. Many who worked the farms and homesteads in the area had to build walls (most were built in the late 1840s and early 1850s) around their lots not to keep personal livestock in but to keep out the cattle of supply companies that allowed their herds to wander freely (Kirch and Sahlins 1992:1:99–165).

### **Agricultural Interests**

In the mid-1860s, Castle & Cooke, established by Samuel Castle and Amos Starr Cooke, backed the first commercial sugar cultivation in Waialua, started by two sons of Levi Chamberlain. Early businesses managed by them and others were unsuccessful, and in 1874 the operation was sold to a partnership including Robert Halstead. Halstead was able to generate a profit, and prospects improved with the development of a railroad line. Castle & Cooke and Halstead together formed Waialua Agriculture Company in 1898. Development continued and soon the company embarked on a mammoth irrigation project to dam Kaukonahua Stream and create the Wahiawā Reservoir.

The Wahiawā Reservoir has been called the “key to Waialua’s irrigation” (Wilcox 1996:109). Completed in January of 1906, it was the largest reservoir in the islands, with a capacity of 2.5 billion gallons (Wilcox 1996:109). At 136 feet (41.5 m) tall, the earthen dam is the highest in Hawai‘i. The 461 foot (140.5 m)-long dam with a 580 foot (176.8)-thick base created a massive reservoir, occupying a 7 mile (11 km) length of Kaukonahua Gulch (Wilcox 1996:109). This reservoir, later dubbed Lake Wilson, delivered 90% of the surface water for the Waialua Sugar Company’s fields. In the book *Sugar Water*, Wilcox describes the ditch system associated with the reservoir:

The source was 8000 acres of watershed at the head of the Koolau Mountains. Lake Wilson was fed by a ditch system known first as the Oahu Ditch and later as the Mauka Ditch Tunnel. It consisted of 4 miles of main ditch and 8 miles of laterals, which included thirty-eight tunnels. It was started in June 1900 and completed in March 1902 at a cost of \$80,000. The capacity of this ditch system was 90.5 mgd. Besides developing water in the Kaukonahua watershed, it also diverted from the Poamoho watershed.

Another 4 miles of ditch, tunnel, and siphons delivered the water from Lake Wilson (as well as from Helemano and Opaepala ditches) to Waialua’s upper fields at 730 feet elevation. This Wahiawā Ditch had a capacity of 50 mgd. The total cost was \$49,177.59, making it one of the least costly projects of its size, averaging out to \$1.5 a lineal foot. Of the ditch’s 20,740 feet, only 1600 feet was in open ditch. The remaining length comprised twenty tunnels, the longest of which was 1742 feet. It had the largest and tallest flume on Oahu: 130 feet high. In 1923, most of the flumes spanning the gulches were replaced by siphons. (1996:109–110)

Sugarcane production became less dominant with some of the land use in Waialua shifting to pineapple and military interests in later years. James Drummond Dole founded the first pineapple plantation in Wahiawā in 1900 (Hawkins 2011). He organized the Hawaiian Pineapple Company in 1901 and packed the first batch of pineapples in 1903 (Napoka 1976). In 1922, Dole leased 12,000 acres (4,856 ha) from the Waialua Agriculture Company for pineapple production (Office of State Planning 1995).

Both sugarcane and pineapple production in the Wahiawā/Kamananui area were enabled by the train service established from Pearl City to Wahiawā, and later up through Hale‘iwa. O‘ahu was the last island to “come aboard” the new mode of transportation following King Kalākaua’s 1878 Act to Promote the Construction of Railways, after railroad service began on Maui in 1879 and on the Big Island in 1880 (Chiddix and Simpson 2004:14). The Oahu Railway and Land Company (OR&L), founded, owned, and ran by Benjamin Franklin Dillingham, began operations in 1889 (Chiddix and Simpson 2004:19).

Established portion by portion, the OR&L line originally spanned from Honolulu to Kahuku, with a branch line running from Waipahu out to Wahiawā that was constructed in 1905 to accommodate the pineapple plantation established there by Dole. Soon after construction, this line was unofficially extended to Hale‘iwa—a “hush-hush track” due to the establishment of Schofield Barracks and the wartime need for back-up transportation (Kneiss 1957:13–14).

Poamoho Camp, to the north of the project area, was constructed in 1912 for workers of the Hawaiian Preserving Company, Ltd. pineapple cannery in Wahiawā. The camp consisted of 20 houses situated around a men’s boarding structure. It remains as a residential neighborhood today, with approximately 300 residents (Boylan 2004), although the houses have been remodeled.

### **The U.S. Military**

Adjacent to Wahiawā, in Wai‘anae ‘Uka, the land underwent increased military use with the establishment of Schofield Barracks. The U.S. military first occupied Schofield Barracks, originally called Castner Village, in 1909. Most major planned building projects were completed by the early 1920s. Soon after World War II began, the facilities were expanded to accommodate the Ranger Combat School created to train soldiers for “jungle” activities. The current Schofield Barracks Military Reservation’s three main training areas included the Impact Zone, the South Range, and the East Range (Sullivan and Dega 2003:21).

The Helemano Military Reservation, north of Wahiawā in Pa‘ala‘a Ahupua‘a, was established in 1943. The reservation served as a communications station for the U.S. Army, and in 1944, a signal center was constructed. The reservation became a permanent sub-installation of Schofield Barracks in 1956 (Towill Corp. 1981).

### **Historic Maps**

Historic maps help to paint a picture of Wahiawā in years past and illustrate the many changes that have taken place in the region. The earliest maps found for this area are from the late 1800s. The first shows two land grants in 1885 (Figure 3). The north and south branches of Kaukonahua Stream are illustrated, and Kokoloea is labeled along the southern boundary of the *ahupua‘a*. The second map dates to 1899 and shows the entire *ahupua‘a* (Figure 4). Several ridges and gulches are illustrated, although the only one labeled is Poamoho Gulch. Land grants are also outlined, and a fence is shown, with points designated as “Kokoloea” and “Paka.” The Government Road runs through the west side of the region with two gates and a bridge depicted. Two houses are shown: one near the south fork of Kaukonahua Stream, and the other on Galbraith lands.

Two maps were found that date to the early 1900s. The first depicts lands of the Waialua Agricultural Company in 1901 (Figure 5). The entire *ahupua'a* is shown with details of natural features such as streams and gulches. The Government Road is illustrated, along with many land grants throughout the region. The second map of this era shows Central O'ahu in 1904 (Figure 6). The only notable addition in Wahiawā is a "pile of stones" that marks the corner of the property boundaries near Poamoho Gulch.

The final two maps date to the mid-1900s. The first depicts the 'Ewa Forest Reserve in 1946 (Figure 7). In the uplands of Wahiawā, a "Mauka Ditch," and the Schofield-Waikane Trail are illustrated. The Poamoho Tunnel and an unnamed trail are shown between Poamoho Stream and the north fork of Kaukonahua Stream. Pineapple lands and a reservoir are in the western portion of the *ahupua'a*. The final map shows Wahiawā in 1950 (Figure 8). The area is much more developed, with a network of streets and several additional reservoirs illustrated.

### **Māhele Land Tenure**

THE MAHELE is rightfully considered one of the most significant chapters in the modern history of Hawai'i. Several legislative acts during the period 1845–1855 codified a sweeping transformation from the centuries-old Hawaiian traditions of royal land tenure to the western practice of private land ownership. (Moffat and Fitzpatrick 1995)

The change in the traditional land tenure system in Hawai'i began with the appointment of the Board of Commissioners to Quiet Land Titles by Kamehameha III in 1845. The Great Māhele took place during the first few months of 1848 when Kamehameha III and more than 240 of his chiefs worked out their interests in the lands of the Kingdom. This division of land was recorded in the Māhele Book. The King retained roughly a million acres as his own as Crown Lands, while approximately a million and a half acres were designated as Government Lands. The Konohiki Awards amounted to about a million and a half acres, however title was not awarded until the *konohiki* presented the claim before the Land Commission.

In the fall of 1850 legislation was passed allowing citizens to present claims before the Land Commission for lands that they were utilizing within the Crown, Government, or Konohiki lands. By 1855 the Land Commission had made visits to all of the islands and had received testimony for about 12,000 land claims. This testimony is recorded in 50 volumes that have since been rendered on microfilm. Ultimately between 9,000 and 11,000 *kuleana* land claims were awarded to *kama'āina* totaling only about 30,000 acres and recorded in ten large volumes.

During the Māhele of 1848, the land of Waialua, at that time held by Princess Victoria Kamāmalu, was divided: Kamāmalu retained thousands of acres in Pa'ala'a and Kawailoa; 134 *kuleana* holdings were awarded; and the western sections of Kamananui and Mokuleia, as far as Ka'ena Point, were given to the government and made available for public purchase. There were no LCA awards in the immediate vicinity of the project area. Although no Central O'ahu lands were awarded to the commoners, they undoubtedly helped farm those lands. There are documents preceding the Māhele which mention the vast cultivated *lo'i* found in this central area (Henry et al. 1992).

Two years after the enactment of the Māhele, King Kamehameha III passed another law, this one allowing foreigners to buy land. The Waihona 'Aina database shows that following the allowance of foreigners to buy land in Hawai'i, the property around present-day Wahiawā were overwhelmingly bought out by Westerners. By 1860, approximately 290 patents were granted, with roughly one in eight sold to foreigners and naturalized citizens, including John S. Emerson and Samuel Northrup Castle (Office of State Planning 1995:1–2). In the case of the project area, those

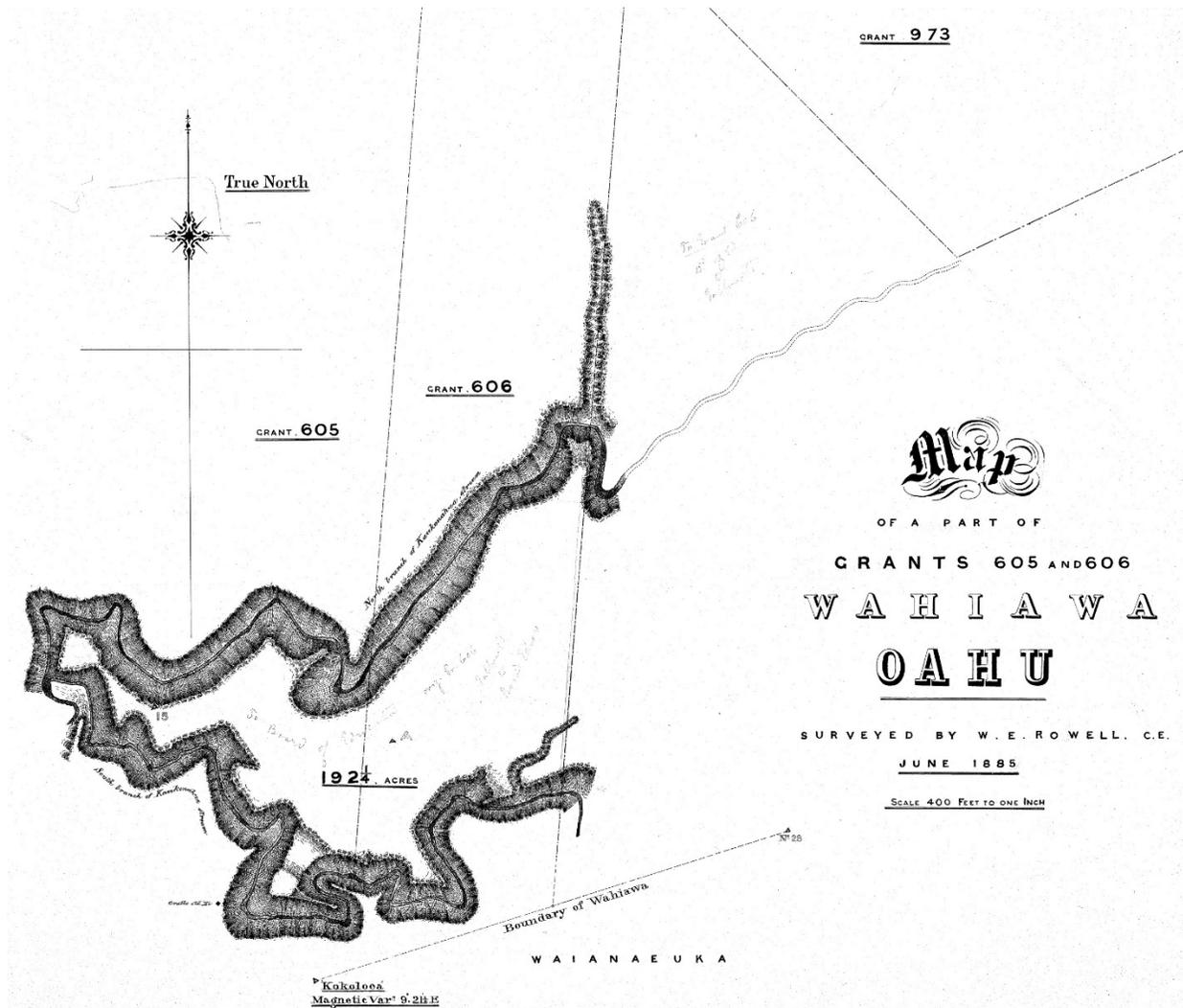


Figure 3. Land grant map of Wahiawā (Rowell 1885).

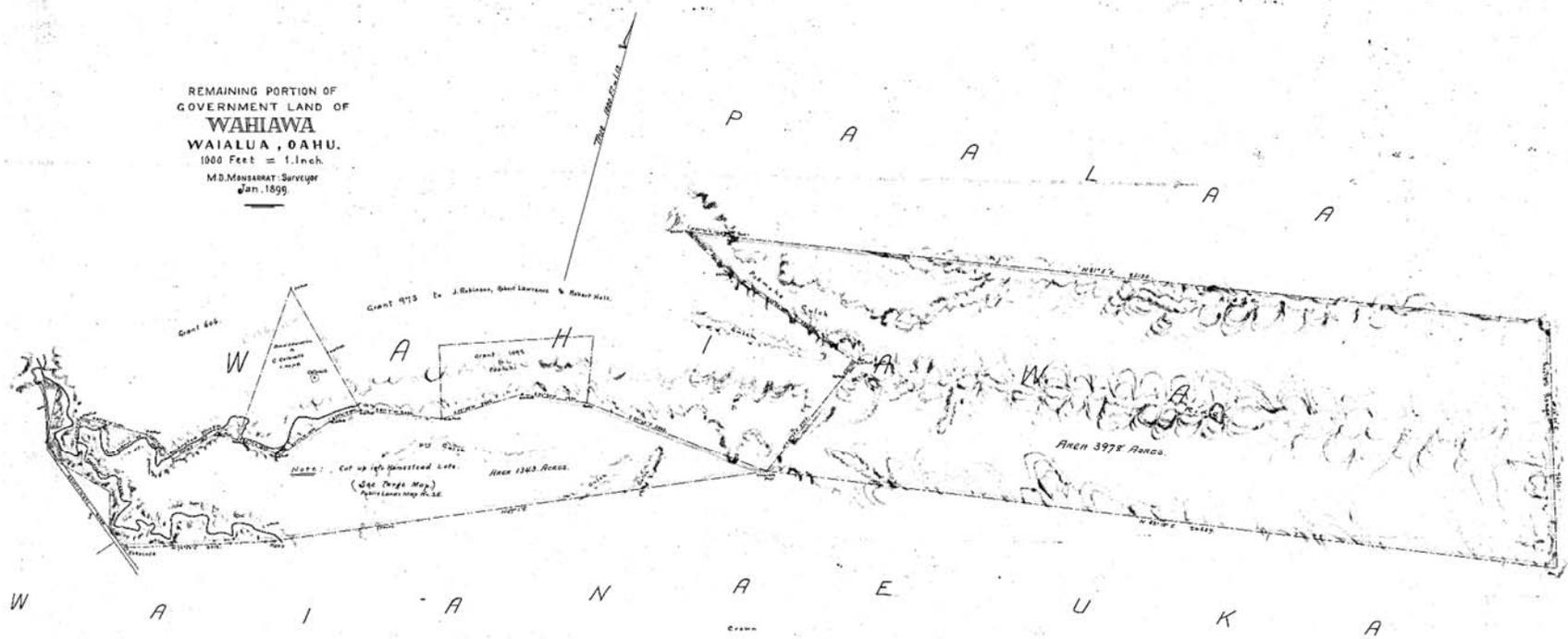


Figure 4. Government land of Wahiawā (Monsarrat 1899).

