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APPENDIX A: (revised)

A CULTURAL APPROACH TO SUSTAINABILITY

A Cultural Approach to Sustainability

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A Cultural Approach to Sustainability

1. Introduction

I kekahi wā, he kaiaulu ʻeleu a paepae nā ahupuaʻa o Turtle Bay Resort. Ma ka ʻāina a i ke kai, ua lawaiʻa nā poʻe, e hāhāpaʻakai, e aulau i nā hala, e kanu paʻa i ko lākou ʻohana, a me e hoʻākoakoa me ko lākou ʻohana. ʻOiai loli ka ʻāina, ke noho loa nei ka ʻuhane aloha o kēia mau ʻāina. Makemake ʻo Turtle Bay Resort e hōʻihi i ka ʻuhane e hanohano ʻana i ka waiwai Hawaiʻi mai nā kūpuna mai. Aia kēia mau waiwai i ka ahupuaʻa paepae ʻo Tomorrow's Ahupuaʻa. Nānā i hope, nānā i mua.

At one time, the ahupua'a of Turtle Bay Resort were a vibrant and sustainable community. On the land and in the ocean, the people fished, gathered salt, harvested hala, buried their families, and gathered with their families. Although the land has changed, the aloha spirit of these lands remains. Turtle Bay Resort desires to respect that spirit by honoring the Hawaiian traditional values. These values are in the sustainable ahupuaʻa called Tomorrow's Ahupuaʻa. Looking forward, looking back.

Today, a growing interest in sustainability has heightened public awareness of the applicability of traditional Hawaiian land use and cultural practices to modern economic activities. This has led to the project team's exploration of the *ahupua`a* natural resources management system to provide a basis for the master planning process.

"In traditional Hawaiian life, an ahupua`a, or land division, was a complete ecological and economic production system that provided all the resources to sustain the community living within its boundaries. Ahupua`a boundaries were the natural geographic formations such as mountain ridges, gulches, and streams, and ahupua`a were typically wedge-shaped, extending from the top of the mountain into the outer edge of the ocean reef. Fish and marine resources were harvested from the ocean, kalo (taro) and `uala (sweet potato) were raised in the lowlands, and upland areas provided trees and other forest products.

The ahupua`a concept is a holistic approach to land management that recognizes the connections between land-based and marine-based natural resources and the dependent relationships between ecological functions. Resources were managed for the collective good of all living within the ahupua`a, based on the principal that activities in one part of the ahupua`a affected all other parts. The ahupua`a concept is used as *the organizing basis for land use planning and natural resource management in Ko`olau Loa."* (Ko`olau Loa Sustainable Communities Plan, Public Review Draft, October 2010)

The following sections outline the inspiration, foundations and practical approaches to implementing these guidelines past, present and into the future. This framework is a work in progress and will evolve overtime as the team consistently engages key stakeholders, obtains feedback and makes adjustments to create best practices around the evolving Tomorrow's Ahupua'a principles for the Turtle Bay Resort Community:

Nana I Mua, Nana I Hope

Looking Forward, Looking Back

The TBR properties include portions of seven ahupua`a (in order from west to east): `Opana, Kawela, Hanaka'oe, `O`io, `Ulupehupehu, Punala`u, and Kahuku. Exploring the history of these ahupua`a has renewed an understanding that the qualities inherent to them are still relevant today and can be translated to guide the decisions affecting the long-term responsible use and management of the land into the future. This new understanding has led to the formulation of a concept called *Tomorrow's Ahupua`a* that has become the guide for this planning process. *Tomorrow's Ahupua`a* strives to learn from the traditions, values, and aspirations of the host culture to develop a sustainable community platform that celebrates the balance of its environmental, socio-political, economic, and cultural resources. The project team looks to the wisdom of the past to provide sound guidelines to build a common sense approach to a new more balanced future.

The efforts that have been undertaken to produce the SEIS embrace the concept of *Tomorrow's Ahupua`a*. To begin with, the project team has discarded the assumption that everything to be known about the land has already been learned. The SEIS presents new studies of the property, including marine resource, flora, and fauna inventories; new social, economic, and cultural impact studies; and a Supplemental Archaeological Inventory Survey (SAIS).

Between 1977 and 2006, no less than 21 separate reports have been prepared documenting the archaeological resources at Turtle Bay. Nearly 30 years of work has culminated in an approval by the State Historic Preservation Division of the Department of Land and Natural Resources of an Archaeological Mitigation Plan in 2007. However, the Owner/Applicant voluntarily elected to prepare the SAIS, in part due to community concerns over potential *iwi kupuna* (human remains) in areas designated for new development but more importantly because it was the right thing to do. To that end, the SAIS was conducted to supplement the previous archaeological work. The land use plan presented in the SEIS is based upon a comprehensive subsurface investigation of the property to determine the presence of any cultural resources.

*Tomorrow's Ahupua`a* honors the important aspects of the traditional ahupua`a; understanding and maintaining lands from mauka to makai; recognizing and stewarding the unique elements and resources of each ahupua`a in order to strive for a path towards higher sustainability; and creating a management framework inspired by the traditional ahupua`a to care for the natural and cultural resources.

As a conceptual framework, *Tomorrow's Ahupua`a*, has led to the formulation of a revised master plan for the Turtle Bay Lands, called the Comprehensive Plan. The Comprehensive Plan is intended to guide design of the proposed expansion of the resort, its approach to sustainability and environmental stewardship, and the resort's future day-to-day operations.

In 2010 Hawai`i's Governor signed into law Act 181 amending Chapter 226, HRS (The Hawaii State Plan) to add a new definition for 'Sustainability' and provide new priority guidelines and principles to promote sustainability. Under state law,

> *"Sustainability means achieving the following:*

- *Respect of the culture, character, beauty, and history of the State's island communities;*
- *Striking a balance between economic, social, community, and environmental priorities; and*
- *Meeting the needs of the present without compromising the ability of future generations to meet their own needs."*

The Comprehensive Plan incorporates this definition into its core principals.

2. Cultural Orientation

Full of resources and beautiful landscapes, Kahuku, O'ahu was the focus of many Hawaiian legends, poems, chants, and songs. The people of Kahuku proudly represented their homeland by wearing plated lau hala (Pandanus leaves) or lei made of hala fruit or seeds. People all over Hawaii immediately identified Kahuku natives by their hala garments. (Thrum 1976:100).

Nani i ka hala ka 'oiwi o Kahuku
The body of Kahuku is beautified by *hala* trees. (Pukui 1983:248).

According to Hawaiian legend, Hi`iaka, the beautiful younger sister of Pele, the temperamental volcano goddess, passed along the north coast of O'ahu on her journey around the Hawaiian Islands. Throughout her odyssey, Hi'iaka encountered many mythical creatures, some of which greeted her with good tidings while others greeted her with great malice. But when she encountered two such creatures Punaho'olapa (marsh) and Pahipahi'alua (ahupua'a west of the area project area) -

in Kahuku they "stole away into shelter of the hala groves without deigning to give [her] any salutation." (Emerson 1978:97) Upset over their disrespectful evasion, Hi'iaka proceeded to reprimand them in a poetic speech that employs the double-meaning of the word *hala*, which can also be defined as a sin or fault. (Emerson 1915:97-8 cited in Silva 1984: C-5).

Punaho'olapa Marsh is also mentioned in a story of a pet shark that killed the brother of his caretakers while defending the breadfruit trees surrounding his pond. Upon killing the man, the shark fled to Punaho'olapa and was never seen again. Man-eating sharks are also said to traverse the underground canals that run from Kahuku all the way to Waipahu in central O'ahu.

Another Hawaiian legend describes the land of Kahuku as an island independent from O'ahu. From the shore to the middle of Waiale'e it floated off the coast of O'ahu, being blown by the trade winds. Many different accounts are told about how the two islands were joined. One tells of the people securing it with fish hooks (McAllister 1933:155), while another tells a tale of two sibling chiefs who pulled the islands together by grasping hands. (Kamakau 1991:38-9).

And, within the portions of the seven ahupua`a that comprise the SEIS lands, 101 Land Commission Awards (LCA) were applied by native Hawaiian kuleana tenants of which 88 were awarded. Kahuku alone had 63 LCAs for small parcels of land to native tenants and in Kawela there were seven awards. The LCA records indicate that the predominant lands uses within these LCAs were for habitation and cultivation of wetland taro.

Kahuku's lands, waterways, and people were significant and important to be well represented in the Hawaiian culture. Clearly, the area's prominence and rich history are a great source of pride for the community.

3. Culturally Sensitive Community Engagement Process

3.1 Basis for Consultation

TBR recognized the necessity to re-engage the community and re-evaluate the project's existing Master Plan. More importantly, TBR saw an opportunity to engage the community in a genuine discussion on the development process.

It quickly became evident to the TBR project team that the legal challenge to the adequacy of the 1985 EIS was just a small part of the community's interest. The community felt disengaged from Turtle Bay's stretch of land. For many, the land contained valuable assets worthy of their consideration and input: Kawela Bay's pristine ocean resources that were once full of vibrant marine life; Kahuku Point, where native Hawaiian burials were known to be present; and Kuilima Hotel, where many families enjoy quick family get-aways. With such important community assets within the project area, the community was anxious to have their input heard.

The TBR project team acknowledged these interests and emotions, and recognized that a process of meaningful engagement and dialogue was necessary to re-establish trust and confidence that TBR would honor and respect this land. In 2010, TBR and its project team began a proactive community outreach, meeting with over 200 individuals and groups before the DSEIS Preparation Notice was released. A list of the individuals and groups consulted during the SEIS process is attached in Part Eight of this document.

A concerted community outreach program continues to engage the Hawaiian community, yielding valuable information regarding traditional and customary practices and potential sites of *iwi kūpuna* (human burial remains). The TBR project team appreciates that the protection and preservation of cultural resources is not only based upon past practices but present-day practices as well. The team understands that the efforts of contemporary practitioners represent a living culture.

In recognition of the rich *moʻolelo* and traditional land uses in the project area, great lengths were taken to contact and invite as many local *kūpuna* (elders) and cultural informants as possible. The individuals and groups consulted represented a wide range of backgrounds and interests on both traditional and customary practices as well as contemporary uses of the TBR SEIS lands. Concerted attempts were made to identify and locate all persons and groups that could make contributions to these discussions through their knowledge of the project area.

3.2 Hawaiian Cultural Consultation Principles

In order to build community involvement throughout the consultation process, the TBR project team (led by Turtle Bay Resort LLC Principals, long-tenured TBR staff, including Ralph Makaiau and Buddy Ako, WCIT Architecture, and Kuʻiwalu Consulting) attempted to establish meaningful relationships with community members, especially those that may be directly impacted by the proposed project. As with any relationship, shared commitments and values are central to its health and longevity. These principles, common in most cultures, are especially important in a Hawaiian context, and allowed for a solid foundation on which to build sustaining relationships with the community.

3.2.1 Purposeful or Mākia

There was an acknowledgement that the time and attention of the community is valuable and should be respected with thorough preparation. Accordingly, each consultation was mindful, with a specific purpose and objective, in order for it to be meaningful. The overarching purpose of each consultation was to listen, discuss, understand, and identify appropriate concerns regarding the Proposed Action and to develop shared strategies to address them.

3.2.2 Respectful or Hōʻihi

The project team understood the importance of a genuine dialogue with the community. To open this type of communication, it was important to ask for permission before acting and to be grateful for the opportunity to discuss important issues with community members and representatives. The act of requesting permission displayed an understanding of core Hawaiian values. It conveyed the respect with which the consultation process was performed and was in accordance with the spirit of the community engagement process. This approach was respected in turn by the community and made for a more open and genuine dialogue.

3.2.3 Humility or Haʻahaʻa

The project team recognized that the community consultation process must be performed with the intention of fostering long-term relationships with the community. It was, therefore, imperative to listen to each stakeholder with attention, respect, and compassion. By humbly seeking the contributions of the community, the project team was able to foster future consultations.

3.2.4 Trustful or Hilinaʻi

Trust is a fundamental component of any relationship. The project team committed to being truthful, open, and honest in the development of the SEIS. When this consultation principle breaks down, relationships with the community can be difficult to rebuild. The project team recognized the frustration by many in the community with the previous developers who the community felt was less than engaging. The project team understands that honesty is required to foster long-term relationships, even when the information may not be received favorably.

3.2.5 Thoughtful or Noʻonoʻo

The SEIS was developed and prepared in a thoughtful manner that reflects the spirit and interests of the most directly impacted community. However the project team is also very cognizant that there are others in the community who may feel that the Project is not in the best interest of the community. The consultation process played a meaningful role in the preparation of the SEIS, and community members understood that their input mattered. Notwithstanding that members of the community may have had differing opinions, it was critical and essential that the general interests of the community were taken into account.

3.2.6 Consistency or Pono

The project team understood that it was important to include the information gathered during the consultation process in the SEIS document. The project team provided consistent and accurate information to ensure transparency in the community engagement process.

3.2.7 Continuity or Hoʻomau

The project team acknowledged that the community consultation process was part of the development of a long-term relationship between the community and the landowners. The continuation of this relationship will continue to be important to maintaining and sustaining the cultural and natural resources

3.2.8 Responsibility or Kuleana

The project team was committed. Once it took on the responsibility of engaging the community, it accepted the responsibility of continuing to engage them in the process, including the convening of a public meeting prior to publication of the DSEIS Preparation Notice. The project team will continue to keep the community informed of the SEIS process and the development of the Revised Master Plan.

3.2.9 Appreciation or Mahalo

The project team recognized that for many in the community, especially the Hawaiian community, participating in a very public process was uncomfortable. This was the case especially for many cultural practitioners and *kūpuna* (elders) that may prefer smaller, more intimate settings. Thus, the project team was very appreciative of those who took the time to talk story or attend the public meetings or smaller group forums. In both settings, the project team provided food and drinks to thank the public for their valuable time. The project team thought it important to demonstrate how grateful it was that community members take the time to speak candidly and share their *manaʻo* (thoughts).

3.3 Consulted Parties and Stakeholders

There are a number of families and organizations who have an active cultural and, in some cases, genealogical relationship to the lands of the proposed project area. There are certain stakeholders whose views and perspectives were given careful consideration because of their cultural, legal, or community affiliation with the area. They include the following:

Kahuku Burial Committee, who represents families and individuals who have a cultural or lineal connection to these lands and have accepted the *kuleana* (responsibility) to *malama i na iwi kūpuna* (care for the ancestral remains);

Turtle Bay Employee Advisory Group, who represents the over 600 employees at Turtle Bay (e.g., housekeeping, grounds and maintenance, golf course staff, etc.);

**Ku`ilima North Shore Strategic Planning Committee,** who was established when Ku`ilima Hotel was initially built and was active in the development of the Unilateral Agreement;

Ko'olauloa North Shore Alliance; who is composed of various environmental and public interest organizations whose mission is to preserve the Country as it is;

Native Hawaiian Organizations and Community Organizations, including Office of Hawaiian Affairs; Oahu Island Burial Council; Hawaiian Civic Clubs from Ko'olau Loa, Ko'olau Poko, and Waialua; Mālama Ohana;, Kahuku Community Association; Ko'olau Loa Neighborhood Board; Queen Lili`uokalani's Children Center; Kahuku Farms; La'ie Kupuna Council; Hawai'i Reserves, Inc.; and Hi'ipaka LLC with Waimea Valley;

Environmental Organizations, including the Hawai`i Chapter of the Sierra Club;

Elected Officials, who serve the Kahuku community at the county and state levels;

Government agencies that have regulatory oversight of the resources on the lands to be developed at TBR, including the State Historic Preservation Division of the Department of Land and Natural Resources, the U. S. Army Corps of Engineers, the U.S. Fish & Wildlife Services, the State of Hawai`i Department of Transportation, and the City's Department of Planning and Permitting.

3.4 Consultation Process and Methods

The project team sought to re-establish a meaningful community relationship with the general public and particularly with the range of stakeholders involved with the lands at TBR. To achieve this, a culturally sensitive consultation process was undertaken, including small "talk story" sessions, informal one-on-one meetings, and presentations at larger public forums. A deliberate attempt was made by the project team to initiate a request with various stakeholders to listen to them in settings or forums in which they were most comfortable. The following is a brief description of the approaches used to reach out to the community and a discussion of some of the results of that engagement.

Individual and small talk story sessions. For many Hawaiians who previously dissociated themselves from community dialogues, requests were made to meet them in informal, one-on-one small talk story sessions. Similarly, elected officials and government agencies were given individualized briefings. For various Hawaiian families, cultural practitioners and resource gatherers, requests were made for small talk story sessions where the discussions could be confidential and respectful.

Public meetings. Members of the project team attended regular public meetings of the Ko'olauloa Neighborhood Board and Kahuku Community Association. Presentations were made to various organizations including the Ko'olauloa and Ko'olaupoko Hawaiian Civic Clubs to provide them a briefing of the Revised Master Plan and to get their *mana'o* (thoughts or wisdom) on cultural practices and issues or concerns they may have about the proposed project. The Association of Hawaiian Civic Clubs also held their annual convention at Turtle Bay on October 26, 2011 and hosted a panel discussion regarding the proposed expansion that included Pi'ilani Smith, Creighton Mattoon, Dawn Chang, and Senator Clayton Hee that was moderated by Na'u Kamalii.

Public Meetings specifically in regards to Turtle Bay Resort Development. On May 11, 2011, representatives of TBR participated in a community forum called Talk Story 3 sponsored by the Defend O`ahu Coalition that was attended by over 100 people, including the Governor and other elected officials. Participants were told by TBR representatives that anyone who signed in and provided an email address would be notified when the SEISPN was available for review. An email list of attendees was subsequently sent to TBR by the Coalition and all of the parties on the list were sent an email in mid August 2011 notifying them of the opportunity to review the SEISPN at the TBR website.

On September 15, 2011, TBR hosted a public forum at the resort to discuss the SEIS Preparation Notice. Although this public meeting was not required by law, it was consistent with TBR's commitment to an open community engagement process. Over 100 people attended the event. Copies of the SEISPN were provided to anyone upon request. Comment forms were distributed and any that were filled out with a name and an email address have been included as a Consulted Party for the purpose of the SEIS.

Cultural Advisory Council (CAC). The TBR project team convened a CAC composed of Hawaiian cultural practitioners, educators, cultural experts, and individuals who could provide independent cultural guidance to TBR as it began to revise its Master Plan and prepare the SEIS.

Kahuku Burial Committee (KBC). Several years ago, a group of individuals who have lineal and cultural connections to these lands gathered to express their willingness to accept *kuleana* to *malama i na iwi kūpuna (responsibility to take care of ancestral bones)* that may be discovered on the project site. The KBC has met regularly and several members may seek formal recognition as lineal or cultural descendants by the O'ahu Island Burial Council for any *iwi kupuna* discovered on the project site. The KBC's *Kahu* (spiritual guide) have been Richard and Lynette Paglinawan, well-respected cultural practitioners.

Dedicated website to the SEIS. The TBR project team established the website www.turtlebayseis.com to keep the public informed of the progress of the Revised Master Plan and the SEIS. The website also provides an opportunity for the community to provide specific input on cultural practices and resources in the area.

Publication. The TBR project team voluntarily published a notice in the Honolulu Star-Advertiser on May 18, 2011 and July 1, 2 and 4, 2012, and in the Office of Hawaiian Affairs' *Ka Wai Ola* in the June 2011 and July 2012 editions informing the public of its intent to develop specific lands identified by tax map keys, also listing the names of the land commission awardees on the property, requesting any information about cultural resources including potential burials. Several responses were received and the TBR project team followed up with the respondents.

Ethnographic Interviews. The archaeological consulting firm, Pacific Legacy, conducted 16 ethnographic interviews of individuals who had a personal association with the area that TBR proposes to develop. Their methodology and results are presented in the CIA prepared for the SEIS.

Commitment to Ongoing Consultation. The purpose of an effective community engagement process is to provide a fair and transparent process that provides accurate and current information to ensure informed decision-making. As referenced earlier, the term *kuleana* implies mutual responsibility. As part of TBR's commitment to ongoing consultation throughout the SEIS process, the project team kept stakeholders informed of various milestones related to the SEIS:

- January 2011 letters were mailed out to Native Hawaiian Organizations and community stakeholders informing them that TBR was preparing an SEIS and requesting an opportunity to meet with them individually or as an organization;
- August 2011 letters were mailed to the community stakeholders sending them copies of the SEISPN and inviting them to a public informational meeting on the SEISPN;
- February 2012 letters were mailed to community stakeholders on the results of the Supplemental Archaeological Inventory Survey (SAIS), including a question and answer fact sheet; and
- June 2012 letters were mailed to community stakeholders providing an update on the status of the SEIS and improvements to the hotel.

4. Hawaiian Traditions and the Natural Environment

The proposed expansion of the Turtle Bay Resort draws its inspiration from the host Hawaiian culture.

Hawaiian traditions include a spiritual and familial relationship with the natural environment and the resources that sustained life in these islands. Every aspect of nature was believed to be alive, and every form of nature was a *Kinolau* (body-form) of one of the numerous Hawaiian gods, deities, or other creative forces. The land, ocean, rain, and winds all were manifestations of the gods and they were revered for both their spiritual qualities as well as their physical ability to provide life-sustaining resources.

In a reciprocal relationship that is central to most aspects of traditional Hawaiian culture, man cared for nature (and its associated gods), and nature and the gods provided for man. Land (ʻĀina), in particular, was revered as if a nurturing elder sibling because of its ability to sustain life. Land's supremacy over man is affirmed in the traditional Hawaiian saying:

He ali'i ka 'aina, He kauwa ke kanaka
The land is a chief, Man is a servant

'Āina encompasses the proper management of the 'āina, kai (ocean), and wai (fresh water) resources. In Hawaiian tradition and story the 'Āina is the elder sibling – and its kuleana (responsibility/obligation) is the feed and nurture its younger sibling, kānaka. Kānaka, focuses on sustainability in economics, social-political, as well as overall health and wellness. The primary kuleana of kānaka is to protect and take care of the elder sibling, the 'āina. In maintaining this relationship *Tomorrow's Ahupua'a* will be a viable anchor in the Ko'olau Loa community for generations to come.

4.1 Traditional Land Tenure in Hawai`i

Hawaii is the most isolated landmass on Earth. Over 2,200 miles from the nearest populated area, Hawai'i is a remote outpost in the middle of the world's largest ocean. Approximately 2000 years ago, voyagers from central Pacific islands arrived on these shores. Archaeological evidence suggests that the descendants of these original settlers navigated back and forth between Hawai'i and their home islands until about 500 years ago. At about the same time, the great chief Umi-a-Liloa divided the largest of the Hawaiian Islands into the four political regions that remain today as the four counties of the State of Hawai'i: Kaua'i, O'ahu, Maui, and Hawai'i. These four *mokupuni* (islands) were further divided into *moku* (districts) and subdivided into *ahupua'a*.

Each land division was governed by an *ali'i* (chief) of a particular rank. Islands were governed by *ali'i nui* (high chief); *moku* were governed by *ali'i 'ai moku* (lower chief); and *ahupua'a* were governed by *ali'i 'ai ahupua'a*. Land in ancient Hawai'i was controlled by these chiefs who held them in trust for all of the people, a central principle of early (pre-1846) land tenure in Hawai'i was the *kuleana* (privilege and responsibility) of these chiefs to care for and employ the resources of the land in a *pono* (balanced) manner.

4.2 Elements of the Ahupua`a

Of the three major land divisions, the *ahupua'a* was particularly important because it represented the scale at which land and its natural resources were most efficiently employed in order to sustain a pre-Western contact population of up to a million people.

The term, *ahupua'a*, was derived from the words *ahu* (alter) and *pua'a* (pig). A stone alter was erected and topped by a carved image of a pig's head. These *ahu* served as a gathering area for the collection of tribute as well as a boundary marker between neighboring ahupua'a. They were often placed at the intersection of the *ahupua'a* boundary and the walking path that ran around most islands.

Ahupua'a contained nearly all the resources Hawaiians needed to survive. Through a system of *kapu* (prohibitions) and *kanawai* (laws), the *ahupua'a* was managed by the *konohiki* (agent of the *ali'i 'aiahupua`a*) who was responsible for the day-to-day operations of the district and combining its natural and human resources in a manner that best served the land, the people it fed, and the chief who governed it.

Although *ahupua'a* varied in size between hundreds and thousands of acres, in most instances they were complete lands sections defined by valleys with boundaries extending from the mountains out into the ocean. Their regions included *mauka* (upland), *kula* (plains), and *makai* (ocean) areas. Fresh water, animal and fish protein, wild and cultivated food and fiber crops, as well as building and tool materials were available in most *ahupua'a* making them largely self-sustaining. Use of these resources was the exclusive privilege of those residing within the *ahupua'a*, although trade between *ahupua'a* was common enough that regular markets were established in some areas.

4.3 Orientations of the Ahupua`a

The elements discussed above focus on the natural features and political structure that together created the basis for the efficient allocation and redistribution of resources within and across the land division. By contrast, the orientations inherent in an *ahupua`a* are the characteristic ways in which the *ahupua`a* reached this efficiency. The *ahupua`a* included environmental, social, political, economic, and cultural orientations; all of which had to function with internal efficiency and be in balance with one another. Weaving through each of these orientations, and across them as well, is the reciprocal relationship that should be maintained among people and between people and the *`aina*.

4.3.1 Environmental

Ancient Hawaiians lived close to the land and were intimately familiar with its rhythm and cycles. Great care was given to ensure that actions undertaken in one section of the *ahupua'*a did not adversely affect the resources in another. The connection between mountain and ocean resources was well-known and the *ahupua'a* was managed as an entire ecosystem. The environmental orientation to the *ahupua'a* provided for the balanced stewardship of its natural resources, and ensured that those resources were managed at a sustainable level consistent with social, political, economic, and cultural norms.

4.3.2 Social

The social orientation of the *ahupua'a* established the human framework necessary to support the community. As was previously noted, reciprocal relationships were fundamental to the organization of the *ahupua'a*. Some relationships were governed by prohibitions and laws, while others through social orientations between people, nature, and the gods. Reciprocal responsible behavior of chiefs and commoners with respect for the resources of the *ahupua'a* provided for a social balance with the natural environment.

4.3.3 Economic

The *ahupua'a* served as the basis for the ancient Hawaiian economy in the same way that business enterprises function today in the global economy. The resources of the *ahupua'a* were expected to provide for the basic needs of the people it fed, and provide a surplus sufficient to pay a tribute or tax to its governing chief. As was previously noted, goods produced in one *ahupua'a* were exchanged for goods from a neighboring region to their mutual benefit and improved overall welfare. This economic orientation provided for the efficient production, distribution, consumption, and exchange of *ahupua'a* resources and services at a sustainable level, and in a manner preserving the necessary reciprocal relationships.

4.3.4 Cultural

Ahupua'a varied in size and their relative endowment of natural resources. This varied geography resulted in cultural orientations of the *ahupua'a* that were place-based and characterized by unique traditions, practices, and *mo`olelo* (stories). The cultural attributes informed the way in which the natural and human resources of an ahupua'a were employed.

5. Tomorrow's Ahupua`a

The owners and stewards of the Turtle Bay Resort believe the elements and orientations of the traditional *ahupua'a* can be employed as a guide to contemporary land use and development. *Tomorrow's Ahupua'a* is a concept developed by the project team that incorporates many of these attributes along with modern best practices to serve as a framework for the implementation of the Turtle Bay Resort Comprehensive Master Planning process and operating principles.

Tomorrow's Ahupua'a honors the important aspects of the traditional *ahupua'a* in order to create a design and management strategy that cares for the land, natural resources, people, and culture of the traditional *ahupua'a* that comprise the project area.

The Turtle Bay Resort Comprehensive Master Plan encompasses eight *ahupua'a* that, over time, have been consolidated into three larger ahupua'a. The SEIS Lands include the *makai* and *kula* lands of the 'Ōpana-Kawela and Hanaka'oe *ahupua'a*, and a portion of the *makai* lands of the Kahuku *ahupua'a*.

5.1 Ahupua`a O ` Ōpana-Kawela

The portion of the SEIS Lands contained within Ahupua`a O ` Ōpana-Kawela consists of approximately 63 acres situated *makai* of Kamehameha Highway, extending from the eastern end of Honokawela Drive east to the resort's West Main Drain, a distance of approximately 4,700 feet or roughly nine tenths of a mile as measured along the coastline. At the resort's western boundary, the property extends inland from the shoreline approximately 200 feet to Kamehameha Highway. At the eastern boundary of the *ahupua`*a, the property extends approximately 1,125 feet from the shoreline to Kamehameha Highway.

The property generally fronts the eastern half of Kawela Bay and the western third of Turtle Bay. The headlands known as Kawela Point constitute the extreme eastern point of Kawela Bay and are situated about midway along the lateral extent of the `Opana-Kawela shoreline.

Kawela Bay is a roughly symmetrical horseshoe-shaped bay with a wide sandy beach. The eastern half of the *ahupua`a* shoreline consists of calcareous sediments chemically bound together into shelves of what is commonly referred to as beach rock. Portions of the beach rock are covered with sand while other areas are exposed. Kawela Bay is somewhat unique among the three bays that front the SEIS Lands in that the embayment is formed through a break in the beach rock shoreline. Both headlands that jut out into the ocean on the west and east sides of the bay are faced with beach rock shorelines. But the sand beach between the headlands is deep and not perched upon a hard substructure as are the other beaches along the property shoreline.

5.1.1 Historic Setting

According to Pukui, *Opana*, which is perhaps related to *`opa* translates as "the squeeze". *Kawela* is translated as "the heat" which is also the name used to describe the coastal portions of the land bordering Kawela to the west. The shoreline at Kawela was referred to as *Wakiu* meaning "northwest wind sound" (Clark 1977: 132). A fishpond of the same name was reportedly once located inland from this beach.

Kahuku and Kawela were designated as Crown Lands of King Kamehameha III during the Great *Mahele* of 1846 that reorganized land tenure throughout the Hawaiian Islands. Of the thirty five land commission awards (LCA) resulting from the *Mahele* that are located within the boundaries of the SEIS Lands, eleven are located in Kawela. House lots are mentioned in twenty-four of the thirty-five claims. There are thirty-six *lo`i* (pond-fields) described in the claims with three claims specifically mentioning *kalo* (taro). Testimonies refer to cultivated bananas, sweet potatoes, *wauke*, sugar cane, bitter melon, *noni*, and orange tree. Other named plants are *Pandanus* trees or *hala* groves and *koa* trees cultivated for canoes. One claim mentions a *puna pa`akai* or brackish spring and on mentions a fishery.

Specific pre-historic settlement patterns at ` Ōpana-Kawela are unknown, but *`olelo* cited in the Cultural Impact Assessment suggest the Kewela Bay supported a resident population. Land Court Awards granted in the mid-1800s provide greater insight. As presented in the CIA, eight Land Court Awards (LCA) were awarded within the SEIS Lands contained within ` Ōpana-Kawela and another seven were granted in the same region, but on properties outside of the SEIS Lands. (Pacific Legacy 2012: Table 1)

In the early 1850s, 8,000 acres at Kahuku, including Kawela and the remainder of the SEIS Lands, were purchased from Kamehameha III and converted to a sheep and cattle ranch that was named Kahuku Ranch. The ranching venture had immediate adverse impacts on the landscape.

As discussed earlier, in 1889 Benjamin Franklin Dillingham chartered the O`ahu Railroad and Land Company (OR&L) and leased the Kahuku lands for the cultivation of sugarcane. By 1899, the railroad line extended from Honolulu around the west side of O`ahu to Kahuku. A 1906 train schedule indicates the train ran from the Waimea Station to Kahuku in 24 minutes with no stops. A 1930 USGS map depicts the railroad extending through the TBR property with stations at Kawela and Kahuku Ranch. A 1932 USGS map shows sugarcane fields extending to the coast and a line of houses fronting Kawela Bay. A 1954 map depicts a series of houses or beach cottages present along the side of Kawela Bay.

Subsequent to the rezoning of the property in 1986 for the then proposed resort expansion, the cottages along the eastern half of Kawela Bay were demolished to make way for the construction of a hotel. Much of the property was grubbed and graded, structural fill material was imported to the site, and several dozen concrete pilings were driven into the earth for the proposed hotel's foundation. Underground utilities were also installed. By the early 1990's, the Japanese economic crisis left the resort's, then Japanese owner to abandon hotel construction at Kawela Bay.

5.1.2 Existing Conditions

The SEIS Lands within the *ahupua`a* of ` Ōpana-Kawela are vacant and generally overgrown with scrub vegetation. The remnant concrete pilings remain in place; some erect and some toppled by erosion.

There is no resident population within the SEIS Lands of the ` Ōpana-Kawela *ahupua`a*.

5.2 Ahupua`a O Hanaka`oe

Approximately 271 acres of the SEIS Lands are contained with Ahupua`a O Hanaka`oe. Within the SEIS Lands, the boundary of Hanaka`oe extends east from the West Main Drain to the East Main Drain which enters the ocean at the approximate mid-point of Kuilima Bay.

Within the SEIS Lands, Hanaka`oe includes the approximate eastern two thirds of Turtle Bay, all of Kuilima Point, and the western half of Kahuku Bay. The length of the coastline fronting the *ahupua`a* is approximately 1.36 miles or just over 7,000 feet.

At its eastern boundary along the East Main Drain, the property extends inland approximately 0.46 miles from the shoreline to Kamehameha Highway, or about 2,453 feet.

5.2.1 Historic Setting

No *`olelo* pertaining specifically to this *ahupua`a* have been identified. However, given its location between Kawela and Kahuku, it is likely that it supported a resident population. As discussed in Section G1a above, the large scale changes to the land resulting from the establishment of a cattle ranch, and later a sugar plantation, transformed the land, and in so doing, erased any surface features that might have informed us of the area's history.

As presented in the Cultural Impact Assessment prepared for the SEIS, four Land Court Awards (LCA) were awarded within the SEIS Lands contained within the Hanaka`oe ahupua`a and another three were granted in the same region, but on properties outside of the SEIS Lands. (Pacific Legacy 2012: Table 1), suggesting an active community engaged in plant cultivation and fishing.

5.2.2 Existing Conditions

Ahupua`a O Hanaka`oe contains the activity center of the resort and includes 500 resort units and 368 residential condominium units (366 are privately owned and 2 are operated as manager's units). The resort units consist of three components: the existing seven-story Turtle Bay Hotel containing 401 resort units; 57 Ocean Villa resort condominium units abutting the hotel on its east side are; and 42 Beach Cottages abutting the hotel to the west. Average daily occupancy of the 500 resort units averages approximately 80%. The residential condominium units comprise two adjacent developments south of the hotel's parking lot; Kuilima Estates East and Kuilima Estates West. The average daily resident population of Kuilima Estates is estimated to be about 223 persons.

5.3 Ahupua`a O Kahuku

Approximately 506 acres of the SEIS Lands are contained within Ahupua`a O Kahuku. The *ahupua`a* extends east from the approximate alignment of the East Main Drain to the eastern boundary of the Turtle Bay Resort, as delineated by Marconi Road. The shoreline of Ahupua`a O Kahuku extends approximately 8,230 feet and includes the eastern half of Kuilima Bay, all of Kahuku Point and about 3,000 feet of shoreline east of the point.