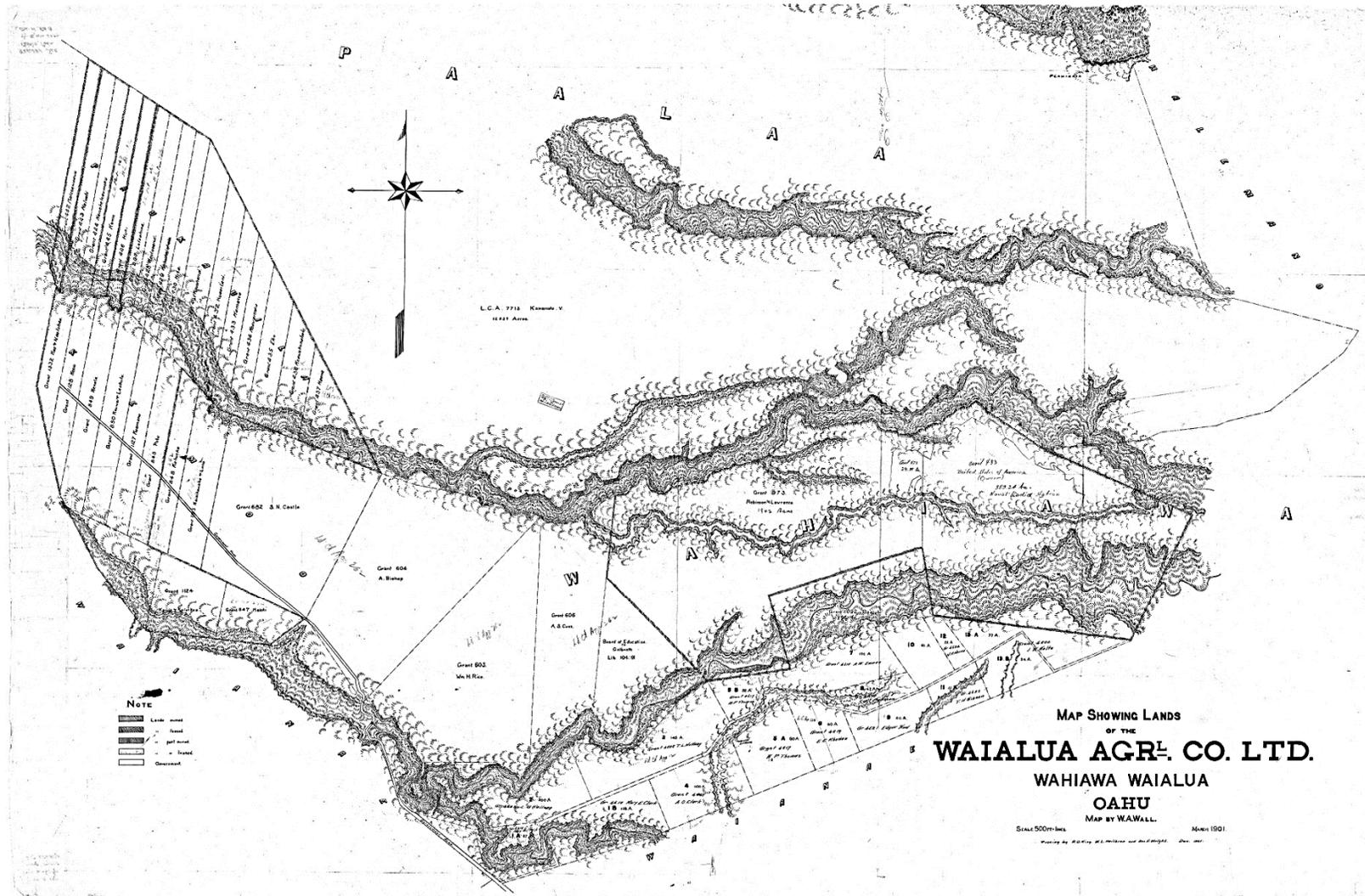


Figure 5. Waialua agricultural land (Wall 1901).

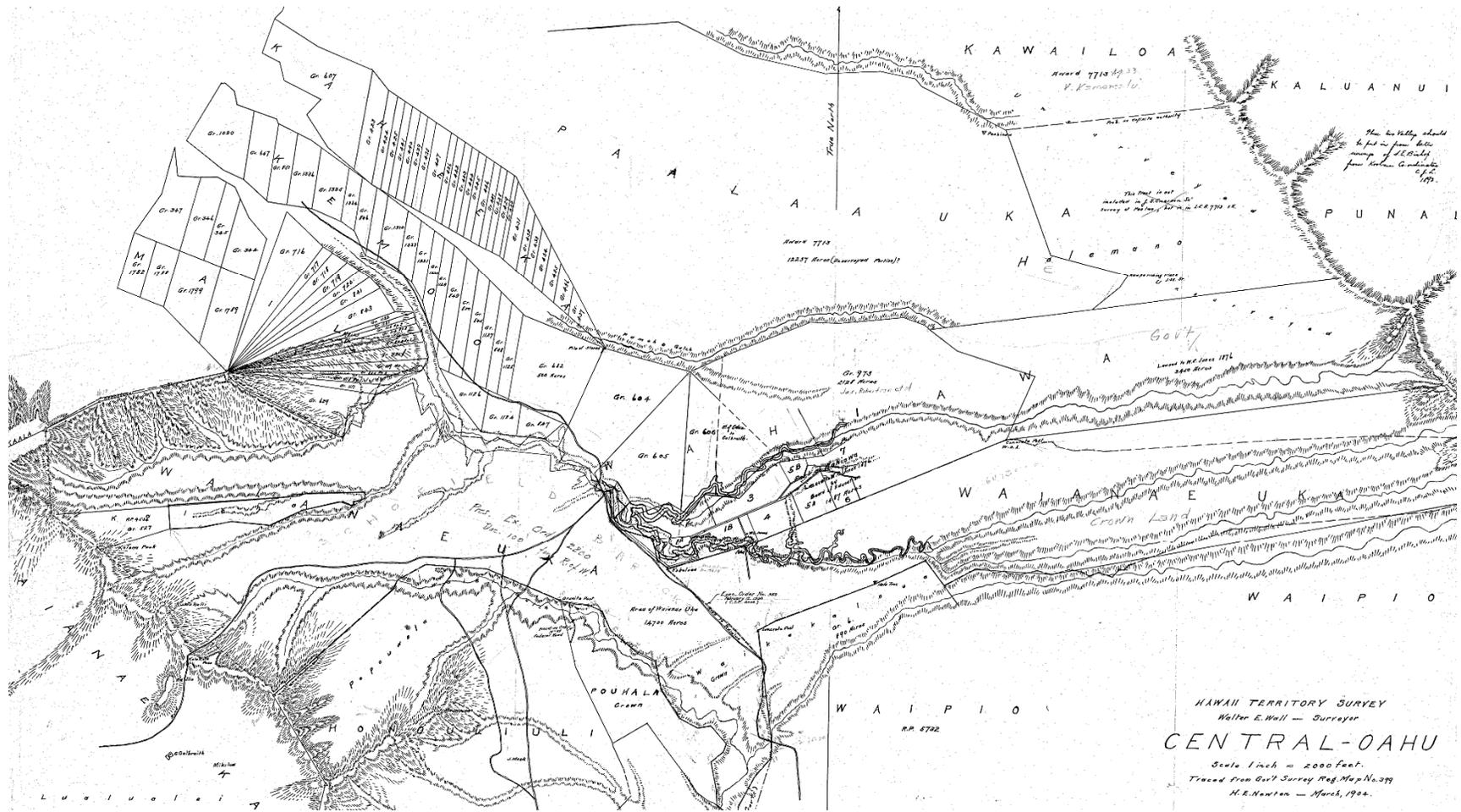


Figure 6. Portion of a Central O'ahu map (Wall 1904).

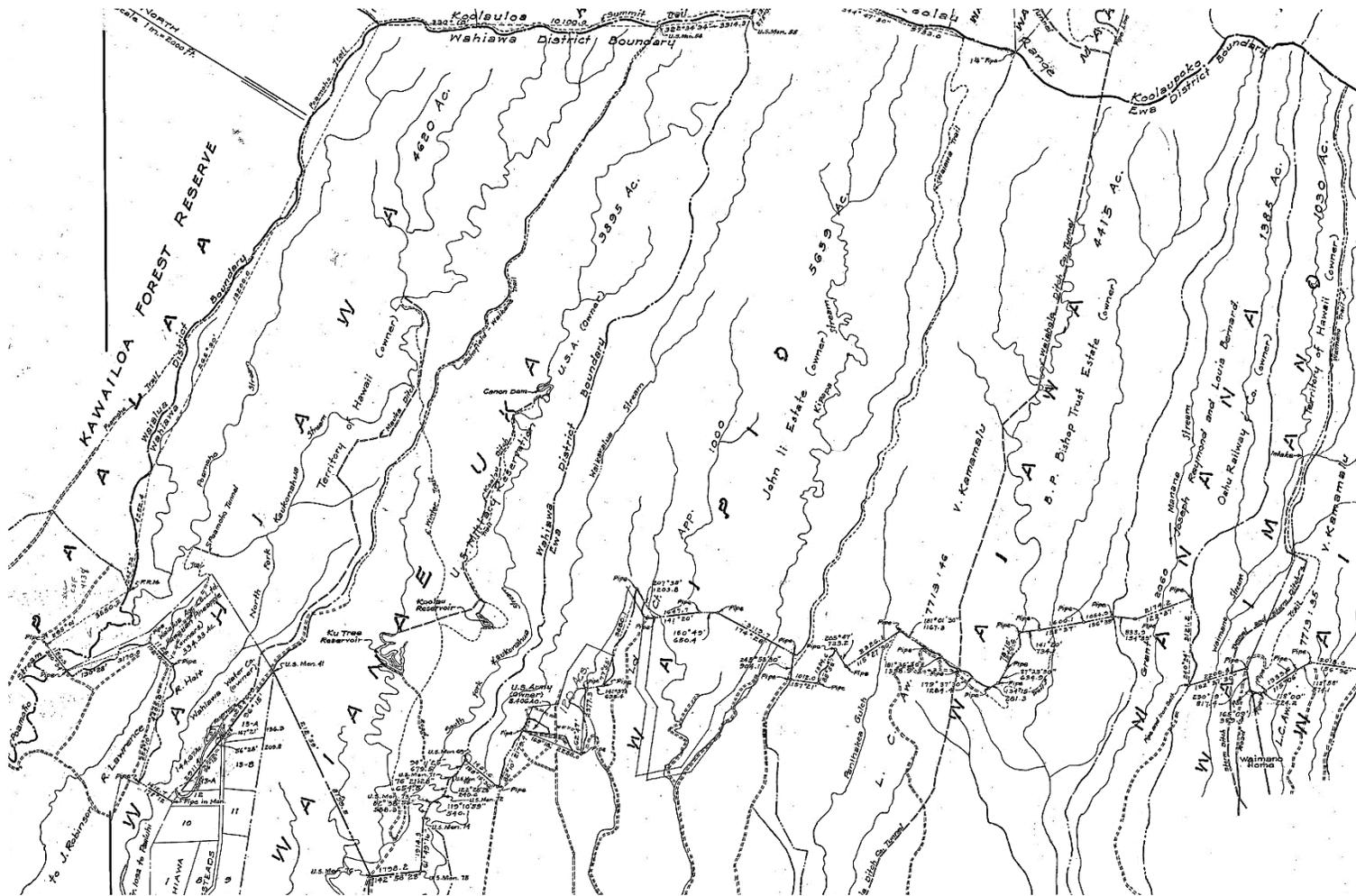


Figure 7. Portion of an 'Ewa Forest Reserve map (Marks 1946).

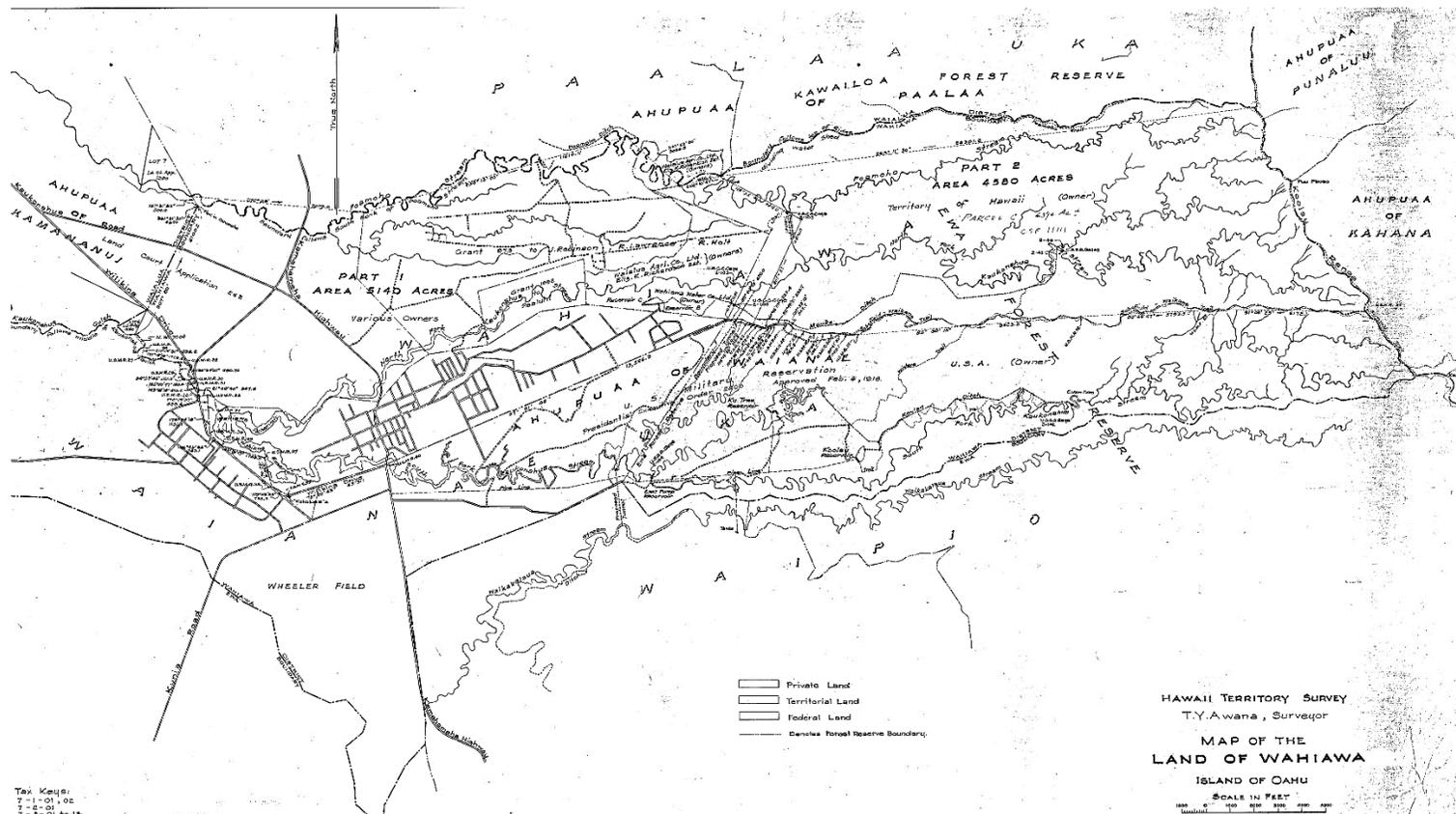


Figure 8. Territory Survey map of Wahiawā (Awana 1950).

lands eventually fell into the ownership of George Galbraith. Neither the exact date of Galbraith's purchase of the property could be found, nor whether he bought his lands all at once or if he bought it piecemeal.

### **Archaeological and Historic Sites**

Many historic sites are located within Wahiawā, the most notable of which is Kūkaniloko, or the Birthing Stones, one of the most sacred sites on O'ahu. Kūkaniloko is comprised of a number of stones associated with royal births, and a birth there legitimized a chief's high ranking right to be a leader (Yent 1999).

The site was established in the 12<sup>th</sup> century, when Nānākāoko and his wife, Kahihokalani birthed their son, Kapawa at Kūkaniloko. This became the traditional birth site of the *ali'i* (Sterling and Summers 1978:139–40; James 2010:113; Beckwith 1970:377). A child born here was then taken to nearby Ho'olonopahu Heiau, the site of the sacred drums 'Ōpuku and Hāwea, that would sound the announcement of sacred births (Yent 1999:18–23). This location, as Beckwith (1970:377) notes, "is one frequently visited by thunderstorms, whose manifestations were regarded as the voice of ancestral gods of the heavens welcoming an offspring of divine rank," and it is therefore possible that the drums "simulated the voice of the deity." Kakuhihewa, later king of O'ahu, was born at Kūkaniloko, "in the sleeping place consecrated by the tabu of Liloe," and was announced according to such a ritual (Sterling and Summers 1978:139).

It is also posited that some of the stones were arranged to represent the various islands of Polynesia, and the area served as a navigational school. One of the stones, shaped somewhat like O'ahu, contains carved ridges aligned with peaks on the Ko'olau and Wai'anae mountain ranges, and these ridges cast shadows across concentric circles at the center of the stone that were likely used in an astronomical/calendrical function to tell the solstice and equinox times of the year (James 2010:114; Yent 1999:35).

Traditionally, Kūkaniloko referred to a much larger area that spanned from Waikakalaua and Līhu'e in the south, Kalena in the west, and Helemano in the north (Yent 1999:15). The central site included 36 stones aligned in two parallel rows of 18 (seats for the presiding chiefs of the island), a resting stone for the woman giving birth, and numerous other stones (Kawaharada 1999:51; Kirch 1996:35). The sitting stones from the original parallel rows of 18, many of which have bowl-like indentations, are now arranged "haphazardly in a small grove of coconut and eucalyptus trees" (James 2010:113).

The entire complex includes approximately 180 stones in a 25 x 50 m area. Petroglyphs have been recorded on three of the stones. Two of the petroglyphs are believed to be post-contact; one petroglyph, identified in Yent (1995:4) as Stone #103, features concentric circles with a dot in the center, and the stone in which the image is set contains fluted points that most likely had "an astronomical function." From Kūkaniloko, "the solstitial and equinoctial positions of the sun could be observed and marked for use as a calendar" (Yent 1999:35).

Identified by McAllister (1933:134–137) as Site 218, the .5-acre (.2-ha) Kūkaniloko site was placed on the National Register of Historic Places in 1972. In 1994, it was listed on the Hawai'i Register of Historic Places, and the size of the official site was increased to 5 acres (2 ha). In 1997, The Department of Land and Natural Resources-State Parks entered into an agreement with the Hawaiian Civic Club of Wahiawā and the Friends of Kūkaniloko, who are the recognized curators of the monument. Tom Lenchenko "placed several alignments of boulders within the 5-acre parcel to symbolize the traditions associated with the site," including the current arrangement (which is not the original) of 36 stones in two parallel rows leading to the site and the 48 stones at the western

edge of the 5-acre site (Yent 1995:14). Other improvements have been made to the site to repair damage and to help protect the site.

Ho‘olonopahu, McAllister’s Site 219 (1933:137) was a *kapu* place for rituals but did not necessarily have a permanent structure. The temporary structure on the sacred site, believed to have been approximately 400 m northwest of Kūkaniloko, was probably constructed of wood of the *mākālei*, a supernatural tree of Moloka‘i. It is said that the drums ‘Ōpuku and Hāwea were kept there (McAllister 1933:137). These sacred drums were sounded to announce an *ali‘i* birth at Kūkaniloko. What remained of the site was presumed destroyed by the 1920s when the land was used for pineapple (Yent 1999:18–23).

The Wahiawā Healing Stones, several rocks with healing properties, are reported to have been moved several times in fairly recent history. In Sterling and Summers (1978:141), William Galbraith recounts that his father and grand-uncle moved a stone from its original location on a river bed on the lower side of the Wahiawā Dam to Kūkaniloko to serve as the headstone of a Hawaiian chief. It was moved to Wahiawa Cemetery in 1927. James (2010:115) gives a slightly more curious account:

In the late 19<sup>th</sup> century, prompted by a dream in which the spirit of the stone addressed him, an Irish rancher by the name of George Galbraith moved the stone from a riverbed to a clearing at Kūkaniloko, where it drew many Hawaiians who experienced its curative powers. Pilgrims flocked to the sacred stones, offering prayers and gifts, and the stone was moved to a cemetery in Wahiawā, a mile away. However, the next day it appeared back at its original location. It was moved again, and again it somehow returned, people said, on its own. A third time it was moved in a wagon from which it fell and broke in two. The two stones now remained at the spot where they were placed, and became even more popular.

Two stones are now located in a Japanese crypt-like shelter near a Hindu structure, worshiped by some as a manifestation of Shiva, at a suburban housing development that was built over the former cemetery at 108 California Street. The larger stone is called Pōhaku Ho‘ola Kino or Keanianileihua, while the name of the smaller rock is not known (James 2010:115–116).

Helemano Trail (connected to the Wahiawa-Pupukea Trail, later called Drum Road) was a traditional thoroughfare near the project area (Kakesako 2002). Not much of the earlier history of the trail is known before the military extended and developed the road in the 1930s, which involved reconstructing old trails and creating new paths (Cultural Resources Section Staff 2012).

The Chinese cemetery of Wahiawā, a historic-era site, was originally located at 130 California Avenue, next to Ka‘ala School (south of the current project area). The site was reported to have been used for the burial of Dole company employees, with the last burial done in 1947. In 1972, all marked and unmarked burials were disinterred and relocated to Mililani Memorial Park (Char and Char 1988:163–164).

### **Previous Archaeological Studies**

The earliest archaeological work in the Wahiawā region was part of McAllister’s islandwide survey (1933). Two sites were identified near the project area: Site 218, Kūkaniloko, and Site 219, Ho‘olonopahu Heiau, both described above. McAllister noted that Kūkaniloko was “one of the two famous places in the Hawaiian islands for the birth of children of tapu chiefs. The other is at Holoholoku, Wailua, Kauai” (1933:134). At the time of McAllister’s survey, Kūkaniloko was the only archaeological site on O‘ahu that was being “officially preserved” (1933:135). Ho‘olonopahu Heiau is where drums were beaten to signal the birth of an *ali‘i*. The site was reported as destroyed by the time of McAllister’s survey, and only pineapple lands remained (1933:137).

Modern archaeological work consists of archaeological surveys, monitoring, and other such projects. The following discussion provides information on archaeological investigations that have been carried out in the vicinity of the project area, based on reports found in the SHPD library in Kapolei, Hawai'i (Figure 9, Table 1).

A surface survey was conducted on Phase I of the Wahiawa Fresh Water Park (Griffin and Yent 1977). Structures found during the survey include a railroad trestle and the roadbed for railroad tracks, as well as a terrace complex that is either historic or historically modified. Griffin and Yent (1977) recommended contacting the Hawaiian Railway Society to determine the significance of the railroad structures. No State Inventory of Historic Places (SIHP) site numbers were assigned.

James Saifuku submitted to the SHPD several drawings of sites he had encountered along Poamoho Stream, drawn from his memory of what had been there in the 1940s (Saifuku 1987a and 1987b). Drawings and notes indicate the presence of traditional Hawaiian artifacts in the pineapple fields along Poamoho Gulch, as well as a rock wall alignment and former *heiau* within the gulch.

An archaeological reconnaissance survey was completed in three areas associated with Helemano family housing construction (Watanabe 1990). Work Area 1 was a waterline re-route approximately 220 m (722 ft.) long, south of the Helemano Radio Station. No cultural features were encountered. Work Area 2 was an access road corridor approximately 15 m (49 ft.) wide and 750 m (2,640 ft.) long, running through former pineapple fields to the northeast of the current project area. Excavation revealed a plow zone in the upper meter that seemed associated with seasonal field preparation. Work Area 3 was approximately 100 m<sup>2</sup>, adjacent to Kamehameha Highway, also in an active pineapple field. No cultural materials were encountered there. No further archaeological work was recommended (Watanabe 1990).

An archaeological inventory survey of Galbraith Trust Lands was performed as part of an environmental impact statement to be submitted in support of a proposed development plan amendment application (Henry et al. 1992). The survey area included the current project parcels, along with additional lands in between and south toward Schofield Barracks. Survey methods included an aerial survey by helicopter, a variable-intensity ground survey, and subsurface testing. During the aerial and pedestrian surveys, two previously identified sites were documented: SIHP 50-80-04-218, Kūkaniloko, located outside of the current project area to the south, and SIHP 50-80-04-4571, a stacked rock wall outside of the current project area to the north (Henry et al. 1992:18). Saifuku (1987a) had previously identified a *heiau* (SIHP 50-80-04-1605) to the north of the current project area, in Poamoho Gulch, but this could not be located. Henry et al. note: "If future development plans include ground disturbance in Poamoho Stream Gulch, further efforts to locate Site 1605 may be necessary" (1992:32). No cultural deposits were found in the shovel tests.

An archaeological assessment of an exploratory well site was completed within the Board of Water Supply Corporation Yard on California Avenue (Colin and Hammatt 1994), south of the current project area. The pedestrian survey produced no findings and the area was determined to be "devoid of archaeological potential" (Colin and Hammatt 1994:7).

A cultural resources overview with an archaeological survey was conducted at the Naval Communications Center Area Master Station (Landrum et al. 1997). No pre-contact archaeological sites were identified, although it was suggested that they may be located in the gulch that was not surveyed (Landrum et al. 1997:i). Several historic buildings were documented.

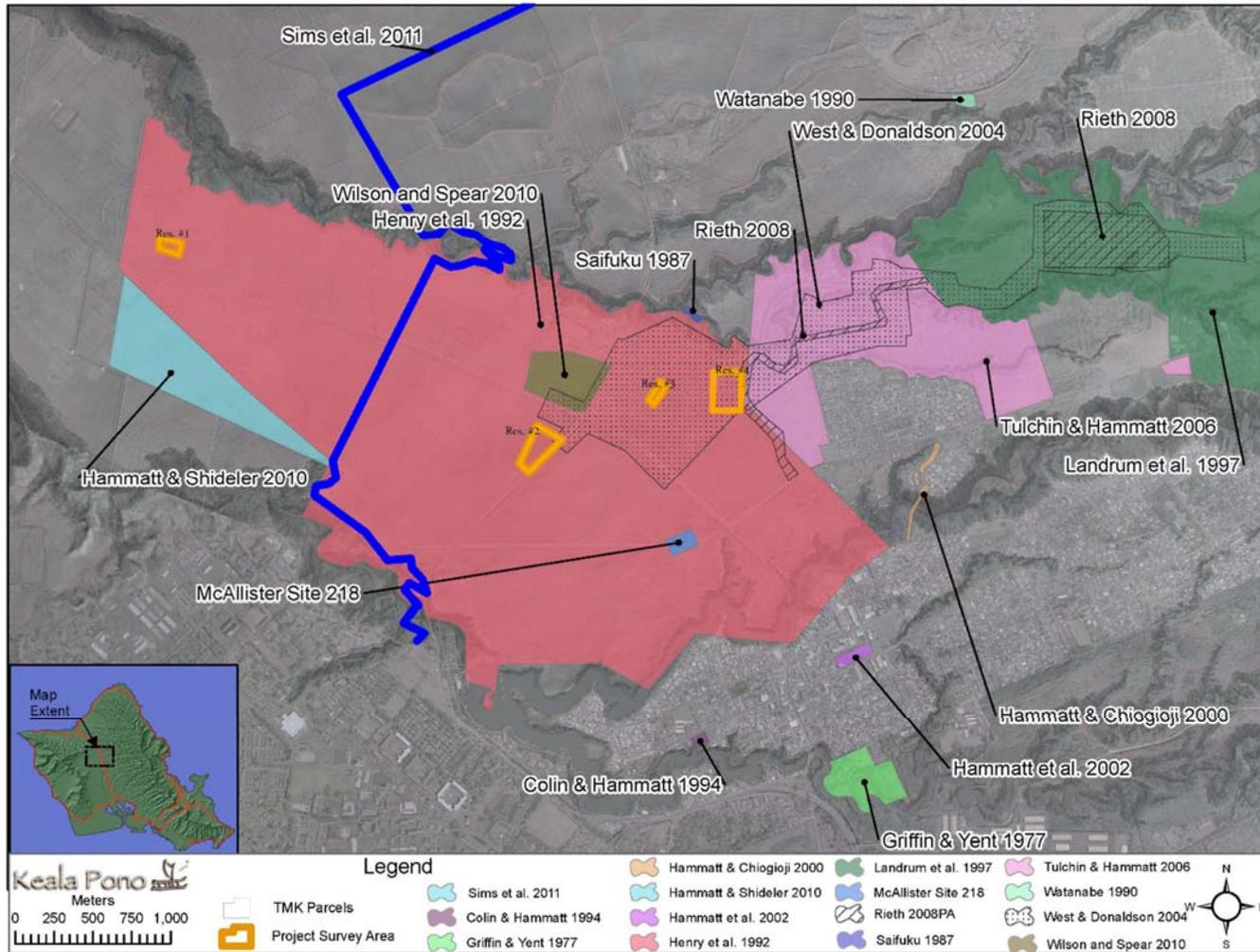


Figure 9. Location of previous studies in the vicinity of the project area.