The eastern boundary of the *ahupua`a* extends inland approximately 6,280 feet, or about 1.18 miles, from the shoreline to Kamehameha Highway

5.3.1 Historic Setting

Of the three *ahupua`a*, Kahuku is most frequently identified in *`olelo* and legend. The name Kahuku appears to be used not only as the name of an *ahupuaʻa* and village, but as a district or place name for the area roughly between ʻŌʻio and Keana Ahupuaʻa. Of the seven *ahupuaʻa* represented in the project area, Kahuku has the most extensive traditional and mythological background.

According to Pukui et al. (1974:67) Kahuku literally translates as "the projection" and is the name of a village, land division, northernmost point, golf course, ranch, schools, forest reserve, as well as surfing beach on Oʻahu. Several other landmarks within the *ahupuaʻa* have traditional names, such as Punamanō, the spring-fed wetland which translates as "shark spring" John Clark (2003:310). Hanakaʻīlio ("work [of] the dog") is a sandy beach located between Kalaeokaunaʻoa and Kalaeuila Points (2003:92). Kalakala ("rough" or "craggy") is the name of the two semi-submerged linear outcrops of limestone that roughly parallel Kahuku Point to the east (Ibid:149).

Traditional accounts of natural resources and environmental conditions are relatively abundant for the *ahupuaʻa* of Kahuku. Traditional land use in Kahuku is also made apparent through legend. The landscape of Kahuku appears to have had several configurations, from the pre-European contact era to the present. During Hawaiian settlement prior to the arrival of Europeans, many parts of the landscape were used for traditional agriculture, habitation, and ceremony, varying from intense to moderate. In the initial Contact period, a good portion of the land lay fallow due to severe population decline and was overgrown in some areas with exotic plant species.

As discussed earlier, the subsequent creation of Kahuku Ranch, followed by cultivation of the land in sugar cane as part of Kahuku Plantation permanently altered its physical characteristics and use.

5.3.2 Existing Conditions

There are no persons residing with the portion of the SEIS Lands contained within the Kahuku ahupua`a, however the MacKenzie kuleana land is situated within the ahupua`a.

6. Implementing Tomorrow's Ahupua`a

Hānau ka ʻāina, hānau ke aliʻi, hānau ke kānaka.
Born was the land, born were the chiefs, born was the people.

Tomorrow's Ahupuaʻa honors and strives to incorporate the fundamental aspects of the traditional Hawaiian ahupuaʻa in order to create a foundation for a comprehensive contemporary management strategy to develop a sustainable community within the Turtle Bay Resort. *Tomorrow's Ahupuaʻa* celebrates and focuses, with a cultural lens, on the proper balance of environmental, social-political and economic resources and incorporates modern innovative best practices to ensure a more sustainable future. *Tomorrow's Ahupuaʻa* is a cultural methodology derived from the traditional ahupuaʻa land management system of Native Hawaiians. Its fundamental notion is that sustainability manifests itself through the balance and relationship of ʻāina (land), kai (ocean), and kānaka (man).

ʻĀina encompasses the proper management of the ʻāina, kai (ocean), and wai (fresh water) resources. Moʻolelo tell us that ʻĀina is the elder sibling – and its kuleana (responsibility/obligation) is to feed and nurture its younger sibling, kānaka. Kānaka, focuses on sustainability of economy, politics, culture, and health and wellness. The primary kuleana of kānaka is to protect and take care of the elder sibling, the ʻāina. In return for this care, ʻāina provides sustenance for the kānaka. In maintaining this relationship, *Tomorrow's Ahupuaʻa* will be a viable anchor in the Koʻolau Loa and North Shore community for generations to come.

Pursuant to Act 181 (2011), the Hawai`i State Plan (Chapter 226, Hawaii Revised Statutes, as amended) has been amended to include the following definition of sustainability:

> "Sustainability means achieving the following
>
> 1. Respect of the culture, character, beauty, and history of the State's island communities;
> 2. Striking a balance between economic, social, community, and environmental priorities; and
> 3. Meeting the needs of the present without compromising the ability of future generations to meet their own needs."

Tomorrow's Ahupua`a has been developed to comply with this definition. It is grounded in not only addressing the values of the Hawaiian culture but in implementing them through an extensive program of action. By proposing a significant reduction in density over that which is allowable under existing land use and zoning ordinances, the Proposed Action is intended to achieve the balance envisioned by the State's definition of sustainability. And of equal importance, *Tomorrow's Ahupua`a*, as envisioned in the Proposed Action, is intended to address the current economic needs of the KNS region in a manner that is attentive to the needs of future generations.

6.1 Environmental Objective

Tomorrow's Ahupua`a includes an environmental objective to "Manage design, development, construction, and operations sustainably in a manner that embodies the spirit of long-established traditional ahupuaʻa system of planning and proactive resource management". The guidelines of this system emphasize the overall moku (land district) and how each individual ahupuaʻa within the project area has a symbiotic relationship between its natural resources and built environment. The proper balance of this relationship ensures economic and social/political sustainability and supports strong health and welfare of its residents, guest and visitors.

Moreover, the intent of this objective and its accompanying guidelines is to respond to Hawaiʻi's complex growth challenges by promoting sustainable practices, high performance energy efficient buildings, economically viable and environmentally mindful development, and by encouraging best practices in new development today.

With the intent of providing a measurable basis for assessment, many of these standards are modeled after and based on highly respected and established programs like the US Green Building Council's LEED (Leadership in Energy and Environmental Design) Green Building Rating System and other similar industry standard best practice rating and measurements systems.

Recognizing that any responsible and reasonable growth of the Koʻolau Loa and North Shore communities will come with some impact to the environment, these guidelines set forth standards designed to proactively minimize the potential environmental impacts of development and looks to establish the foundation of Turtle Bay Resort's approach to defining a reasonable, responsible and balanced path to a more sustainable future.

6.2 Social-Political Objectives

To encourage and sustain the well being of the community, the resort must offer a meaningful contribution to the quality of life of its people. For the purposes of the SEIS, quality of life is defined by the balance of kānaka economic obligations, social interactions, and recreational opportunities. The objective to "Provide enhanced access to the shoreline for residents, visitors and locals from nearby communities by the provision of additional parks, shoreline access points and a shoreline trail interconnecting them", establishes a practical means for achieving this goal. Within Ko`olau Loa and the North Shore, the coastline is critical to the community's recreational and social needs. Providing unencumbered and easy access to a well maintained, safe and clean coastline is integral to both ʻāina and kanaka.

The objective to "Assist with local housing needs by providing additional housing units affordable to members of the local community beyond what is presently required", contributes to all three aspects of the sustainable formula; economic, social and cultural. By providing new affordable housing opportunities, above and beyond statutory obligations, the Proposed Action is fulfilling its obligation to ensuring the social well-being of the greater community. The provision of this new community housing in close proximity to one of the region's employment centers, as well as to new recreational opportunities, is intended to promote social health and wellness.

6.3 Economic Objectives

While many of the Proposed Action's objectives are interrelated, three of them focus on the project's economic relationship to the moku and to the long-term sustainability of the ahupua`a. The economic objective to "Create a healthy balance of economic, social and cultural vitality while maintaining the rural character of the resort's coastal area by focusing critical development mass within the ahupua`a of Hanaka`oe around the existing hotel", is grounded in the principals of sustainability. Preservation of the resort's rural character is critical to its economic vitality and to the health of the ʻāina. Its rural sense of place is what distinguishes Turtle Bay Resort from its competitors in the visitor industry. And yet, a visitor destination area must include a full range of services and amenities to address the needs of its guests and residents.

To achieve this balance, the Proposed Action concentrates the resort amenities in the central area around the existing hotel and distributes the much lower density land uses throughout the remainder of the property. In this way, the region's rural character is preserved and nurtured. The vital economic core of the resort can function as an activity center without compromising the unique rural character of the resort's setting.

The objective to "Ensure the long-term preservation of the Agricultural Lands through the implementation of a conservation easement on the Agricultural Lands", is intended to strengthen the relationship between the resort and its valued agricultural properties. In a sustainable model, agricultural productivity becomes a crucial component of economic vitality. By nurturing agricultural production on its property, the resort extends economic benefits to its farmers and to the larger local community within which they live, work and play.

The objective to "Integrate the resort into the fabric and daily activities of the local community" emphasizes the fundamental principle that economic activity is derived from the individual endeavors of kānaka. To function as a valuable component of the ahupua`a as well as the larger moku, the resort must become closely aligned with its surrounding host communities, from which it derives its unique character. To achieve this, the resort must strive to become not only an employment destination, but also a social and recreational destination for its employees, their families, and their friends.

The objective to "Operate the resort as a place that will be equally welcoming to locals from neighboring communities as to visitors from afar", not only articulates this philosophy, but actualizes it. To be economically sustainable, the resort must be engaged in the community.

7. ʻĀina and Kānaka Guidelines

Managing Hawaiʻi's contextual island ecosystem(s) and their valuable finite natural resources is one of the primary purposes of *Tomorrow's Ahupuaʻa*. This system emphasizes the overall moku (land district) and how each individual ahupuaʻa within the project area has a symbiotic relationship between its natural resources and built environment. The proper balance of this relationship ensures economic and social/political sustainability and supports strong health and welfare of its residents, guest and visitors..

The following guidelines are intended to allow the traditional relationship between ʻāina and kānaka to flourish. ***ʻĀina Guidelines*** focus on land stewardship, master planning & design, and environmental infrastructure and green buildings. ***Kānaka Guidelines*** focus on community engagement. Collectively these guidelines provide a comprehensive management plan for the conservation and preservation of the cultural and natural resource of *Tomorrow's Ahupuaʻa*.

It is intended that the guidelines be applied to each of the development sites that together constitute the Proposed Action, e.g. sites H-1, H-1, RR-1 etc. Because of the phasing of development over an eleven-year period and the differing types of projects proposed, individual sites may be constructed by different developers. For these reasons, to achieve the vision of *Tomorrow's Ahupua`a,* it is important that uniform guidelines are applied to all development sites.

7.1 ʻĀina Guidelines

7.1.1 Land Stewardship

Uwē ka lani, ola ka honua.
When the heavens weep, the earth lives.
When it rains, the earth revives.

In the traditional ahupuaʻa, land stewardship is a key component. A core component of this land stewardship was an appropriate balance of the relationship between kānaka and ʻāina. The traditional ahupua`a principles of a self-sustaining ecosystem was dramatically altered through the changing uses of the land in the Ko'olau Loa moku, i.e. ranching and plantation. The goal of *Tomorrow's Ahupuaʻa* is to embrace traditional land management principles, employing a model that engages stewardship protocols and promotes the application of environmental guidelines that help to restore the balance between ʻāina and kānaka.

Nānā i hope
Looking Back

Mohala i ka wai ka maka o ka pua.
Unfolded by the water are the faces of the flowers.
Flowers thrive where there is water, as thriving people are found where living conditions are good.

In Hawaiʻi's island-ecosystem, wai is the key element of the ahupuaʻa. The ʻōlelo no'eau above captures the common understanding that where there was wai, there were thriving Hawaiian communities. Wai is utilized in several core terms in the Hawaiian language. For example, the word for wealth is waiwai. An ahupuaʻa rich in wai is a wealthy ahupuaʻa. Kānāwai (laws) were also framed around wai management. Wai flowed from the ridges of the ahupuaʻa to the ocean, and could not be owned by any individual. Instead, wai was managed as a valuable natural resource for the entire community.

One of the important functions of wai was to feed the lo'i. Lo'i are irrigated terraces used to cultivate crops, such as kalo, the staple of the Hawaiian diet. Lo'i kalo (taro terraces) were strategically placed near the kahawai (streams) within the ahupuaʻa. This provided the taro patch with easy access to stream water that could irrigate its terraces. ʻAuwai (irrigation systems for the lo'i) were engineered to direct the flow of water from the uppermost terrace to the lower terraces and eventually back into the stream. As the stream water flowed in and out of each and every terrace, it collected nutrients that fed back into the natural habitat of the stream, which produced abundant resources. Although kānaka diverted water, the water was returned to the stream in its full capacity and richer. This was extremely important as it ensured that every kānaka who used the water from the top of the ahupuaʻa to the bottom had access to the stream resources in its full capacity. Wai management in the traditional ahupuaʻa is an excellent example of traditional land stewardship.

Nānā i mua
Looking Forward

He huewai ola ke kanaka na Kāne.
Water is life and Kāne is the keeper of water.

Tomorrow's Ahupuaʻa seeks to reestablish sustainable land stewardship and to reconstruct a modern balance of ʻāina and kānaka. In order to engage land stewardship in the project area, an intimate understanding of the ʻāina is required. Comprehensive planning and analysis has been and will continue to be completed to understand how to maintain, manage, and conserve the ahupuaʻa 's natural resources. This includes protective measures for management of native habitats and water resources. Land stewardship guidelines further address stewardship concerns such as iwi kūpuna (burials), agricultural conservation, and erosion control. The goal of the land stewardship guidelines is to proactively enhance and preserve specific natural and cultural assets as well as existing threats. The guidelines strive to ensure that kānaka practices are designed to protect, preserve, and steward the ʻāina, therefore creating a modern day system of balance.

Meaning a healthy balance considering all of the environmental, social-political and economic realities of the project in today's world.

Conducting site research and analysis will help build upon a comprehensive understanding of the site and its surroundings, and ensure that the built environment is responsive and respectful of its past, current and future place within the project and in the greater Koʻolau Loa community.

7.1.1.1 Guidelines

Prepare a Site Analysis narrative describing the essence of the project and how the project responds to the unique history, culture, and characteristics of the project site. This analysis should include regarding the following:

- Cultural Environment - Describe archeological sites & significant events that occurred on or near the site.

- Natural Environment - Include a resource habitat and native vegetation inventory describing existing conditions of the development site, vegetative cover and habitat. At a minimum, this inventory must include the following:
    - Identification of endangered species habitat.
    - Identification of heritage and champion trees.
    - Describe all wildlife, topography, water, view corridors, and other landscape features.
    - Selected removal of invasive species

- Built Environment - Describe any existing structures, utilities, transportation services, and other infrastructures.
  Explain how site features in all three categories shaped the final development.

7.1.1.2 Strategies

The specified guidelines require the team to conduct a thorough inventory and analysis of the environmental assets and cultural/historic attributes of the site, which will ultimately define the parameters for its future development. Identifying opportunities to understand the land, sustainable uses, and conservation strategies will help the team write a statement that defines the "Site Inventory."

These inventories or analysis are typically accomplished through voluntary development planning exercises/studies by a Developer hiring an expert team of specialists, or government mandated analysis such as an Environmental Impact Statement (EIS) or Environmental Assessment (EA).

Typically with an existing development site, area information is available through the federal government, the State of Hawaiʻi, and other agencies or non-profit organizations that may have already collected general information for their own planning purposes. Development may begin by contacting the local planning office, state historic preservation office, state geographic information department, and state wildlife management agency. Private groups may also be able to assist with data assembly. Data may exist in many formats; the use of geographic information systems may facilitate organization and utilization of information. Greater care must be given in the inventory for areas that may be impacted by development.

7.1.1.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Completed a comprehensive Site Analysis and developed the Proposed Action for the project area working with a number of qualified, well respected team of consultants and experts.

- In the process of completing the Supplemental Environmental Impact Statement (SEIS) that updates all related site technical reports providing key information to complete and maintain a thorough Site Analysis evaluation and refined land plan. Key updated reports are provided in appendix of the SEIS.

7.1.2 Iwi Kupuna

The purpose is to preserve and protect *iwi kūpuna* (human remains) by avoiding adverse impacts to *nā iwi kūpuna* and, where avoidance is not possible, to mitigate impacts through respectful and culturally appropriate protocols and treatment.

7.1.2.1 Guidelines

For Hawaiians, *nā iwi* (bones) are the essential physical material of a person with ʻ*uhane* (spirit) providing a person's psyche. The manifestation of immortality, however, was in *nā iwi* because only *nā iwi* survived and remained as the lasting embodiment of an individual. As a result, *nā iwi* symbolized the link between *kūpuna* (ancestors) and the eventual mortality of living Hawaiians. By placing *nā iwi* in the ground to eventually become part of *haumea* (earth), Hawaiians ensured a place for the bones forever. Furthermore, *nā iwi* were a source of *mana* (spiritual power) of the deceased to that ground, in that *ahupua*ʻ*a*, and to the entire island. The entire area becomes sacred with *mana* because of the location of *iwi kūpuna*.

At the request of the TBR owners, the following documents have been completed:

- A Supplemental Archaeological Inventory Survey (SAIS) to ensure the protection of cultural resources, including *iwi kūpuna* by describing the current TBR facility and the environment of the area, presenting the results of historical documentary and archaeological background research for the general Kahuku area and, specifically, the TBR property, and conducting subsurface fieldwork to identify the areas of greatest sensitivity to the potential for subsurface human remains;

- A Cultural Impact Assessment (CIA) to identify cultural resources including traditional and customary practices and information on possible *iwi kūpuna* that may exist within the TBR property through archival research and community consultation;

- A Cultural and Natural Resource Management Plan (CNRMP) that will provide a cultural framework to inform decision making and facilitate sound management practices regarding cultural resources, including *iwi kūpuna;*

- A Cultural Management Plan (CMP) to set guidelines and procedures that will be used for report and respond to any inadvertently discovery of historic properties, including *iwi kūpuna* on all activities related to TBR; and

In addition, ongoing coordination continues with the Kahuku Burial Committee (KBC) who represents families who have a lineal or cultural connection to the TBR lands and have accepted the *kuleana* (responsibility)to *mālama i nā iwi kūpuna* (care for the ancestral bones).

7.1.2.2 Strategies

Because the sand dunes along the coast are known to have *iwi kūpuna,* TBR has intentionally avoided planning development along these areas to avoid potential adverse impact to known and potential burials. Previously identified and inadvertently discovered human skeletal remains have been found within the SEIS lands. Some of these *iwi kūpuna* have been preserved in place and others have been relocated to permanent re-interment preservation sites within each *ahupuaʻa*. For specific details on the *iwi kūpuna* that have been previously identified, refer to the Supplemental Archaeological Inventory Survey (SAIS).

The KBC, in coordination with TBR and with approval by the State Historic Preservation Division (SHPD) in consultation with the Oʻahu Island Burial Council (OIBC), will identify permanent re-interment sites within each of the three *ahupuaʻa* as possible re-interment sites for either previously identified or inadvertently discovered *iwi kūpuna* that SHPD or OIBC have either been preserved in place or given permission to relocate the *iwi kūpuna.* However, OIBC/SHPD will make the final determination.

All subsurface excavation related to planning, construction, operation and maintenance are subject to either on-call or on-site archaeological monitoring depending on whether the area is highly sensitive to potential subsurface *iwi kūpuna.*

7.1.2.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- The fieldwork and final report for the SAIS has been completed and will be submitted to SHPD for approval;

- The CIA has been completed and is appended to the SAIS;

- The CNRMP has been completed and is appended to the SAIS;

- The CMP has been completed and approved by TBR for incorporation into TBR's operation and maintenance program; and

- The KBC meets regularly to address issues related to *iwi kūpuna.*

7.1.3 Native Habitat Enhancement & Restoration

The purpose is to enhance and restore the site's native plants, wildlife habitats, wetlands, and bodies of water while stopping the spread of established invasive species, preventing infestation of new invasive species, and making best efforts to eradicate those invasive species.

7.1.3.1 Guidelines

Use mostly native plants, to enhance and restore predevelopment native ecological communities, water bodies, or wetlands on the project site. Work with a qualified biologist and landscape architects to ensure that restored areas will have the mostly native species assemblages, hydrology, and other habitat characteristics that likely occurred in predevelopment conditions.

- Identify previously disturbed areas that, if restored, would enhance the overall value of the property in terms of habitat and wildlife values.

- Restore disturbed areas (excluding the building or road footprints and associated structures) as practical and economically viable.

- Enhance disturbed areas (excluding the building or road footprints and associated structures, walkways, decks, etc.) returning them to a natural state that conforms to surrounding habitat.

- Create and commit to implementing a 10-year Invasive Species Management Replacement & Monitoring Plan in conjunction with the Oʻahu Invasive Species Committee (OISC) to identify, map, control, and eventually replace as much of the invasive species identified by the general OISC membership as economically viable and biologically possible.

7.1.3.2 Strategies

- Consider restoration and enhancements that could include, but not be limited to:
  - Trees, shrubs, and plants that require structure and diversity, use less irrigation, fertilization, and prohibit invasive species;
  - Aquatic habitat; and
  - Natural water features.

- Use the National Invasive Species Management Plan http://www.invasivespeciesinfo.gov.

- Consider alternatives to toxic spraying as removal technique. Consider rangeland mitigation in context to adjacent riparian and water courses.

- Implement restrictions that permit the planting of only native or non-invasive species in any landscaping.

- Ensure proper management of invasive species throughout the build-out of a development. Implement policy of contact avoidance with invasive infested areas. These policies will be necessary to avoid unknowingly assisting the spread of invasive species (e.g., seeds becoming stuck in tire treads or mud on the vehicle and being carried to unaffected areas).

- Alternative site designs that include measures to be taken to avoid impact to critical vegetation and habitat.

- Summary of the critical findings related to protection of habitat and vegetation.

- Outline of a long-term management plan that identifies responsible resources and funding in order to protect the habitat and vegetation.

- The inventory and report must be prepared by a professional who possesses the proper experience, education, certifications, and a strong understanding of native ecology. Work with local experts to determine the appropriate strategy for preserving native species.

7.1.3.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Updated Flora and Fauna Study on the entire property which inventories all the current species, locations and provides a solid foundation and recommendations for developing a long-term plan to re-establish native species and enhance the native habitat;

- Selected highly respected Walters Kimura Motoda (WKM) as master planning landscape architect/designer/advisor to refine a master landscape enhancement plan consistent with *Tomorrow's Ahupua`a* principles;

7.1.4 Agricultural Enhancement & Conservation

The purpose is to preserve agricultural resources by protecting prime and unique soils on farmland from development and encouraging community-based food production, improving nutrition through increased access to fresh produce, supporting preservation of small farms that produce a wide variety of crops, and supporting local economic development that increases the economic value and production of farmlands and community gardens.

7.1.4.1 Guidelines

Strategize to locate as much of the project development footprint such that it does not disturb prime soils, unique soils, or soils of state significance as identified in a state Natural Resources Conservation Service soil survey.

Work with the local community to facilitate a planned farmers' market that is open or will operate at least once weekly for at least five months annually.

7.1.4.2 Strategies

- Locate new development on areas of the site not within a state or locally designated agricultural lands or agricultural preservation districts.

- Develop strategic master plan to maximize state-of-the-art agricultural production, community farming, agri-tourism where appropriate and educational programs on how to produce as much food as possible to serve the community.

7.1.4.3 Implementation: Master Developer Progress-to-Date

TBR is working to establish productive working ag lands that provide significant produce for the resort, community and greater Oahu has completed or is working on the following:

- Agreement with Trust for Public Lands to conclude a conservation easement for all of the 470 acres of agricultural land on the Mauka side of Kamehameha Hwy to provide for Agricultural Use forever.

- TBR is developing a comprehensive Ag Lands Master Plan to establish a more strategic approach to crop selection and production to supply as much locally grown food to the project, neighborhood, region and Oahu as possible.

- Repositioning onsite restaurant facilities and menu to be focused on farm to table food offerings that use the food from the Ag production in the Kula lands.

7.1.5 Erosion Control

The purpose is to minimize potential erosion of, slopes, changes in grade, cleared area, and cut and fill volume.

7.1.5.1 Guidelines

Restore slope areas with native plants or noninvasive adapted plants.

7.1.5.2 Strategies

- Instead of building on steep slopes, these areas can be used to enhance the natural environment surrounding the project. Potential strategies can include the following: aggregate the natural areas and link significant habitats with corridors of undisturbed land to promote ecological connectivity; utilize open spaces, parks, trails, critical habitats, wetlands, water bodies, riparian corridors, buffers, and private outdoor areas to create a wildlife habitat network.

7.1.5.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Refining Proposed Action preliminary comprehensive drainage plan to minimize erosion, and improve the management of storm water runoff through the use of bio-swales and detention and retention basins to control the flow during major storm events.

7.1.6 Water Resource Management (Kai & Wai)

The purpose is to reduce pollution and hydrologic instability from stormwater, reduce flooding, promote aquifer recharge, and improve water quality by emulating natural hydrologic conditions.

7.1.6.1 Guidelines

Create a surface and ground water conservation plan with the assistance of hydrologists and water quality specialists that will protect water quality and quantity in streams and groundwater sources.

The plan should identify ways to conserve water quantity and quality through reduced irrigation, efficient systems, alternative sources of water for irrigation, water harvesting and storage, and storm water runoff.

The plan should address application of fertilizers and pesticides and show that all federal permit requirements and Best Management Practices (BMP) have been followed for managing storm water runoff.

7.1.6.2 Strategies

- Identify ways to conserve water quantity and quality through reduced irrigation, efficient systems, alternative sources of water for irrigation, water harvesting and storage, and storm water runoff.

- Aquatic projects require a scientific approach that should involve specialists. Geomorphologists and aquatic biologists should be involved to assist in development strategies. Gain technical assistance from local conservation districts for any projects that would modify stream beds or banks or beach areas.

7.1.6.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Working with technical and cultural consultants to coordinate storm and wastewater management in a way to maximize use of bio-swale filtering and minimize the amount of silt and runoff into the nearshore marine and other sensitive areas.

- TBR is presently studying the use of herbicides and pesticides on the golf courses to determine best practices to minimize any impacts to water resources.

- Refining Proposed Action preliminary comprehensive drainage plan to minimize erosion, and improve the management of storm water runoff through the use of bio-swales and detention and retention basins to control the flow during major storm events to the ocean.

- A proposal to restore the alignment of Kawela stream to its original and more environmentally sensitive alignment corresponding to the West Main Drain in Turtle Bay.

- Continue to expand initiatives designed to promote awareness of the unique water resources and how to enhance and protect these resources.

- Continued improvement in the operation and management of the resort's two (2) golf courses has yielded invaluable information about the relationship between golf course operations and groundwater and near-shore water quality.

- Planned re-design of the Fazio golf course to incorporate the front 9 holes into open space and support for recreation and natural bio-swale to support drainage while blending the back 9 holes as part of the Palmer 18 holes.

- Continued systematic monitoring of near shore water quality that started in the mid-1980s in an effort to ensure that near shore water quality is not impacted by golf course operations.

- The responsible use of treated effluent from the resort's Wastewater Treatment Plant as an irrigation supplement on the Palmer Course that has resulted in a substantial reduction in the need for herbicides.

- As the resort expands and the volume of treated effluent available for use to supplement the irrigation requirements of the golf courses. The resort owners are planning to upgrade the Wastewater Treatment Plant (under separate ownership) filter system so that the effluent can be used in other areas closer to residential zones, thus allowing responsible management of this water resource.

7.1.7 Comprehensive Cultural & Natural Resource Management Plan

The purpose is to preserve, enhance and conserve native and indigenous plants, wildlife habitat, wetlands, and water bodies.

7.1.7.1 Guidelines

Create and commit to implementing at least a ten-year management plan for new or existing onsite native habitats, water bodies, and/or wetlands and their buffers, and create a guaranteed funding source for management. Involve a qualified biologist or a professional from a Hawaiian natural resources agency or natural resources consulting firm in writing the management plan and conducting or evaluating the ongoing management. The plan must include biological objectives consistent with habitat and/or water resource conservation, and it must identify:

- Procedures, including personnel to carry them out, for maintaining the conservation areas.

- Estimated implementation costs and funding sources.

7.1.7.2 Strategies

- Employ an Adaptive Management strategy to revisit management decisions to ensure they are providing the desired outcome.

- Establish a Konohiki Council to provide guidance for decision making in each of the three ahupua`a that constitute the SEIS Lands.

- Develop strict lighting practices for site, effectively eliminating light pollution into the habitat or corridor. Lights must be directed downward and inward toward the building.

- Develop strict noise pollution practices in accordance with wildlife needs. Many animals have peak activity during nocturnal hours.

- Remove vegetation that attracts animals away from designed habitat and corridors. For example, removing fruit trees and replacing them with native plants will reduce the tendency for wildlife to leave habitat or corridor.

- Locate refuse and other animal attractants effectively from habitat and corridor areas.

7.1.7.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- For over 2 years with over 150 individuals or groups, reaching out to the community for cultural and technical advisory on matters of Conservation and Resources Management.

- Sponsoring and hosting annual Ocean Fest Event open to the public to promote awareness of the ocean and beach resources and education of how to better protect these resources.

- Developing a Cultural and Natural Resources Management Plan as a means to coordinate the long-term preservation of natural and cultural resources at the resort.

7.2 Master Planning & Design

ʻO ke kahua ma mua, ma hope ke kūkulu.
First the foundation, and then, the building.

The purpose is to provide an overarching plan that addresses all the components of the development project in a manner that ensures their integration and successful implementation. A master plan establishes the philosophy and vision for the development that, in turn, creates the foundation for design guidelines to establish a consistent and uniform standard of quality.

Nānā i hope
Looking Back

E lauhoe mai nā wa`a; i ke ka, i ka hoe, i ka hoe, i ke ka; pae aku i ka ʻāina.
Paddle together, bail, paddle; paddle, bail; paddle towards the land.

The ahupuaʻa was the epitome of master planning and design in Hawaiʻi. Although each ahupuaʻa was managed and planned distinctly, there are salient principles that guided the design of ahupuaʻa in general. The ahupuaʻa was part of an organized island management system. The island or mokupuni was the largest division, and each was divided into districts or moku. Each moku was further divided into multiple ahupuaʻa. The ali'i (chief) ruling system, the Hawaiian political system, mirrored these land divisions. The ahupuaʻa provided a valuable supplement to the political system by increasing social and political relations between neighboring communities.

The ahupuaʻa allowed for the master planning and design of large land tracts. It is a system of organizing self-sustained land sections divided from the mountain ridges to the outer reefs of the ocean. Each ahupuaʻa includes the ʻāina, kai, and wai resources within its boundaries. This land division system was first established under Oʻahu aliʻi nui (high-ranking chief) Maʻilikukahi, between approximately 1450–1500. Several generations later, this management framework was also incorporated on Hawaiʻi Island by ruling chief ʻUmi. Soon after, it was implemented throughout the entire pae ʻāina (archipelago). Both aforementioned chiefs were renowned for their sustainable ruling practices with hallmark periods of peace and prosperity. This new system had greatly diminished disputes over resources. Both ali'i introduced the ahupuaʻa framework in order to increase social, political, and economic sustainability as well as overall island-wide stability.

Master planning was a highly specialized function that ensured resource management and equitable access. In the ahupuaʻa, placement of homes, temples, structures, agricultural plots and walkways were very deliberate. Many considerations were taken into account such as the orientation of natural resources, design of the built environment (agriculture plots, heiau, house sites), and the needs of the community. This served to increase the productivity of each region as well as the collective operation and efficiency of the moku and larger mokupuni.

Nānā i mua
Looking Forward

ʻAu i ke kai me he manu ala.
Cross the sea like a bird.

Tomorrow's Ahupuaʻa strives to ensure that the master planning and design guidelines include an engagement of the larger community. Through this communication with the host community, *Tomorrow's Ahupua`a* can more accurately identify all of the cultural assets of the project area. This includes both the wahi pana (important sites) and recreational spaces. Wahi pana will be celebrated through an increased commitment to protection and maintenance. Further, the guidelines will address the individual character of each ahupuaʻa, including the wahi pana, to bolster connectivity between stakeholders within the project area. Master planning and design will increase the balance between the needs of kānaka while maintaining the capacity of the ʻāina.

Tomorrow's Ahupuaʻa also seeks to provide the community with improved access to the various places and resources they need. A major consideration in master planning is transportation, which, when planned effectively, enables all members of the community adequate access to housing, places of work, goods and services, and recreation. It also provides moku connectivity, and provides alternative transportation options to the automobile.

One of the main goals of the master planning and design guidelines is to increase connectivity and human mobility in the project area and beyond in order to improve economic and social sustainability and enjoyment. By working toward this goal, *Tomorrow's Ahupuaʻa* will also contribute to the overall health and wellness of the moku by including environmental indications such as reducing its greenhouse gas emissions in its guidelines. This will ensure that developers consider internal and regional connectivity in their design and help identify the greatest opportunities to achieve connectivity and mobility.

7.2.1 Resort Connectivity

The purpose is to provide direct and safe connections for pedestrians and vehicles (cars, trucks, bicyclists, skateboards, etc) to local destinations, neighborhood centers, existing trails systems, and parks and beaches.

7.2.1.1 Guidelines

Make continuous provisions for bicycling and walking along, or parallel to, all streets within the project. Pedestrian and bicycle facilities shall comply with the American Association of State Highway and Transportation Officials, Guide for the Planning, Design, and Operation of Pedestrian Facilities, The Institute of Transportation Engineers (ITE), or similar widely accepted standards.

Connect trails, sidewalks, bicycle lanes, and other facilities to adjacent existing or planned facilities to establish or expand larger networks.

7.2.1.2 Strategies

- Design and develop a multi-modal internal transportation system with many practical and highly efficient options for moving people and resources within the resort community, as well as connecting to other outside transportation corridors.

- Include pedestrian or bicycle through-connections between the development and existing trail systems, local destinations, and publicly owned parks and beach.

7.2.1.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Removed barriers to entry by permanently opening vehicular gates to the resort and publicly inviting residents, community members, visitors and guests to use the Turtle Bay Resort public beach areas, shoreline and property trail systems in a responsible manner at their own risk.

- Increased public beach access and associated parking to 40 stalls allowing residents in Kahuku closer more efficient access to quality fishing, surfing, walking, and general access to a wide variety of beach environments.

- Developed Heli Huli adventure center which provides a variety of efficient and transportation options (bicycles, mopeds, seaways…) and activities that keep residents, visitors and guest opportunities for recreation and entertainment on site vs. using vehicles to travel to other destinations on the North Shore.

- Invested in path improvements and consistent security patrols that allow public access to Kawela Bay from Kam Hwy at users own risk.

- The Proposed Action would increase the number of public beach accesses at the resort and provide new pedestrian paths to the oceanfront and throughout the property.

- Work towards obtain Grants to connect the bike/ pedestrian path from Kahuku to Sunset.

7.2.2 Community Connectivity

The purpose is to encourage transit use and reduce driving by providing safe, convenient, and comfortable transit waiting areas and safe and secure bicycle storage facilities for transit users.

7.2.2.1 Guidelines

Work with the transit agency or agencies serving the project to identify transit stop locations within and/or bordering the project boundary to identify where transit agency-approved shelters and any other agency-required improvements, including bicycle racks, should be placed. At those locations, install approved shelters and any required improvements, or provide funding to the transit agency for their installation.

Work with the transit agency or agencies to review and update the internal transit plan from every few years to maximize efficiencies and effectiveness of the plan.

Work with the transit agency or agencies serving the project to provide kiosks, bulletin boards, and/or signs that display transit schedules and route information at each public transit stop within and bordering the project.

7.2.2.2 Strategies

- Provide transit stop shelters and bicycle racks adequate to meet projected demand with a guideline of one shelter and one bicycle rack at each transit stop.

- Shelters should be covered, be at least partially enclosed to buffer wind and rain, and have seating and illumination.

- Bicycle racks should have a two-point support system for locking the frame and wheels and must be securely affixed to the ground or a building.

- Provide transit incentives to promote use of public and/ or private intermodal transportation options.

7.2.2.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Continued cooperation and support of The Bus stops on site and future turnouts along Kamehameha Highway to facilitate more convenient public transportation without negative impacts on highway traffic.