**Table 1. Previous Archaeology in Wahiawā**

<b>Author and Year</b>	<b>Work Completed</b>	<b>Findings</b>
McAllister 1933	Islandwide Survey	Identified Site 218, Kūkaniloko, and Site 219, Ho‘olonopahu Heiau near the project area.
Griffin and Yent 1977	Archaeological Inventory Survey	Documented terraces in Kaukonahua Stream and a railroad bed.
Saifuku 1987a and b	Site Drawings	Documented several new sites, including a wall and <i>heiau</i> along Poamoho Stream.
Watanabe 1990	Archaeological Reconnaissance Survey	No findings.
Henry et al. 1992	Archaeological Inventory Survey	No findings.
Colin and Hammatt 1994	Archaeological Assessment	No findings.
Landrum et al. 1997	Cultural Resources Overview Survey	Documented several historic buildings.
Hammatt and Chiogioji 2000	Archaeological Assessment	No findings.
Hammatt et al. 2002	Archaeological and Cultural Impact Evaluation	No findings.
West and Donaldson 2004	Archaeological Inventory Survey	No findings.
Tulchin and Hammatt 2006	Literature Review and Field Inspection	Identified historic railroad trestle foundations.
Reith 2008	Archaeological Monitoring	No findings.
Hammatt and Shideler 2010	Archaeological Assessment	No findings.
Wilson and Spear 2010	Archaeological Inventory Survey	No findings.
Sims et al. 2011	Archaeological & Cultural Monitoring	Identified a subsurface charcoal lens.

An archaeological assessment of a 16-inch water line route connecting the Wahiawā and Whitmore Village water systems was conducted east of the current project area (Hammatt and Chiogioji 2000). No surface archaeological sites were observed. No further archaeological work and no monitoring during construction activities were recommended.

An archaeological and cultural impact evaluation for the Wahiawā Community Transit Center was completed, which involved a literature review and field inspection (Hammatt et al. 2002). The field inspection revealed no surface archaeological sites and the cultural and historic research produced no evidence of traditional, historic, or ongoing cultural practices.

An archaeological survey was conducted at the proposed location of the new Hawaii Regional Security Operations Center (HRSOC), including a new access road (West and Donaldson 2004). Surface surveys were conducted, portions of which overlap with the current project area. Subsurface testing, consisting of two shovel test units, was conducted only on military land. No cultural materials were found in the pedestrian survey or shovel tests. It was concluded that “the project area has a low potential for any archaeological resources, and no further archaeological treatment or consideration is recommended” (West and Donaldson 2004:iii).

A literature review and field inspection were done for the proposed Whitmore Village development project (Tulchin and Hammatt 2006), adjacent to the easternmost parcel of the current project area. During the field inspection, Tulchin and Hammat (2006) encountered one historic property, a series of historic railroad trestle foundations in the northeastern portion of their project area that are presumed to be part of a spur off the OR&L Helemano Extension (Tulchin and Hammatt 2006:28). No SIHP site number was given in the report. An archaeological inventory survey was recommended to further document the site.

Archaeological monitoring was performed at the HRSOC, east of the current project area (Reith 2008). No archaeological features, deposits, or artifacts were found; however, historical documents and previous archaeological studies describe a *heiau* and a traditional stone wall in the vicinity, suggesting “the possibility that truncated subsurface features and, more likely, agricultural features within the drainages are present” (Reith 2008:5).

An archaeological assessment was completed for a proposed composting facility in a parcel adjacent to the current project area (Hammatt and Shideler 2010). The field inspection yielded no finds. Observations indicated that the landscape had been impacted by decades of sugarcane and pineapple cultivation.

An archaeological inventory survey of 34.117 acres (13.807 ha) of former agricultural land was conducted south of Poamoho Camp (Wilson and Spear 2010). Fieldwork consisted of a pedestrian survey and 24 test excavations. The surface survey yielded no sites. Subsurface testing revealed a layer of tilled soil at 0–80 cmbs, with modern debris over a soil layer of dark reddish-brown clayey silt (Wilson and Spear 2010:7). No subsurface cultural remains were encountered and no further archaeological work was recommended.

Archaeological and cultural monitoring were conducted for the construction of the Helemano Trail, located to the west of the current project area, extending from Schofield Barracks Military Reservation to Helemano Military Reservation (Sims et al. 2011). A subsurface charcoal lens, SIHP 50-80-04-7173, was identified near the north edge of the plateau above Kaukonahua Gulch. The lens was excavated in full and two radiocarbon dates were obtained. A sample of *‘ulei* dated to 371±30 BP (1440–1530 and 1550–1640 cal AD), while a sample of *‘ulu* dated to 393±31 BP (1430–1530 and 1550–1630 cal AD) (Sims et al. 2011:50). The lens was interpreted as a pre-contact combustion feature (Sims et al. 2011).

### **Summary and Settlement Patterns**

According to the Hawaiian history and culture scholar George Kanahale, the major colonization of the Hawaiian Islands occurred around AD 300 (Kanahale 1995). The initial settlers came from other Pacific Islands looking for a new home that was accessible to the sea and able to sustain their new population. Although the Central O‘ahu area was rich with fresh water and food resources, it was far upland from the canoe landing sites on the seashore and the abundance that the ocean provided. As a result, it was settled relatively late compared to the villages on the coastal areas.

While the earliest form of society throughout the Hawaiian Islands centered on extended family units headed by a number of patriarchs, as the population expanded, it evolved into a strict hierarchal class-society ruled by divine chiefs. It is suggested that the archipelago’s organization under divine chiefdoms probably first appeared around AD 800 (Kanahale 1995). The Hawaiian Islands consisted of several sovereign island kingdoms independent of each other for almost 1,000 years. During this time, different islands were consolidated under one ruler, and at other times, the chiefdoms consisting of several islands were splintered, all of this fluidity due to inter-island wars and alliances.

Regarding the project area in the present-day region of Wahiawā and upper Kamananui, its appearance on the historical record begins as the birthplace and home of the great chiefly line known as the Lō Ali‘i. Therefore, all of Central O‘ahu was a sacred region peopled by high-ranking chiefs. At the center of these chiefly lands were the hallowed grounds called Kūkaniloko.

As the birthplace and residence of the high chiefs, Central O‘ahu remained a sacred place throughout the centuries even after the O‘ahu kingdom fell to the Maui kingdom of Chief Kahekili, and the Maui kingdom subsequently fell to the Hawai‘i kingdom of Chief Kamehameha. In the late 18<sup>th</sup> century, the arrivals of Westerners to O‘ahu, first under the rule of Kahekili and then under Kamehameha, eventually brought with it incursions into Central O‘ahu for sandalwood harvesting. It also brought the infiltration of newly introduced animals such as cattle into the central uplands from ranching enterprises around the island, yet Central O‘ahu continued to be the land of the chiefs.

At the time of the Māhele, the Central O‘ahu locale of Wahiawā was not yet delineated as its own district, and the project area was within Kamananui Ahupua‘a. With the increased presence of foreign influence and interests in the islands, the 19<sup>th</sup> century ended with the overthrow of the Hawaiian monarchy by foreign residents backed by their foreign government. The overthrow was in 1893, and it was followed by American annexation in 1898.

That same year, the Waialua Agriculture Company, a sugarcane-growing enterprise, was founded, and it soon embarked on a project to dam the Central O‘ahu waters and create a massive reservoir later named Lake Wilson. With this reservoir, there was established an important irrigation system which enabled the plains of Central O‘ahu to be converted into fields of sugarcane and pineapple. In 1912, land was set aside to house pineapple plantation workers in a housing project called Poamoho Camp.

Around the same time that the sugarcane and pineapple industries were profiting from the cultivation of Central O‘ahu fields, the American military established its presence in the adjacent area of Wai‘anae Uka. The Army lands of Schofield started as Castner Village in 1909, but by 1920, most of the major construction was done, and it remains a significant military base today. Another important but smaller military installation was established in Pa‘ala‘a in 1943. This is the present-day Helemano Military Reservation, and it was designated a sub-installation of Schofield in 1956.

By the latter half of the 20<sup>th</sup> century, Central O‘ahu had seen a marked growth in its population with a corresponding increase in housing at Schofield Barracks Military Reservation, Wahiawā Town, and Whitmore Village. Poamoho Camp still exists today next to the open lands of the project area at the Galbraith Estate, and next to that, Kūkaniloko is now a historical property protected by the State of Hawai‘i (Henry et al. 1992). After raising several generations of families, this area of O‘ahu, now recognized as its own district of Wahiawā, continues to grow and prosper.

### **Anticipated Finds and Research Questions**

Given the extensive alteration of the land during the pineapple and sugar eras, a relevant research question may be to determine if any vestiges of post-contact land use remain. The noteworthy sites Kūkaniloko and Ho‘olonopau Heiau are near the project area, therefore the project lands were frequented in pre-contact times. Also significant were the adjacent lands of Wai‘anae Uka which served as training grounds for the warriors, and also the lands of Helemano which were the haunts of the man-eating ones. Although the Central O‘ahu region was peopled by the *ali‘i*, there was a steady presence of *maka ‘āinana* and *kauwā*, who undoubtedly were the ones working the noted *lo‘i kalo* and *kula ‘uala*. They were also mentioned to be present, though at some distance, during the birthing ceremonies of the royals. All of this suggests that the lands in the project area may reveal a wide range of archaeological remains. Site types that may be encountered include traditional

agricultural or habitation structures, as have been found along nearby gulches, or subsurface features such as the charcoal lens that was uncovered during the monitoring of Helemano Trail. In addition, there may yet be a host of artifacts to be found. These may include items associated with warfare (e.g., weaponry), games (e.g., *'ulu maika*), and tools (e.g., adzes).

Remnants of historic-era land use would likely be related to sugar or pineapple cultivation, and might include the remains of water control features and/or historic artifacts, or vestiges of the OR&L railway and its infrastructure. WWII-era use of the region might be evident in bunkers, pillboxes, and other military structures. Portions of the pre-contact trail that was still observed by Ii (1959:98) after the arrival of foreigners might also be uncovered.

Research questions are a general inquiry geared toward the specific use of this area from the pre-contact period into the post-contact. Initially, the investigation seeks to uncover the following:

1. What extent of archaeological and cultural resources from the pre-contact era still remain on the landscape? And if any new resources are identified, to what extent are they associated with nearby Kūkaniloko and the centuries of chiefly residence in the area?
2. Are there any undocumented significant post-contact remnants from the use of the land by ranchers, by the military, or by the sugarcane and pineapple industries?

Depending on what archaeological resources are identified, the research questions will become more specifically focused in consultation with SHPD.

## METHODS

Pedestrian survey and subsurface testing were conducted on October 8, 2014 by Windy McElroy, PhD and Jeffrey Lapinad. McElroy served as Principal Investigator, overseeing all aspects of the project.

For the pedestrian survey, the ground surface was visually inspected for surface archaeological remains, with transects walked for each of the four project areas. Of the 30.83-acre (12.48-ha) survey area for all four reservoirs, 100% was covered on foot. The boundaries of the project areas were marked by surveyors stakes, and a State of Hawai'i surveyor was present for the archaeological surveys of Reservoirs 1, 2, and 4 to answer any questions regarding the project boundaries.

Vegetation was relatively light in most areas, consisting of California grass that had been partially cleared prior to the survey (Figure 10). Because of the high visibility, the spacing between archaeologists was relatively wide, with archaeologists spread 5–10 m. Archaeological sites and their boundaries were identified visually, with any feature possibly made or used by humans and more than 50 years old considered a site, although none were found.

Test trenches (TR) were excavated in eight locations throughout the survey area: two trenches at Reservoir 1; two trenches at Reservoir 2; one trench at Reservoir 3; and three trenches at Reservoir 4. A mini excavator was used for digging of the trenches at Reservoirs 1 and 2 (Figure 11), while a backhoe was used at Reservoirs 3 and 4. Vertical provenience was measured from the surface, and trenches were excavated to sterile deposits. Profiles were drawn and photographed, and sediments were described using Munsell soil color charts and a sediment texture flowchart (Thien 1979). Trench locations were recorded with a 3 m-accurate Garmin GPSmap 62st, and all trenches were backfilled after excavation, except for TR 8 at Reservoir 3. This latter trench was left open by request of the leasee.

The scale in all field photographs is marked in 10 cm increments. The north arrow on all maps points to magnetic north. Throughout this report rock sizes follow the conventions outlined in *Field Book for Describing and Sampling Soils*: Gravel <7 cm; Cobble 7–25 cm; Stone 25–60 cm; Boulder >60 cm (Schoeneberger 2002:2–35). Collected material is being temporarily curated at the Keala Pono office in Kāneʻohe and final disposition will be determined in consultation with the landowner and SHPD.



**Figure 10. Reservoir 4, facing south, showing vegetation conditions.**



**Figure 11. Excavation of TR 4 at Reservoir 2, facing south.**

## RESULTS

Pedestrian survey and subsurface testing were conducted in the 30.83 acre (12.48-ha) project area. No historic properties were found and the entire area was previously disturbed by pineapple cultivation. Excavation of eight test trenches did not yield any evidence of subsurface cultural deposits or features. The only find was previously disturbed historic material at Reservoir 3.

### **Community Consultation**

Community consultation for the project was conducted in the form of Cultural Impact Assessment (CIA) interviews by Keala Pono Ethnographer, Dietrix Duhaylonsod, BA. Interviews were done in person with Aunty Kaleo Paik, Uncle Glen Kila, and Chris Oliveira on October 13, 2014. Aunty Kaleo was interviewed separately, while Uncle Glen and his nephew, Chris Oliveira, were interviewed together. Uncle Tom Lenchanko was consulted in a face to face meeting on November 3, 2014, and he shared his thoughts but requested to submit his comments in writing. Aunty Vicki Pakele opted to write a letter statement instead of having an interview.

The interviewees are *kūpuna* whom the community recognizes as cultural experts, aside from Chris Oliveira who is from a younger generation; he is a cultural practitioner with ties to the project area. In general, some of the interviewees support agricultural development, but most expressed reservations due to the presence of subsurface archaeological features. Uncle Tom also questioned the legitimacy of land conveyance and ownership. Uncle Glen and Chris noted that Kūkaniloko covers a much larger area than what the site is designated as today. Several other questions and concerns were raised by the interviewees. These include seeing limits stipulated on the development so that farming plans do not change later into a future blueprint for buildings, disclosing exactly where the reservoirs will be pumping water from, and implementing a program of cultural monitoring during construction. Finally, Uncle Glen and Chris stressed the importance of keeping the community involved in the cultural monitoring process, and they specifically requested that Uncle Tom Lenchanko and the Wahiawā Civic Club be consulted because of their ties to and knowledge of the area.

### **Pedestrian Survey**

The surface survey included 100% of the 30.83-acre project area. The survey areas were relatively flat and free of stones, and supported non-native vegetation, predominantly California grass. These conditions suggest previous disturbance. In addition, the ground had been tilled in the past, and scraps of black plastic indicative of pineapple cultivation were evident throughout.

No surface archaeological features were found within any of the project areas. However, it was noted that Reservoir 3 had been extensively disturbed in recent times (Figure 12), and historic material was visible on the surface near the center of the survey area. The backdirt piles were searched in the vicinity of the historic material and any diagnostic artifacts were collected. This amounted to 85 items of glass and ceramic (see Laboratory Analysis). Given that this material was not found *in situ* and its primary context has been lost, the artifacts were not assigned a site number.

### **Subsurface Testing**

A total of eight trenches were excavated throughout the property to determine the presence or absence of subsurface cultural deposits or material (Table 2, Figure 13). Note that stratigraphy was actually quite uniform throughout the project area, and the variability in color seen in the following photographs is due to differences in lighting conditions (very sunny or overcast).



**Figure 12. Reservoir 3, showing the extent of recent disturbance. Orientation is to the northeast.**

TR 1 was located near the south corner of Reservoir 2 (see Figure 13). The trench measured 6.5 m long and .65 m wide. It was excavated to 135 cm below surface (cmbs), well into sterile sediment. Stratigraphy consisted of an organic-rich deposit with black plastic fragments typical of pineapple cultivation, above the sterile layer (Figure 14). No cultural deposits or features were identified.

TR 2 was placed within the east-central portion of Reservoir 2 (see Figure 13). The trench measured 5.2 m long and .65 m wide. It was excavated to 140 cmbs, well into the sterile layer. Stratigraphy was composed of an organic-rich deposit containing black plastic fragments typical of pineapple cultivation, above the sterile layer (Figure 15). No cultural material or deposits were found.

TR 3 was on the east side of Reservoir 1 (see Figure 13). It measured 5.5 m long and .65 m wide. The trench was excavated to 80 cmbs, into very compacted sterile sediment. Stratigraphy consisted of an organic-rich deposit containing black plastic fragments typical of pineapple cultivation, above the sterile layer (Figure 16). No cultural deposits or features were identified.

TR 4 was placed on the west side of Reservoir 1 (see Figure 13). The trench measured 5.7 m long and .65 m wide. It was excavated to 70 cmbs, into very compacted sterile sediment. Stratigraphy consisted of the same organic-rich deposit with black plastic, above the sterile layer (Figure 17). No cultural material or deposits were found.

TR 5 was placed on the southwest side of Reservoir 4 (see Figure 13). The trench measured 4.7 m long and .65 m wide. It was excavated to 135 cmbs, well into the sterile layer. Stratigraphy was composed of an organic-rich deposit containing black plastic fragments typical of pineapple cultivation, above the sterile layer (Figure 18). No cultural materials or deposits were found.

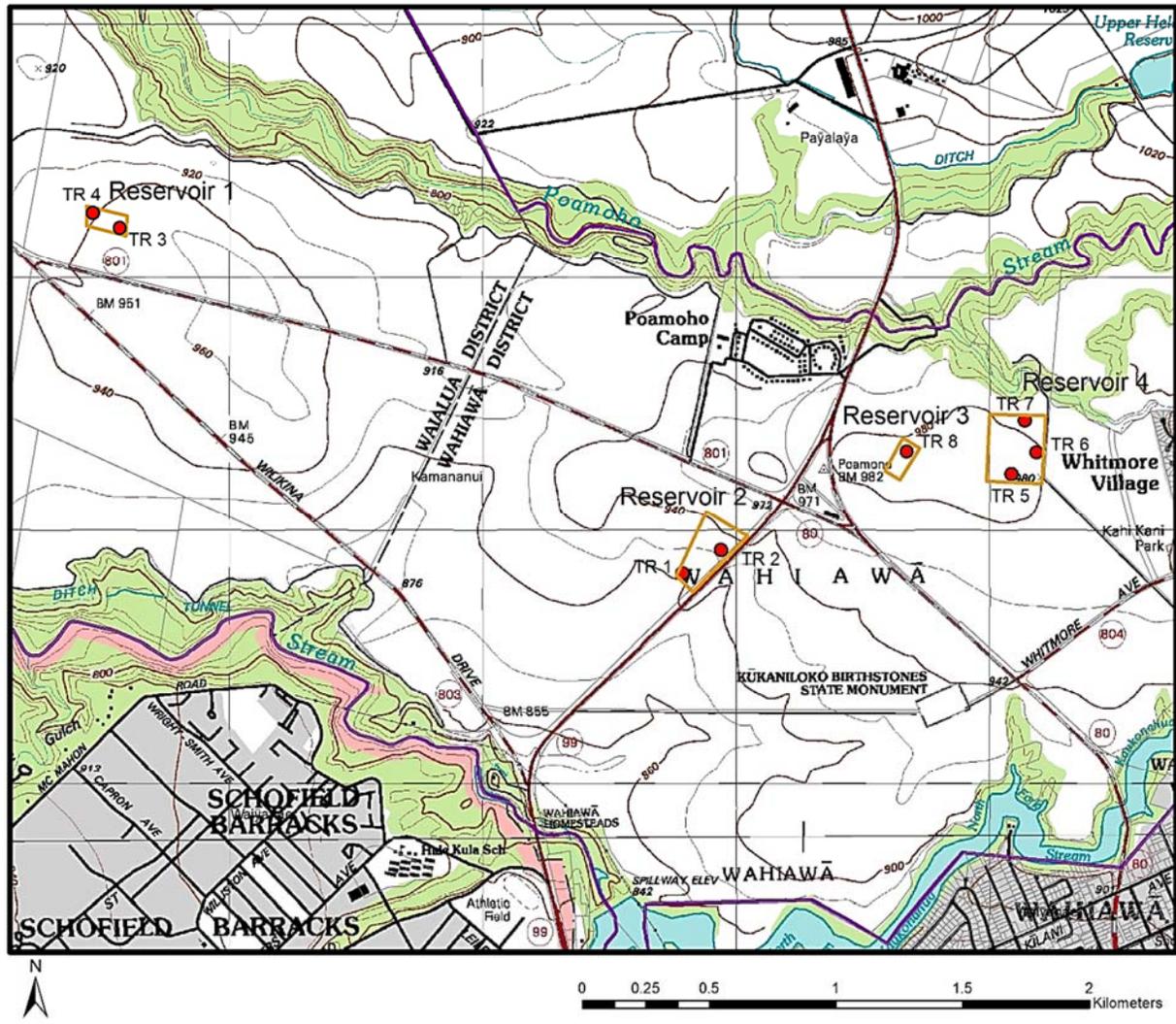


Figure 13. Location of Trenches 1–8 on a USGS Schofield Barracks quadrangle.

**Table 2. Sediment Descriptions**

<b>Location</b>	<b>Layer</b>	<b>Depth (cmbs)</b>	<b>Color</b>	<b>Description</b>	<b>Interpretation</b>
TR 1	I	0–75	2.5YR 2.5/2	Silty clay loam; 1% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	75–135+	2.5YR 2.5/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 2	I	0–45	2.5YR 2/3	Silty clay loam; 1% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	45–140+	2.5YR 3/6	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 3	I	0–42	2.5YR 2/3	Silty clay loam; 10% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	42–80+	10R 3/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 4	I	0–30	2.5YR 2.5/2	Silty clay loam; 10% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	30–70+	10R 3/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 5	I	0–58	2.5YR 3/3	Silty clay loam; 10% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	58–135+	2.5YR 3/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 6	I	0–48	2.5YR 3/3	Silty clay loam; 5% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	48–100+	2.5YR 3/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 7	I	0–65	2.5YR 3/3	Silty clay loam; 10% roots; 1% rocks; modern debris; smooth, very abrupt boundary.	Pineapple Cultivation
	II	65–130+	2.5YR 3/4	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile
TR 8	II	0–70+	2.5Y 3/6	Silty clay loam; 1% roots; 1% rocks; base of excavation.	Sterile

TR 6 was positioned in the east-central portion of Reservoir 4 (see Figure 13). The trench measured 4.9 m long and .5 m wide. It was excavated to 100 cmbs, well into the sterile layer. Stratigraphy was composed of an organic-rich deposit containing black plastic fragments typical of pineapple cultivation, above the sterile layer (Figure 19). No cultural deposits or features were identified.

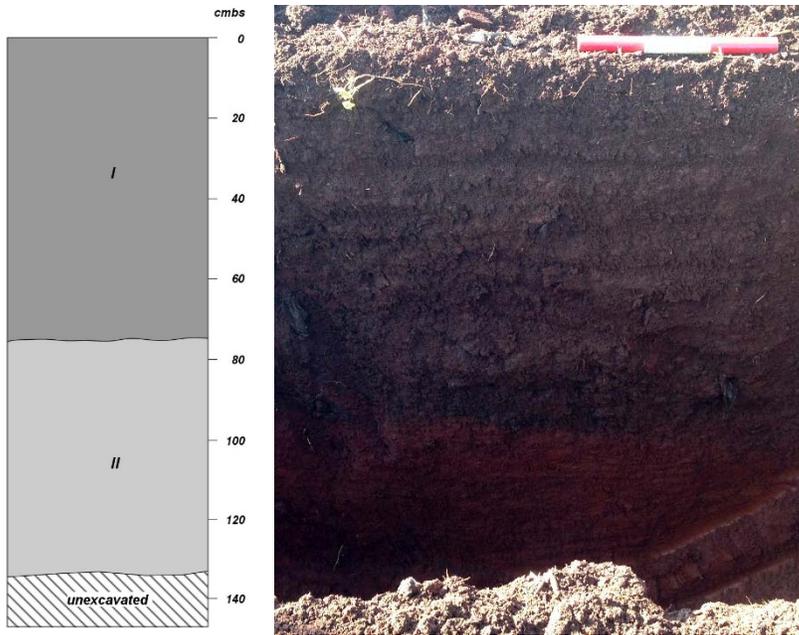


Figure 14. TR 1 south face profile drawing (left) and photo (right).

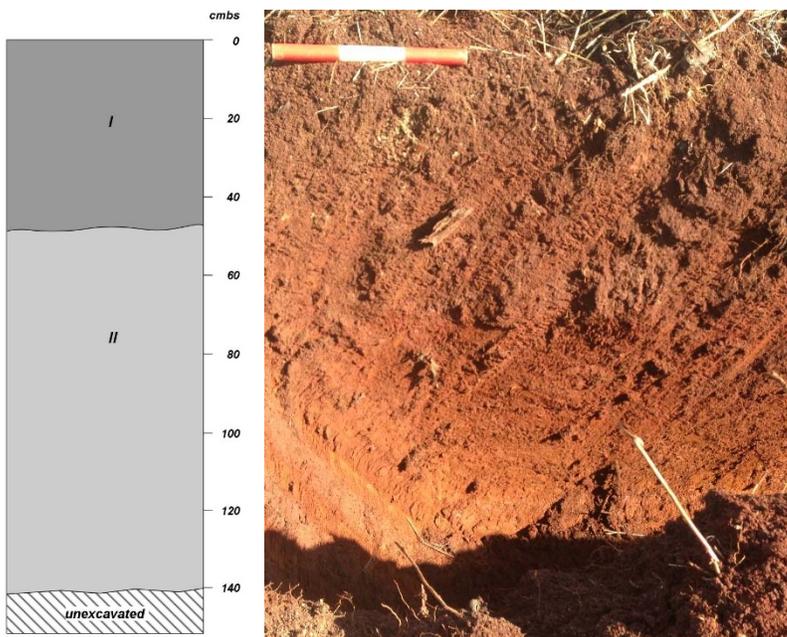


Figure 15. TR 2 northwest face profile drawing (left) and photo (right).

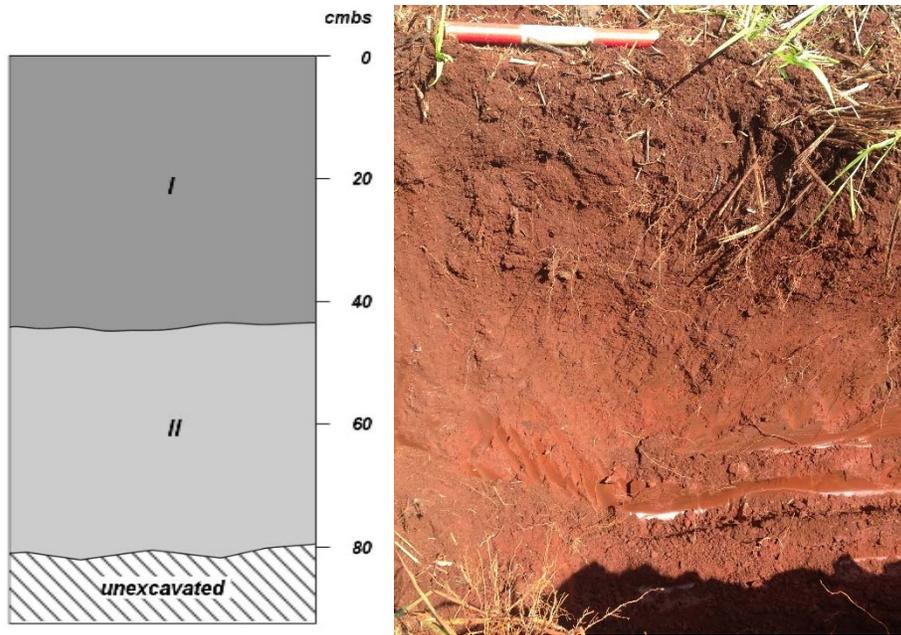


Figure 16. TR 3 northwest face profile drawing (left) and photo (right).

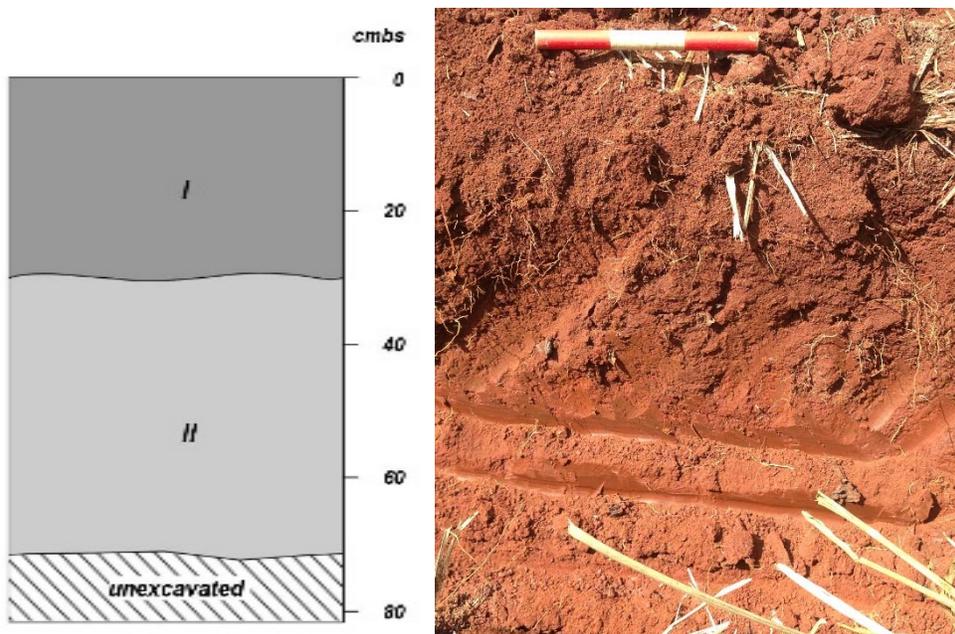


Figure 17. TR 4 southwest face profile drawing (left) and photo (right).