- Adding 5 parks totaling 73.3 acres, and 12 public access points.

- Invested in path improvements and consistent security patrols that allow public access to Kawela Bay from Kamehameha Highway at users' own risk.

- Plans to write and apply for grants to pay for the connection of the bike/ pedestrian path from Kahuku to Sunset.

- In process to complete Traffic Demand Management plan that seeks to define efficient and feasible programs to enhance connectivity including but not limited an internal shuttle system with energy efficient vehicles, building bike/ pedestrian paths and more…

7.2.3 Recreation & Open Space

The purpose is to create and/or expand recreational opportunities while minimizing any potential user conflicts and resource impacts.

7.2.3.1 Guidelines

In cooperation with appropriate agencies, prepare an assessment of supply and demand for different types of recreational experiences in the project vicinity.

- Identify existing and potential recreation opportunities and possible users.
- Identify sources of potential user conflict.
- Outline strategies for fostering positive interactions among users, organizations and land managers as new recreation services and opportunities are proposed and developed.

Locate recreation services and facilities at a site that minimizes the impact on the existing ecosystem and environment both socially and biologically.

- Prepare a management plan that demonstrates how the site's resources and carrying capacity will be respected and how the facility design and operation will minimize user conflicts.

7.2.3.2 Strategies

- Prepare a management plan that demonstrates how the site's resources and carrying capacity will be respected and how the facility design and operation will minimizes user conflicts.

7.2.3.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Removed barriers to entry by permanently opening vehicular gates to the resort and publicly inviting residents, community members, visitors and guests to use the Turtle Bay Resort public beach areas, shoreline and property trail systems in a responsible manner at their own risk.
- Increased public beach access by expanding associated parking to a total of 40 stalls allowing residents in Kahuku area closer more efficient access to

quality fishing, surfing, walking, and general access to a wide variety of beach environments.

- Develop Heli Huli adventure center which provides a variety of efficient and transportation options and activities that retain residents, visitors and guest opportunities for recreation and entertainment on site, and in so doing reduces the use of vehicles to travel to other destinations on the North Shore.

- Invested in path improvements and consistent security patrols that allow public access to Kawela Bay from Kamehameha Highway at users' own risk.

- The Proposed Action would increase the number of public beach accesses at the resort and provide new pedestrian paths throughout the property.

- Work towards obtaining grants to connect the bike/pedestrian path from Kahuku to Sunset.

- By providing new park areas with unrestricted parking, TBR is improving the community's access to recreational and open space areas.

- As the new parks will be privately owned and operated with security provided by the resort, users will be ensured a safe and secure recreational environment.

7.3 Environmental Infrastructure & Green Buildings

Ka manu ka`upu halo `alo o ka moana.
The albatross that observes the ocean.
A careful observer.

In the ahupuaʻa, mālama ʻāina is a cultural framework that captures kānaka obligation to the ʻāina. The goal of mālama ʻāina is to preserve the integrity of the natural environment and simultaneously provide for all of the needs of kānaka. Mālama has numerous meanings including take care of, preserve, protect, save or maintain. ʻĀina means land, however, a literal translation reveals its root meaning: that which feeds'. The mālama ʻāina principle is defined as to take care of that which feeds'. Mālama ʻāina maintains the balance between kānaka and ʻāina.

Nānā i hope
Looking back

Hahai no ka ua i ka ulula`au.
The rain follows after the forest.
Destroy the forest, the rains will cease to fall.

Mālama ʻāina was practiced on both the ahupuaʻa and ʻohana levels. In the ahupuaʻa, mālama ʻāina practices were protected by the kapu (laws or restrictions). These kapu were enforced by the konohiki (land manager), a position appointed by the ali'i. Within the ʻohana, there were values and morals that were strictly followed. These practices are still prevalent in Hawaiian communities with subsistence lifestyles, and include but are not limited to the following: take only what you need, never waste resources, and use everything you take. These ʻohana values were applicable to fishing, farming, gathering and water management. Every ʻohana practiced mālama ʻāina in order to maintain the balance of ʻāina and kānaka.

Native Hawaiians have always had a keen understanding of the finite resources of their island-ecosystem. Further, this is witnessed by the innate spiritual connection between ʻāina and kānaka. Kinolau were the physical manifestations of the gods found on the ʻāina. Many of the kinolau for Kāne and Kanaloa are found within this moku. Fresh water, kalo, kō (sugarcane), and ʻo`opu are a few of the kinolau of Kāne. The ocean, mai`a (banana), he`e (octopus), and hīhīmanu (stingray) were kinolau of Kanaloa. Hawaiian spirituality was founded in concepts of the ʻāina. Therefore, mālama āina ensured the balance between kānaka and ʻāina by taking care of the Akua and their kinolau.

Nānā i mua
Looking forward

ʻA'ole i ke`ehi kapua`i ike one o Hauiki.
Has not set foot on the sands of Hauiki.
One does not know much about a place until one has been there.

Mālama ʻāina is an integral aspect of *Tomorrow's Ahupuaʻa*, giving consideration to the rich characteristics of the region and the need to minimize the impact of development on the surrounding environment. Environmental infrastructure and green building guidelines will begin to restore the integrity of the ʻāina, as well as ensure that future development will be thoughtful, engaging both traditional practices of mālama ʻāina and the modern practices of environmentally-minded development.

The impact of the built environment, including design, construction, and operation is significant. The built environment imposes on our natural resources, and without proper planning, can destroy the very attributes that inspire us to live in these places. Similar to water metering to promote efficient water use, requirements throughout this section focus on efficient use and reuse of water and energy resources. These include direct approaches such as sharing services, managing electrical loads, water efficiencies, and water quality. They also include indirect approaches such as expanded renewable energy production and resource management during construction.

7.3.1 Energy Efficiency

The purpose is to reduce adverse environmental effects from energy used for operating public infrastructure.

7.3.1.1 Guidelines

Design, purchase, or work with the City & County of Honolulu to install all new infrastructure, including but not limited to traffic lights, street lights, and water and wastewater pumps, to achieve at least a 15% annual energy reduction below an estimated baseline energy use for this infrastructure. The baseline is calculated with the assumed use of lowest first-cost infrastructure items.

7.3.1.2 Strategies

- Conventional mercury vapor streetlights consume about twice the energy as newer high-pressure sodium (HPS), low-pressure sodium (LPS), and metal halide lamps.

- LED (light emitting diode) technology lighting is also available offering significant cost-saving opportunities (especially for traffic signals where LEDS use 82-93% less energy than incandescent bulbs).

- Complement water conservation with energy efficiency and conservation in the supply, storage, and distribution of water using appropriate energy-saving technologies and devices (e.g., high efficiency pumps). When appropriate and cost-effective, use renewable energy technologies (e.g., PV) in water supply and treatment systems.

- Install green roofs or shading to reduce heat gain on buildings thereby lowering the heat coefficient and demand for cooling.

7.3.1.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Lighting retrofit throughout the resort that forecasts reducing energy demand by 20% to 25%.

- Installation of a Renewable Energy Solar Photovoltaic System that will provide clean energy for approximately 10% of the current demand.

- Installation of energy monitoring and smoothing of energy quality forecast to reduce energy demand by approximately 5%.

- Develop education and incentive programs that inform and work to change behavior of employees, guests and residents to conserve energy and resources.

- Evaluation of all energy systems for opportunities to reduce and convert to renewable energy sources.

- Require all new site development adhere to energy star and LEED standards.

- Researching feasibility of other wind and solar systems to improve energy efficiency.

- Installation of green roofs on existing hotel's lower roof areas of approximately 50,000 sq ft.

7.3.2 Renewable Energy

The purpose is to encourage on-site renewable energy production to reduce the adverse environmental and economic effects associated with fossil fuel energy production and use.

7.3.2.1 Guidelines

Incorporate on-site nonpolluting renewable energy generation, such as solar, wind, and/or biomass, with production capacity of at least 5% of the project's annual electrical and cooling energy cost.

7.3.2.2 Strategies

- Use of alternative power generation sources is one way to reduce Hawaii's major dependency on fossil fuels. On-site production should be explored including use of wind and solar.

7.3.2.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- See Section 7.3.1.3 (Energy Efficiency Implementation) above;

7.3.3 Wastewater Management

The purpose is to help reduce the potential for pollution from wastewater and encourage water reuse.

7.3.3.1 Guidelines

Design and construct the project to retain on-site at least 25% of the average annual wastewater generated by the project (exclusive of existing buildings), and reuse that wastewater for irrigation purposes to replace potable water.

7.3.3.2 Strategies

- Perform a soil/climate analysis to determine appropriate, adaptive landscape material and design the landscape plan accordingly to minimize or eliminate irrigation needs.

- Where irrigation is required, use efficient irrigation means. Outdoor water use can be reduced by any of the following: native Hawaiian plant species selection, irrigation efficiency, captured storm water, reused wastewater effluent or grey-water, or use of water specifically conveyed for non-potable water use (i.e., irrigation ditch).

- Consider using storm water, grey-water, and recycled wastewater effluent for irrigation.

7.3.3.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- TBR currently treats all wastewater to an effluent standard that allows for the safe use of the wastewater to irrigate the Palmer golf course or place excess in State Health Department approved injection wells that allows for the safe and environmentally responsible filtering of this resource into the ground for healthy reuse in the environment. As the resort expands the volume of treated effluent available for use will increase. To supplement the irrigation requirements of the golf courses, the resort owners are planning to upgrade the Wastewater Treatment Plant (under separate ownership) filter system so that the effluent can be used in other areas closer to residential zones, thus allowing responsible management of this water resource.

7.3.4 Water Usage

The purpose is to conserve Oahu's valuable water resources over the long-term and raise owner and consumer awareness of this need.

7.3.4.1 Guidelines

Verify that all projects will include metered water use in the final development to the extent possible.

For public water systems, the system shall individually meter users, and the metering shall be strictly enforced. If service to the development or structure is not provided via public water system, the individual users (i.e., irrigation users, individual wells, etc.) shall individually meter use. Where technologies allow, the intent is to raise owner and consumer awareness about their water use and potential for waste with the ultimate goal being to promote conservation and wise use of water resources.

7.3.4.2 Strategies

- For public water systems, the system should individually meter users, and the metering should be strictly enforced.

- If service to the development or structure is not provided via public water system, the individual users should individually meter use (i.e., irrigation users, individual wells, etc.).

7.3.4.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- All replacement fixtures for renovation projects including guestroom, spa/ fitness and restaurant renovations & future development will meet current LEED water efficiency standards.

- In process of evaluating water use by facility to determine current conservation opportunities.

7.3.5 Reuse & Recycle

The purpose is to reduce the volume of waste deposited in landfills.

7.3.5.1 Guidelines

Meet at least four of the following five guidelines below and publicize their availability and benefits:

- Include as part of the project at least one recycling or reuse station, available to all project occupants, dedicated to the separation, collection, and storage of materials for recycling; or locate the project in a local government jurisdiction that provides recycling services. The recyclable materials must include, at a minimum, paper, corrugated cardboard, glass, plastics, and metals.

- Include as part of the project at least one drop-off point, available to all project occupants, for potentially hazardous office or household wastes; or locate the project in a local government jurisdiction that provides collection services. Examples of potentially hazardous wastes include paints, solvents, oil, and batteries. If a plan for post-collection disposal or use does not exist, establish one.

- Include as part of the project at least one compost station or location, available to all project occupants, dedicated to the collection and composting of food and yard wastes; or locate the project in a local government jurisdiction that provides composting services. If a plan for post-collection use does not exist, establish one.

- Include recycling containers adjacent to other receptacles or recycling containers integrated into the design of the receptacle.

- Recycle and/or salvage at least 50% of nonhazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and specifies whether the materials will be stored on-site or commingled. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume.

- Use recycled content in materials for new infrastructure such as roadways, parking lots, sidewalks, unit paving, and curbs. Also include water retention and detention basins, tanks and vaults, storm water, sanitary sewer, steam energy distribution, and water piping.

7.3.5.2 Strategies

- Include recycling containers adjacent to other receptacles or recycling containers integrated into the design of the receptacle.

- Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and specifies whether the materials will be stored on-site or commingled.

- Use recycled content in materials for new infrastructure such as roadways, parking lots, sidewalks, unit paving, and curbs. Also include water retention tanks and vaults, storm water, sanitary sewer, steam energy distribution, and water piping.

7.3.5.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Operations currently implements recycling programs in back of house, rooms, and throughout the resort, which the Master Developer intends to enhance into future operations.

- Purchasing policy to buy when available and competitively priced, biodegradable or other environmental products which naturally breakdown or recycle easily.

7.3.6 Night Sky Protection

The purpose is to minimize light trespass from project sites, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction, and reduce adverse effects on wildlife environments.

7.3.6.1 Guidelines

“Shared areas” of a project are spaces and facilities dedicated to common use.
In residential areas, at least 50% of the external luminaries must have fixture-integrated lighting controls that use motion sensors to reduce light levels by at least 50% when no activity has been detected for 15 minutes.

In all shared areas, install automatic controls that turn off exterior lighting when sufficient daylight is available and when the lighting is not required during nighttime hours.

Stipulate *covenants, conditions, and restrictions* (CC&R) or other binding documents to require continued adherence to the requirements.

7.3.6.2 Strategies

- Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution.

- Minimize site lighting where possible and model the site lighting using a computer model.

- Technologies to reduce light pollution include full cutoff luminaries, low-reflectance surfaces and low-angle spotlights.

7.3.6.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Operations in the implementation of the lighting retrofit is evaluating all opportunities to replace up or heavy light pollution with down lighting and or reduce lighting fixtures;

7.3.7 Utility Construction & Resource Management

The purpose is to reduce environmental impacts and provide economic alternatives to traditional open cut methods of utility installation, rehabilitation, or replacement.

7.3.7.1 Guidelines

The development team shall demonstrate measures to:

- Monitor and reduce water system loss due to transmission system leaks.
- Reduce wastewater system infiltration and inflow (I&I).
- Have established and routinely update a "Capital Improvements Plan" (CIP) that addresses public utilities.
- Provide a written commitment to the appropriate use and implementation of Trenchless technology for the rehabilitation, replacement, or installation of water, wastewater, or storm water conveyance utilities.
- Avoid use of Poly Vinyl Chloride (PVC) in any new utility material where possible.

7.3.7.2 Strategies

- Minimize: surface disruption, trench excavation, asphalt and concrete pavement removal, and replacement.
- Reduce: fuel consumption, traffic congestion, air and noise pollution, business disruption and land fill deposits.
- If trenchless technology is an appropriate method for utility construction, the list below provides potential technologies by category.

  Rehabilitation:
  - Cured-In-Place Pipe (CIPP) / Fold-in-Form
  - Slip lining
  - Spiral Re-lining

  Replacement:
  - Pipe Bursting
  - Dynamic Pipe Bursting
  - Static Pipe Bursting
  - HDD Air Impactor Assisted Pipe Bursting

New Installations:

- Bore and Jack
- Unguided
- Guided
- Pipe Ramming
- Horizontal Directional Drilling (HDD)
- Microtunneling
- Tunneling

7.3.7.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Specifying up-to-date preferred utility construction methods and systems to be incorporated into our plans and specifications where available and economically feasible.

7.3.8 Green Building Programs: LEED Certification Priority

The purpose is to design and construct sustainable buildings and structures by meeting at a minimum, the perquisites for LEED New Construction for habited structures.

7.3.8.1 Guidelines

The national green building leadership standard, LEED, was developed to elevate the design and construction industry to a more sustainable level. Use of the LEED family of products forms the basis for a sustainable, habited structure and serves as an effective measurement tool. LEED Accredited Professionals support the design and construction teams in meeting requirements and earning points, and documents the progress of the project in this third-party verified system.

Built environments encompass all constructed entities. Habited structures are enclosed, occupied, and conditioned. Non-habited include but are not limited to structures that are not enclosed, occupied or conditioned, such as transit shelters, bridges, retaining walls, and landscape features. The required LEED NC prerequisites for habited structures include:

- Construction Activity Pollution Prevention;

- Fundamental Commissioning of the Building Energy Systems;

- Minimum Energy Performance;

- Fundamental Refrigerant Management;

- Storage & Collection of Recyclables;
- Minimum Indoor Air Quality Performance; and
- Environmental Tobacco Smoke Control

7.3.8.2 Strategies

- All structures are encouraged to use the appropriate LEED rating system as their guide throughout design and construction. LEED registration and certification is a requirement for all new structures. http://www.usgbc.org

7.3.8.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- TBR is committed to requiring all major development structures meet the LEED certification standards for new structures on all individual site development;

7.4 Kānaka Guidelines

7.4.1 Community Engagement

Ho`okahi ka `ilau like ana.
Wield the paddles together.
Work together.

In the Hawaiian language, the term for community is kaiaulu. What is less commonly known is that kaiaulu is also the word for environment. This emphasizes the interrelationship between kānaka and ʻāina. Communities were built in harmony with the natural environment, and even the traditional governance structure of the community mirrored the division of the land: the hierarchy of leadership corresponding to the extent of responsibility (*kuleana*) over the land. In *Tomorrow's Ahupuaʻa* the emphasis on kaiaulu will be apparent both within the development area and with the larger Koʻolau Loa community.

Nānā i hope
Looking Back

Ua lehulehu a manomano ka `ikena a ka Hawaiʻi.
Great and numerous is the knowledge of the Hawaiian people.

The ahupuaʻa were governed by kapu established by the ali'i. Kapu were placed on all practices to ensure the highest level of resource management. In turn, kānaka guidelines were designed to protect and preserve the environment as well. Fishing practices, for example, were regulated by strict kapu that were enforced as social norms. In the case of the ʻopelu, a highly prized fish, a specific kapu from February to July banned fishing. This kapu protected the fish during its spawning season allowing the species to replenish. This provided protection for the species and replenishment of the natural ecosystems.

Other kapu were based on location. In Ka`u, there were two fishing seasons inshore fishing and deep-sea fishing. The seasons were opposite. During the summer, inshore fishing took place; this correlated with the time the Paʻakai (sea salt) was dried and available. Much of the harvest was salted and saved to eat throughout the year. In the winter months, deep sea commenced. This allowed the in-shore fish, limu (seaweed), and shellfish to replenish.

Conservation is the key to kapu system. It provided a coordinated resource management effort, and ensured the balance between ʻāina and kānaka was maintained and ultimate efficiency was achieved.

Nānā i mua
Looking Forward

ʻA`ohe pau ka `ike i ka hālau ho`okahi.
All knowledge is not taught in same school.

In *Tomorrow's Ahupuaʻa*, a thriving community depends on a diverse cross-section of inhabitants and activities. The Koʻolau Loa Communities share a common thread: the local residents maintain strong and proud connection to the surrounding lands and to each other. For years, these communities have grown around small businesses, local agriculture, and shared recreational resources. The guidelines promote productive and balanced communities by prioritizing mixed-use developments, small businesses, employment opportunities, housing diversity, and affordable housing provisions, live-work proximity, continuity, and access to public spaces, and safe walkable developments.

Long-term community viability requires the sustainably constructed project to remain connected to the Koʻolau Loa moku. Project teams are required to develop a plan for ongoing improvement once the project is occupied. Financial investments through donations to local organizations are also recognized in this section. A sustainable project gives back to the community throughout its life cycle. Support for local and regional businesses, by ongoing employment of local designers, builders, craftsman, and service providers, are essential elements of any sustainable project. To this end Turtle Bay Resort, LLC is working to establish the Turtle Bay Foundation to provide a vehicle to socially and financially support important community causes and organizations.

7.4.2 Public Access

The purpose is to provide public spaces and encourage recreational and traditional cultural activity and interaction as well as foster and maintain community and connectedness beyond the development.

7.4.2.1 Guidelines

Develop a Community Place-Making Plan including all public spaces and connections. Develop programs to support activities such as farmers' markets, community gatherings and street parties, fun runs, community gardening, etc. Promote actions that encourage public access.

7.4.2.2 Strategies

- Create & maintain public amenities (picnic tables, restroom, etc.) at accessible points.

- Seek opportunities through local, state, and national agencies to provide safe, clean, and maintained access.

- Contact Hawaii State Park agencies to discuss partnership opportunities and information on designing recreational features, etc.

7.4.2.3 Implementation: Master Developer Progress to Date

TBR has completed or is working on the following:

- TBR proposes to increase the number of public shoreline access from the requisite 8 to a total of 12.

- TBR has removed the security gate at the resort entrance to facilitate unrestricted access and parking at the resort.

- TBR has welcomed community to access the shoreline and trail systems for cultural and recreational purposes.

7.4.3 Educational Programs

The purpose is to promote common understanding and appreciation of Hawai'i's bioregional resources, and minimize environmental impacts through educational opportunities that teach conservation and ecological concepts.

7.4.3.1 Guidelines

Create a comprehensive program for residents, visitors, and/or employees that accurately interprets the region's natural history and the site's specific ecological, cultural, historical, and geological features.

Institute ongoing educational programs for users and employees that will minimize user impacts upon the site and recreational facilities. These programs should demonstrate how best management practices provide for a continued functioning ecosystem and long-term resource and facility protection.

7.4.3.2 Strategies

- Encourage coordinated participation of user groups, associations, government entities, educators, etc., in the development of these programs and or facilities.
- Encourage the guide/provider to pursue additional guide training and/or certification in knowledge of site environment.
- Leave No Trace at http://www.lnt.org/index.php
- Improve, update, and maintain interpretive displays and educational opportunities for the recreational user and provider on an annual basis.
- Facilitate outdoor ethics training for operators and staff, and provide volunteer incentives/opportunities.
- Encourage different user groups and associations to cooperate in the protection of the resources as well as establish a code of ethics for each user group.
- Integrate concepts of life cycle assessments for those engaged in facility design, construction, and maintenance.
- Research opportunities to include ethics discussions and training in other (i.e., safety) educational situations.
- Create evening programs, field seminars, printed materials and websites for users.

7.4.3.3 Implementation: Master Developer Progress-to-Date

TBR has completed or is working on the following:

- Providing space and building an Ocean Education desk in the TB Hotel to be staffed by partner non-profit groups including NOAA divisions of The Whale Sanctuary, Malama Pupukea, The Monk Seal Foundation and others to promote educate residents, guests and community members on the responsible use of the shoreline and ocean consistent with *Tomorrow's Ahupua`a* principles.

- Heli Huli adventure center is providing a cultural education tour 5 days a week by renowned Waimea Valley culture expert called the Hawaiian Cultural Excursion. This one of a kind cultural experience is a 60-minute beach walk that explores Turtle Bay's majestic shoreline and its many hidden coastal wonders. Visitors learn about the rich history of the Hawaiian Islands and O'ahu 's North Shore, observe unique plants and animals which call the area their home, a d listen to ancient stories and chants that were handed down from generation to generation.

- Hosting and sponsoring Ocean Fest event for the past two (2) years that focuses on ocean and beach education and safety.

7.4.4 Community Outreach and Development

The purpose is to continue ongoing public dialogue and partnerships among all stakeholders affected by, or interested in, supporting sustainable developments and communities.

7.4.4.1 Guidelines

Choose one or several participation techniques to engage the public and public service providers in the planning and design processes. Examples include, but are not limited to: surveys, review boards, web sites, public meetings, workshops, charrettes, focus groups, public comment, citizen advisory committees, participatory decision making, open houses, and neighborhood meetings.

Basic components of any public participation program should:

- Provide comprehensive information on development and a process to keep those with an interest in the strategy informed.

- Ensure dialogue will be meaningful and influential in the decision making process.

- Provide inclusive consultative mechanisms for all stakeholders affected by, or interested in, the public participation process throughout the life of the project.

- Provide feedback to stakeholders underscoring where concerns were reflected in the decision making process.

- Build collaboration among key leaders and civic institutions to encourage successful implementation of the project.

7.4.4.2 Strategies

- Establish a *Konohiki* Council for each of the three ahupua`a that constitute the SEIS Lands to provide cultural guidance.

- Provide comprehensive information on development and a process to keep those with an interest in the strategy informed.

- Ensure dialogue will be meaningful and influential in the decision making process.

- Provide inclusive consultative mechanisms for all stakeholders affected by, or interested in, the public participation process throughout the life of the project.

- Provide feedback to stakeholders underscoring where concerns were reflected in the decision making process.

- Build collaboration among key leaders and civic institutions to encourage successful implementation of the project.

7.4.4.3 Implementation: Master Developer Progress To Date

TBR has completed or is working on the following:

- TBR has conducted a proactive public outreach program over the past two (2) years that has engaged hundreds of people in its planning and SEIS process.

- Assisted, supported, kept informed and consulted with the Ku'ilima North Shore Strategic Planning Committee (KNSSPC) Cultural Sub-Committee, Kahuku Burial Committee, Ko'olauloa Neighborhood Board, Turtle Bay Employee Groups, Ko'olau Loa North Shore Association, and others.

7.4.5 Local/Regional Support

The purpose is to support balanced communities and enhance the quality of life in the Koʻolau Loa and surrounding communities with a diversity of volunteering, donations, sponsorships, and charitable giving. Emphasize outcomes – direct benefits to the people and places in the Koʻolau Loa & North Shore Communities.

Encourage innovation in and implementation of environmental stewardship practices.

7.4.5.1 Guidelines

Build upon the existing community outreach plan that demonstrates a commitment to open, two-way communication with the surrounding community. The plan should respond to broad issues about the projects role in the community, such as:

- Job creation
- Philanthropic activities within the community
- Sustainability activities and programs
- Environmental issues
- Mentoring of other businesses
- Community development or redevelopment

7.4.5.2 Strategies

- Job creation
- Philanthropic activities within the community
- Sustainability activities and programs
- Environmental equity issues
- Mentoring of other businesses
- Community development or redevelopment

7.4.5.3 Implementation: Master Developer Progress To Date

TBR has completed or is working on the following:

- Efforts to form the Turtle Bay Foundation a 501(c)3 non-profit organization whose purpose is raise to provide resources to support and promote community wide cultural and resource education, academic education, health/ fitness, healthcare, agricultural and general wellbeing of the Ko’olau Loa community and Turtle Bay Resort Employees, Residents and their ahupua’a.

8. Stewardship of the Ahupua`a: Guidelines, Councils, and Konohiki

Cultural guidelines and management practices, based on the *Tomorrow's Ahupua'a* concept, are planned to be developed to provide a framework to implement the elements and orientations of the *ahupua'a* . The guidelines are intended to "guide" and are not proposed as "cookie-cutter" solutions to all possible situations, but rather capture the essence of the unique features of each ahupua`a. Further, it is anticipated that guidelines will evolve and change over time in a dynamic learning process.

Architectural guidelines will be proposed to achieve balance and design harmony, but not design homogeneity. These guidelines will be flexible enough to allow for individual expression but will also ensure an identifiable kinship of style among neighboring projects. Cultural guidelines will provide a comprehensive source of stories, histories, traditions, and practices that can inform projects. A premium will be placed on involving local practitioners and experts to ensure authenticity and to honor the sense of place of each ahupua'a.

Operational guidelines will be aligned with specific cultural and environmental attributes of the *ahupua'a*, and are planned to reflect the reciprocal relationships that exist between among men and between man and the natural environment.

Consistent with traditional land management principles, plans call for a *Konohiki* or responsible person to ensure that each ahupua`a was healthy. Thus, as part of the overall cohesive and consistent management of each ahupua`a, a *Konohiki* could be identified in each *ahupua'a* with the *kuleana* to ensure that project operations are consistent with the attributes of *Tomorrow's Ahupua'a*. They are envisioned to be the eyes, ears, voices, and spirit of the comprehensive plan. The *konohiki* could guide operators, residents, visitors, and *kama'aina* toward a balanced use and stewardship of the *ahupua'a* lands. Together with representatives from each region within each *ahupua'a*, the *konohiki* could facilitate meaningful discussions and resolve any disputes that may arise. The *Konohiki* could engage groups from outside the project area *ahupua'a*, paying particular attention to the Kahuku Community Association and the Kupuna – currently represented by the Kahuku Burial Committee.

The *Konohiki* could also facilitate a continuous dialogue to ensure that issues and concerns that affect the entire community will be recognized and addressed, with the goal of balancing the well-being of the project area *ahupua'a* with the needs of the greater *moku*.

9. Natural and Cultural Resource Education Outreach

Turtle Bay Resort (TBR) currently owns and controls 852 acres *makai* of Kamehameha Hwy between Kahuku Point to the east and Kawela Bay to the west that includes almost 5.0 miles of coastline, dunes, the 100 acre Punaho'olapa Marsh, and a multitude of natural and cultural resources. Although the land has been 100% disturbed over several decades due to ranching, sugar cane production, military and modern 20th century development, there are many unique treasures on this property today.

In addition, TBR owns 470 acres of *mauka* of Kamehameha Hwy that is currently open space of in agricultural production. TBR has entered into an agreement with The Trust for Public Lands and the North Shore Community Lands Trust to record a conservation easement over the *mauka* property and protect it for agricultural production, incubation, education, agri-tourism and recreation forever.

One of TBR's key missions and part of its core values is to "*Malama* the *'Aina*" or "care for the land" and actively steward the natural and cultural resources that exist on the Resort and in our community.

Since taking over ownership in Feb 2010 TBR has been working to establish strategic relationships and partnerships with community, governmental, non-governmental agencies, and respected experts to better understand the unique eco-systems, cultural sites/ history, flora, fauna, marine, and terrestrial species so that we can develop programs and plans to protect and enhance these resources.

9.1 Programs/ Partnerships, Plans & Events

The following programs and partnerships are either in existence or planned for the resort.

9.1.1 Ocean Education / Conservation Program

Ocean Education and Conservation at Turtle Bay Resort focuses on an active partnership with the North Shore Ocean Education Coalition (NSOEC). The NSOEC was developed by a group of community members from Ko'olauloa/North Shore, with the support of non-profits, state and federal organizations. Its mission is to expand awareness and educational opportunities for children, their families and other residents, as well as, visitors to Hawaii. NSOE sites include **Turtle Bay Resort** and the **James Campbell National Wildlife Refuge**. Other sites will be added.

The NSOEC mission is to increase awareness/knowledge about the ocean, marine life and ecosystems in order to protect, restore, and manage the use of ocean resources and inspire local and global conservation including:

Local Hawaiian traditions remind us of the time-honored Native Hawaiian value of *kuleana* (responsibility) to care for this unique, fragile place and its many resources through strong conservation and protection principles. The need to *malama ka pae 'aina* (care for the archipelago) continues in honoring the past and in looking to the future.

Teaching children, youth and the community how to *malama* (care for) the ocean as the ancient Hawaiians did may be one of the most important lessons that the Center can teach. To do this, the Center partners with non-profit organizations to protect, and restore the ocean and it's animals and educate children, youth, the local community and visitors about traditional Native Hawaiian values, practices and traditions that will ensure the sustainability of our ocean, it's animals and the Hawaiian culture.

NSOEC at **TBR** is coordinated by Dottie Kelly, Chair, and includes the following partnership agencies and community groups:

- Hawaii Department of Education- Kahuku Complex
- Hawaiian Monk Seal Response Team Oahu – Leslie MacPherson
  (i) **Includes a currently defined protocol with our security team, residents and guests to notify response team when Monk Seals are seen on property.**
  (ii) **Team members regularly come out and put signs and barriers to protect the seals from unhealthy interaction with humans.**
- Hawaiian Islands Humpback Whale National Marine Sanctuary – Joe Paulin
- Hui O Hau'ula (Non-Profit Project in Ko'olauloa & Fiscal Agent) – Matt Limtiaco
- MalamaPupukeawaimea.org – Bob Leinau
- NOAA Fisheries Service – Pacific Islands Regional Office (PIRO)
- Turtle Bay Resort (TBR) – Office on site – www.turtlebayresort.com

Following is a description of existing NSOEC Center Activities:

- Annual North Shore Ocean Fest held at Turtle Bay Resort in June.
- Annual Welcome Back the Whales event held at Turtle Bay Resort
- Summer Camp for children, youth and parents hosted annually.

In addition, the following activities are planned:

- Educational classes/programs for K -12 students with a special emphasis on students from Ko'olauloa/North Shore of Oahu.
- Meeting space, wet labs, offices and exhibit space are needed for collaborators to meet, conduct activities and to store equipment, supplies and materials.
- Cultural teaching of Hawaiian practices to "*malama* the ocean." This includes programs/curriculum/activities on honoring the past (who we were), celebrating the present (who we've become), and envisioning the future (what we want).
- Service Learning programs/ projects will be planned and implemented to enhance experiential learning.

- Habitats for Ocean animals will be provided/preserved to enhance experiential learning about the ocean, its animals and ecosystem.
- Media Center &Viewing Theatre to enhance visual learning.
- Center activities primarily focus on species that are indigenous to Hawaii including Hawaiian Monk Seals, Turtles, Humpback Whales, and Pacific Dolphins.
- Environmental learning with hands-on activities will be provided.

9.1.2 Land Education/ Conservation Programs

TBR is actively developing a **Golf Course Best Management Plan** to supplement current conservation practices of careful monitoring and responsible application of irrigation, herbicides and pesticides on the golf course.

TBR is actively developing an **Endangered Species Management Plan** to provide an integrated awareness and protection plan for all special animal species on property. TBR is Working Rana Biological Consulting to develop these plans, including training for golf course and grounds maintenance employees; partner vendors; and residents and visitors on environmental protection and ecosystem enhancement.

TBR is also coordinating with the US Fish and Wildlife Service for review and input on its plans; and aligning its efforts with adjacent James Campbell Wildlife Refuge.

These management plans will include planned enhancements to the 100-acre Punaho'olapa Marsh ecosystem with paths for viewing wildlife and an interpretive education displays in Park P-3 adjacent to the marsh.

9.1.3 Cultural Management Plan

TBR has instituted a Cultural Management Plan (CMP) that defines guidelines and procedures that are actively used to ensure the protection of historic properties (which includes human remains) discovered at TBR, including during planning construction, operations and maintenance.

APPENDIX E: (revised)

MARINE RESOURCES IMPACT ANALYSIS

E

Turtle Bay Resort

Nearshore Marine Ecosystem Survey

(Revised)

Prepared for:

Turtle Bay Resort

Prepared by:

Oceanit Laboratories, Inc.
828 Fort Street Mall, Suite 600
Honolulu, Hawaii 96813

~~September 2012~~
July 2013

Ecosystem Survey of Nearshore Marine Resources and Water Quality Along the Turtle Bay Resort Shoreline, North Shore Oahu, Hawaii. (Revised)

Prepared for:

Turtle Bay Resort

Prepared by:

Oceanit Laboratories, Inc.
828 Fort Street Mall, Suite 600
Honolulu, Hawaii 96813

~~September 2012~~
July 2013

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1. INTRODUCTION

1.1 Project Description

The Turtle Bay Resort on the North Shore of O'ahu is in the process of designing a re-development plan for the resort area fronting Kawela Bay, Turtle Bay, and Kuilima Bay (Figure 1-1). In 1985 a unilateral agreement was reached with the City and County of Honolulu that governed the density and distribution of potential development across the project site. An EIS describing the proposed development was published in 1988. "Pre-construction" water quality and marine environmental surveys were initiated by Oceanit in 1989 and carried on through 1994, but ultimately discontinued when development was halted. In 2010 efforts were initiated to update the EIS. This report represents our efforts to re-examine the water quality and nearshore marine resources along the coastline of the proposed development.

The Proposed Action suggests an approximately 60 percent reduction from the density proposed in the original expansion as formalized under the 1985 Unilateral Agreement. The proposed development concentrates higher density in the resort's existing core area - the Hanaka'oe ahupua'with two new hotel sites and a new community gathering place in proximity to the existing Turtle Bay Hotel. The sites originally proposed for hotel development in the ahupua'a of 'Ōpana-Kawela (to the west) and Kahuku (to the east) will be developed instead with resort-residential units and will be limited to much lower density developments. At 'Ōpana-Kawela, the proposed density is about 25 percent of what is allowable under existing zoning. Similarly, the Kahuku ahupua'a development is planned for affordable community housing and resort-residential with 65 percent less density than is allowed under existing entitlements. The result is the concentration of development in the central core of the SEIS Lands and the general preservation of a rural character to the east and west.

The Proposed Action provides two additional hotel sites, rather than the five approved in the current land use entitlements, and the number of hotel units is reduced from 2,500 to 625. By implementing shoreline setbacks, the development preserves public access to the entire shoreline as intended in the Unilateral Agreement.

This document reviews the nearshore ocean water quality and living marine resources along the Kawela Bay, Turtle Bay, and Kuilima Bay Shoreline, discusses where and how these resources may be unique, and offers recommendations as to how future development, particularly related to drainage, may minimize any long term adverse impacts to these resources.

1.2 Generation of Information for this Report.

The information for this report is drawn primarily from a series of studies conducted along this shoreline over the past twenty-five years including:

- Oceanit 1987. An engineering study for desilting considerations for Kawela Bay.
- Oceanit 1994. A summary of oceanographic, water quality, benthic monitoring, and sea turtle surveys conducted quarterly from 1989 through 1993 at Kawela Bay, with bi-annual water quality and benthic surveys at the West Main Drain (Turtle Bay), and East Main Drain ('Ō'io Stream, Kuilima Bay).
- Oceanit 2001-2004. Three reports detailing investigations of water quality and currents adjacent to the Kawela Bay, West Main Drain (Turtle Bay), and East Main Drain ('Ō'io

Stream Kuilima Bay) conducted between 2001 and 2003 for the City and County of Honolulu as part of the Ko‘olauloa Flood Protection project. Water quality included year-long measurements at half-hour intervals of physical water quality parameters fronting each outlet.
- AECOS – 2006. Preconstruction water quality summary report and proposed water quality sampling plan, Turtle Bay Resort Master Plan Development, Kahuku, O‘ahu, Hawai‘i.
- AECOS – 2011. Results from water quality surveys fronting stormwater outfalls in Kawela Bay, Turtle Bay, and Kuilima Bay, conducted quarterly from 2006 to the present.
- Oceanit – 2011. Results of Benthic Monitoring Surveys at Kawela Bay, the West Main Drain and East Main Drain, and sea turtle observations at Kawela bay during the winter and summer of 2011.

The scope of this report is intended to fulfill the requirements of an environmental impact study to describe existing living marine resources and water quality near the project site. It also is to define likely impacts caused by the proposed development, and to outline areas where actions may mitigate any anticipated foreseen adverse impacts. The State of Hawai‘i is obligated to protect public resources including water quality, living marine resources, and cultural and aesthetic attributes of our state for the enjoyment of all and preservation for future generations. The State also is required to enforce Federal regulations relating to endangered and protected species including sea turtles and marine mammals. To meet these requirements this study aims to understand the physical, biological, and water quality aspects of the site so that critical public resources can be preserved or enhanced and adverse impacts minimized. To understand the environment a series of surveys have been carried out to document the present condition of the nearshore marine ecosystem and to specify any unique or critically important characteristics.

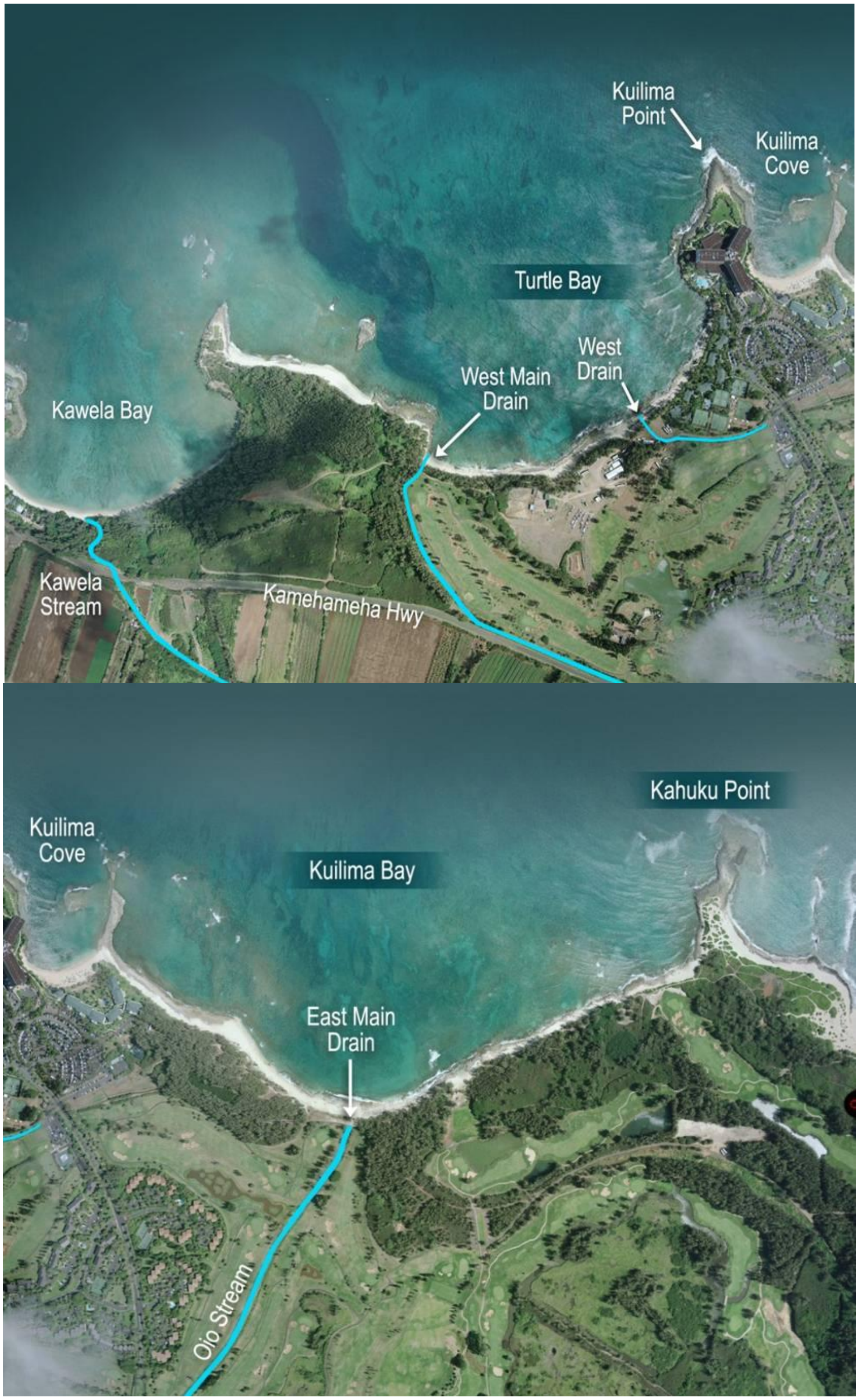


Figure 1-1. Project locations

2. GENERAL SITE DESCRIPTION – KAHUKU COASTLINE

The project site extends along two miles of the "Turtle Bay Resort Shoreline" on the North Shore of O'ahu and includes Kawela Bay at the far western end, Turtle Bay, Kuilima Point, and the Kuilima Bay, to Kahuku Point (Figure 1-1).

Each of these bays and shorelines have widely different physical characteristics that impact both the normal quality of the water and the benthic habitats that support the algae, corals, invertebrates, fish, sea turtles, and marine mammals that frequent this coast. The principle factors influencing the nearshore ecosystem are the geology of the coastal plain, the four main storm water outflows across the shoreline, the nearshore bathymetry, the coastal currents and waves, extractive fisheries, and pollutant loads generated both by nature and by human activities. This section discusses features common to all three shoreline segments.

2.1 Coastal Geology and Subsurface Hydrology

The geology and geomorphology of the shoreline is extremely important to the nearshore ecology as it provides the physical substrate upon which the ecosystem exists. In addition, it directs water flow in surface channels and defines the subterranean groundwater flow. The shoreline geology also influences the areas protected or exposed to waves and currents.

From a regional perspective, the Kahuku coastline (which contains the Turtle Bay Resort Shoreline) consists of a relatively narrow, flat coastal plain backed by steep hills with steep valleys holding small flashy streams. Much of the character of the coastline is the result of past sea level elevation changes. During periods of lower sea levels, the primary streams carved channels through what is now a shallow reef area (Macdonald, et al, 1990). One such 400-foot wide channel can be clearly seen in aerial photographs cutting through the reef from the east end of Turtle Bay (Figure 2-1).

During periods of higher sea levels coral grew seaward from the abrupt coastline and formed what is now the flat coastal plain supporting the development area. The sediments that cover the coastal plain are a mixture of ancient marine deposits interbedded with alluvial deposits from the streams. Numerous portions of the plain are at low elevations and groundwater emerges at the ground surface to form wetlands, some of which are tidally influenced.

The shoreline along much of the coast is hardened by a natural formation of lithified calcium carbonate sand commonly called "beach rock." When calcareous sediments along a shoreline are exposed to alternating fresh and salt (ocean) water tidal flows, the pH differences in these waters cause the sand particles to bind together into a hard cement-like material. These calcareous formations often form abrupt shoreline faces several yards high, but in sheltered coves can support perched sand beaches (Mcdonald, et al, 1990).

The sand dunes behind the shoreline typically accrete to elevations several feet higher than much of the inland coastal plain and the aeolian sand dune structure can lead to drainage problems. During heavy or prolonged rainfall events, when surface flows are blocked by the shoreline sand dunes, ponding and flooding occurs in low-lying areas. The calcareous nature of much of the coast subjects it to the formation of karst cave systems (Macdonald, et.al., 1990). The low pH of fresh groundwater dissolves underground tunnels through which the fresh water flows to the ocean.

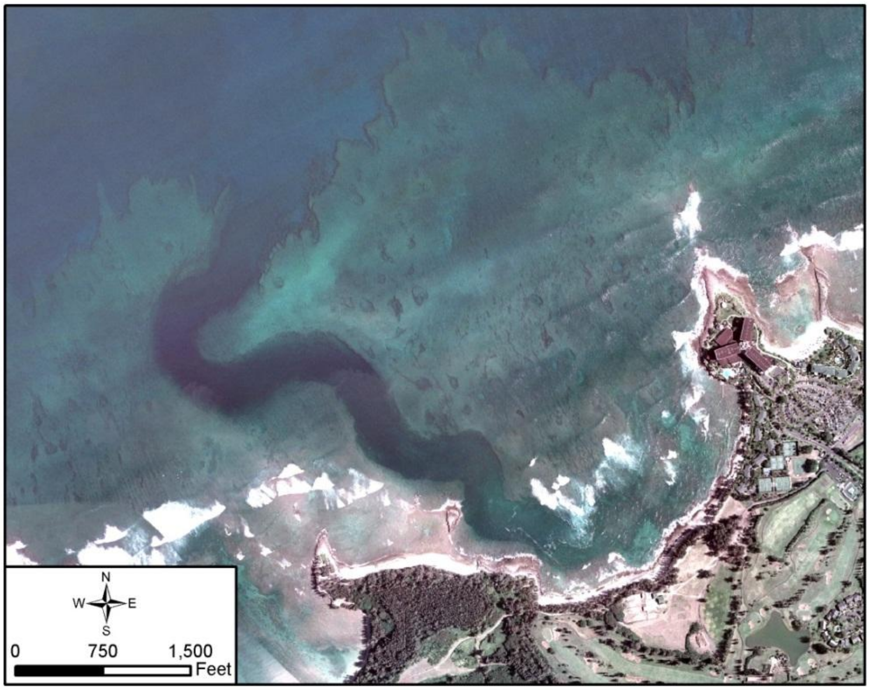


Figure 2-1. Large channel through the reef near the West Main Drain

These cave systems result in concentrated areas of freshwater flow to the ocean and form conduits through which part of the runoff from the mountains enters the sea. Under most conditions rainfall and stream flow from the mountains percolates into the groundwater and discharges into the ocean through this karst cave system.

The regional groundwater flow direction in this area is to the north or northeast and is divided between the shallow caprock flow and the deeper basal discharge. Takasaki and Mink (1985) estimated that the coastal discharge in the Kahuku area was 3.3 mg/mile, or about 80 cubic feet of fresh water per day per linear foot of coastline. This number includes both the deep bedrock and shallow cap-rock aquifers. Assuming the shoreline is similar to the 'Ewa plain caprock (Giambelluca, 1986) and has a caprock area over and above the development of 2.3 square miles, the recharge from rainfall should be 6.1 percent, with 20 percent discharge to the shallow caprock from deep basal flow. This yields a shallow discharge of about 0.66 million gallons per day per mile, or about 17 cubic feet of freshwater discharge per linear foot of coastline per day. (Appendix D Discharge Calculations.)

During periods of heavy rainfall the infiltration capacity of the soil and the capacity of the karst conduits are insufficient to carry the flow, and under these conditions significant flooding problems can result. Because the majority of the shoreline is higher than the inland areas of the plain, stormwater tends to pool and cause flooding until the shoreline dune perimeter is breached and the stormwater discharges into the ocean. When the capacity of the soil infiltration and karst system is exceeded, the additional storm water floods low-lying areas on both sides of Kamehameha Highway.

2.2 Coastal Streams

There are four principle storm-water outfalls through the coast including the Kawela Stream (in Kawela Bay), the West Main Drain, the West Drain (in Turtle Bay), and ʻŌʻio Stream at the East Main Drain along the Kuilima shoreline just west of Kahuku Point. Each of these outfalls will be discussed in subsequent sections as part of the description for each shoreline unit. The following is a more general discussion concerning drainage across the entire project site.

The Kawela, ʻŌʻio, and Hoʻolapa Streams originate from the three principle valleys directly above the proposed development (Figure 1-1). The drainage areas of these streams above the Kamehameha Highway are presently 952 acres (Kawela), 1,555 acres (ʻŌʻi), and 298 acres (Hoʻolapa). The streams are intermittent with surface flows reaching the coast only during a few significant storm events each year. Often, especially during the winter, the Kawela and ʻŌʻio streams may be flowing at upper mountain elevations but the flows percolate to groundwater and into the karst cave system as they approach the coastal plain. The Hoʻolapa Stream crosses Kamehameha Highway just west of Marconi road through a relatively old bridge structure with a width of only about ten feet and flows directly into the Punahoʻolapa Marsh. When the marsh overflows during heavy rainfall events the water flows to the ʻŌʻio stream on the golf course and out to sea through the East Main Drain.

The present alignment of Kawela Stream, with inflow to Kawela Bay, may be an artifact of plantation stream alteration to serve irrigation needs. As the Kawela Stream emerges from its valley it makes an abrupt turn to the West and roughly parallels the highway until it is aligned with Kawela Bay where it again turns and enters the ocean near the center of the bay. Kahuku Plantation maps from 1890 and 1892 (Figure 2-2) do not show the stream in this alignment but rather show the mouth of the small stream entering the bay being fed only from a cluster of Kuleana Lots apparently surrounding a spring just inland of the Bay. Because Kawela Valley is directly aligned with the large pre-historic stream channel through the reef at the west end of Turtle Bay, it is probable that this channel through the reef marks the natural historical outfall of Kawela Stream to the ocean. Of the 952 acres above the highway within the present Kawela Stream drainage area, 680-acres are within Kawela Valley above the West Main Drain, and only 272 acres are above Kawela Bay.

Stream channel diversion was a common practice among plantation managers to improve irrigation and promote efficient drainage to enhance crop growth. It is likely that subsequent stream channel realignment occurred as a result of construction of the Kahuku Airfield during WWII and subsequent conversion of these areas to a golf course in the 1960s. USGS maps from the 1950's show ʻŌʻio stream entering the ocean at what is now the small swimming cove on the east side of the existing main Turtle Bay Resort hotel building. Since the time the golf course was constructed the bed of the ʻŌʻio Stream below the highway rests within a relatively straight alignment between the mouth of ʻŌʻio Gulch and the East Main Drain. During heavy stream flow events the golf course tends to act as a storm water detention basin until the drainage channels are opened. Several of the lower ponds on the golf course are tidally influenced and therefore also act as drains to the ocean.

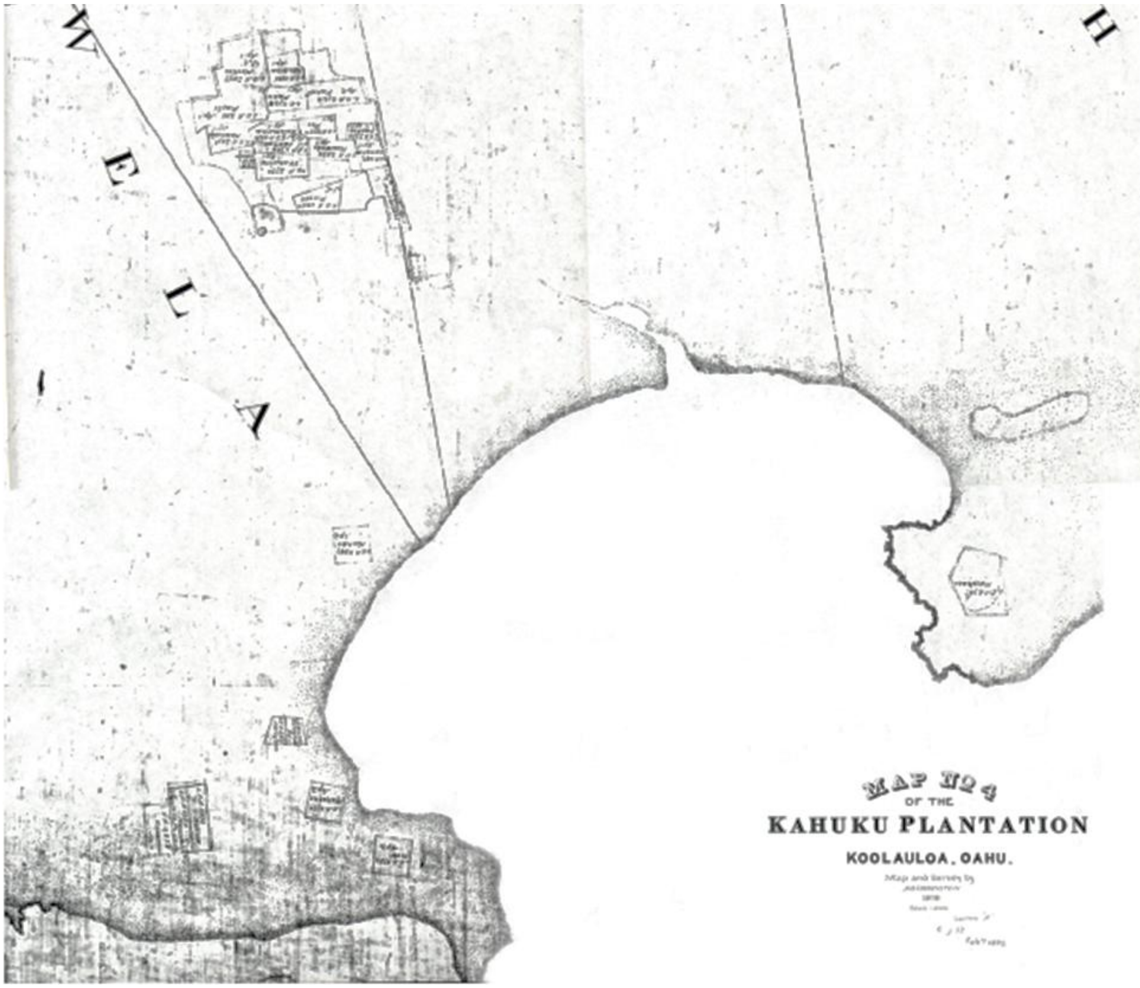


Figure 2-2. Map of Kawela Bay circa 1890

2.3 Oceanography: Waves, Tides, and Currents

Waves, tides, and currents are important to the ecology of a coastal site and are not generally impacted by coastal ocean developments. Understanding the coastal dynamics helps determine the fate of sediments, nutrients, and other substances brought into the nearshore area from land sources. Wave conditions for the entire shoreline were determined from existing offshore wave statistics (North Pacific Marine Advisers Data Set: NOAA).

Waves that approach this coastline can be characterized into two classes. The most common are trade wind generated waves approaching from the northwest (NW). In addition large winter swells from the north-east (NE) will impact the shoreline for brief periods during the winter.

Wave climate is defined by the distribution of wave heights, periods and direction. Figure 2-3 is a graphical representation termed a "wave rose" that displays wave heights and directions from which waves will approach the Turtle Bay Shoreline. The wave exposure for the Turtle Bay Shoreline is from the north between about 315 degrees (NW) to forty-five degrees (NE) with other wave directions blocked by the island. The most dominant waves are trade-wind generated waves from the NE (45 percent) and ENE (22 1/2 percent a dominant wave height of about 5.2 feet and period of about ten seconds. The North Shore of O'ahu is famous for its large winter waves which tend to come from the NW (315º) and NNW (337.5º). These wave trains are commonly in the range of three to 10 feet high and periods between eight to 14 seconds, with heights greater than 20 feet occurring on an annual basis (Figure 2-4).

As waves approach the shoreline, they undergo deformation from shoaling and refraction. Wave shoaling is caused by bottom friction and refraction is caused by change in depth. During episodes of high surf, water may build up against the shoreline, causing a local rise in sea level by as much as ten degrees of wave height. This increased depth allows greater wave energy to cross any shallow reefs, impact the shoreline, and cause increased turbidity from re-suspended sediments. The increased depth of water along the shore also accentuates the characteristics of currents transporting water away from the coastline through passes in the reef. Wave induced impacts specific to each of the three embayments are discussed separately below.

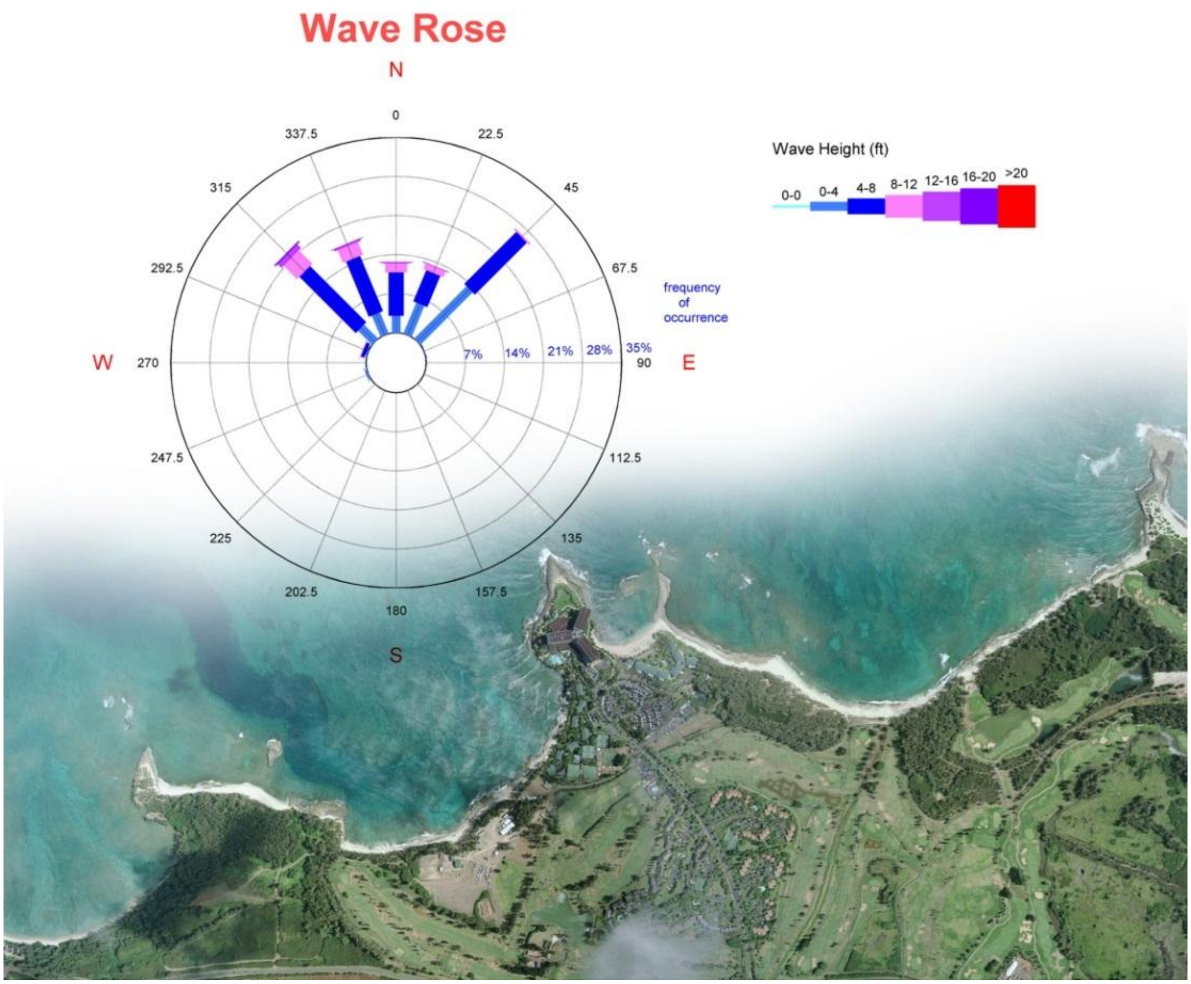


Figure 2-3. Project coastline showing dominant wave directions

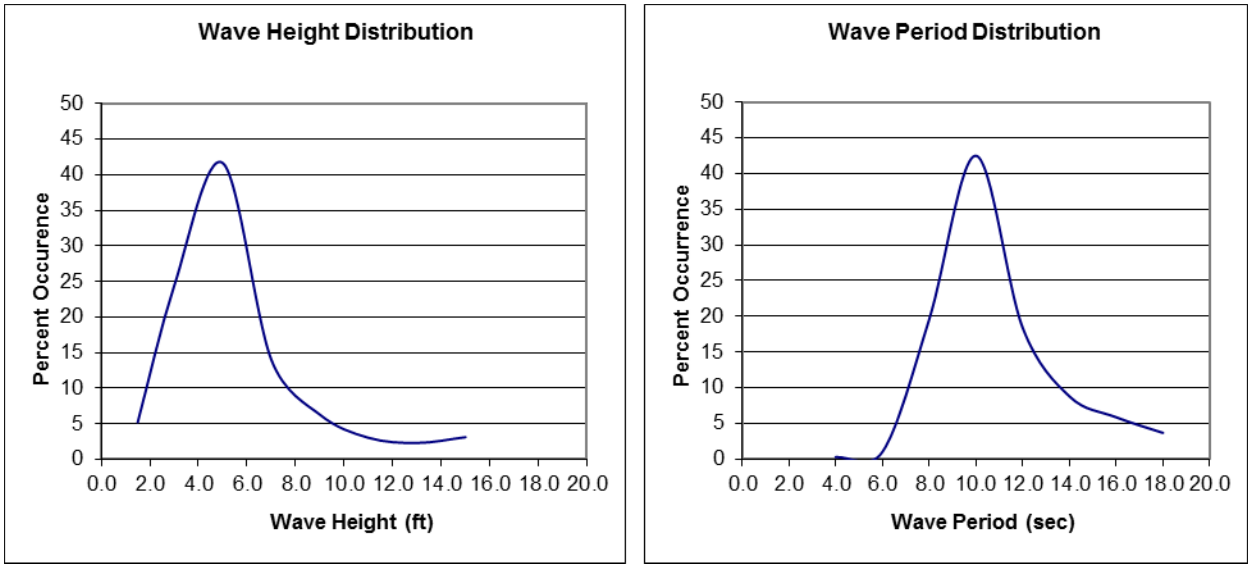


Figure 2-4. General ocean wave characteristics off the Kuilima shoreline, O'ahu, Hawai'i

O'ahu is located within the North Equatorial Current which approaches the island chain from the east. This typically results in a slow but dominant offshore current from east to west. Nearshore currents are more variable as they are largely driven by wind, waves and tides. Currents were measured in each of the bays using drogues on incoming (flood) and outgoing (ebb) tides. These results are discussed separately below.

2.4 Water Quality

The State of Hawai'i has developed a water quality standard for open coasts during dry and wet seasons that applies to this coastline. Because each of the three coastal segments are referred to as "Bays" and each may be subject to significant fresh water inflow, we also will be including the State Standard water quality for Embayments for comparison purposes. These values are shown in Table 2-1. In recognition of the fact that water quality varies naturally over a range, the State defines each standard in terms of a geometric mean, a value not to be exceeded more than 10 percent of the time (36 days per year) and a value not to be exceeded more than two percent of the time (seven days per year). Water samples taken in the field are characterized by their location, time, and depth of sample, with some measurements performed using field instruments (pH, temperature, salinity, turbidity, dissolved oxygen) additional analyses in the laboratory (Chlorophyl-a, total nitrogen, nitrate plus nitrite, total phosphorus, total suspended solids, and lab turbidity). The significance of each of these test parameters in interpreting water quality is summarized in the dialogue box "Water Quality Basics" of Figure 2-5.

Water quality data at all three bays has been examined during three separate studies over a period of two decades using a total of 724 samples analyzed for water quality parameters.

- From 1989 through 1994 surface and mid-water samples were taken at nearshore, mid-shore, and off-shore locations in each bay on a quarterly basis. The 232 samples that make up this data set form the basis from which to assess any changes in water quality over time.
- Between 2000 and 2002 studies by the City and County of Honolulu were undertaken to understand the merits of various storm-water outfall locations along the Turtle Bay

Shoreline. The purpose of this study was to establish an environmental baseline for the nearshore area and to determine the degree of mixing at each outfall location and to monitor short term changes in water quality. At each outlet site (Kawela, Turtle Bay, Kuilima Bay) a single meter was installed to record water quality at half-hour intervals, 24 hours a day for one year. In addition, six surface water sample sites closely aligned off each outlet site were monitored on a monthly basis for 11 months (198 samples total). Comparing the similarity of the six samples off each outfall to one another gives a good indication of the degree of mixing and ability to assimilate stormwater inflow at each site.

- Since 2006 quarterly water quality samples have been obtained from all three bays at stations similar to those used in prior surveys. Data from these 294 samples form the basis to examine present day water quality and changes observed during the past two decades.

Data sets from each of the above studies, with summary statistics, are included in appendices attached to this document. Usually, water quality from a common shoreline would be analyzed as one set of data. However, because of differences between each of the bays and the relative abundance of data, this report will first examine water quality within each bay, and then at the end of the report summarize any differences between the bays and their independent storm water outfalls.

Table 2-1. State Standard Water Quality Values Applicable to Project Shoreline

Open Coast Dry Season Parameter	**Geometric Mean**	**Not to Exceed more than 10-percent of the time**	**Not to Exceed more than 2-percent of the time**
Total Nitrogen ug N/L	150	250	350
Nitrate + Nitrite ug N/L	5	14	25
Total Phosphorus ug P/L	20	40	60
Chlorophyll-a ug/L	0.50	1.50	3.0
Turbidity NTU	0.4	1.00	1.5
Total Suspended Solids mg/L *	15	25	35
Open Coast Wet Season Parameter	**Geometric Mean**	**Not to Exceed more than 10-percent of the time**	**Not to Exceed more than 2 percent of the time**
Total Nitrogen ug N/L	200	350	500
Nitrate + Nitrite ug N/L	8	20	35
Total Phosphorus ug P/L	25	50	75
Chlorophyll-a ug/L	1.50	4.50	8.5
Turbidity NTU	1.5	3.00	5.00
Total Suspended Solids mg/L *	25	45	50
Embayment Parameter	**Geometric Mean**	**Not to Exceed more than 10-percent of the time**	**Not to Exceed more than 2-percent of the time**
Total Nitrogen ug N/L	200	350	500
Nitrate + Nitrite ug N/L	8	25	35
Total Phosphorus ug P/L	25	50	75
Chlorophyll-a ug/L	2	5	10
Turbidity NTU	1.5	3.00	5.00
Total Suspended Solids mg/L *	35	45	50

TSS standards are from original State WQ standards. This parameter is not included in the present State Standards.

Water Quality Basics

The State of Hawai'i has defined basic water quality criteria listing parameter concentration appropriate for different types of water bodies including streams, estuaries, bays, and open coasts during wet and dry seasons. The Turtle Bay Shoreline is classified as "Open Coastal" waters, although in some of the more enclosed bays the "Embayment" water quality standards may be more appropriate. Understanding that water quality varies over time in natural systems, the standards provide a geometric mean water quality, a concentration not be exceeded more than 10 percent of the time (36 days per year) and a concentration not to be exceeded more than two percent of the time (seven days per year). These quantities are given in Table 2-1 of the main report.

Nitrate plus Nitrite Nitrogen (NO3 + NO2) are reduced inorganic forms of nitrogen and are required by plants – including phyto-plankton – for growth. Nitrate and nitrite are readily soluble in groundwater, are not adsorbed by soils, and are commonly high in nearshore areas where groundwater or stream water enters the ocean. Excess nitrogen (above State Standards) is considered a pollutant because it can lead to plankton blooms or excess benthic algae growth which can adversely impact the environment. However, plants require a balance of nutrients for growth and in cases where nitrogen is already in excess of requirements, additional nitrogen is not likely to have any significant impact on algae growth.

Total Nitrogen (TN) includes nitrate plus nitrite and all other organic and inorganic forms of nitrogen in water. There are many potential sources of nitrogen in groundwater including degraded plant and animal material, fertilizers, bacterial action, and animal waste products.

Total Phosphorus (TP) includes all organic and inorganic forms of phosphorous. Unlike nitrogen, phosphorus is typically adsorbed to subsurface minerals and is therefore not usually present at high concentrations in ground water. It is usually a limiting nutrient in nearshore waters. Plants, including phytoplankton and benthic algae, require about one atom of phosphorous for every eight to 12 atoms of nitrogen to sustain growth, so, even a small quantity of phosphorus added in the presence of nitrogen-rich groundwater, will result in significant algae growth.

Chlorophyl-a (Chl-a) is a primary pigment of photosynthesis in plants, including phytoplankton. Measurement of Chl-a in water is an indicator of phytoplankton growth. High Chl-alevels are associated with nutrient rich water supporting plankton growth. Because plankton takes time to grow, high Chl-a levels are an indicator of a low circulation rate and available nutrients for growth.

Total Suspended Solids (TSS) is the physical measurement of the dry weight of suspended solids in a water sample. This parameter is measured in a laboratory by sieving a known volume of water through a fine filter, then drying and weighing the filtered sediment, expressed in terms of milligrams per liter (mg/L)

Turbidity (NTU) is a measurement of the cloudiness of water determined by measuring the amount of light reflected off of particles in the water sample and is expressed as the unit-less measure of Nephlometric Turbidity Units (NTU). Turbidity and TSS vary directly with each other but turbidity also is affected by the size, color, and reflective nature of the particles. Turbidity can be measured with an instrument in the field, but TSS analyses must be done in a laboratory.