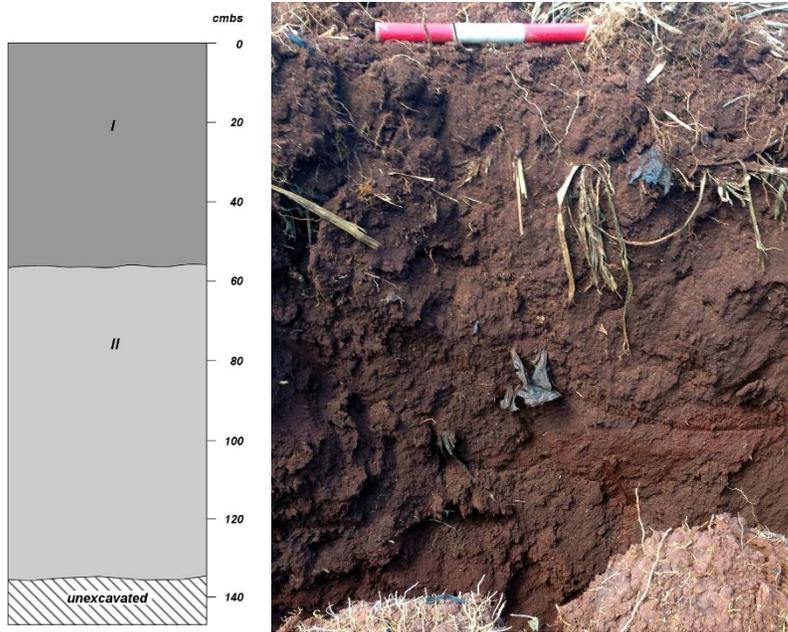


Figure 18. TR 5 west face profile drawing (left) and photo (right).

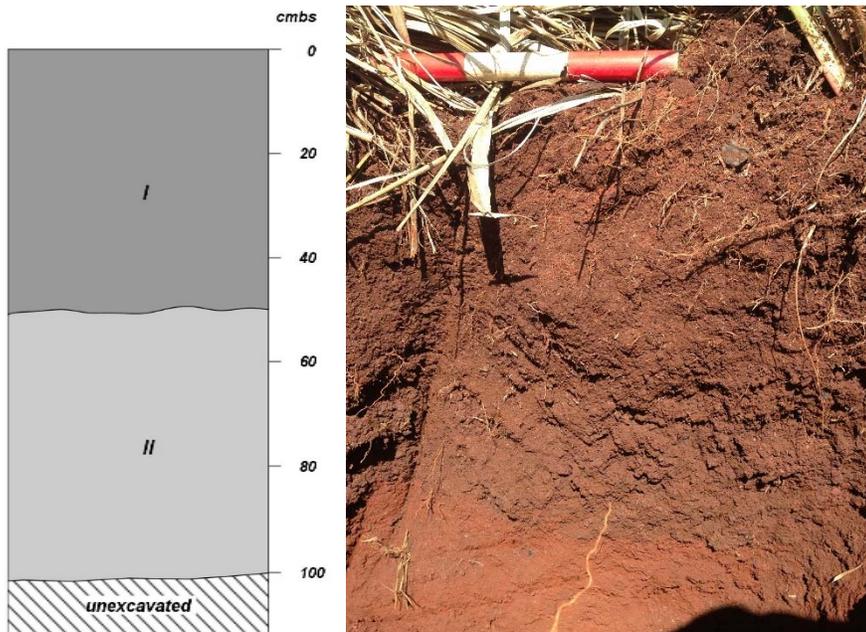


Figure 19. TR 6 north face profile drawing (left) and photo (right).

TR 7 was located toward the northwest corner of Reservoir 4 (see Figure 13). It measured 5.2 m long and .5 m wide and was excavated to 130 cmbs, well into the sterile layer. Stratigraphy consisted of the same organic-rich deposit with black plastic fragments, above the sterile layer (Figure 20). No cultural material or deposits were found.

TR 8 was located toward the northeast end of Reservoir 3 (see Figure 13). Only one trench was excavated at this reservoir because of the extensive previous disturbance in this area (see Figure 12). The trench measured 4.1 m long and .5 m wide. It was excavated to 70 cm below the disturbed surface, which is approximately 115 cm below the natural ground surface. Only the sterile layer was exposed in this trench, as the upper organic-rich layer had already been removed (Figure 21). No cultural deposits or features were identified.

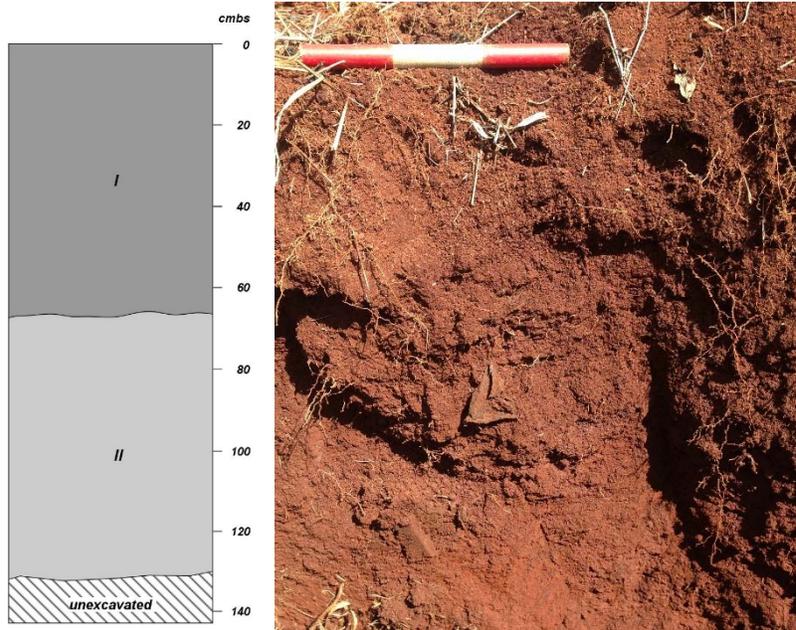


Figure 20. TR 7 east face profile drawing (left) and photo (right).

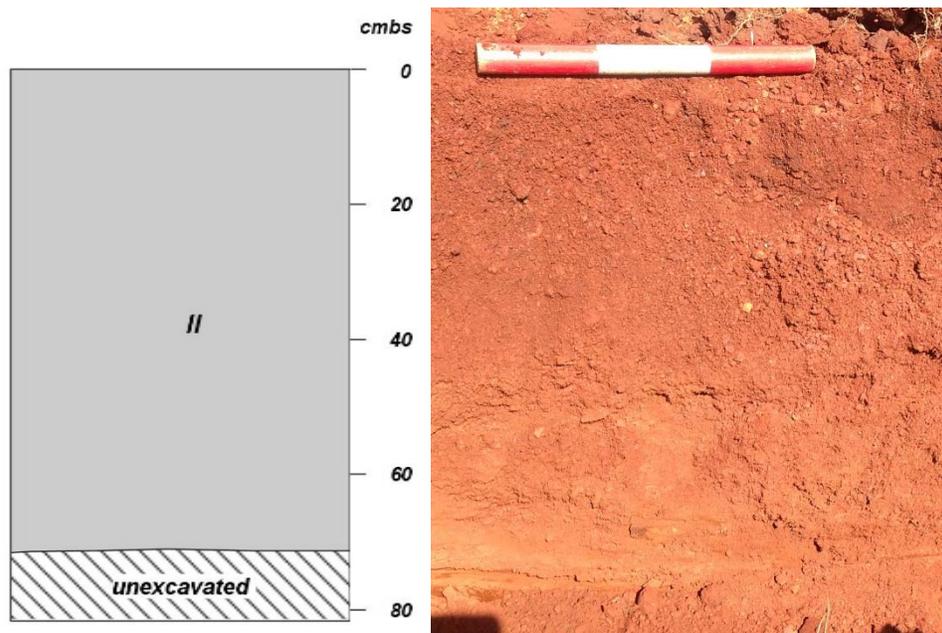


Figure 21. TR 8 north face profile drawing (left) and photo (right).

## Laboratory Analysis

During the archaeological inventory survey, 85 historic artifacts were found. The artifacts consisted of 10 whole glass bottles, 50 bottle glass fragments, and 25 ceramic/tableware fragments. This collection was gathered in its entirety out of a secondary context at Reservoir 3.

### Bottle Glass

All terminology used to describe bottle traits and all bottle dating information in this report section is based on information from the U.S. Department of Interior, Bureau of Land Management (BLM)/ Society of Historic Archaeology (SHA) “Historic Glass Bottle Identification and Information Website” (BLM/SHA 2014). The Wahiawā material included 10 whole bottles and 50 bottle glass fragments. Data for all glass is presented in Table 3, while a selection of whole bottles are pictured in Figures 22–24.

### *Bottle Mold Seams and Finishes*

There are three major technological divisions in the manufacture of glass bottles. In the United States, free-blown utilitarian bottles generally pre-date 1860. From ca. 1800, bottles were mouth-blown into some type of mold and the mouth of the bottle was finished by hand. Around 1903, Michael Owens invented a fully-automatic bottle machine (ABM) to blow bottles from the base to the lip. By 1920, in North America, use of the fully automatic machines had completely replaced the older methods of manufacture. Thus the mold-blown era for American bottles extends from ca. 1800 to 1920, which overlaps with the fully automatic machine-made bottle era from ca. 1903 to the present (BLM/SHA 2013\_Glassmaking).

There are no definite free-blown bottles in the Wahiawā collection; all are machine blown or mold blown and thus post-date 1903. Also, thicker mold seams and bubbles in the glass generally mean the bottles and bottle fragments collected originated from an earlier manufacturing date, pre-1930s.

In the mid- to late- 19<sup>th</sup> century, molds became more complicated, having two or more parts. The most common mold used was a two-piece mold with a separate cup-bottom plate. These types of bottles have a mold seam around the base of the bottle, and two side seams that run vertically up the sides of the bottle. The side mold seams usually end on the neck, as the lip on mold-blown bottles was finished by hand. Two bottles (Acc. # 15 and 16) in the collection were made in a four-piece cup mold (see Figure 22) and several other bottle fragments were made in some type of two-piece or four-piece mold. Two-piece molds were the dominant form used in the post-1880 period. One wine/champagne bottle base fragment (Acc. # 45) had no side seams and was probably produced in a turn mold, commonly used from 1880–1915. In a turn mold, the seams are erased during the manufacturing process (BLM/SHA\_Glassmaking).

During the mold-blown era (ca. 1800–1920), the lip of the bottle continued to be finished by hand. Determining the method employed in finishing a mouth-blown bottle can be one of the more useful diagnostic tools in determining the approximate manufacturing date range.

The standard tooled finish was first used as early as the 1860s with smaller bottles, although it became the dominant finishing method by the 1890s. The glass for the finish is not added, but the neck of the bottle is refired and formed into the finish by a lipping tool. Some diagnostic features of the tooled finish are side mold seams that fade out on the neck of the bottle below the finish, concentric horizontal tooling marks present on the finish and upper neck, absence of glass sloping over onto the upper neck, and absence of the interior ridge in the bore in an improved tooled finish, first used around 1890. The side seams end at the finish or extend almost to the rim of the finish.

**Table 3. Data for Glass Artifacts**

<b>Provenience</b>	<b>Acc. #</b>	<b>L/H (cm)</b>	<b>Diam. (cm)</b>	<b>Contents</b>	<b>Origin; Date</b>	<b>Description</b>
Reservoir 3, unknown depth	15	19.7	6 x 3.4	Soda	American, ca. 1910	Whole clear glass bottle; "WAIALUA SODA WORKS LTD. BOTTLE IS NOT SOLD" on body; "W.S.W." on round base; two vertical seams only on body; one horizontal seam just above lettering on body; bubbles in glass. 4 piece cup mold, mold blown. Tooled Hutchinson finish. See example in "Elliott & Gould 1988 Hawaiian Bottles of Long Ago" on page. 129, fig. 128, bottle number 317.
Reservoir 3, unknown depth	16	19.9	6 x 3.2	Soda	American, ca. 1908	Whole clear glass bottle; "WAIALUA SODA WORKS" on body; "W" on round base; two vertical seams only on body; one horizontal seam just above lettering on body; metal stopper inside; bubbles in glass. 4 piece cup mold, mold blown. Tooled Hutchinson finish. See example in "Elliott & Gould 1988 Hawaiian Bottles of Long Ago" on page. 127, fig. 126, bottle number 312.
Reservoir 3, unknown depth	17	13.8	2.2	Utilitarian	American, 1905-1930	Whole aqua glass bottle, rectangular base and body; "88" on base; two seams that extend to base but not to lip; bubbles in glass. Patent lip with a tooled finish. Mold blown.
Reservoir 3, unknown depth	18	16.5	4.5 x 2.9	Utilitarian	American, 1905-1920	Whole aqua/light green glass bottle; four triangles on base; two seams only on body; bubbles in glass. Patent lip applied top, and a tooled finish.
Reservoir 3, unknown depth	19	11.3	2.7	Utilitarian	American, Post 1920	Whole clear glass bottle; rectangular base and body; "120 H" on base; two seams only on body. Eternal screw threaded top, machine made.
Reservoir 3, unknown depth	20	9.3	5.3 x 3.7	Shoe Polish	American, 1910-1930s	Whole clear glass bottle; "WHITTEMORE'S POLISH" on shoulder; "3" on base; two seams extend from base to lip; bubbles in glass. Two piece cup mold, machine made, with a bead finish.
Reservoir 3, unknown depth	21	9.5	5.3 x 3.5	Ink	American, Post 1905	Whole aqua glass bottle; two seams only on body, with a round base. Patent finish, Mold blown., most likely ink an well as it fits the shape commonly used between 1900-1930s
Reservoir 3, unknown depth	22	6.4	6.1 x 3.1	Ink	American, 1910-1930s	Whole clear glass bottle, recently broken; "CARTER'S MADE IN USA" on base; two seams extend from base to lip; bubbles in glass. Bead finish, machine made.

**Table 3. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>L/H (cm)</b>	<b>Diam. (cm)</b>	<b>Contents</b>	<b>Origin; Date</b>	<b>Description</b>
Reservoir 3, unknown depth	23	5.4		Utilitarian	1905-1920	Base fragment of clear glass bottle; rectangular base and body; two seams. Machine made. Most likely a medicine bottle.
Reservoir 3, unknown depth	24	5.7	2 x 1.7	Utilitarian	1905-1920	Whole clear glass bottle; octagonal base and body; two seams only on body. Patent finish, machine made. Most likely a medicine bottle
Reservoir 3, unknown depth	25		6.1	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "WAIAL SODA WORKS LTD. BOTTLE IS NOT SOLD" on body; "W.S.W." on base; two seams; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	26		6.1	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "WAIALUA SODA WORKS LTD. BOTTLE IS NOT SOLD" on body; "W.S.W." on base; two seams; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	27		6.1	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "WAIAL SODA WORK LTD. BOTTLE IS NOT SOLD" on body; "W.S.W." on base; two seams; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	28		6.1	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "LTD. BOTTLE IS NOT SOLD" on body; "W.S.W." on base; two seams; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	29		6.1	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "DA W LTD. BOTTLE IS NOT" on body; "W.S.W." on base; one seam visible; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	30			Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; deformed from heat; "NOT SOLD" on body; "W.S.W." on base; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	31		5.9	Soda	American, ca. 1910-1912	Base and body fragment of light green glass bottle; "KS BOTTLE IS NOT SOLD" on body; "WAIALUA" on base; two seams on body; bubbles in glass. Mold blown.