Figure 2-5. Water Quality Basics

2.5 Sea Turtles

Sea Turtles are commonly encountered along the entire project coastline from the shoreline out to at least the 100-foot bathymetry contour. The hawksbill turtle (*Eretmochelys imbricate*) is endangered throughout its range. They were listed as Endangered under the Endangered Species Act (ESA) in 1978 (43FR32800). Hawksbill turtles in Hawai'i nest primarily on the Big Island of Hawai'i where approximately 10 to 15 turtles nest annually (Sietz 2010). Hawksbills have been reported from other locations on O'ahu's North Shore, and although there have been no verified sightings from Kawela Bay, Turtle Bay, or Kuilima Bay, this protected species likely inhabits these waters.

Figure 2-6. Green Sea Turtle, Photo: A Bruckner, NOAA

Green sea turtles (*Chelonia mydas*) in the Pacific have been listed as Threatened under the ESA since 1978. These turtles are primarily herbivorous in the wild and graze off of macro-algae. Their preferred foraging areas include protected bays, such as Kawela Bay, where a variety of macro-algae proliferate over shallow shelves and reef flats protected from large surf (Balazs et al 1987).

The National Marine Fisheries Service Honolulu office (G. Balazs, pers communication) reports that basking green turtles resting and/or sleeping on the beach are commonly reported at Kawela Bay and Turtle Bay and nesting activity also is occasionally reported. The success or failure of turtle nest hatching at Kawela or Turtle Bays has not been documented. This is not unusual as the nests are difficult to locate, and beach-goers who may witness a hatching event are not commonly present near midnight when the juvenile turtles emerge to make their escape to the sea.

Visual surveys of turtle abundance and distribution were conducted in Kawlea Bay by Oceanit for five days per quarter (seventeen quarters) between December 1989 and December 1994. A repeat of the surveys was conducted for five days in the winter and five days in the late summer of 2011. The bay was surveyed three times per day by a single observer standing consecutively at each of five points around the perimeter of the bay and staring out onto the water for a period of 25 minutes at each location to watch for surface breathing activities of turtles. This survey was conducted three times each day for 2 ½ hours after sunrise, mid-day, and before sunset. Because of the shallow nature of the bay, the small size of each zone being observed and the frequency of turtle surfacing (approximately four to six minutes), a high degree of confidence is developed regarding the number of turtles in each zone. In addition to observing turtle activity, notes have traditionally been taken on human activities within the bay during the period of observation. The results of observed human activities are discussed in the section specific to Kawela Bay. The zones are identified in Figure 3-3.

Table 2-2. Turtle Counts in Kawela Bay for 10 days, winter and summer, 2011

WINTER					Total Count					SUMMER					Total Count				
		Mornin	Noon	Evening	Mornin	Noon	Evening					AM	Noon	PM	AM	Noon	PM		
	Zone 2	1	1	0	7	16	8				Zone 2	4	1	2	11	10	13		
	Zone 5	1	4	3							Zone 5	1	0	3					
3/15/11	Zone 4	1	5	2						9/19/11	Zone 4	1	4	2					
	Zone 3	2	2	1							Zone 3	3	4	3					
	Zone 1	2	4	2							Zone 1	2	1	3					
	Zone 2	3	0	1	13	13	6				Zone 2	5	3	4	14	16	12		
	Zone 5	1	4	1							Zone 5	2	2	3					
3/16/11	Zone 4	2	3	2						9/21/11	Zone 4	3	4	3					
	Zone 3	3	3	1							Zone 3	2	4	1					
	Zone 1	4	3	1							Zone 1	2	3	1					
	Zone 2	2	0	1	3	8	8				Zone 2	3	4	5	16	19	16		
	Zone 5	0	3	2							Zone 5	3	4	3					
3/18/11	Zone 4	0	2	3						9/22/11	Zone 4	4	3	4					
	Zone 3	0	1	2							Zone 3	3	5	3					
	Zone 1	1	2	0							Zone 1	3	3	1					
	Zone 2	2	1	1	11	13	8				Zone 2	4	3	3	19	22	13		
	Zone 5	3	3	4							Zone 5	4	4	3					
3/20/11	Zone 4	3	5	2						9/23/11	Zone 4	5	6	3					
	Zone 3	2	2	0							Zone 3	4	4	2					
	Zone 1	1	2	1				Zone Average			Zone 1	2	5	2				Zone Averages	
	Zone 2	2	0	0	8	3	9	Zone 2	1.00		Zone 2	5	3	4	12	19	15	Zone 2	3.5
	Zone 5	1	1	3				Zone 5	2.27		Zone 5	3	3	3				Zone 5	2.7
3/25/11	Zone 4	1	1	3				Zone 4	2.33	9/24/11	Zone 4	1	5	3				Zone 4	3.4
	Zone 3	2	0	2				Zone 3	1.53		Zone 3	1	3	4				Zone 3	3.1
	Zone 1	2	1	1				Zone 1	1.80		Zone 1	2	5	1				Zone 1	2.4
Average		**1.68**	**2.12**	**1.56**						Average		2.88	3.44	2.76					
					AM	Noon	pm	Average											
			Daily Average		**8.4**	**10.6**	**7.8**	**8.9**					**Daily Average**		**14.4**	**17.2**	**13.8**	**15.1**	
			Standard Devia		**3.8**	**5.1**	**1.1**	**4.6**					Standard Deviation					**3.46**	

Between 1989 and 1993 a total of 58 observation days (174 morning, noon, afternoon observation periods) recorded an average of 7.35 turtles in the bay at any given time with 68 percent of these observations (one standard deviation) falling between 1.96 and 12.75 turtles in the bay during any time period. During eighteen time periods (approximately 10 percent) no turtles were observed in the bay, with a maximum number of turtles (24) observed on the morning of September 14, 1991. During the five winter (March) days in 2011 (15 total observations, morning, noon, and afternoon) the average number of turtles observed at any given time was 8.93 with 68 percent of these observations (one standard deviation) falling between 5.24 and 12.63 turtles in the bay at any given time. The maximum number of turtles observed in the whole bay during a 2011 winter time period was 16, and the minimum was three turtles. During the five summer (September) days of observation in 2011 (fifteen observation periods) the number of turtles in the bay at any given time ranged from 10 to 22 with an average of 15.1. Sixty-eight percent of these observations fell between 11.7 and 18.6 turtles in the bay at any given time. The average number of turtles seen in the bay during 2011 (summer and winter) was twelve. The average number of turtles has increased from a daily average 7.35 in the early 1990's to 12.0 this past year between 1993 and 2011 and the number of periods when no turtles are observed in the bay has fallen from 10 percent to zero percent. This 50 percent increase in the turtle population in the bay is statistically significant at a 95 confidence interval. There does not appear to be any difference in turtle abundance between the five observation zones or between the times of day when observations were conducted.

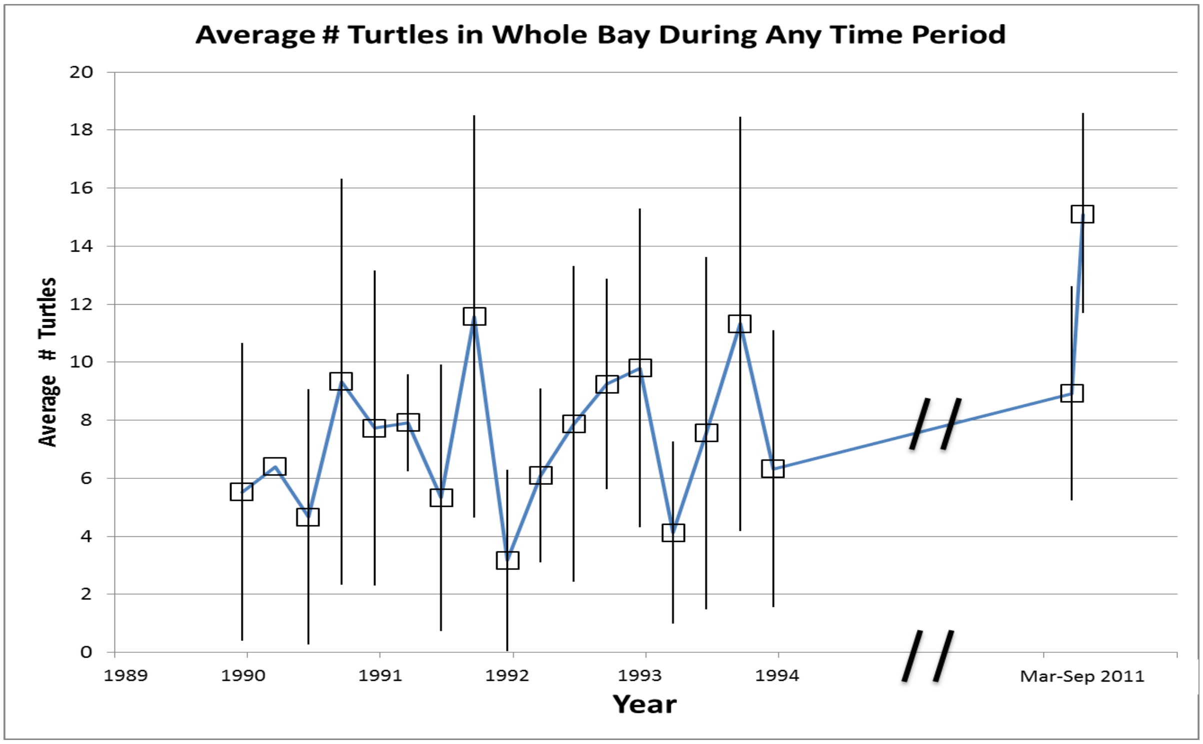


Figure 2-7. Average (+/- 1sd) number of turtles in Kawela Bay, per 2.5-hour observation period

The National Marine Fisheries Service (NMFS) does not undertake standardized in-water monitoring to assess population abundance in this region. The most relevant turtle information from this area comes from the Pacific Islands Fishery Science Center Marine Turtle Research Program (PIFSC MTRP) that records information from turtle strandings. This data set provides evidence that green turtles of all age classes utilize this coastal area, but it appears most important to juvenile and sub-adult green turtles from 40-70 centimeters with shell length (SCL). Since 1985 the NMFS has recorded a total of 85 turtles that were stranded from Kawela Bay, Turtle Bay, and the Turtle Bay Resort beaches. Forty-nine of those turtles were stranded and documented as mortalities, about half of which were of unknown etiology. Reports of stranded turtles included information on turtle size by carapace length. By graphing the length of turtles stranded over the past 25 years, we can see that the average carapace length of stranded turtles has increased from 50 centimeters (20 inches) to 62 centimeters (25 inches) (Figure 2-8). The more recent samples of stranded turtles (2005-2010) show a definite increase in the numbers of larger turtles) (Figure 2-8). This is consistent with the growth and recovery of the population over time since protected by the ESA in 1978 (Balazs and Chaloupka 2004). Green turtles in Hawai'i are expected to reach maturity at > 80 centimeters SCL (Zug et al 2002), and grow at a rate of approximately 2 1/2 centimeters per year (Balazs and Chaloupka 2004), represented in Figure 2-8 by the dashed line through the data.
by the dashed line through the data.

Fibropapillomatosis (FP), is a debilitating tumor disease of the skin and internal organs, and is the most significant known cause of stranding and mortality in green turtles in Hawai'i. FP accounts for 28 percent of stranded turtles and 88 percent mortality rate of stranded turtles (Chaloupka et al

2009). FP causes large fleshy tumor growths, often around the eyes and mouth of turtles, and typically causing mortality through starvation. While the primary cause of mortality in stranded turtles along the project coastline is unknown, the single known cause of mortality with highest prevalence (80 percent) in stranded turtles is FP. FP among the Hawai'i green turtle population appears to have peaked about a decade ago Chaloupka et al 2009), but persists in the population at varying spatial scales (Van Houtan et al 2010).

According to Van Houtan et al (2010), FP rates in the North Shore of O'ahu have declined over time, but have not declined at the same rate in Kahuku where the disease continues to persist. Importantly, Van Houtan et al (2010) suggest a potential relationship exists between the prevalence of FP and the State's land use, waste-water management practices and invasive microalgae.

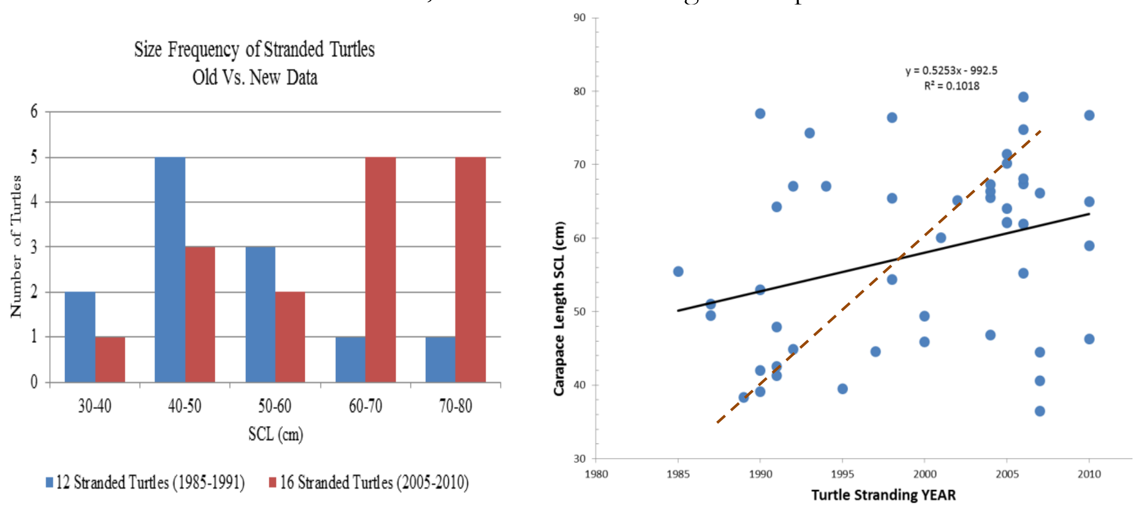


Figure 2-8. Data from NMFS turtle stranding database for project shoreline showing (left) increased prevalence of larger turtles in recent years, and (right) overall trend of increased size over entire time period. Dashed line is average growth rate of individual turtles (~2.1 cm/yr).

Reported Causes of Turtle Stranding	#	Percent
Unknown	40	48.2
Fibropapilloma (FP)	15	18.1
Net entanglement	8	9.6
FP / Vascular fluke infection	7	8.4
Fishing line entanglement	4	4.8
Rope entanglement	2	2.4
Shark attack	2	2.4
Vascular fluke infection	1	1.2
FP + Shark attack	1	1.2
FP + Trauma	1	1.2
Gunshot	1	1.2
Plastics in intestines	1	1.2
	83	100%

Table 2-3. NOAA Reported Turtle Strandings Along Project Shoreline

Combined turtle mortalities related to man's activities (net and rope entanglement, gunshot, and plastic ingestion) totals about 19 percent of all mortalities in the project area. Man's activities, particularly involving fishing activities, are a significant factor in turtle mortalities (Nitta and Henderson 1993; Chaloupka et al 200p).

Hence). care must be applied to ensure that proposed development does not increase nitrogen and other nutrient loads into the marine environment that is known to promote invasive algae grown (Smith et al 2010

It is unlikely that development of the shoreline leading to increased nearshore human activity would have any measurable adverse impact on adult sea turtles along the coast, if reasonable precautions and educational outreach programs are initiated. Two major ways that humans impact turtle mortality are from contact with boat propellers and from gill net entanglement, neither of which are likely to increase as a result of the proposed development. Sea turtles are known to habituate to the presence of humans in or on the water and would not likely remove themselves from grazing habitat due to the presence of people in the water in quantities likely to result from the planned development.

Sea turtle nesting has been documented along this shoreline, and as the population continues to recover the importance of this area to nesting turtles may increase. Artificial lighting is known to disorient hatchlings (http://www.georgiaseaturtlecenter.org/research-programs/beach-monitoring/ beach-lighting/). It is likely that increased lighting and beach activity during breeding season evening hours could dissuade turtles from emerging to lay eggs on these beaches. Furthermore, when turtle hatchlings emerge from their nest in the middle of the night, they orient towards the brighter sky above the ocean. Any development that may increase relative ambient lighting contributing to lighting pollution in this area should therefore adopt a lighting plan that shields direct light away from the beach and uses longer wavelength (yellow) lights that are not attractive to hatchling turtles.

2.6 Monk Seals

Hawaiian monk seals (*Monachus schauinslandi*) have been listed as Endangered under the Endangered Species Conservation Act (now ESA) in 1973 and as of 1976 and also are protected by the Marine Mammal Protection Act of 1972. About 90 percent of the 1,161 seals estimated to be members of the total population in 2008 (NMFS 2011) live around the Northwestern Hawaiian Islands (NWHI), but a growing sub-population also is found throughout the main Hawaiian Islands (MHI) (Baker, et al 2011a).

Figure 2-9. Monk Seal

Credit: NMFS, 2007

NOAA reports that from the 1970s through 1990, Hawaiian Monk Seals in the Main Hawaiian Islands (MHI) were present but in low numbers and rarely seen. Since 1990 these populations have been increasing with an estimate of 133 individuals noted in 2001 (Baker and Johanos, 2004), and estimated 150 to 200 individual seals in 2011 (C. Littnan, NMFS, pers. comm.). These seals are primarily distributed around Ni'ihau, Kaua'i, Moloka'i, and O'ahu. Although survival rates appear higher in the MHI, NOAA has expressed concerns about the potential of an increased incidence of disease, fisheries interactions and intentional killings of seals as they interact with human populations in the MHI (NMFS 2007).

As part of the NMFS Monk Seal Recovery Program, 21 male seals were removed from the NWHI and released into the waters of the MHI in 1994. These males were moved as part of a successful effort to reduce male aggression and increase female survival at Laysan Island, where males previously outnumbered females by over 2:1 (Johanos et al 2010, Baker et al 2011b). Although there have been a few relocations of seals from the MHI to the NWHI for management purposes, this is the only relocation of seals from the NWHI to the MHI to date (Baker et al 2011b), and cannot account for the bulk of the increase in population documented around the MHI. All female seals in the MHI occur here naturally, and the few relocated males that remain are well over 20 years old, nearing the end of their natural life span (T. Johanos, pers. comm.).

The increasing population and good condition of pups around the MHIs is in positive contrast to the continuing dwindling populations in the NWHI. It is theorized that the lower density of seals in the MHI and the scarcity of large predators that either compete for food or predate seal pups, are key elements of the seals recovery. However, there is concern that as populations increase mortalities due to fisheries interactions (nets, hooks), boating impacts, and potential human borne diseases could adversely impact this population revival.

Estimates of Monk Seal populations along the North Shore of O'ahu also continue to increase with 18 individually recognized individuals (seven female, seven male, four juveniles) having been sighted from the project coastline (Kahuku Point – Kawela) between 2002 and 2011 (NMFS, 2012). These eighteen individuals account for 422 of the 543 sightings during this period (Table 2-4).

Table 2-4. Number of reported Hawaiian monk seal sightings on O'ahu between Kawela Bay and Kahuku Point since 2002 (data from NMFS 2012)

Location	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
Kahuku Pt.	0	2	0	0	0	1	6	0	11	4	**24**
Kaihalulu Beach	0	1	4	3	78	12	20	6	117	107	**348**
Kawela Bay	0	0	1	0	3	1	1	5	8	4	**23**
Kuilima Cove	0	0	2	1	6	6	0	6	11	7	**39**
Turtle Bay	1	1	6	14	17	20	14	4	22	10	**109**
Total	**1**	**4**	**13**	**18**	**104**	**40**	**41**	**21**	**169**	**132**	**543**

It is difficult to translate "sighting" data into a population abundance estimate, but it is clear that the population along this shoreline has definitely increased during the past decade. Of the three aerial surveys conducted by NMFS around the entire O'ahu shoreline in 2000, 2001, and 2008, no monk seals were sighted along the project coastline. Three monk seal births were documented from this shoreline on Kaihalulu Beach during the summers of 2006, 2010, and 2011. This compares to a total of 78 pups born in the MHI over the last two decades. It is known that the mother and pup will remain together and in the same general area for the six to seven week nursing period (NMFS, 2012). These births and the increased trend in sightings indicate that this coastline is an important habitat for Hawaiian monk seals.

As part of the turtle surveys (see above) conducted for this study, the waters of Kawela Bay were observed for 85 days between 1989 and 1994, and no seals were observed during this period. During only 10 observation days conducted in 2011, one seal was observed repeatedly on a single day. This single observation has little mathematical significance, but is in line with NOAA's conclusions that seal populations are increasing around the Main Hawaiian Islands and along the project shoreline.

No direct or delayed impacts to Hawaiian Monk seals are anticipated from the development. Around the MHIs, the human activities of greatest concern to NOAA Monk seal researchers are the potential for entanglement in fishing gear, impact from boats, or predation by fishermen who may view the seals as direct competitors for fish resources. None of these sources of mortality are likely to increase as a result of resort development because the anticipated clientele are not likely to engage in these activities.

However, indirect impacts including increased interactions with fishermen, surfers, kayakers, and other ocean recreational uses can be anticipated as a result of improved access to the public and increases in shoreline population. While direct contact or close proximity to endangered species is discouraged by NOAA, they have not attributed any measurable adverse impact from these interactions to Monk Seal populations. These potential secondary impacts may be minimized through a public education process.

2.7 General Marine Environment

The project shoreline is along the north face of Oʻahu and is subject to high wave energy every winter. These waves materially impact the character of the reefs along the shore.

NOAA has mapped benthic structure and habitats into broad classifications using aerial survey techniques (Figure 2-10). East of Kahuku Point the majority of coastlines are dominated by an offshore reef with a distinct shallow reef crest and large finger and groove reef formations extending from the reef crest out to sea. These reefs are subject to year-round trade-wind swells, but are protected from the large North-Pacific storm swells.

However, from Kahuku point to Kaʻena Point these regular linear reef features tend to be much diminished with deeper less linear reef crest formations. The "spur and groove" reef dominated by "turf algae" as indicated in the NOAA charts (Figure 2-10) fronting Kuilima Bay does have limited deep finger and groove formations but is lacking the intact linear reef crest typical of reefs east of Kahuku Point.

The disjointed nature of the Kuilima Bay reef actually offers an increase in habitat diversity with a matrix of deeper channels interspersed with shallow reef outcroppings. Although the NOAA database indicates that the reef off of Turtle Bay is "pavement with sand channels" with benthic cover consisting primarily of "turf algae" this reef has significant coral cover and is quite similar to barrier reefs east of Kahuku Point, but with a deeper less distinct reef crest.

The dominant feature within Turtle Bay is the lagoon between the beach and the reef. At the east end of the beach the lagoon is quite shallow, but deepens rapidly towards the west end where it becomes a major deep channel out through the reef. The sides of this channel are protected from wave impact, but exposed to significant currents and support a very diverse coral community.

The deeper reefs offshore of Kawela Bay display disorganized finger and groove formations around several upraised patch reefs. These patch reefs suffice to break the energy of the large winter swells, well offshore of the shallow mouth of the bay. The mouth of the bay, only a few feet deep, has significant coral cover (estimated 30 to 50 percent), but also presents a lush algae mat over solid substrates. The character of each of the bays will be described in greater detail in later sections.

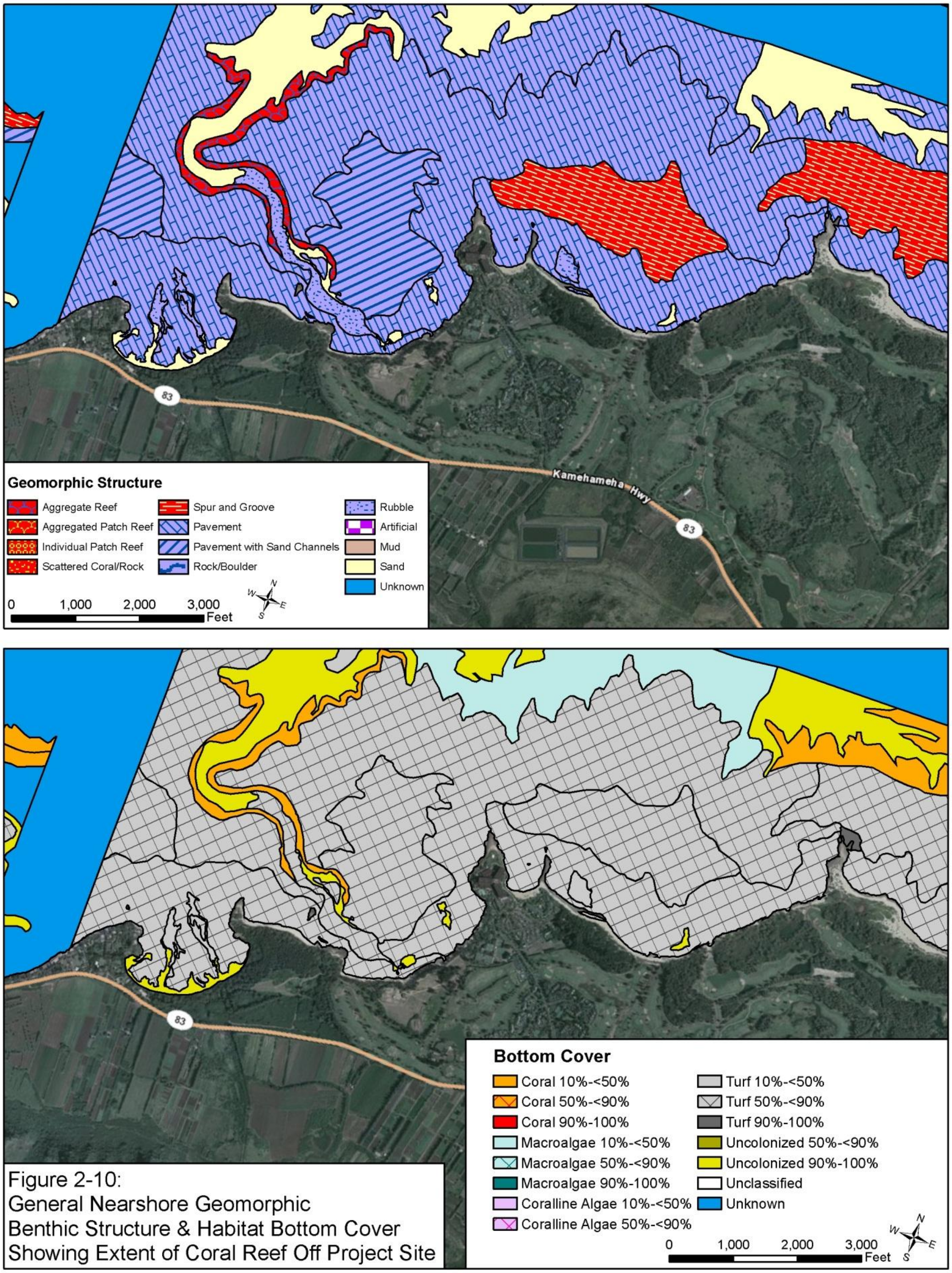


Figure 2-10:
General Nearshore Geomorphic Benthic Structure & Habitat Bottom Cover Showing Extent of Coral Reef Off Project Site

3. KAWELA BAY

3.1 General Physical Description

The development property boundary extends west to the midpoint of the Kawela Bay shoreline with the first development parcel to consist of a public park bordering the Kawela Stream mouth. The entrance of Kawela Stream to Kawela Bay is fixed in location by the break in the railroad track bed (circa ~1900) that can still be found in the Hau-bush jungle between the Kamehameha Highway and the ocean. The stream mouth is closed by a sand berm that only opens a few times per year in response to relatively intense rainfall flow events. Kawela is somewhat unique among the three bays in that the embayment is formed through a break in the beach rock shoreline. Both headlands that jut out into the ocean on the west and east sides of the bay are faced with beach rock shorelines. But the sand beach between the headlands is deep and not perched upon a hard substructure as are the other beaches along the property shoreline. This 1,500 foot break in the beach-rock shoreline is consistent with the high volume of fresh ground water entering the ocean through this embayment (see Figure 3-7).

The bathymetry of the bay is critical to the understanding of water quality within the bay and is displayed in Figure 3-1 and Figure 3-2. From a broad perspective the bay is relatively shallow, less than 10-feet, with no clear deep passage to the open ocean and a distance from the stream mouth to the 30-foot contour of about 3000 feet.

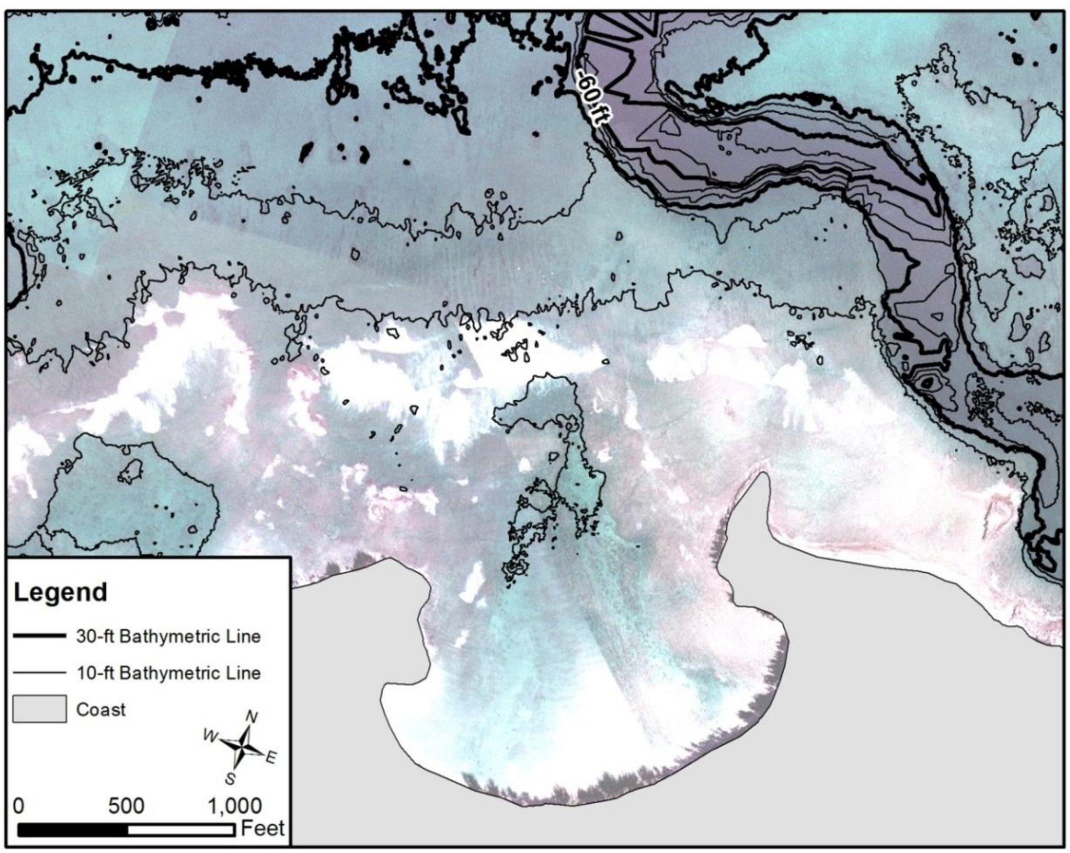


Figure 3-1. Bathymetry of Kawela Bay and offshore waters.

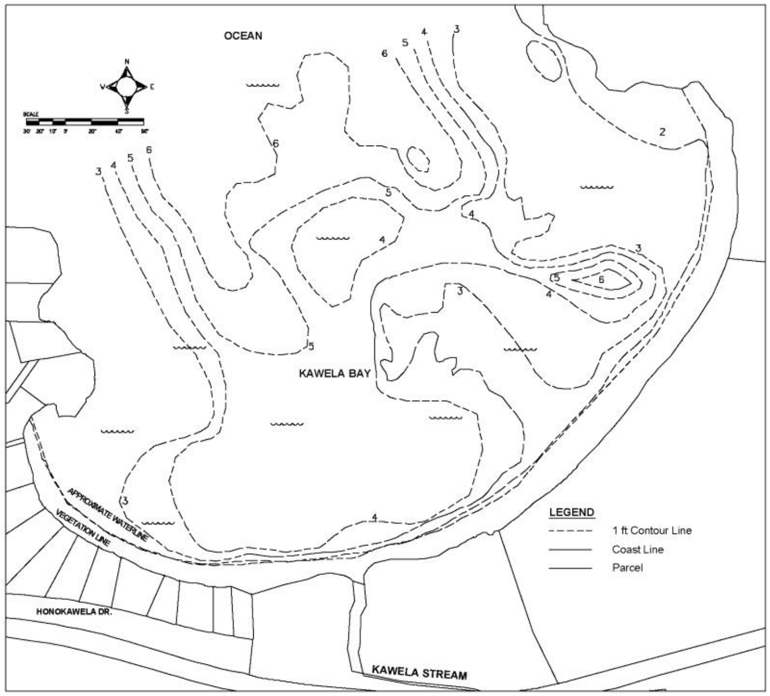


Figure 3-2. Kawela Bay fine scale bathymetry. Depths in feet at MLLW

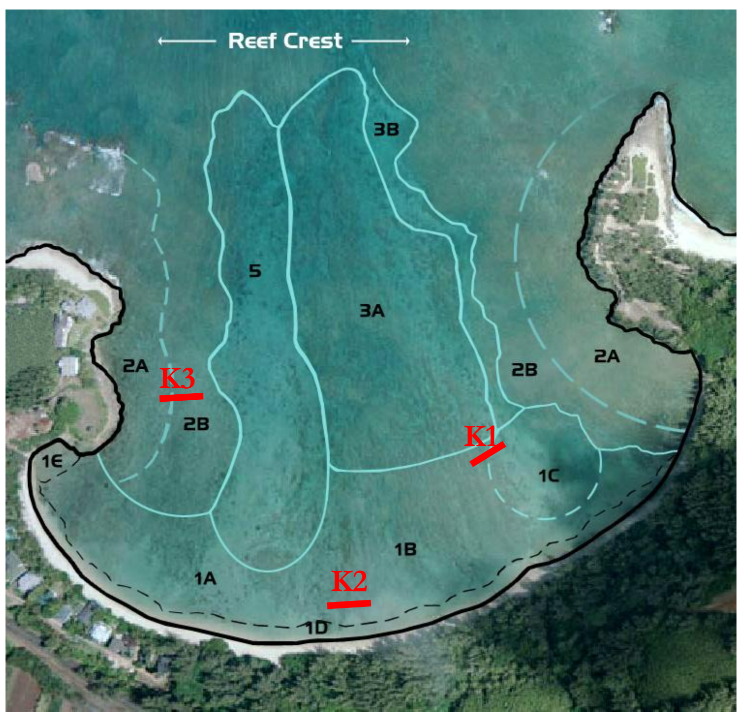


Figure 3-3. Five principal habitat zones in Kawela Bay: 1) inner bay sand, soft sediments, rubble, and scattered corals, 2) shallow hard substrate bench with abundant algae 3) central shallow back-reef with coral and macro-algae, 4) offshore reef crest, and 5) wide sand channel with unique large coral colonies. K1, K2, and K3, in red are the hundred-foot long benthic transect locations.

The bay is a roughly symmetrical horse-shoe shape with shallow shelves beneath the east and west headlands (Figure 3-1 and 3-2). The middle of the bay is relatively shallow, only a couple of feet deep, with narrow finger-and-groove coral structures perpendicular to the shore through the center of the bay. Note that the depths given are relative to the tide at mean-lower-low-water (MLLW) so actual water depth would typically be one or two feet deeper than indicated.

There are channels on both sides of the bay separating the shallow headland shelves from the reef in the center of the bay. However, the channel on the west side of the bay is much wider (~100 ft) and deeper (~6-8 \ft) with a clean coral sand substrate. One important feature is the relatively deep (~6 ft) area on the east side of the bay isolated inside the headland shelf but 100-200 feet off shore. This is the area that, in 1987, held several feet of very fine silt material and prompted the developer (at that time, Asahi Juken) to investigate means to remove the mud and improve water quality in the bay. Subsequent studies suggest that removing the primary source of the mud (Kawela Stream) may be a more prudent approach to water quality improvement. Although thick mud was not evident at this site during the 2011 surveys, this end of the bay remains much more turbid than the western side of the bay.

3.2 Waves and Currents in Kawela Bay

Drouges, small buoys with large under-water surface area, were placed at various areas within the bay and their drift path tracked over several hours during ebb and flood tides. The interpretation of these pathways is shown as general current patterns in the figures below. Both headlands of the bay have relatively shallow ledges where waves break and surge across these platforms is significant.

Currents within the bay are primarily wind and wave driven but with an important overlay of groundwater inflow. In the main western half of the bay, the overall direction of the current seems to be counter-clockwise where the inward flow occurs on the west side of the bay then exits through the center and at the east corner by flowing along the shore and then out to sea through the center and east portion of the bay.

Water circulation in the east portion of the bay is much slower and tends to form a clock-wise gyre with a long residence time. Figure 3-5 show the interpolated current from the field study. Note how this current pattern mirrors the salinity variations shown in Figure 3-7.

Fresh water tends to percolate through the beach in the west end of the bay, rise to the surface, and flow out through the center of the bay where it is joined by flow from a spring near the center of the bay (Figure 3-7).

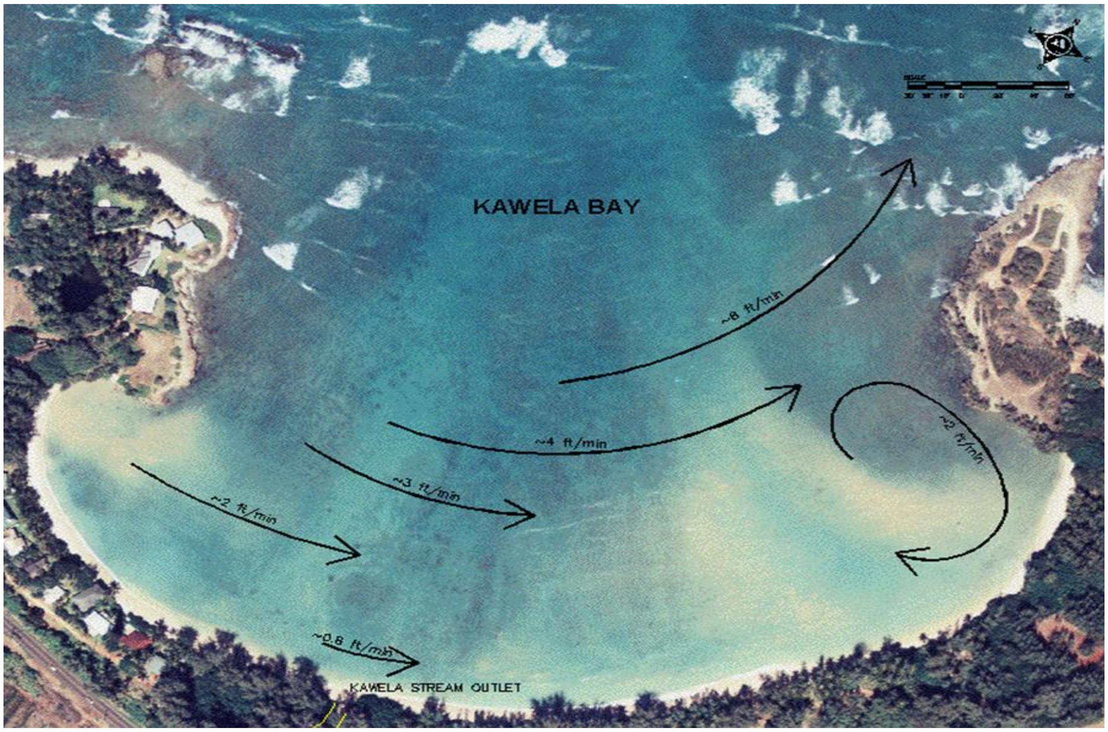


Figure 3-4. Interpolated Current During EBB Tide

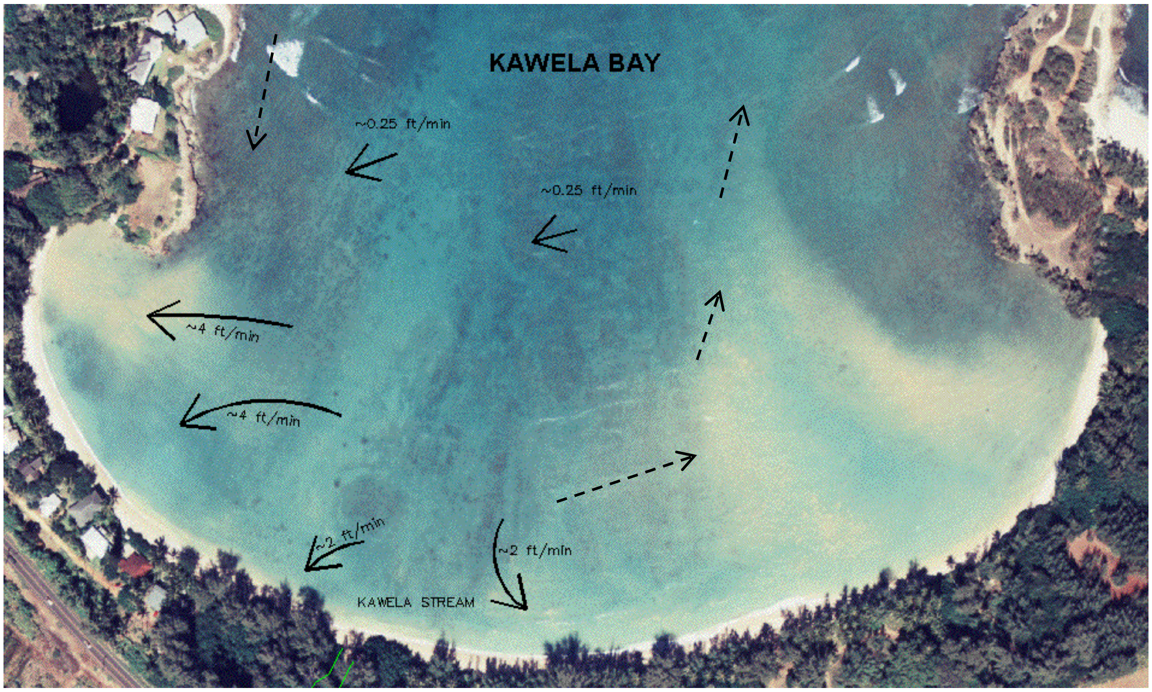


Figure 3-5. Interpolated Current During Flood Tide

3.3 Water Quality in Kawela Bay

Water quality has been examined during three separate long-term studies 1989-1994, 2001-2002, and 2006-2011, with collection points as shown in Figure 3-6. The large scale physical characteristics of the bay such as its bathymetry, current patterns, and salinity profiles are likely stable over a period of decades. However, water quality has the potential to change over much shorter time periods in coastal areas. In 1987 (Oceanit, 1987) a detailed salinity and bathymetry survey of the bay was conducted from which Figure 3-7 is derived. The figure shows a strong groundwater inflow of fresh water from the western portion of the beach. An inflow of approximately 5,000 gallons per minute (Oceanit 1987) of fresh groundwater was estimated to be required to sustain the observed low-salinity plume. This fresh water rises to the surface and is transported out through the center of the bay with the dominant current. Near the center of the bay a fresh water spring adds additional water to this flow. This mid-bay freshwater spring has been confirmed visually and is still active as of 2011. During low tide multiple groundwater freshets may be observed eroding the beach slope as the groundwater flows through the sand beach at the west end of the bay showing the persistence of this groundwater flow. This strong and consistent flow of groundwater into the bay is an important factor in the interpretation of water quality results because the groundwater tends to carry significant quantities of nutrients into the bay.

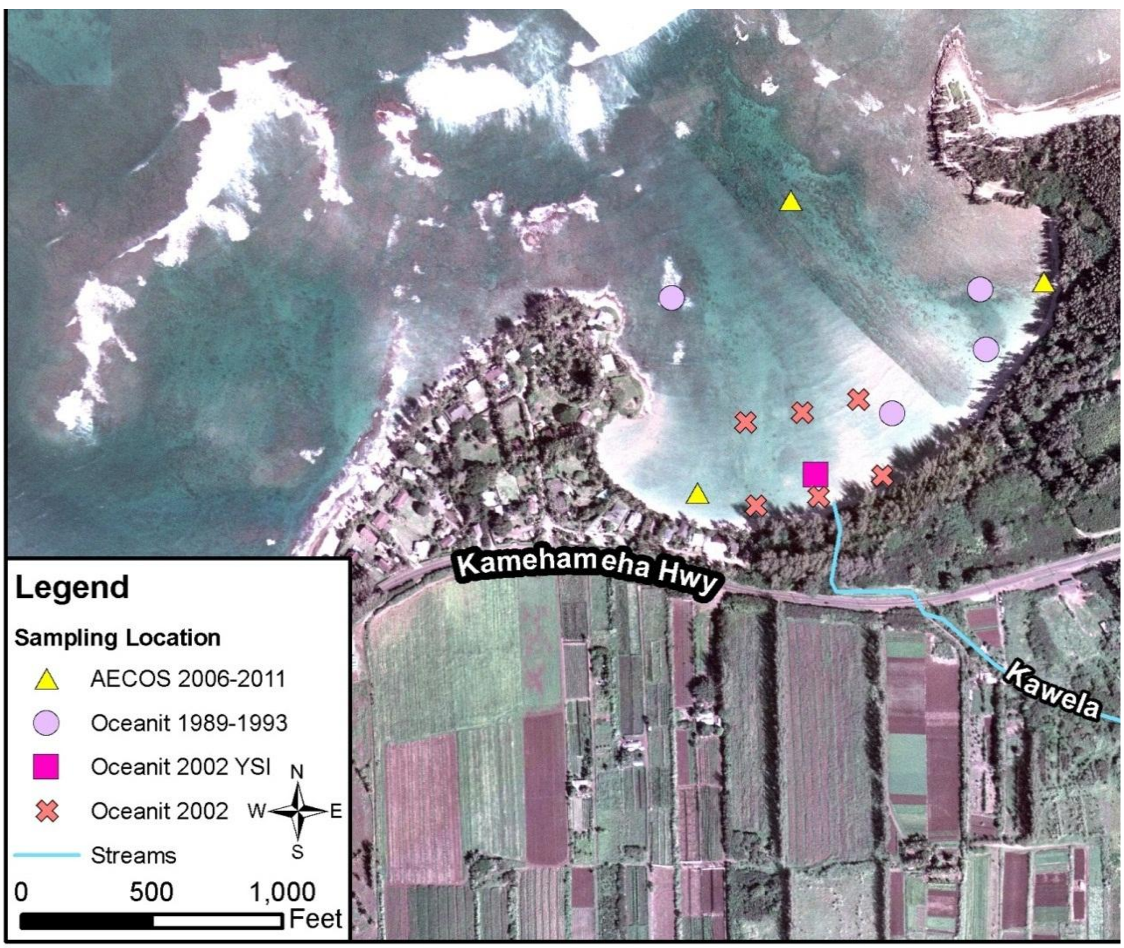


Figure 3-6. Locations of water quality sampling stations in Kawela Bay since 1989.

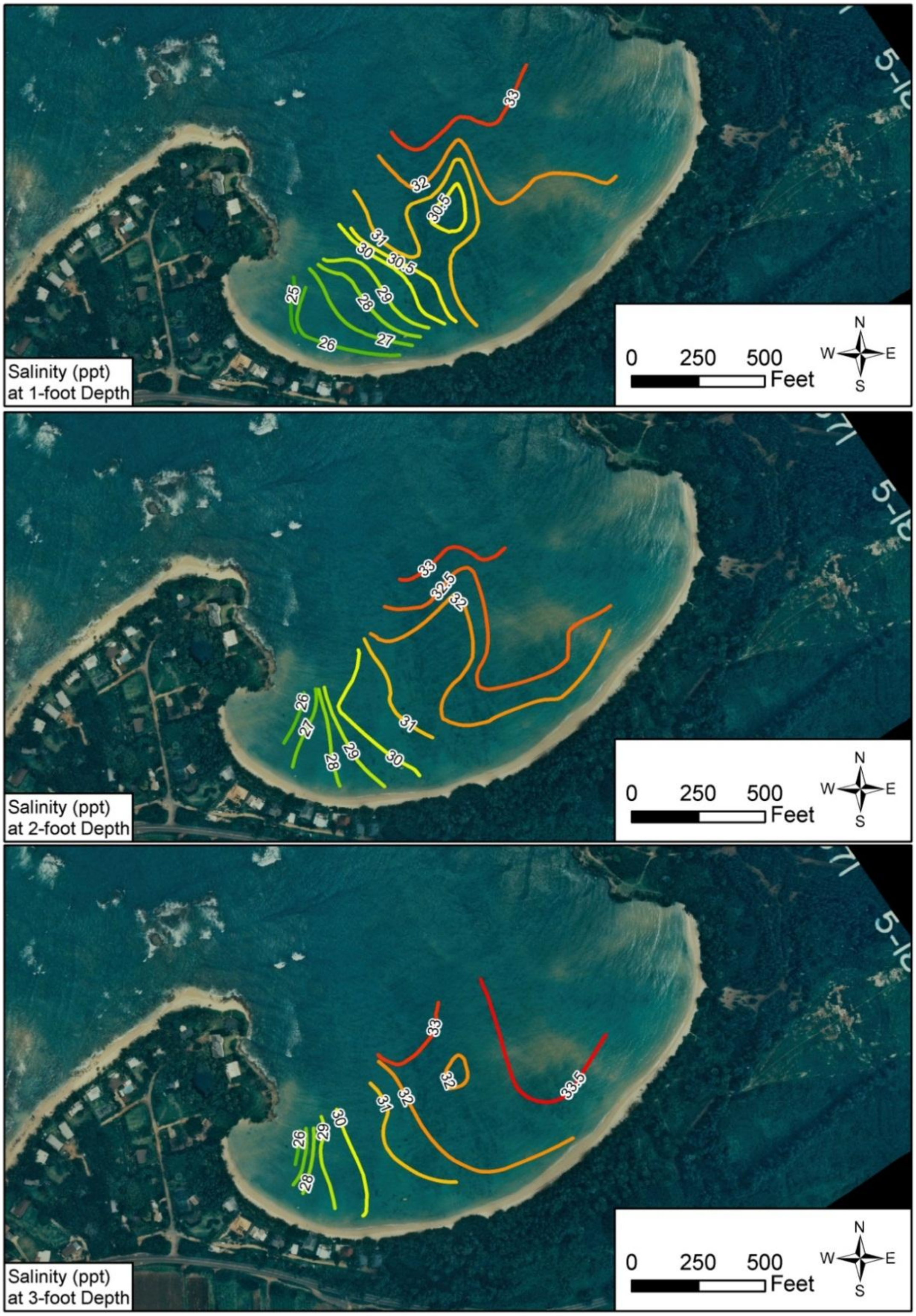


Figure 3-7. Salinity profiles in Kawela Bay at surface (top) two-foot depth (middle) and three-foot depth (bottom) indicate a strong source of fresh water at the West end of the bay as well as from a spring near the center of the bay.

From June 1989 through December 1993 surface and bottom samples were taken from four locations each quarter (Figure 3-6) for a total of 152 samples. Three of the sample sites were in the central and east bay surrounding the area with soft sediments and prevalent high turbidity. The fourth, a control site, was in the west bay at the edge of the sand channel was subject to more open ocean waters. The study concluded that the sediment was from Kawela Stream based upon high content of non-calcareous organic particles, and from observations of the stream outflow.

Figure 3-8. Kawela Stream flowing brown high turbidity water across beach into the bay.

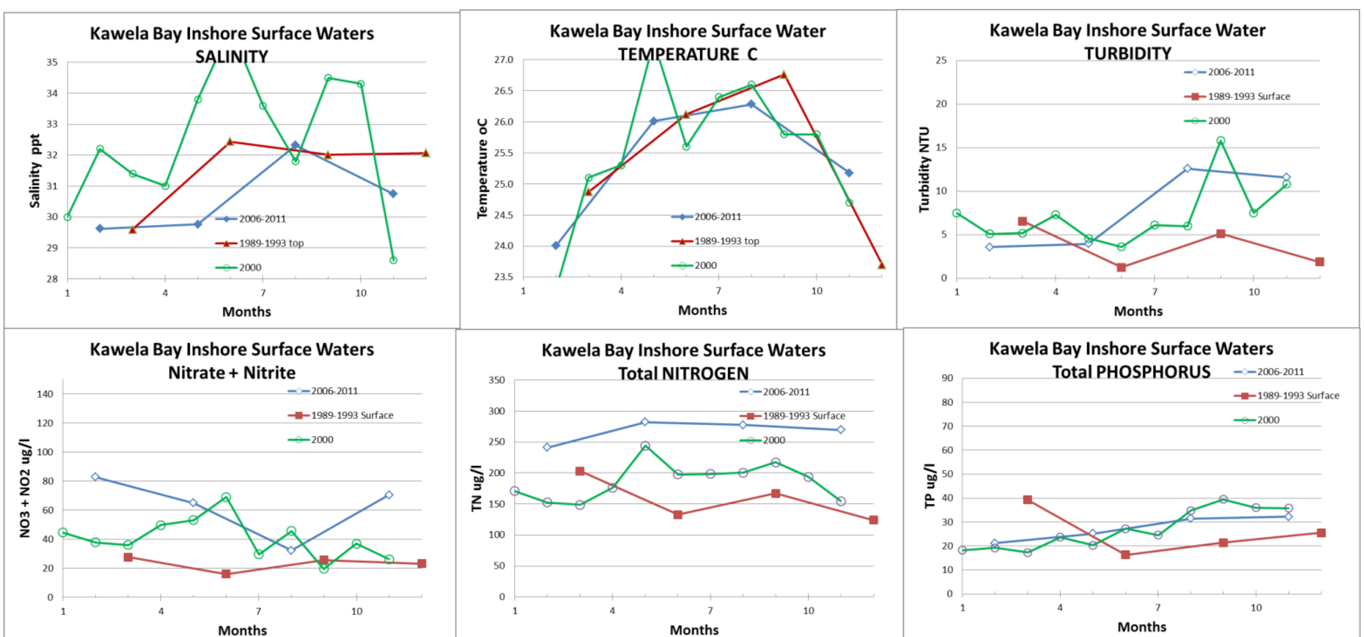
For the large majority of days the flow of Kawela Stream terminates at the sand beach berm and percolates slowly through the berm to the bay. During the infrequent occasions (~3-4 times per year) when the stream flow is sufficient to break through the beach barrier the entire bay is usually extremely turbid for days. Following these stream flow events the water turbidity in the west end of the bay usually clears within a few days, while the east end of the bay often remains turbid for several weeks to a month. Following a very large storm event in March of 1991 that flooded most of Kahuku, turbidity within the bay ranged from 88 to 4,000 NTU. But even when the Kawela Stream is not flowing to the bay, the water quality of the bay rarely meets State Standards for open coastal waters. Samples taken in the early 1990's and more recently in the past five years show that nitrate plus nitrite concentration in samples are highly correlated with groundwater inflow to the bay. High concentrations of total nitrogen and total phosphorus are correlated with high turbidity either as phytoplankton growth or associated directly with eroded sediments from stream flow events. Much of the water within the bay has N:P ratios (by weight) between 4:1 and 10:1 (Figure 3-10) which is ideal for plankton and algae growth. In the central and western portions of the bay the environment appears to have responded to the combination of high nutrients and high water turnover rates (currents) with abundant growths of macro-algae. In the eastern bay, with much lower currents and long resident time, these nutrients appear to lead to a prevalent turbidity caused by a combination of suspended terrigenous silt and plankton growth.

The major flood of March 1991 gave rise to plans for improved drainage along the Kahuku coastline and a need to better understand water quality off of individual stormwater outfall points. During 2001-2002, 11 monthly samples were obtained from three nearshore and three offshore (300 ft) locations directly fronting the Kawela Stream mouth for a total of 66 samples. During this same period a YSI-datasonde water quality meter was affixed just above the bottom in about five feet of water directly off the stream mouth, where it recorded physical water quality data (temperature, pH, depth, salinity, turbidity) at half hour intervals for the entire year. A single month of data from the YSI is displayed as data visualization charts in Figure 3-101. This figure displays the large variance in water quality values during daily and tidal cycles. Averaged data from the monthly samples is plotted against annualized data from both the 1990 and 2010 era surveys in Figures 3-9 and 3-10.

Table 3-1. Summary of Water Quality in Kawela Bay

Kawela Bay Water Quality		Temp.	Diss. Oxygen	pH	Salinity	Turbidity	Total Susp. Solids	Ammonia	Nitrate + Nitrite	Total Nitrogen	Total Phosphorus	Chlorophyll a	Silicates
		(° C)	(mg/L)		(ppt)	(NTU)	(mg/L)	(ug N/L)	(ug N/L)	(ug N/L)	(ug P/L)	(ug/L)	(ug/L)
1989-1994													
	K1-1 - surface	25.19			32.19	2.9			17.46	137.8	22.0		
	K1-2 - mid-water	25.11			32.62	5.1			10.44	457.0	31.8		
Each Value	K2-1 - surface	25.34			31.76	3.5			17.39	143.8	23.9		
Geo Mean of	K2-2 - mid-water	25.23			32.71	14.4			14.32	206.4	55.7		
19 quarterly	K3-1 - surface	25.19			31.61	2.9			22.2	151.6	20.5		
samples	K3-2 - mid-water	25.13			32.20	5.7			14.62	174.1	27.9		
	K4-1 - surface	25.03			32.23	1.2			13.9	134.3	13.9		
	K4-2 - mid-water	25.00			33.98	1.4			6.77	111.4	14.8		
	K1,K2,K3 Ave	**25.24**			**31.85**	**3.08**			**19.02**	**144.39**	**22.12**		
2002													
Each GM of	Near Shore (10 ft)	25.40	7.5		31.50	11.3	18.9		54.2	217.3	35.3	1.90	
33 samples	Off Shore (300 ft)	25.30	7.8		33.40	3.1	6.2		27.2	156.4	18.7	0.70	
	Average	**25.35**	**7.7**		**32.45**	**7.2**	**12.6**		**40.7**	**186.9**	**27.0**	**1.30**	
2006-2011													
	East	25.45	6.49	8.11	31.71	7.4	16.7	1.73	16.45	219.2	25.4	1.28	3232
Each GM of	West	25.32	6.71	8.09	29.40	5.8	14.8	1.68	102.16	316.0	28.6	1.16	6305
21 samples	Offshore Surface	25.24	6.82	8.13	33.88	1.3	6.6	1.51	3.10	156.9	12.7	0.38	626
	Offshore Bottom	25.20	7.06	8.15	34.48	1.2	7.4	1.27	2.62	152.0	12.3	0.41	400
	East, West Ave	**25.38**	**6.60**	**8.10**	**30.55**	**6.6**	**15.8**	**1.70**	**59.31**	**267.6**	**27.0**	**1.22**	**4768**
Open Coast	Wet Season					0.50	20	3.5	5	150	20	0.30	
State WQ Std	Dry Season					0.20	10	2.0	4	110	16	0.15	

* Measured constituents with a geometric mean greater than the State WQ Open Coast Wet season standard are noted in blue



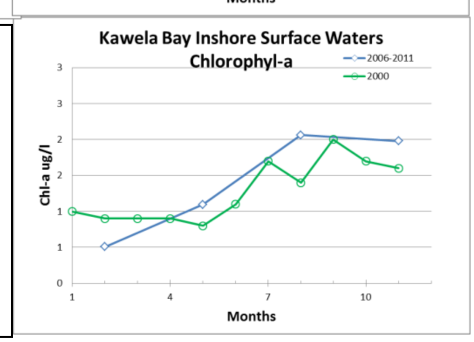


Figure 3-9. Graphs of averaged annualized data for each data set (1989-1994, 2001, 2006-2011). Inshore surface waters of Kawela Bay.

Summary Water Quality Results from Two Surveys, Two Decades Apart

1989-'94 / 2006-'11

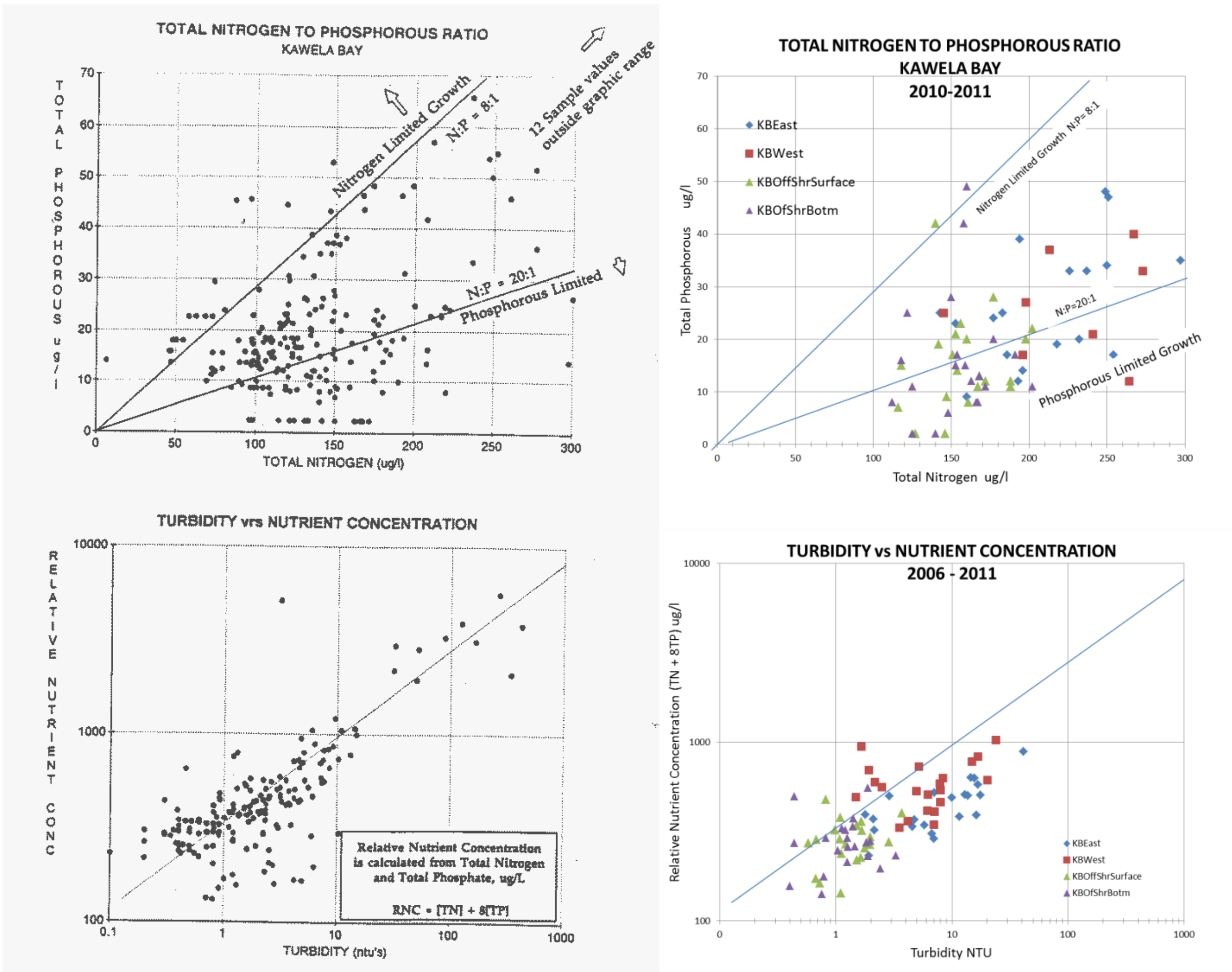


Figure 3-10. Comparison of water quality in Turtle Bay from 1989-1993. (Left) to present 2006-1011 (Right). All lines are in the same locations to ease visual comparison between data-sets. Recent data set appears to be lacking the few very high turbidity events measured previously but shows an overall shift to higher turbidity levels. Although total phosphorous levels are relatively unchanged, the increase in nitrate plus nitrite and total nitrogen appear significant.

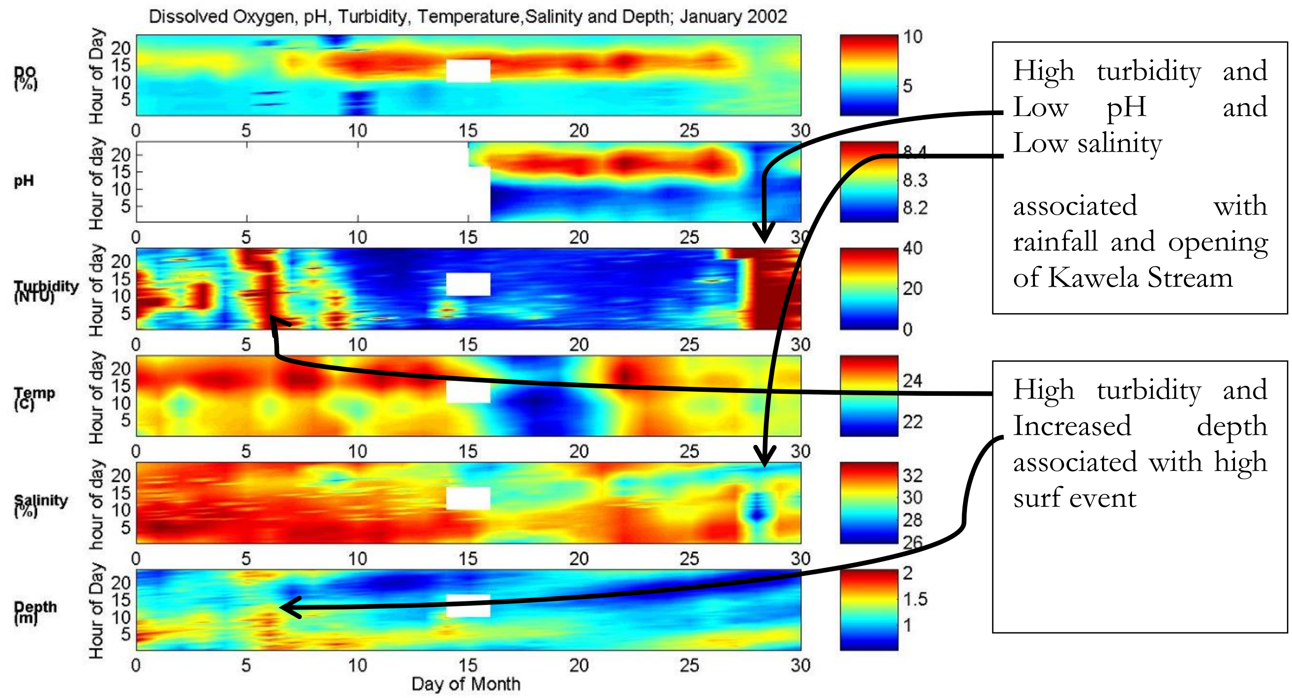


Figure 3-11. One month of hourly water quality data from just off Kawela Stream mouth during January 2002. Days of the month are read across the bottom, with the hour read along the vertical axes. The value of each parameter is expressed as a color according to the scale to the right of each graph. It is important to note the highly variable nature of each parameter over the course of each day as well as over days. Long term "trends" in water quality could be related to a trend in the time of day or fine scale location of samples taken.

The 2002 study concluded that turbidity was more than ten times higher than the State standard for dry open coasts, and that high turbidity events could be associated both with stream openings (Jan 26-30, 2001 in Figure 3-11) and, to a lesser degree, with high surf events (Jan 6, 2001 in Figure 3-10). The closely spaced sample sites off the stream mouth showed that there were differences in water quality between both nearshore/offshore and east/west along the shoreline. Both nitrogen and phosphorus nutrients were in higher concentrations within the groundwater plume near shore on the west side of the bay and exceeded the State standard for dry open coasts. Total phosphorous (TP) was highest during the summer months. The high levels of TP were correlated with high chlorophyll-a levels, particularly when coupled with total nitrogen concentrations at a ratio of about 1:5. As phosphorus is not normally this high in groundwater (it usually becomes adsorbed to sediments) this indicates a relatively close source of phosphorus to the groundwater. These sources could include the adjacent agriculture fields or the adjacent home lots. The study concluded that Kawela Bay was not suited to receive enhanced stormwater discharge due to the low rate of mixing and transport within the bay.

Beginning in 2006 until the present, four water samples (two nearshore, two offshore) have been taken at three locations within the bay (Figure 3-6) on a quarterly basis for a total of 80 samples. Initial comparison of the results from these samples would seem to indicate that the near-shore sites show an increase in the concentration of nitrate plus nitrite, total nitrogen, and possibly total phosphorus as compared to samples taken in 2002 or during the early 1990's. However, it is also noted that the three datasets show a trend in location of samples taken and this is a more likely source of this variation. During 1989-1994 the three nearshore samples were in the center-west portion of the bay. The 2001 samples were in the center-east portion of the bay, off the stream mouth. The two 2006-2011 sample locations were very close to shore (high groundwater influence) and one was at the west end of the bay within a known groundwater plume. Therefore, the relatively small trends seen in the dataset are consistent with the location of the samples taken within the bay. This is particularly interesting because the 1989 sample effort began not long after the last of the residents had moved away from the east end of the bay and septic systems associated with the homes became unused. If cesspools were delivering a significant load of nutrients through the sand berm one would have expected a decrease in nearshore TP concentrations over time in the east end of the bay. This decrease in phosphorus over time has not been seen. With the exception of a high total nitrogen value, all water quality parameters from the station at the east end of the bay from 2006 to the present are indistinguishable from the samples near this same location taken two decades ago. However, it remains true that the bay receives more nutrients than is likely appropriate according to state standards and this problem is exacerbated by the shallow nature of the bay and it's relative low rate of exchange with ocean waters.

The data indicates that the waters of Kawela Bay do not meet State water quality standards of an open wet coastline. While a large quantity of nutrients are delivered to the bay in groundwater, the majority of sediments and their associated nutrients enter the bay during infrequent flow events of Kawela Stream. Removal of this source of nutrients and sediments to the bay would greatly improve water quality over a period of years. Given the large quantity of fresh groundwater entering the bay, low circulation and mixing within the bay, and inefficient transport to the open ocean, consideration should be given to minimizing storm water flows to this body of water. Given the physical aspects of the bay and high groundwater inflow, it may be more appropriate to use State water quality standards associated with embayments rather than open coastlines.