**Table 3. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>L/H (cm)</b>	<b>Diam. (cm)</b>	<b>Contents</b>	<b>Origin; Date</b>	<b>Description</b>
Reservoir 3, unknown depth	32			Soda	American, ca. 1910-1912	Body fragment of clear glass bottle; "WAIALUA SODA WORKS LTD. NOT SOLD" on body; one vertical and one horizontal seam visible; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	33			Soda	American, ca. 1910-1912	Body fragment of clear glass bottle; "WA SODA WORKS LTD. BOTTLE IS NOT SOLD" on body; two vertical and one horizontal seam visible. Mold blown.
Reservoir 3, unknown depth	34			Soda	American, ca. 1910-1912	Body fragment of clear glass bottle; "AIALUA A WORKS LTD. S NOT" on body; one seam visible. Mold blown.
Reservoir 3, unknown depth	35			Soda	American, ca. 1910-1912	Body fragment of clear glass bottle; "A RKS" on body; one seam visible; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	36			Soda	American, ca. 1910-1912	Body fragment of clear glass bottle; "WAIA" on body; bubbles in glass. Mold blown.
Reservoir 3, unknown depth	39		7.8	Soda	American, 1906-1914	Base and body fragment of aqua glass bottle; "A. B. Co. E 3" on base; two seams on body; bubbles in glass. American Bottle Co. emblem on base. Mold blown, two piece cup mold (BLM SHA 2014)
Reservoir 3, unknown depth	40			Soda	American, 1911-1917	Body fragment of very light green glass bottle; "HONOLUL HONOLU" vertically oriented on body; bubbles in glass. Two piece cup mold, Mold blown. Tooled crown top finish. See page 189 of Elliott and Gould (1988) fig. 188 bottle number 837.
Reservoir 3, unknown depth	41		2.6	Soda	American, 1912-1915	Lip, neck, and shoulder fragment of clear glass bottle; script "e," backwards "j," and "m" as well as "KC MO" on shoulder; two seams visible on neck; bubbles in glass. Crown top tooled finish, Mold blown.
Reservoir 3, unknown depth	42			Soda	American, 1910-1920	Body fragment of very light aqua glass bottle; "LU, T." vertically oriented on body. Most likely read "...HONOLULU T.H" referring to Territory of Hawaii as shown in many examples of different Hawaii brand soda works bottles in Elliott and Gould (1988).

**Table 3. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>L/H (cm)</b>	<b>Diam. (cm)</b>	<b>Contents</b>	<b>Origin; Date</b>	<b>Description</b>
Reservoir 3, unknown depth	43			Soda	Post 1905	Base and body fragment of clear glass bottle; "44 x" on base. Machine made.
Reservoir 3, unknown depth	44		6.1	Alcohol	1905-1920	Base and body fragment of dark green glass bottle. Machine made.
Reservoir 3, unknown depth	45		6.3	Alcohol	1890-1920	Base and body fragment of dark amber glass bottle; bubbles in glass. Round base, with a small kick-up. Turn mold.
Reservoir 3, unknown depth	46		2.6	Soda	American, Post 1910	Lip, neck, and shoulder fragment of light green glass bottle; two seams visible on neck and shoulder. Crown top finish, Mold blown.
Reservoir 3, unknown depth	47		7.0	Soda	American, 1902-1920	Base and body fragment of aqua glass bottle; "830" and "IPG Co" in diamond on base; no seams visible; bubbles in glass. Two piece cup mold, mold blown. Illinois Pacific Glass Co. emblem on base (BLM SHA 2014).
Reservoir 3, unknown depth	48		2.5	Soda	Post 1910	Lip, neck, and shoulder fragment of light green glass bottle; two seams visible on neck and shoulder.
Reservoir 3, unknown depth	49		7.8	Soda	Post 1910	Round base and body fragment of light green glass bottle; "12" on body; two seams visible from base to body. Mold blown.
Reservoir 3, unknown depth	50			Utilitarian	American, 1905-1930	Base and body fragment of light green glass bottle; rectangular base and body; "88" on base.
Reservoir 3, unknown depth	51		6.3	Soda	American, 1906-1909	Base and body fragment of aqua glass bottle; recently broken; "AB D 25" on circular base; two seams from base to body; bubbles in glass. Mold blown, two piece cup mold. American Bottle Co. emblem on base (BLM SHA 2014).

**Table 3. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>L/H (cm)</b>	<b>Diam. (cm)</b>	<b>Contents</b>	<b>Origin; Date</b>	<b>Description</b>
Reservoir 3, unknown depth	52		2.7	Soda	American, 1910-1920	Lip, neck, and shoulder fragment of aqua glass bottle; two seams on neck and shoulder; bubbles in glass. Applied crown top and tooled finish, mold blown.
Reservoir 3, unknown depth	53		2.7	Soda	American, 1910-1920	Lip, neck, and shoulder fragment of aqua glass bottle; no seams. Crown top tooled finish.
Reservoir 3, unknown depth	54		2.9	Utilitarian	American, 1910-1920s	Lip, neck, and shoulder fragment of clear glass bottle; two seams visible on neck and shoulder; bubbles in glass. Straight brandy finish, mold blown.
Reservoir 3, unknown depth	55		2.4	Utilitarian	American, Post 1920	Lip, neck, and body fragment of clear glass bottle; square body; two seams visible from lip to body; bubbles in glass. External thread srew top, mold blown.
Reservoir 3, unknown depth	56		2.8	Soda	American, ca. 1910-1912	Lip, neck, and body fragment of clear glass bottle; one seam visible on neck and shoulder; portion of metal stopper intact; bubbles in glass. Blob top, tooled finish.
Reservoir 3, unknown depth	57		2.3	Utilitarian	American, Mid to late 1920s	Lip, neck, and shoulder fragment of clear glass bottle; no seams visible; bubbles in glass. Oil finish.
Reservoir 3, unknown depth	58		2.5	Utilitarian	American, Post 1920	Lip, neck, and shoulder fragment of clear glass bottle; two seams visible from lip to shoulder; bubbles in glass. External threaded screw top. Mold blown.
Reservoir 3, unknown depth	59		6.0	Soda	American, ca. 1910-1912	Base and body fragment of clear glass bottle; "W" on base; one seam visible on body; bubbles in glass. Machine made.
Reservoir 3, unknown depth	60		2.5	Soda	American, ca. 1910-1912	Lip, neck, and shoulder fragment of clear glass bottle; no seams visible. Blob top finish. Most likely mold blown.

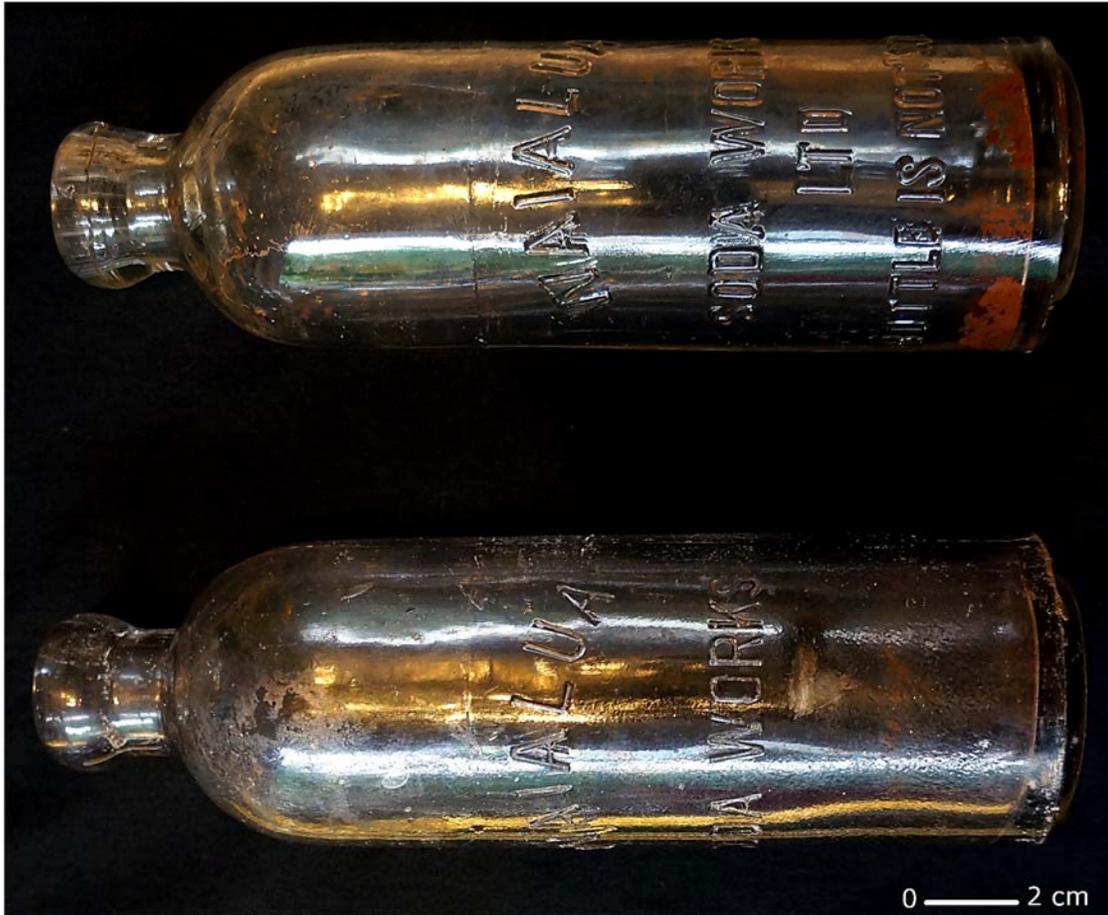


Figure 22. Acc. # 15 (top) and 16 (bottom), found in secondary context.

Five beverage bottles (Acc. # 15, 16, 19, 54, and 57), had a standard tooled finish (BLM/SHA 2014\_Finishes).

In 1903, Michael Owens invented a machine that replaced the human glassblower. The machine was used to blow wide-mouth bottles as early as 1905 and narrow-necked bottles (such as beverage bottles) as early as 1908. The Automatic Bottle Machine blew a bottle from base to lip, usually using a two-piece cup mold. The two side seams extend to and over the lip of the bottle, although the lip seams could be erased later by fire-polishing (BLM/SHA 2014\_Bottle Dating\_Machine-Made Bottles). There were only two bottles that have machine made characteristics with a seam that runs all the way to the lip, which are Acc. # 20 and 58.

#### ***Bottle Contents and Information***

In the mold-blown and early years of the machine-made periods, information on the glass manufacturer, the brand, the bottler, and the distributor, and other information were embossed (raised



**Figure 23. Bottles from secondary context. Left to right: Acc. # 17, 19, 18.**

letters formed from a mold plate) on the bottle. After ca. 1910, most machine-made bottles lost the embossing and switched to paper labels. In 1933, label information was baked onto the bottle color enamels, called Applied Color Label (ACL) (BLM/SHA 2014\_Glossary). No bottles with paper labels were found in the collection, as these paper labels would have deteriorated. There were also no bottles with ACL bottle labels found.

In the Wahiawā collection, we have identified several different soda works bottles that read “W,” “W.S.W.,” and “WAILUA” on their bases, which has given us a narrow date range of ca. 1910–1912. Other embossed lettering and variations on the Wailua Soda Works bottles and fragments have made it possible to identify each bottle to a specified date of ca. 1908 to about ca. 1913. Another bottler’s maker’s mark is a connected “AB” and “A.B. Co.” which is from the American Bottle Co. The connected AB mark almost certainly belonged to the American Bottle Co. instead of Adolphus Busch. The dates for the use of the mark probably extended from about 1904 until at least 1909, and possibly as late as 1917 (BLM/SHA 2014\_ABConnectedMark\_BLockhart). See the glass bottle table for more information (Table 3).



**Figure 24. Bottles from secondary context. Left to right: Acc. # 20, 21, 22.**

### **Ceramics**

Ceramics found during the survey consist of both porcelain of Japanese/Asian and Euro-American origin (Table 4 and Figures 25–28). The majority of the ceramic items however were porcelain items made in Japan for the export market.

#### ***Trademarks/Markers Marks***

The word trademark was used on English pieces after the Trademark Act of 1862. Coincidentally the McKinley Tariff Act of 1891 required that the name of the country where the ceramic was originally made must be printed on each piece. Sometimes country names were used as part of the mark before 1891 with the earliest known date for Japan being 1921 (Kovel and Kovel 1986).

The mark of the Royal Coat of Arms icon (a lion and a unicorn) of Great Britain consists of the maker's name and the word "England" below the name. Staffordshire used this specific mark from 1873 to 1907, and "England" was added to the mark in 1891. Thus, the tableware was manufactured from 1891 to 1907 (Stoke on Trent\_Potteries 2014).

#### ***Japanese and Asian wares***

Official Japanese emigration to Hawai'i did not occur until 1868. The main immigration period for Japanese brought to Hawai'i to work in the sugar plantations is from 1868 to 1907 (Nordyke and Matsumoto 1977:162). A recent study on Japanese immigration to Hawai'i has stated that before emigration to Hawai'i began, no Japanese products were shipped there (Moriyama 1985:109). This leads us to conclude that none of the Japanese ceramics/tableware artifacts in our collection could have been brought to Hawai'i prior to 1868.

Several of the porcelain pieces found in the Wahiawā collection were made with a blue stencil transfer print technique called "Dashed Line," as a dashed line separates the different design

**Table 4. Data for Ceramic Artifacts**

<b>Provenience</b>	<b>Acc. #</b>	<b>Portion</b>	<b>Surface Decoration</b>	<b>Vessel Form</b>	<b>Origin, Date Range</b>	<b>Comments</b>
Reservoir 3, unknown depth	1	body fragment	blue floral		Japanese, porcelain post 1868	Porcelain, white paste, lead transparent glaze, blue floral transfer print, thickness .5 cm
Reservoir 3, unknown depth	2	rim fragment	blue dashed line		Japanese, porcelain post 1868	Diameter of rim 17 cm; thickness .6 cm, blue stenciled dashed-line transfer print.
Reservoir 3, unknown depth	3	base fragment	blue floral	bowl	Japanese, porcelain post 1868	Diameter of base 7.5 cm; thickness .4-1.2 cm lead transparent glaze, blue floral transfer print.
Reservoir 3, unknown depth	4	base fragment	none		Euro-American, Earthenware/ Ironstone, post 1880	Diameter of base 8 cm; thickness .3-.5 cm; black unicorn and "...RE" on base which resembles that of the Royal Arms found on many of the mid-19 <sup>th</sup> century to early 20 <sup>th</sup> century tablewares as seen in Kovel & Kovel (1986) page 10-14 in the Animals and Insects section.
Reservoir 3, unknown depth	5	base fragment	none	bowl	Euro-American, earthenware/ ironstone, post 1880	Diameter of base 7 cm; thickness .2-.4 cm; black possible horse or unicorn on base, with "HIRE...ND." Burned. The emblem resembles that of the royal coat of arms which belongs to Staffordshire England tablewares, which are made of earthenware/ironstone.
Reservoir 3, unknown depth	6	rim fragment	red floral patterning, inside only	plate	Euro-American 1828-20 <sup>th</sup> century	Diameter of rim 26 cm; thickness .4-.6 cm; rim slightly scalloped, with red transfer print.
Reservoir 3, unknown depth	7	base fragment	green stripes, outside only	cup	Asian, porcelain 1870-1920s	Porcelain, base to body fragment, with celadon glaze, and high footring. Diameter of base 5 cm; thickness .3-.7. Most likely an Asian/Japanese style straight-sided tea cup.