3.4 Marine Biological Resources

3.4.1 Benthic Surveys: Fish, Coral, and Algae

Benthic habitat and water quality surveys have been conducted along this shoreline by Biengfang and Brock (1981) over a five-year period by Oceanit (1994) and again during the winter and summer of 2011. Benthic survey techniques have changed and improved over the years, particularly with the advent of digital underwater cameras, GPS positioning, and the ability to use computers to assist with photograph analyses. The surveys done in 1981 were conducted across measured transects, but data was only recorded by hand. The survey locations for the 1989-1994 studies were located primarily in response to a proposal (never implemented) to suction dredge accumulated silt from Kawela Bay. These same three survey locations were placed K1) in the highly turbid area about 200 feet offshore of the east end of the beach K2) over the shallow back-reef section about 200 feet offshore near the center of the beach, and K3) at the west end of the bay from the edge of the sand channel towards the shore just inside the point. In 1989 all three survey start points were fixed with (CDUA permitted) cement block anchors. Photographs of grids (0.25m^2) laid at 10-foot intervals on a tape measure extending from this fixed point were taken to quantify benthic substrate.

The survey locations in Kawela Bay were selected to be consistent with those used in the 1994 study. These sites represent very nearshore habitats and were selected as representing areas most likely to document changes in the environment if restoration measures (suction dredging, stream realignment) were ever implemented. A more general characterization of the bay as a whole was conducted qualitatively aided by aerial photographs as depicted in Figure 3-3. During the winter and late summer of 2011 three 100-foot transect surveys were established ~~conducted~~, one each in the east bay, central bay 200 feet off shore, and at the edge of the sand channel near the western mouth of the bay (K1, K2, and K3 respectively in Figure 3-3). The first two sites (K1, K2) approximated survey locations used during the early 1990's and the third survey was able to locate underwater markers and therefore duplicates the third transect from the 1990's. At each transect the starting point of each transect is fixed. A diver begins at the starting point and swims along a compass heading moving slowly over the course of the transect making a record of all fish seen within approximately six feet (2m) either side of the transect. The first diver conducting the fish counts is followed by a second unrolling a negatively buoyant cloth measuring tape to a fixed distance of 100-feet (~30m, total area 120m^2). At the end of the survey tape, the route is reversed with photos taken along the length of the tape to document the benthic substrate and biotic cover.

The 2011 surveys were documented using an underwater digital camera mounted on a monopod with a set focal length of 26-inches yielding a photo surface area of just over two square feet (0.20m^2). This short focal length, and resulting small photo area, was necessary due to the often shallow and relatively turbid nature of these nearshore habitats. The monopod was placed on the survey tape at two-foot intervals with the 50$^+$ photos almost adjacent to one another and making a nearly continuous record of the bottom just under 1.3 feet wide and 100 feet long with a total area of 107 ft^2 (10m^2). The photographs were then examined on a computer using a program (Coral Point) to randomly select 10 points from each photo. At each point the substrate was identified and classified (hard substrate, boulder, rock, cobble, rubble, gravel, coarse sand, fine sand, or mud) and the overlaying organism was identified, if possible, to genus. This resulted in the identification of the substrate type and marine organisms present at approximately 500 randomly selected points along each transect. It is uncommon for a substrate to be completely bare, but it is quite common for that cover to consist of a very fine and thin mat of algae too small to identify. Results of the 2011 fish surveys are presented in

Table 3-2 with the benthic survey data presented in

Table 3-2.

Results of the 2011 benthic survey are presented in Table 3-2 with the fish surveys data presented in Table 3-2 and representative photographs from each transect in Figure 3-13. As would be expected from this very nearshore survey, most of the fish observed are small reef-dwelling species, primarily herbivores and omnivores. The most prevalent species seen are small wrasses, and surgeon fish. The lack of observed predatory fish is most likely due to the shallow water and relatively poor visibility. The benthic survey data shows that coral was not plentiful in this inner bay environment. At the K1 site (far right side – muddy water) there are numerous large (1-2m^3) coral heads, but they are almost completely covered with algae. The small areas of live coral on these heads show obvious signs of stress, likely due to the very silt laden environment. The nearshore central bay (K2) is typical of shallow back-reef areas displaying low vertical profile with ample sand in pockets and small coral rocks and rubble mobilized across the surface by occasional storm waves. Coral cover is lowest in the area, likely due to the unstable substrate and fish count are also low likely in response to a lack of cover. Site K3 was selected primarily as a positive control as its location on the shelf at the west end of the bay typically provides it with ample surge and oceanic water. Corals at this site, while still not abundant, were by far the healthiest with no observed tissue stress. The quantitative data from these recent surveys are consistent with the findings of both the 1994 study (Oceanit) and the 1981 survey (Biengfang and Brock).

Figure 3-12. The protected waters of Kawela Bay support a broad range of algae and invertebrate species, such as this large nudibranch

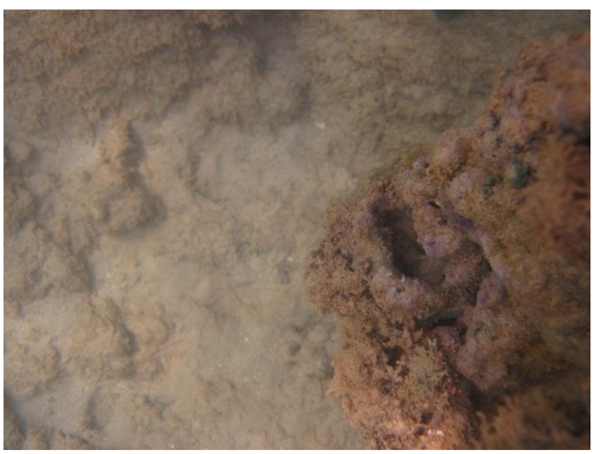
Table 3-2 (Revised). Benthic substrate and benthic biota survey results from Kawela Bay, 2011.

	Kawela ~~Kaweal~~ Site 1			Kawela Site 2			Kawela Site 3		
	March	Sept	% cover	March	Sept	% cover	March	Sept	
	# Points	# Points	%	# Points	# Points	%	# Points	# Points	%
BIOLOGICAL SUBSTRATE	18	na	3.5	70	77	14.6	104	166	26.0
CORAL	9	na	1.8	0	2	0.2	9	9	1.7
OTHER INVERTEBRATES	0	na	0.0	0	0	0.0	0	1	0.1
CORALLINE ALGAE	34	na	6.7	13	6	1.9	45	18	6.1
TURF ALGAE	449	na	88.0	423	368	78.3	361	275	61.2
NATIVE ALGAE	0	na	0.0	0	4	0.4	13	3	1.5
INVASIVE ALGAE	0	na	0.0	0	40	4.0	0	24	2.3
CYANOBACTERIA	0	na	0.0	0	1	0.1	0	0	0.0
UNKNOWN	0	na	0.0	0	0	0.0	0	0	0.0
TAPE, QUADRAT, SHADOW	0	na	0.0	4	2	0.6	8	4	1.2
Substrate Total	510		100.0	510	500	100.0	540	500	100.0

	Kawela ~~Kaweal~~ Site 1			Kawela Site 2			Kawela Site 3		
	March	Sept	% cover	March	Sept	% cover	March	Sept	% Cover
PHYSICAL BENTHIC SUBSTRATE	# Points		%	# Points	# Points	%	# Points	# Points	%
Benthos (BENTH, HARD)	229		45.0	191	129	31.8	395	316	68.6
Boulder (BOULD)(ROCK)	1		0.2	13	8	2.1	1	1	0.2
Cobble (COB)	24		4.7	54	45	9.8	22	1	2.2
Rubble (RUB)	210		41.3	139	192	32.9	44	15	5.7
Gravel (GRAVEL)	8		1.6	36	19	5.5	5	2	0.7
Coarse Sand (CSAND)	11		2.2	46	48	9.3	72	162	22.6
Fine Sand (FSAND)	19		3.7	30	57	8.6	0	0	0.0
Mud (MUD)	7		1.4	0	0	0.0	0	0	0.0
Substrate Total	509		100.0	509	498	100.0	539	497	100.0

Table 3-3. Results of fish surveys from three transects in Kawela Bay, 2011

		Kawela Bay						
		K1		K2		K3		Total
		March	Sept	March	Sept	March	Sept	Fish
Surgeon Fish	Acanthurus leucopareius							
	Acanthurus nigrofuscus	2		2				4
	Acanthurus triostegus	8		3	3			14
	Acanthurus xanthopterus			2				2
Butterflyfish	Chaetodon auriga	2		1				3
Goat fish	Mulloidicthys flavolineatus							
Box fish	Canthigaster jactator	1				1	1	3
	Canthigaster amboinensis					1		1
	Ostracion meleagris					1		1
Wrasses	Coris flavowittata							
	Coris venusta				12	1		13
	Labroides phthirophagus				1			1
	Stethojulis balteata							
	Thalassoma duperrey	3		3	3	6		15
	Thalassoma purpureum							
	Thalassoma trilobatum							
Damselfish	Plectroglyphidodon imparipennis					1		1
	Plectroglyphidodon johnstonianus							
	Abudefduf abdominalis				2			2
	Stegastes marginatus	2				2		4
Triggerfish	Rhinecanthus rectangulus					1		1
	Total Species Count	6	0	5	5	8	1	14
	Total Number Fish	18	0	11	21	14	1	65


1. Kawela Bay East Transect quadrant photo


1.Kawela Bay East transect detail photo

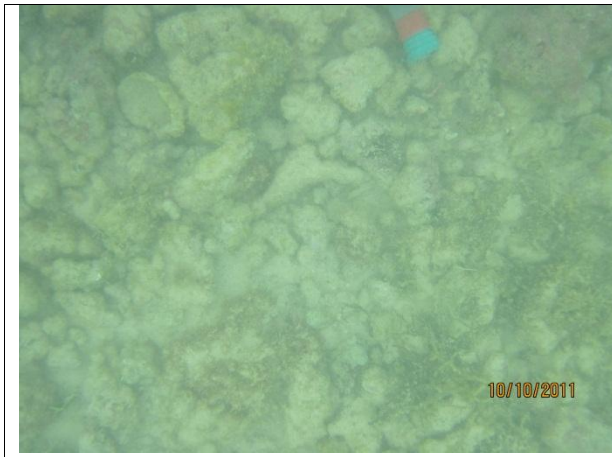
 2.Kawela Bay Center Nearshore quadrant photo	 2.Kawela Bay Center Nearshore detail photo
 3.Kawela Bay West quadrant photo	 3.Kawela Bay West detail photo

Figure 3-13. Representative photographs from three transects within Kawela Bay

There are five major habitat types within Kawela Bay covering a total of about 50 acres (Figure 3-3). The bay is protected from constant ocean trade wind swells by a fringing reef at the center of the bay and by raised headlands and adjacent shallow limestone benches to the east and west. Waves larger than about three-feet break well off shore maintaining the body of the bay in a relatively quiescent condition. The bay supports a highly diverse growth of corals, fish, sea turtles and macro-algae.

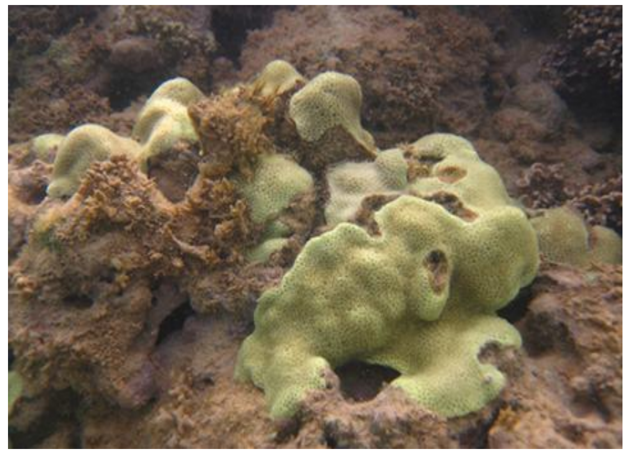


Figure 3-14. Corals in the east bay often show signs of siltation stress

The inner bay (biotype 1) fronts the beach shoreline and is protected from constant ocean swells and currents by the headlands and shallow central reef. Biotype 1A (Figure 3-3) is primarily sand or hard bottom with low relief at depths from three to six feet in the west side of the bay. This biotype typically has high water clarity but often with a well-defined fresh water lens at the surface. Biotype 1B is shallower generally two to four feet and consists of the inner portion of the finger-and-groove central reef. Finger-and-grooves are formed on a reef in response to wave action and scouring by sand. Sand channels tend to form in line with the wave direction, and corals grow on either side of the channel, protected from scouring by elevation. In this habitat the finger-and-groove formations are indistinct with lower relief and greater quantity of rubble and sand. Small coral colonies within this zone are more numerous on the west side of the zone away from the typically turbid water common on the east side of the bay. Biotype 1C consists of an isolated low point in the bathymetry with depths of up to about eight feet. This area accumulates soft sediments and is often very turbid. The narrow (20 to 40 foot wide) steep sand beach (Biotype 1D) extends the entire length of the bay shoreline, with the toe of the sand beach terminating at a depth of two to three feet where it meets the inner rubble zone of Biotype 1A and 1B.

The shallow shelves fronting both headlands (Biotype 2) are divided into a very shallow (2A) and slightly deeper (2B) habitats. The benthic substrate in 2A presents itself as a very flat but pitted calcareous substrate supporting a dense growth and broad variety of macro-algae and occasional sea urchins. This substrate is usually swept with waves and may be exposed, or nearly so, during low tides. Slightly deeper the habitat (2B) expresses greater irregularity with the presence of sand patches in depressions, coral rock boulders scattered across the surface, and occasional coral colonies. This slightly deeper habitat appears to be a favorite for grazing by green sea turtles. The bench along the eastern headland has an abrupt edge dropping several feet into a channel. Along the western headland the depth of the bench increases gradually to the edge of the sand channel and supports a variety of coral growth in a surge habitat.

The center of the bay is characterized as a coral reef habitat with high cover of several varieties of corals dominated by lobe coral (*Porites lobata*) but with at least seven other species prevalent (*P. lutea, P. compressa, P. duerdeni, Pavona duerdeni, Montipora flabellate, Pocillopora meandrina*). The inner shallower portion of Biotype 3 displays classic “finger and groove” coral and sand channel formations that extend into Biotype 1 near shore.

There is no distinct reef crest, the inner portion of the biotype displaying a depth of two to three feet and then gradually increasing to a depth of four to six feet at the outer edge where the finger and groves become deeper and more prominent. The west side of this biotype (3B) may either be termed a major groove or a minor channel, strewn with boulder sized lobe coral colonies up to the abrupt ledge forming the outer limits of the shallow benches of Biotype 2B. As the water increases in depth outside the bay, the reef takes on the characteristics of a deeper and wider surge channels that eventually grade into deep patch reefs of Biotype 4.

Biotype 5 is somewhat unique in that it consists of a relatively wide and deep sand channel with about a dozen immense free standing lobe coral colonies of *Porites lutea* (ex. *P. evermanni*). These colonies range from about three-feet to 12-feet in diameter.

3.4.2 Human Activities at Kawela Bay

As part of the sea turtle surveys (Section 2.5), observers were asked to note beach and ocean activities in Kawela Bay. This process was initially instituted to merely keep the observer "observant" by decreasing the monotony of the long observation periods, but it has more than proven a unique perspective to the change in beach and ocean recreational activities over time. Log sheets from individual observations taken from 1989-1993 were re-analyzed in 2011 and data regarding human activities were distributed into two either Beach Activities (playing/walking, shore-fishing) or Water Activities (swimming, boating/surfing). This information was compared to similar data accumulated during the surveys conducted in 2011.

Human activity within the bay has seen marked changes as compared to activities observed in the early 1990's. Table 3-4 displays the average total number of people during a single day observed engaging in a variety of activities in the water or on the beach at Kawela Bay. Because of the way the observations are made, these estimates are likely slightly high. For instance, one person walking on the beach for one hour will be counted twice, once in each consecutive 25-minute observation period. This yields a high estimate of total population although it may be balanced somewhat by those people who accessed the beach during the day sometime between the three 2 ½ hour sample periods. During the early 1990's the total average daily number of people either in the water or on the beach was about 22, whereas in 2011 there were about 60 people per day at the bay.

The highest number of people observed during any single 25 minute observation period was 21 on the beach and five in the water, during a Saturday afternoon in September of 2011. All categories of beach and water use except for boating and scuba diving have seen increases. The most significant increase, kayak use, appears related to the regular daily kayak guided tour that is sponsored through the Turtle Bay Resort.

Table 3-3. People counts at Kawela Bay

	1990-1993	2011
Average Daily Total People at Kawela Bay	**22.0**	**60.1**
Beach Activities (total)	**17.1**	**42.6**
· Playing, walking on beach	13.3	38.2
· Shorefishing	3.8	4.4
Water Activities (total)	**4.9**	**17.5**
Swimming	**2.2**	**5.6**
· Snorkelers	0.6	1.9
· Swimming/Playing in Water	1.3	3.7
· Divers	0.3	0.0
Boating/Surfing	**2.7**	**11.9**
Surfing	**1.4**	**7.4**
· Standup	0.1	3.1
· Surfing	0.6	3.9
· Boogie Boards	0.2	0.4
· Wind Surfers	0.5	0.0
Kayaking	**0.4**	**18.4**
· Kayak	0.4	18.1
· Kayak fishing	0.0	0.3
Boating	**0.9**	**0.1**
· Canoe	0.5	0.0
. Boat fishing	0.0	0.0
· Boating	0.5	0.1

Table 3-4. Water Related Activities at Kawela Bay, Five Days in September 2011

Date	Seen From	Morning	Noon	Evening
9/19/11	Zone 2	1 pole fisherman	1 throw net	2 throw nets
	Zone 5	1 pole fisherman,7 kayaks getting staged	1 throw net, 1 snorkler	2 throw nets
	Zone 4	1 pole fisherman, 6 kayaks	none	1 sailboat
	Zone 3	6 kayaks	two pole fishermen	none
	Zone 1	1 pole fisherman, 6 kayaks	1 standup paddler, 2 swimmers, ? polefisherman	1 sailboat (same as in zone 4), ? pole fishermen
9/21/11	Zone 2	none	4 surfers	2 swimmers
	Zone 5	none, two people on beach staging kaya	2 surfers	4 surfers
	Zone 4	none,two people on beach staging 7 kay	2 surfers	3 surfers, 2 polefishermen w/ 3 poles
	Zone 3	7 kayaks	none	3 surfers, 2 polefisherman
	Zone 1	7 kayaks	none	4 surfers (in zone for duration of obsr)
9/22/11	Zone 2	none	7 kayaks	1 swimmer
	Zone 5	none	7 kayaks	none
	Zone 4	none,two people on beach stageing kay	7 kayaks	1 surfer, 1 standup paddler
	Zone 3	1 surfer, 8 kayaks	2 pole fisherman	1 surfer, 1 stand up paddler
	Zone 1	1 surfer, 8 kayaks	none	1 surfer, 2 standup paddlers
9/23/11	Zone 2	none	7 kayaks (in zone 10:48-10:57)	none
	Zone 5	none	7 kayaks (in zone 11:16 -11:24)	4 snorklers
	Zone 4	none	7 kayaks	3 swimmers, 1 standup paddler, 2 surfers
	Zone 3	8 kayaks	none	1 standup paddler, 2 surfers
	Zone 1	1 standup paddler, 8 kayaks	1 boogie borader	1 standup paddler (in zone 6:12 till end)
9/24/2011 Saturday	Zone 2	2 standup paddlers, 1 surfer	6 kayaks (in zone 10:45 till 10:57)	2 surfers
	Zone 5	1 standup paddler, 1 surfertwo people o	2 stand up paddlers, 1 jetski, ? kayaks, 1 surfter	1 standup paddler
	Zone 4	none	1 surfer, 2 stand up paddlers	5 swimmers
	Zone 3	8 kayaks	1 standup paddler	none
	Zone 1	10 kayaks, 3 surfers, 2 standup paddlers	none	none

4. TURTLE BAY

4.1 General Physical Description

Turtle Bay beach is a half-mile long crescent of white sand perched on top of a beach-rock shoreline. Kuilima Point at the east end of the beach blocks most of the trade-wind generated swells from the beach, although these swells do wrap around the peninsula to create a popular surf break in the lee of the Turtle Bay Resort. The active reef crest is well off shore from the beach (~2000 feet) with a significant back-reef lagoon between the beach and reef.

Turtle Bay's unique bathymetry has a dramatic impact on water flow and water quality in the bay. As mentioned earlier (Section 2) during prehistoric times the ocean was as much as 60 feet (17 meters) higher than present, during which time much of the flat coastal plain was formed and upon which the project site now rests. But during times of lower sea levels (by as much as 200-feet!) the coastline was much farther out to sea, and coastal streams formed channels across the broad plateau. A remnant of the prehistoric Kuilima Stream bed snakes through the reef from the west end of Turtle Bay in a deep 350-foot wide channel and meets the shoreline about a third of the way along the beach towards the main hotel (Figure 4-1). This channel is a dominant factor in the hydrology and ecology of Turtle Bay as described below under currents and waves.

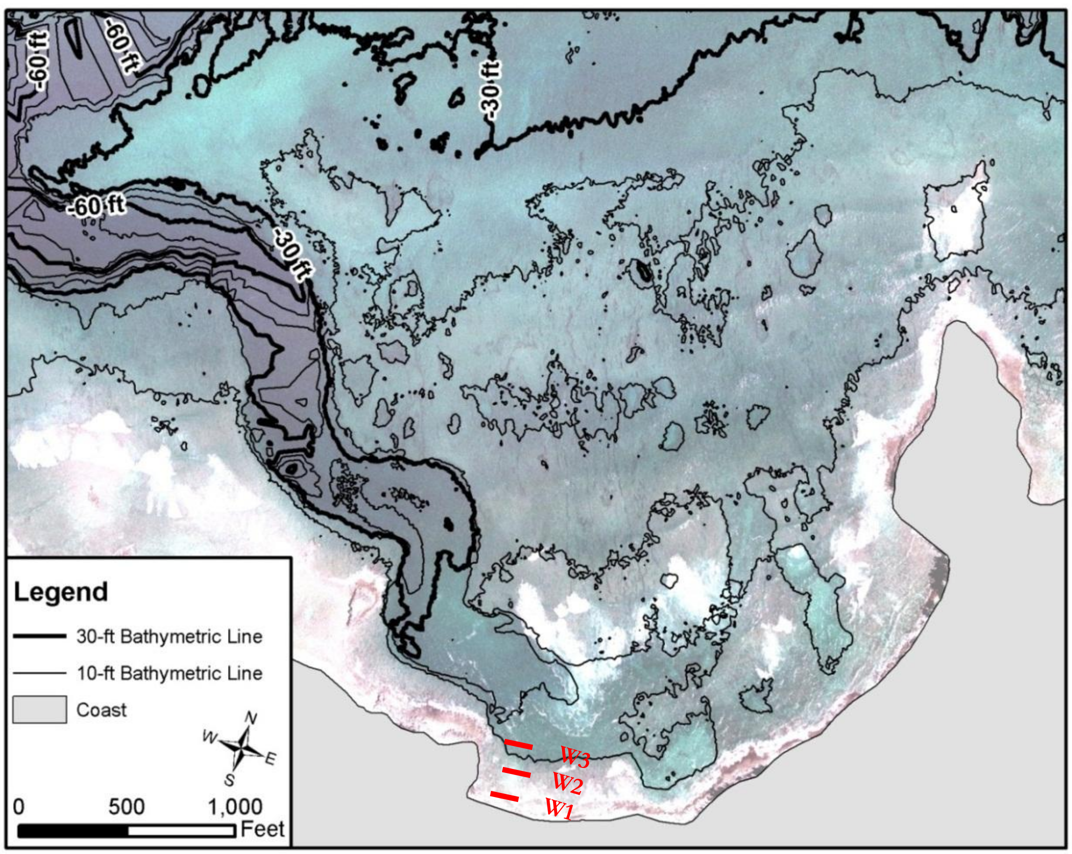


Figure 4-1. Turtle Bay Bathymetry showing submerged ancient stream bed that controls hydrology within the bay. Red lines mark locations of 100-foot long survey transects W1, W2, and W3

Because the sand beach is perched on top of a lithified beach-rock shoreline, the toe of the beach sand is either above or, at most, slightly below water line. Along the eastern portion of the bay closest to the main resort buildings, the nearshore displays the characteristics of a shallow back-reef substrate. The bathymetry is relatively flat consisting of coral rubble substrate at a depth of two to six feet consolidated by a cover of algae and invertebrate growth. Small depressions or ridges filled with coarse sand and rubble and interspersed with small coral rocks thrown back from the reef face by past storms. Occasional small corals, more prevalent further from shore, grow on raised outcroppings above the action of the scouring sand. Small fish, primarily damsals, wrasses, and occasional box-fish and trigger fish are associated with the scattered cover provided by ridges, small corals and coral boulders. The nearshore along the western half of the beach provides a significantly different appearance. Here the prehistoric stream channel is roughly parallel to the shore forming a 350-foot wide relatively deep (6-12 foot) lagoon. At the extreme west end, a narrow (200-foot) apron of hard substrate remains between the shore and the edge of the channel, but this apron is highly rugose and includes scattered boulders presenting a complex substrate. Our three benthic transects were located over this nearshore apron. Closer to the center of the beach the old stream channel crosses the shoreline. The substrate on the bottom of this submerged stream bed consists of sand and rubble with boulder debris particularly nearer the shoreline. This more irregular substrate in the nearshore with ample groundwater intrusion provides excellent habitat for the abundant growth of a wide variety of algae along the shoreline at the west end of the beach. The algae proximity to deeper water, and enhanced cover also supports a greater variety of fishes in the nearshore as compared to the east end of the beach. While the edges of the submerged stream bed provide enhanced substrate, the rubble and sand bottom of the bed provide very limited habitat.

Two storm water drainages, the West and the West Main, outfall into Turtle Bay, neither of which receives significant flows from mountain streams or inland valleys. The West Drain consists of two 48-inch culverts placed in a concrete headwall at a cut through the beach-rock shoreline about mid-way along the beach. The West Drain receives flows from the golf course and the general resort premises only during heavy rainfall events. During light to moderate rainfall events the golf course and resort grounds are typically infiltrated with the large majority of rainfall. The West Main Drain is located at the extreme west end of the perched sandy beach against the base of the rocky headland and consists of two, forty-eight-inch drains ending at a concrete headwall at the top of the beach with a short channel cut through the beach-rock shoreline to the ocean. During summer sand from the adjacent perched beach often completely covers these outlets (Figure 4-2) and requires physical sand removal prior to the arrival of winter storms to allow flow to the ocean. The normally dry stream bed follows upstream around the west edge of the golf course and then parallels the Kamehameha Highway in a broad swale. The swale receives flow partially from the golf course, but primarily through a two-foot wide culvert beneath the highway (Figure 4-2) fed by the lower slopes of the Koʻolau mountains. The total drainage area of both the Kuilima and the West Main Drains is about half a square mile (80 acres).

About 600 feet from the beach the far side of the old stream channel is visible as an abrupt vertical ledge rising to within about five feet of the surface. In the lagoon this ledge varies from almost zero-feet to well over 10 feet in height. As one follows the channel seaward, the near vertical face of the old stream bed wall approaches 20 feet in height above a uniform sand and rubble bottom. The reef crest at a depth of three to five feet is another 1000 feet beyond the edge of the channel.

Figure 4-2. West Main Drain Outlet (above) to Turtle Bay is typically buried in sand when not actively flowing. The small channel under Kamehameha Highway (right) limits flow to the West Main Drain from mauka of the highway.

White water from the waves breaking over the reef crest dissipates where it crosses into the lagoon channel. No surveys have been conducted over this section of the reef because it is far from the stream and storm drain outfall points. However, qualitative observations show this reef to be typical of other reefs along this windward shoreline consisting of a relatively flat pavement substrate covered with algae mat intermixed with sand and rubble patches and occasional coral heads on raised substrate. With the exception of the ancient stream bed channel the crest of the reef is continuous across the width of the bay and of relatively uniform width and depth.

4.2 Waves and Currents

Direct north swells and trade-wind swells that wrap around the Kuilima peninsula approach the shoreline as three-four foot waves through a minor channel at the east end of the bay. Larger swells from the north-west tend to break over the shallow reef crest and dissipate as white-water moving over the back-reef and into the lagoon. Currents within the bay are primarily driven by the pulsing of the white-water over the reef and, to a lesser degree, by wind direction. The overall direction of the current seems to be counter-clockwise where the inward flow occurs on the east side of the bay then exits at the east corner by flowing along the shore then by cutting diagonally across the bay.

Figure 4-3 shows the interpolated current from the field study during ebb and flood tides. Both show the current in a counter-clockwise orientation. Under conditions of normal trade-wind swells with surf across the shallow reef into the deeper nearshore back-reef lagoon, there is a dominant outward current to the ocean through the channel at the southwest end of the beach immediately off the outfall of the West Main Drain.

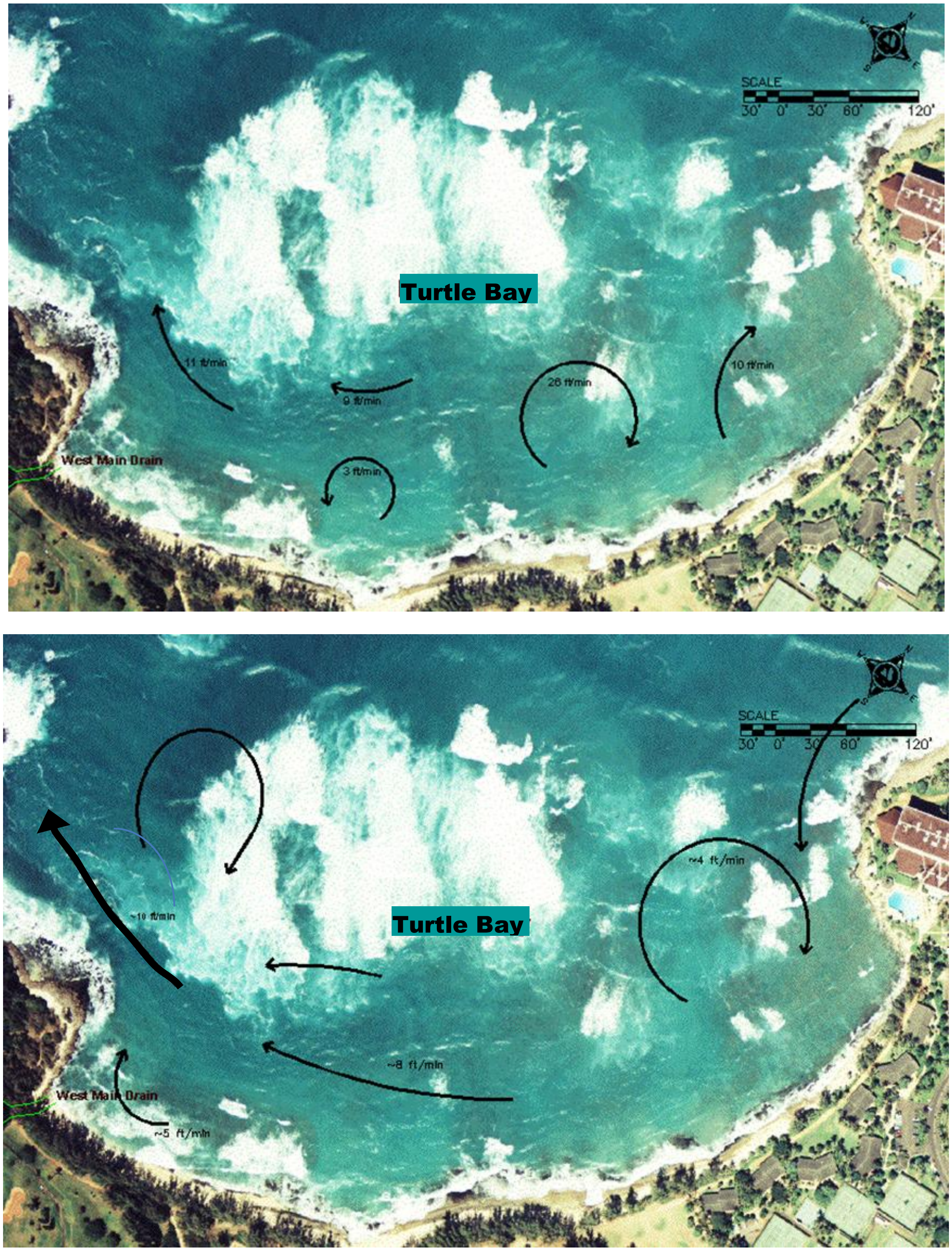


Figure 4-3.Water current circulation in Turtle Bay during rising tide (top) and falling tide (bottom) showing wave pumping over shallow fringing reef into deeper nearshore lagoon with the majority of outflow occurring through the deep channel through the reef at the south-west end of the bay.

4.3 Water Quality

Water quality has been monitored in Turtle Bay during three time periods, semi-annually from 1989-1994, monthly for one year during 2001-2002, and quarterly from 2006 to the present. The location of these samples is shown in Figure 4-4.

Table 4-1 displays the geometric mean value for each water quality constituent collected at each of the sample sites within Turtle Bay, and then averaged for the whole-bay during each of the three survey periods for each constituent. The graphics in Figure 4-5 present the same three data sets, but with the geometric means expressed by month, to show any seasonal trends in the data. The graphs are all of the same scale as those of Figure 3-8 for Kawela Bay and Figure 5-4 for Kuilima Bay to allow for ease of comparison between bays. Figure 4-6 displays one month of hourly data from the 2002 survey as a data visualization graph for physical water quality constituents only. A standard XY plot of this same one-month data set is presented in Appendix B for comparison.

Turbidity values are rarely below the State Water Quality Standard for Wet Open Coasts (0.5 ntu). Turbidity values are typically higher in nearshore (~2ntu) than from offshore sample sites (~1ntu). As can be seen from Figure 4-6 there is a great deal of variability in turbidity from day to day and even from hour to hour during a given day. Turbidity appears to be correlated with water outflow events from the West Main Drain, with high wave events, and with summer low wave periods (and presumably low circulation) causing high chlorophyll-a levels associated with plankton blooms.