**Table 4. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>Portion</b>	<b>Surface Decoration</b>	<b>Vessel Form</b>	<b>Origin, Date Range</b>	<b>Comments</b>
Reservoir 3, unknown depth	8	rim fragment	raised vine pattern, inside only, no color		Asian, porcelain post 1868	Diameter of rim 14 cm; thickness .2 cm.
Reservoir 3, unknown depth	9	rim to base fragment	blue floral	bowl	Japanese, porcelain post 1868	Two articulating fragments; diameter of rim 13 cm; diameter of base 5 cm; thickness .3-.8 cm, blue floral transfer print.
Reservoir 3, unknown depth	10	rim fragment	blue floral		Japanese, porcelain post 1868	Rim portion too small to measure diameter; thickness .2 cm, blue floral transfer print.
Reservoir 3, unknown depth	11	rim to base fragment	blue floral	bowl	Japanese, porcelain post 1868	Diameter of rim 12 cm; base portion too small to measure; thickness .2-.7 cm, blue floral transfer print.
Reservoir 3, unknown depth	12	rim fragment	blue floral	bowl	Japanese, porcelain post 1868	Diameter of rim 14 cm; thickness .3-.4 cm; raised mark on outside surface, blue floral transfer print.
Reservoir 3, unknown depth	13	base fragment	blue half flower	bowl	Japanese, porcelain post 1921	Diameter of base 4.5 cm; thickness .3-.6; "TRADEMARK MADE IN JAPAN" on base in blue with half flower transfer print.
Reservoir 3, unknown depth	14	base fragment	blue and green leaves, outside only	bowl	Japanese, porcelain post 1921	Diameter of base 4 cm; thickness .2-.6 cm; "TRADEMARK DE IN APAN" in blue on base with half flower graphic.
Reservoir 3, unknown depth	15	rim fragment	none	bowl	Euro-American ironstone/hotelware 1880 to present	Diameter of rim 17 cm; thickness .4 cm, white ironstone/hotelware fragment.

**Table 4. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>Portion</b>	<b>Surface Decoration</b>	<b>Vessel Form</b>	<b>Origin, Date Range</b>	<b>Comments</b>
Reservoir 3, unknown depth	16	base fragment	none		Euro-American ironstone/hotelware 1880 to present	Diameter of base 12 cm; thickness .3 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	17	rim fragment	none	plate	Euro-American ironstone/hotelware 1880 to present	Diameter of rim 26 cm; thickness .4-.5 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	18	foot or knob fragment?	none		Euro-American ironstone/hotelware 1880 to present	Thickness .2-.9, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	19	base fragment	none		Euro-American ironstone/hotelware 1880 to present	Diameter of base 3 cm; thickness .3-.5 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	20	rim fragment	none	cup	Euro-American ironstone/hotelware 1880 to present	Diameter of rim 9 cm; thickness .3-.4 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	21	rim fragment	none	bowl	Euro-American ironstone/hotelware 1880 to present	Diameter of rim 14 cm; thickness .2-.4 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	37	rim to base fragment	blue floral	bowl	Japanese, porcelain post 1868	Diameter of rim 14 cm; diameter of base 4 cm; thickness .2-.4 cm.

**Table 4. (Continued)**

<b>Provenience</b>	<b>Acc. #</b>	<b>Portion</b>	<b>Surface Decoration</b>	<b>Vessel Form</b>	<b>Origin, Date Range</b>	<b>Comments</b>
Reservoir 3, unknown depth	38	rim to base fragment	blue and brown/green unidentified design, outside only; blue band outside footring	bowl	Japanese, porcelain post 1868	Diameter of rim 10 cm; diameter of base 4 cm; thickness .2-.7 cm.
Reservoir 3, unknown depth	61	rim fragment	none	plate	Euro-American ironstone/hotelware 1880 to present	Diameter of rim 26 cm; thickness .4-.5 cm, white ironstone/hotelware fragment.
Reservoir 3, unknown depth	62	body fragment	none		Euro-American ironstone/hotelware 1880 to present	Thickness .2-.3 cm, white ironstone/hotelware fragment.

elements. These were made in Japan from about 1870 to the 1920s and exported to Japanese communities on the west coast of the United States, Hawai‘i, and anywhere the Chinese had made an overseas settlement (Ross 2012:5). An example of the “Dashed Line” technique is shown on Acc. # 2 (see Figure 25).

### *Euro-American wares*

A durable type of ironstone, called Hotelware, became popular after 1880 (Lebo 1997:Appendix G:5). Several of the Ironstone base fragments (Acc. # 4 and 5) have partial stamp marks visible with the Royal Coat of Arms and what most likely read “Staffordshire, England” (see Figure 26). There were numerous potteries in Staffordshire, but the placement and style of the letters and the figures on the coat of arms are most similar to the mark used by George Jones & Sons between 1873 and 1907 (Stoke-on-Trent Potteries 2013). Ironstone (whiteware) is a type of refined earthenware introduced in 1840. These wares are sometimes molded, but have little to no decoration.



Figure 25. Ceramics found in secondary context. Left to right: Acc. # 1, 2, 3.



Figure 26. Ceramics from secondary context. Acc. # 4 (left) and 5 (right).



Figure 27. Ceramic plate fragment, Acc. # 8, from secondary context.

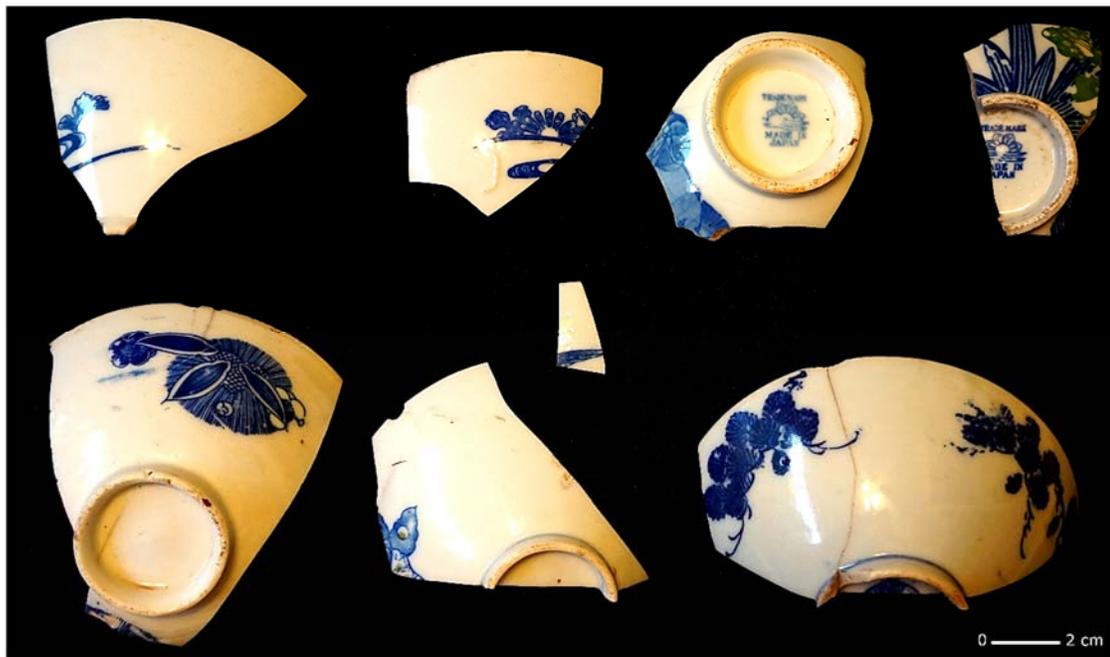


Figure 28. Ceramics from secondary context. Bottom left to right: Acc. # 37, 38, 9. Center: 10. Top left to right: Acc. # 11, 12, 13, 14.

## Laboratory Analysis Discussion

The Wahiawā collection has material that could date back to as early as 1868 with the Japanese porcelain fragments found without any maker's marks (Acc. # 1–3, 8–12, 37 and 38), or as late as 1930 with the Whittemore's Polish bottle (Acc. # 20) and Carter's Ink well (Acc. # 22). The possible date range for the collection would be the late 19<sup>th</sup> century to the early 20<sup>th</sup> century. Artifacts, including many beverage bottles and household ceramics, indicate that this trash is most likely related to residential property usage, possibly from laborers working on the pineapple and sugarcane fields.

The majority of glass (66%) consisted of soda bottles, with more than half (52%) of the soda bottles identifiable as manufactured by Waiialua Soda Works. The Waiialua Soda Works bottles could be dated to within a few years, between ca. 1910 and 1912. Other glass uses include utilitarian (23%), alcohol (4.5%), ink (4.5%), and shoe polish (2%).

The ceramics were roughly evenly split between Euro-American (48%) and Asian (52%). Of the Asian ceramics, most (85%) were Japanese in origin. All of the items with identifiable vessel form were tableware, with 11 bowl fragments, three plate fragments, and two cup fragments. This suggests residential use, with possibly two or more households represented, given the split between Euro-American and Asian items.

## Summary of Findings

Pedestrian survey and subsurface testing at all four reservoir sites confirmed extensive disturbance from earlier pineapple cultivation, and at Reservoir 3, from modern bulldozing activity. No surface or subsurface archaeological sites remain in any of the four survey blocks. At Reservoir 3, an assemblage of historic material was collected from the surface in a heavily disturbed area. Given that this material was not found *in situ* and its primary context has been lost, the artifacts were not assigned a site number. A total of 85 items were collected, including 10 whole glass bottles, 50 bottle glass fragments, and 25 ceramic/tableware fragments. Much of the collection consisted of Waiialua Soda Works bottles, manufactured between ca. 1910 and 1912. Ceramic tableware was also common, with both Euro-American and Asian pieces represented. The items may have been deposited as trash from pineapple or sugarcane laborers.

## CONCLUSION AND RECOMMENDATIONS

An archaeological inventory survey was conducted for TMK: (1) 7-1-001:002 (por.) and :005 (por.) in Wahiawā Ahupua‘a, Wahiawā District, and TMK: (1) 6-5-002:010 (por.), Kamananui Ahupua‘a, Waialua District, on the island of O‘ahu. This was done in preparation for ground disturbance associated with construction of four reservoirs. The archaeological assessment included pedestrian survey that covered 100% of the four reservoir project areas, as well as test excavations consisting of eight trenches.

No pre- or post-contact surface architecture was found during pedestrian survey of the project areas. All areas were found to be disturbed by pineapple cultivation. Likewise, subsurface testing did not yield any evidence of subsurface cultural features or deposits. Stratigraphy consists of the pineapple cultivation layer speckled with black plastic fragments, with a sterile layer below.

Evidence of more recent disturbance was noted at Reservoir 3, as the entire area had been bulldozed. An assemblage of historic material was collected from the surface and in backdirt piles, in secondary context. These consisted of 85 items of ceramic and glass that may be trash from pineapple or sugarcane field laborers. Items within the collection may date to as early as 1868 or as late as 1930.

The ceramics were roughly evenly split between Euro-American and Asian. Of the Asian ceramics, most were Japanese in origin. The majority of glass consisted of soda bottles, with more than half of these from the Waialua Soda Works. The Waialua Soda Works bottles could be dated to within a few years, between ca. 1910 and 1912.

In sum, archaeological survey was conducted on TMK: (1) 7-1-001:002 (por.) and :005 (por.) in Wahiawā and TMK: (1) 6-5-002:010 (por.) in Kamananui. No archaeological sites were found, and the only remains were glass and ceramics collected from a disturbed context. Construction of the four reservoirs will have no effect on historic properties because no historic properties occur within the project area. Archaeological and/or cultural monitoring is recommended, however, due to community concerns regarding the potential to encounter subsurface archaeological remains.

It should be noted that isolated human burial remains may be discovered during construction activities, even though no evidence of human burials was found during the survey. Should human burial remains be discovered during construction activities, work in the vicinity of the remains should cease and the SHPD should be contacted.

## GLOSSARY

<b>ahupua‘a</b>	Traditional Hawaiian land division usually extending from the uplands to the sea.
<b>akua</b>	God, goddess, spirit, ghost, devil, image.
<b>ali‘i</b>	Chief, chiefess, monarch.
<b>‘auwai</b>	Ditch, often for irrigated agriculture.
<b>boulder</b>	Rock 60 cm and greater.
<b>California grass</b>	The invasive <i>Brachiaria mutica</i> that forms dense stands up to 2 m tall.
<b>cobble</b>	Rock fragment ranging from 7 cm to less than 25 cm.
<b>gravel</b>	Rock fragment less than 7 cm.
<b>heiau</b>	Place of worship and ritual in traditional Hawai‘i.
<b>kalo</b>	The Polynesian-introduced <i>Colocasia esculenta</i> , or taro, the staple of the traditional Hawaiian diet.
<b>kapu</b>	Taboo, prohibited, forbidden.
<b>kauwā</b>	Outcast or slave caste within the traditional Hawaiian social hierarchy.
<b>konohiki</b>	The overseer of an <i>ahupua‘a</i> ranked below a chief; land or fishing rights under control of the <i>konohiki</i> ; such rights are sometimes called <i>konohiki</i> rights.
<b>Kū</b>	The Hawaiian god of war.
<b>kula</b>	Plain, field, open country, pasture, land with no water rights.
<b>kuleana</b>	Right, title, property, portion, responsibility, jurisdiction, authority, interest, claim, ownership.
<b>lo‘i, lo‘i kalo</b>	An irrigated terrace or set of terraces for the cultivation of taro.
<b>lua</b>	The ancient style of fighting involving the breaking of bones, dislocation of joints, and inflicting pain by applying pressure to nerve centers.
<b>luakini</b>	Large <i>heiau</i> of human sacrifice.
<b>Māhele</b>	The 1848 division of land.
<b>maka‘āinana</b>	Common people, or populace; translates to “people that attend the land.”
<b>makai</b>	Toward the sea.
<b>mākālei</b>	A supernatural tree of Moloka‘i Island; parts of its root were placed near fishpond gates to attract fish.
<b>mauka</b>	Inland, upland, toward the mountain.
<b>mō‘ī</b>	King.
<b>moku</b>	District, island.
<b>mo‘olelo</b>	A story, myth, history, tradition, legend, or record.
<b>‘ōlelo no‘eau</b>	Proverb, wise saying, traditional saying.
<b>olonā</b>	The native plant <i>Touchardia latifolia</i> , traditionally used for making cordage.
<b>pu‘uhonua</b>	Place of refuge.

<b>sandalwood</b>	<i>Iliahi (Santalum)</i> , several varieties endemic to Hawai‘i. Known for their aromatic wood and medicinal qualities. Heavily exported in the 1800s.
<b>stone</b>	Rock fragment ranging from 25 cm to less than 60 cm.
<b>‘uala</b>	The sweet potato, or <i>Ipomoea batatas</i> , a Polynesian introduction.
<b>‘ūlei</b>	The native shrub <i>Osteomeles anthyllidifolia</i> , the berries of which were eaten, sewn into <i>lei</i> , and used to make lavender dye, and its hard wood used to produce a variety of implements.
<b>‘ulu</b>	The Polynesian-introduced tree <i>Artocarpus altilis</i> , or breadfruit.
<b>‘ulu maika</b>	Stone used in the <i>maika</i> game, similar to bowling.

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