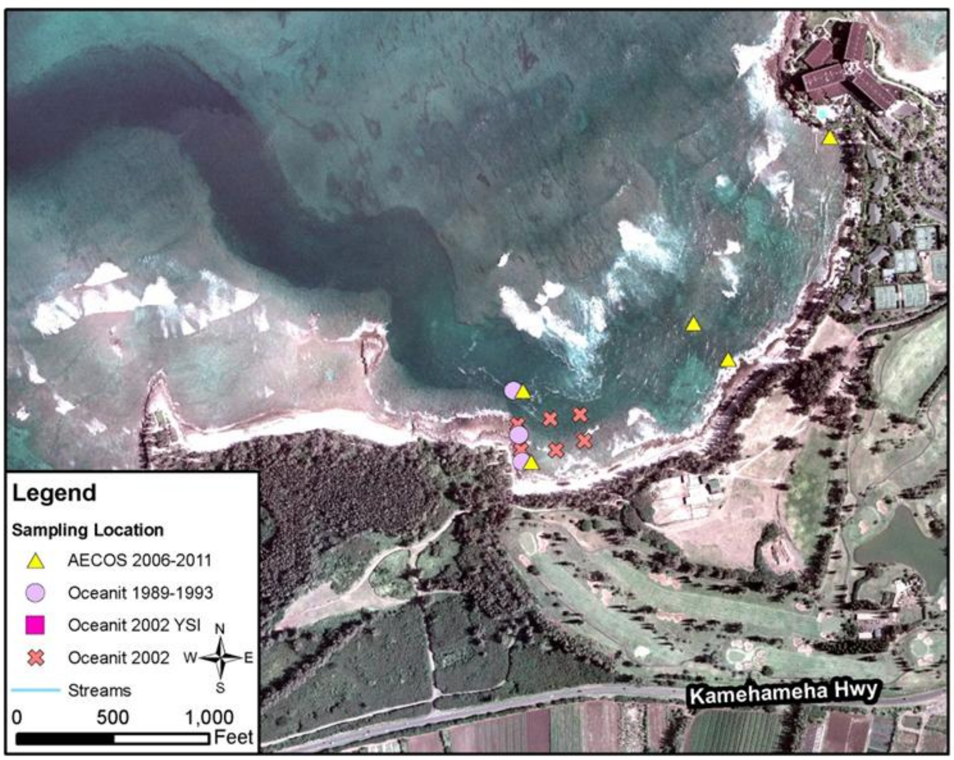


Figure 4-4. Location of water quality samples taken during 1989-1994, 2002, and 2006-present

Table 4-1. Summary of Water Quality from three surveys over 22 years at Kawela Bay

Turtle Bay Water Quality		Temp.	Diss. Oxygen	pH	Salinity	Turbidity (lab)	Total Susp. Solids	Ammonia	Nitrate + Nitrite	Total Nitrogen	Total Phosphorus	Chlorophyll a	Silicates
		(° C)	(mg/L)		(ppt)	(NTU)	(mg/L)	(ug N/L)	(ug N/L)	(ug N/L)	(ug P/L)	(ug/L)	(ug/L)
1989-1994													
	W1-1 surface	24.5	6.2		31.8	1.5			16.7	181	19.5		
	W1-2 - mid-water	24.6	6.2		32.7	1.8			20.5	186	16.2		
Each Value	W2-1 - surface	24.4	6.4		34.2	0.8			8.3	113	12.0		
Geo Mean of	W2-2 - mid-water	24.3	6.4		34.4	0.7			4.7	104	11.0		
10 semi-annual samples													
	Average	**24.47**	**6.29**		**33.26**	**1.19**			**12.53**	**146**	**14.7**		
2002	West Turtle Bay												
Each GM of	Near Shore (10 ft)	25.12	7.5	8.08	33.63	2.4	7.8		4.1	154	15.9	0.93	
33 samples	Off Shore (300 ft)	25.11	7.5	8.17	35.43	1.7	5.0		2.8	124	11.7	0.47	
	Average	**25.11**	**7.5**	**8.1**	**34.53**	**2.0**	**6.4**		**3.4**	**139**	**13.8**	**0.70**	
2006-2011	East nearshore	26.06	7.2	8.3	33.95	2.3	10.9	2.0	20.9	208	17.9	1.31	967
	Cntr nearshore	25.77	6.8	8.2	34.20	1.5	8.6	1.7	6.2	176	16.7	0.86	559
Each GM of	Cntr 300 ft offshore	25.53	6.7	8.2	34.49	1.1	6.6	1.4	7.3	162	11.4	0.42	451
21 samples	West nearshore	25.49	7.0	8.2	33.02	1.5	8.7	1.7	34.2	208	21.4	1.02	1525
	West 300 ft offshore	25.28	6.7	8.2	34.40	1.1	6.7	1.4	6.5	163	10.5	0.43	495
	Average	**25.62**	**6.88**	**8.23**	**34.01**	**1.50**	**8.32**	**1.64**	**15.02**	**183.37**	**15.59**	**0.81**	**799.50**
Open Coast	Wet Season					0.50	20	3.5	5	150	20	0.30	
State WQ Std	Dry Season					0.20	10	2.0	4	110	16	0.15	

* Measured constituents with a geometric mean greater than the State WQ Open Coast Wet season standard are noted in blue

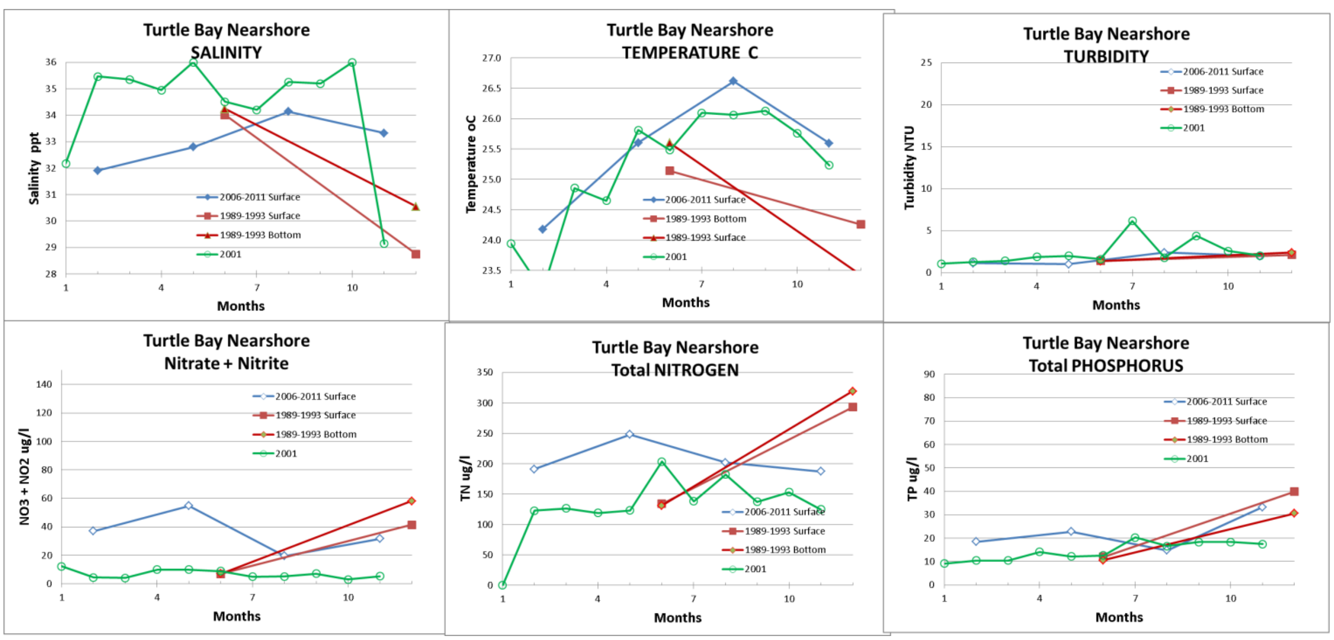
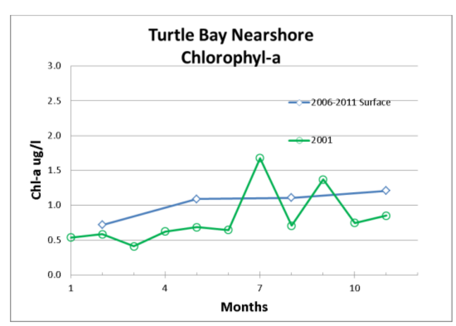


Figure 4-5. Graphic display of annualized averaged data from three studies conducted in Turtle Bay since 1989.



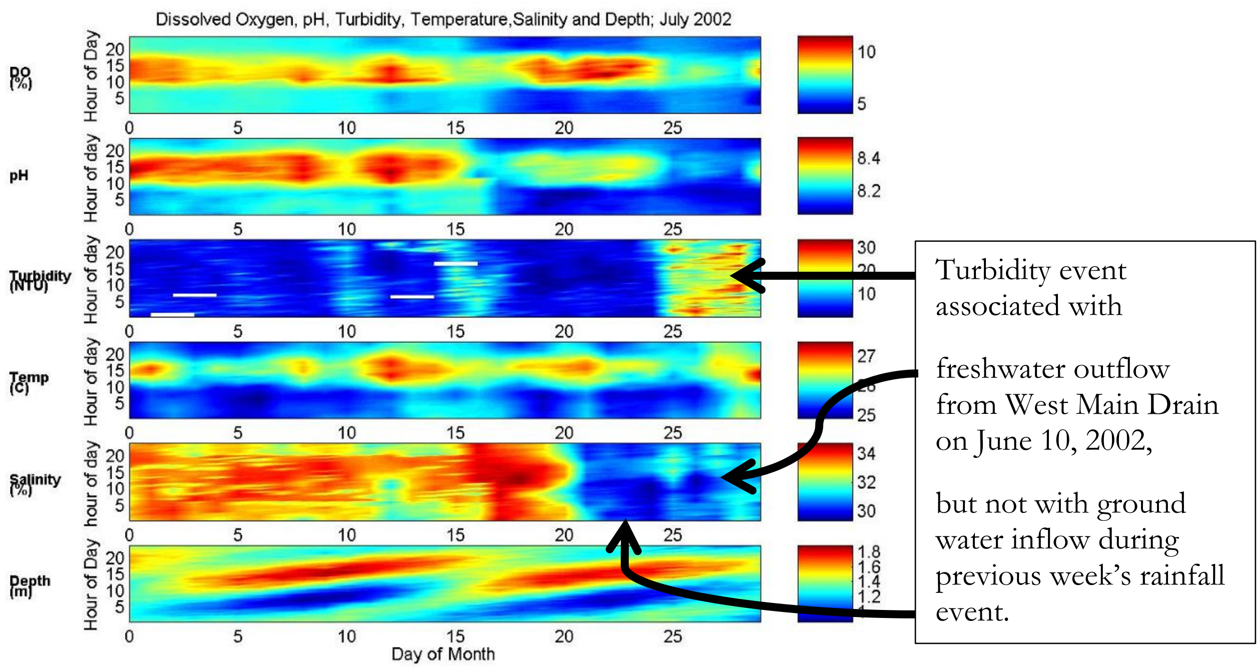


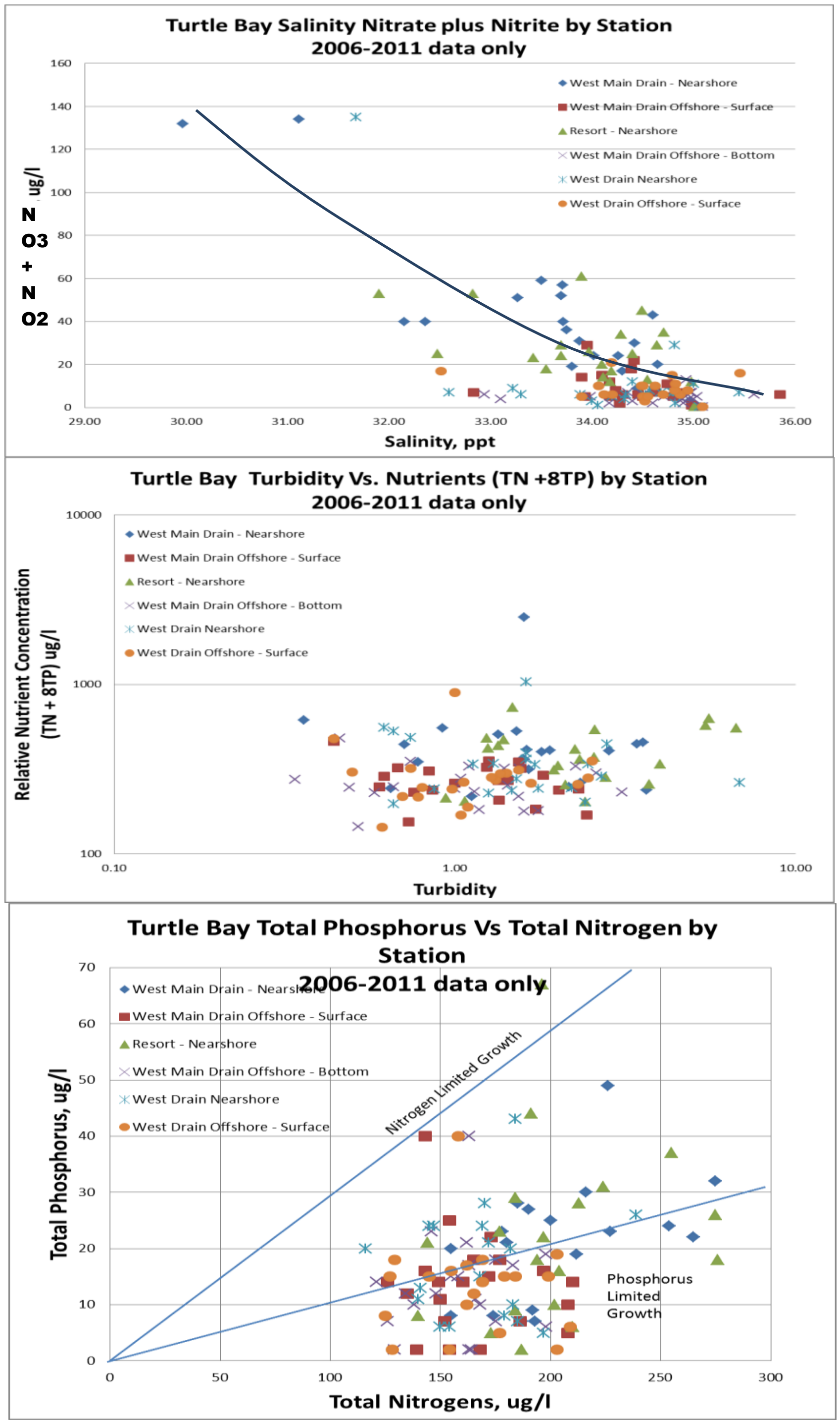
Figure 4-6. Data visualization graphic from Turtle bay June, 2002

Although turbidity levels are higher than state standards, it is unrealistic to assume that this standard is achievable in shallow nearshore areas subject to the turbulence of waves and currents. The State previously used a geometric mean of 20 mg/l for Total Suspended Solids as a water quality constituent along near shore open coasts. All of the sample geometric means are well within this standard. There does not appear to be any long term trend in turbidity levels within Turtle Bay.

Total nitrogen, and nitrate plus nitrite levels typically exceed the State Water Quality standards, particularly at the very nearshore sample stations. The higher nitrogen concentrations in nearshore samples show that these constituents are likely carried to the shore in groundwater. Because of the strong relationship between nitrogen concentration and ground water input (Figure 4-7) the two most practical ways to lower nitrogen in nearshore waters would be to either lower the nitrogen in the ground water or to increase the rate of mixing and offshore transport of nearshore waters.

Total phosphorous concentration is likely a more important variable than nitrogen concentrations in nearshore aquatic environments, because it is typically the limiting nutrient for plankton or plant growth. In contrast to Kawela Bay where TP concentrations were generally above State Water Quality Standards, in Turtle Bay these concentrations are, with one exception, generally lower than the State Water Quality Standard. Therefore in Turtle Bay the growth of algae and phytoplankton is generally phosphorous limited and there is not a strong correlation between turbidity (caused by plankton growth) and total nutrient concentration (Figure 4-7). Water quality within Turtle Bay appears to be strongly influenced by the rapid exchange of water with the open ocean as it is pumped in across the reef by wave action and exits through the drowned stream bed. Nutrient levels within the bay can reach very high concentrations during storm water outflow events through the West Main Drain, but due to the high exchange rate these high concentration do not persist and water quality rapidly improves. There is no apparent long term trend in water quality within the bay.

Figure 4-7. Top: Relation between Salinity and nitrate plus nitrite in Turtle Bay. Middle: Relationship between total nutrients (TN+8TP) and turbidity, and Bottom: TN Vs TP in Turtle Bay



2006-2011 data only. Compare to Figure 3-10

4.4 Marine Biological Resources

4.4.1.1 Benthic Surveys: Fish, Coral, and Algae

Benthic marine surveys were conducted in the nearshore waters in Turtle Bay off the West Main Drain during March and September 2011. The surveys were conducted along 100-foot transects parallel to shore approximately 50-feet, 100-feet, and 150 feet off the shoreline at the extreme west end of the bay. The nearshore survey is over a heavily scoured rough hard substrate in the surge zone just below the beach in about 4 feet of water. The survey 100 feet offshore is still over a hard beach-rock substrate but slightly deeper with slightly less surge, more gravel, and greater vertical relief. Both transects display abundant macro algae, calcareous algae, and occasional small corals. The third survey, at 150 feet from shore is deeper (six to ten feet) and lies just inshore of the edge of the submerged prehistoric stream bed. Substrate is highly irregular along this outer transect with large cracks and caves in solid substrate and provides a myriad of niches in which fish and invertebrates find refuge. This transect displayed both the highest total fish count (35) and the greatest number of fish species seen (eight).

Table 4-2. Benthic survey results from three transects within Kawela Bay, 2011

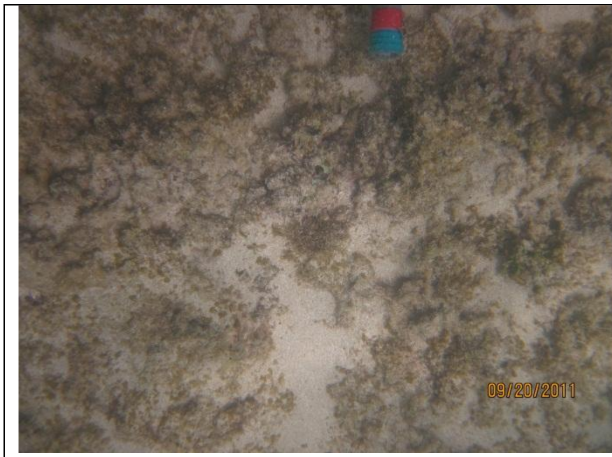
	1			2			3		
	Turtle Bay Nearshore			Turtle Bay MidShore			Turtle Bay Channel		
	March	Sept	% cover	March	Sept	% cover	March	Sept	
RESULTS SUMMARY CHART	# Points	# Points	%	# Points	# Points	%	# Points	# Points	%
SUBSTRATE (only)	58	151	20.7	31	136	16.7	1	496	49.7
CORAL	0	1	0.1	0	0	0.0	5	0	0.5
OTHER INVERTEBRATES	0	0	0.0	0	0	0.0	0	0	0.0
CORALLINE ALGAE	27	54	8.0	56	9	6.5	88	0	8.8
TURF ALGAE	406	115	51.6	387	280	66.7	399	0	39.9
NATIVE ALGAE	14	21	3.5	11	70	8.1	4	0	0.4
INVASIVE ALGAE	0	1	0.1	0	1	0.1	0	0	0.0
CYANOBACTERIA	0	155	15.3	0	0	0.0	0	0	0.0
UNKNOWN	0	0	0.0	3	0	0.3	0	0	0.0
TAPE, QUADRAT, SHADOW	5	2	0.7	12	4	1.6	4	4	0.8
TOTAL POINTS	510	500	100	500	500	100	501	500	100

	1			2			3		
	Turtle Bay Nearshore			Turtle Bay MidShore			Turtle Bay Channel		
	March	Sept	% cover	March	Sept	% cover	March	Sept	% Cover
CATEGORIES			%						
BENTHIC SUBSTRATE									
Benthos (BENTH, HARD)	258	187	45.8	390	287	68.9	405	437	83.9
Boulder (BOULD)(ROCK)	0	0	0.0	0	0	0.0	0	2	0.2
Cobble (COB)	2	8	1.0	0	4	0.4	21	17	3.8
Rubble (RUB)	1	6	0.7	9	25	3.5	74	26	10.0
Gravel (GRAVEL)	0	3	0.3	6	6	1.2	4	4	0.8
Coarse Sand (CSAND)	6	8	1.4	2	165	17.0	0	8	0.8
Fine Sand (FSAND)	212	280	50.7	89	0	9.1	1	5	0.6
Mud (MUD)	0	0	0.0	0	0	0.0	0	0	0.0
Substrate Total	479	492	100.0	496	487	100.0	505	499	100.0

Table 4-3. Fish transect results from two surveys of three transects in Turtle Bay, 2011

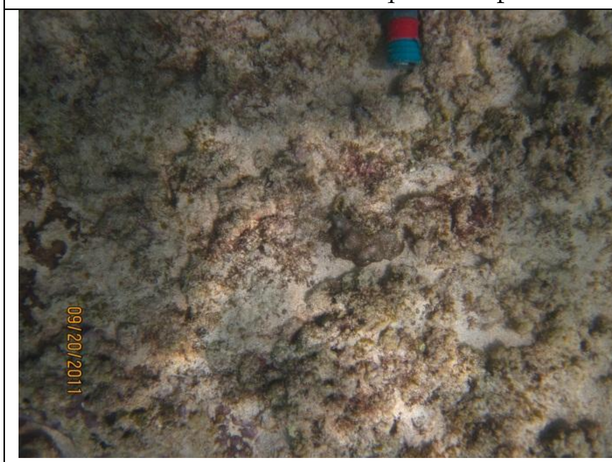
				Turtle Bay				
			W1		W2		W2	Total
		March	Sept	March	Sept	March	Sept	Fish
Surgeon Fish	Acanthurus leucopareius						2	2
	Acanthurus nigrofuscus						2	2
	Acanthurus triostegus		3		3		8	14
	Acanthurus xanthopterus							
Butterflyfish	Chaetodon auriga							
Goat fish	Mulloidicthys flavolineatus							
Box fish	Canthigaster jactator					1		1
	Canthigaster amboinensis							
	Ostracion meleagris							
Wrasses	Coris flavowittata						1	1
	Coris venusta	9	3	3	2	6	3	26
	Labroides phthirophagus							
	Stethojulis balteata						2	2
	Thalassoma duperrey	4	3	9	5	17	14	52
	Thalassoma purpureum	2		2		1	1	6
	Thalassoma trilobatum	1				1		2
Damselfish	Plectroglyphidodon imparipennis		5	3	2	7	8	25
	Plectroglyphidodon johnstonianus						1	1
	Abudefduf abdominalis						1	1
	Stegastes marginatus			1		1	3	5
Triggerfish	Rhinecanthus rectangulus	4	1	2		1	2	10
	Total Species Count	5	5	6	4	8	13	15
	Total Number Fish	20	15	20	12	35	48	150

Figure 4-8. Complex benthic communities are common over nearshore lagoon reef flat



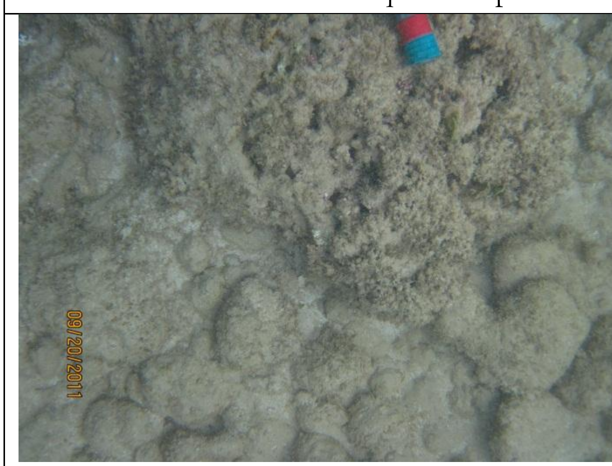
West Main Drain Nearshore quadrant photo

West Main Drain Nearshore detail photo



West Main Drain Mid-shore quadrant photo

West Main Drain Mid-shore detail photo



West Main Drain Offshore quadrant photo

West Main Drain Offshore detail photo

Figure 4-9. Representative photos from three transects in Turtle Bay in shallow water off the West Main Drain Outlet

5. KUILIMA BAY

5.1 General Physical Description

Of the three embayments along the project coastline, Kuilima Bay is the most exposed to the open ocean. The shoreline is dominated by reef-rock supporting a perched beach from Kuilima Cove to Kahuku Point. Although the long beach makes this shore popular for beach walking, the rough shoreline and exposure to open ocean waves makes access to the water challenging. Midway along the beach near the center of the bay, a 20-foot wide channel has been excavated through the beach rock shore to allow for the passage of stormwater from ʻŌʻio Stream, but this depression is often filled with sand from the perched beach to either side. The shoreline is a vertical beach-rock face dropping to a sand and rubble bottom in six to eight feet of water. The sand bottom extends about 200 feet from shore where its depth gradually increases to about 12 feet. Beyond this a hard bottom substrate with scattered corals and reef rubble gradually shallows to a depth of six to eight feet over an indistinct reef crest about 500 feet off shore. The reef crest is discontinuous near the center of the bay with passes deeper than 10-feet extending from nearshore to offshore areas. This deep reef crest allows a significant quantity of wave energy to impact the shoreline, much more than either Turtle Bay or Kawela Bay. The 30-foot depth contour is reached about 2000 feet off shore across multiple hard bottom reef areas.

The coral reef off of this section of coast does not form a contiguous barrier against the open ocean swells, and is physically closer to the shore than at either Turtle Bay or Kawela Bay. Because of the relative discontinuity of the reef, there is a greater diversity of habitat in the nearshore reef. NOAA coral reef habitat maps for this shoreline (Figure 2-10) categorize this reef as "Spur and groove" formation dominated by "turf" cover. However this greatly oversimplifies the character of the reef. The bay receives outflow from the ʻŌʻio Stream near the center of Kaihalulu Beach less than a mile East of the Turtle Bay Kuilima Resort. The stream outlet is often termed the "East Main Drain." Total Stream length is approximately four miles up to the top of the Koʻolau Mountains at an elevation of 1200 to 1600 feet. The total direct watershed area is approximately 2.56 square miles. During periods of heavy rainfall and runoff the ʻŌʻio Stream also receives overflow runoff from the Punahoʻolapa Wetland and the Hoʻolapa Stream.

The alignment of ʻŌʻio Stream has been changed several times according to historical maps of the area. Kahuku Plantation maps from the 1890's (State register 1460 Map 3 and Map 4) show this stream ending not far from the foot of the mountains at the "Old Government Road," with no outlet to the ocean. In maps from 1932 (State Topo Survey Map No. 4754) much of the land is designated as "sugar plantation" and the stream mouth is shown out-letting into the small cove just east of Kuilima Point and present location of the Turtle Bay Hotel. During the 1940's when aviation landing strips were constructed across the site, the mouth of the stream again becomes unclear, but by 1952, USGS maps show the stream again out-letting (as Kuilima Stream) at Kuilima Point, with another un-named stream skirting the west end of the Kahuku Airfield and entering the ocean at the present site of the ʻŌʻio Stream. The present straightened alignment appears to have been constructed as part of the golf course construction in the 1960's. Once the stream crosses under the Kamehameha Highway onto the Turtle Bay Shoreline plateau, the elevation is very low and waters from adjacent watersheds may co-mingle under heavy flow events. The stream courses along a relatively straight path from the Kamehameha Highway through the grounds of the Turtle Bay Golf course, through a primarily grassed, and typically dry, swale. Under heavy rainfall storm-flow conditions adjacent fairways may be flooded and flow direction is dependent upon which stream mouth (ʻŌʻio Bakahan to the east) is open to the ocean. The mouth of the ʻŌʻio stream is confined by a golf course road bridge constructed over three 3-foot diameter drainage pipes leading to the beach.

Beach sand that accumulates at the ocean end of these outlets must be mechanically cleared to allow the passage of storm waters.

Others (R.M. Towill, Aug. 1998) have determined that a 100-year flood would produce a peak storm flow in ʻŌʻio Stream of approximately 5,600 cubic feet per second (cfs). The present three 3-foot diameter pipes can handle only about 2000 csf. The City has proposed improvements to the ʻŌʻio stream channel to contain the storm flow including the construction of a 70-foot Kamehameha Highway bridge, and a 100-foot wide approximately nine foot deep grassed swale across the golf course. Conceptual plans have not yet been developed to modify the outlet structure making it capable of handling the 8000 cfs flow anticipated from ʻŌʻio Stream and other sources during a 100-year storm event.

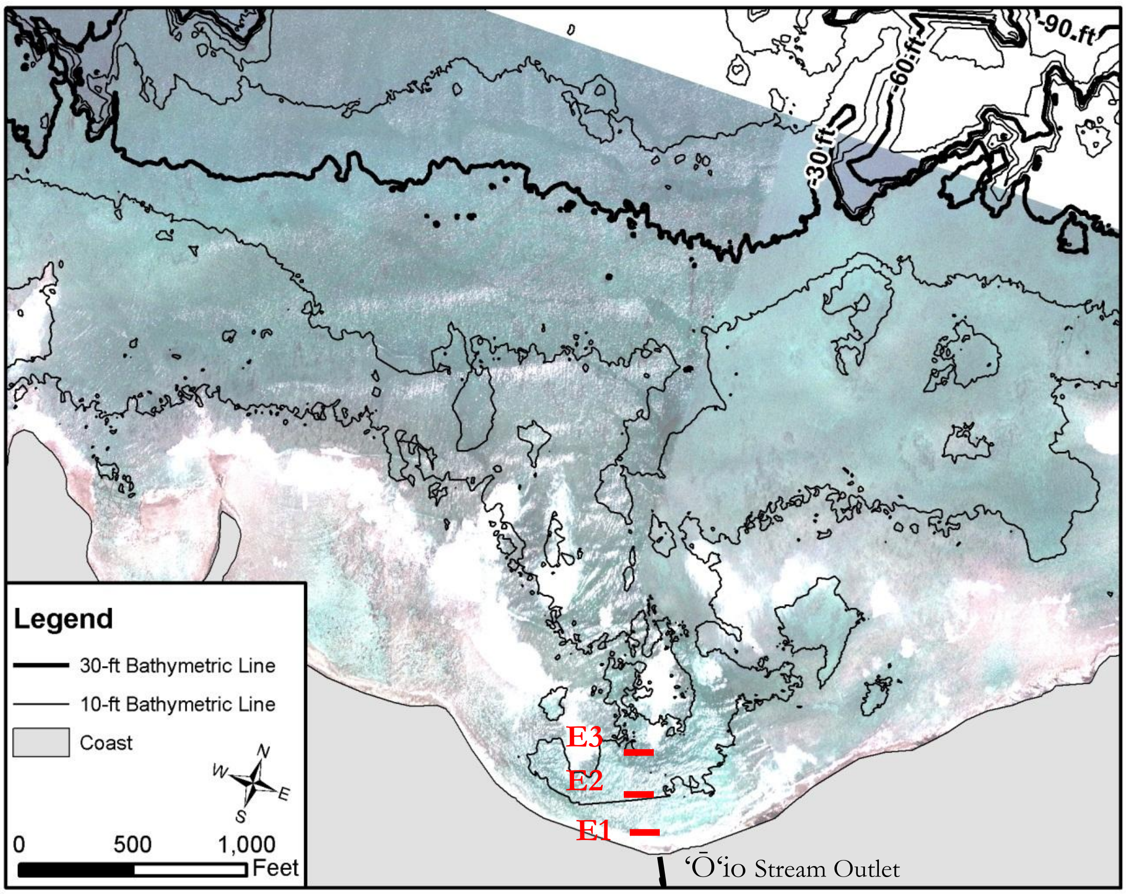


Figure 5-1. Bathymetry of Kuilima Bay showing location of ʻŌʻio Stream and transect locations

5.2 Waves and Currents

Of the three bays along the project coastline, the East Main Drain within Kuilima Bay presents the most open shoreline to the ocean waves and currents. The reef directly off of the East Main Drain is not as well formed, as wide, or as shallow as the reef off of Turtle Bay and subsequently allows much more wave energy to pass to the shore. Nearshore currents, both during rising and falling tides, were long shore from east to west, directly towards the main Turtle Bay Hotel facility (Figure 5-2). This is consistent with visual observations during outflow events where the plume of muddy water stays relatively close to shore and moves towards the west.

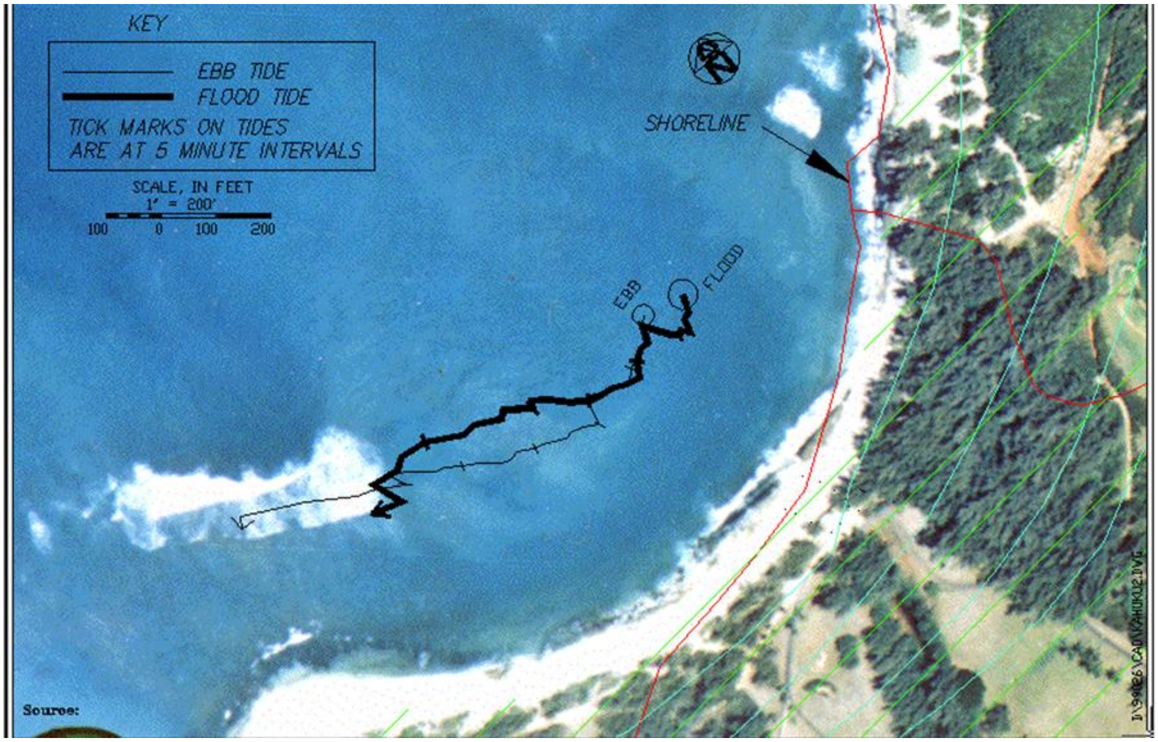


Figure 5-2. Nearshore currents in Kuilima Bay are along shore towards Kuilima Point

5.3 Water Quality

Water quality has been monitored in Kuilima Bay during three time periods, semi-annually from 1989-1994, monthly for one year during 2001-2002, and quarterly from 2006 to the present. The location of these sample sites is shown in Figure 5-3.

Table 5-1 displays the geometric mean value for each water quality constituent collected at each of the sample sites within Kuilima Bay for each survey period, and then the whole-bay average during each survey period for each constituent. The graphics in Figure 5-4 present these same three data sets, but with the geometric means expressed by month, to show any seasonal trends in the data. The graphs are all of the same scale as those of Figure 3-8 for Kawela Bay and Figure 4-5 for Turtle Bay to allow for ease of comparison between bays. Figure 5-5 displays one month of hourly data from the 2001 survey as a data visualization graph for physical water quality constituents only.

Nitrate plus nitrite levels in the ocean waters off the ʻŌʻio stream outlet are generally low, consistent with Oceanic or open dry coastline concentrations indicating low groundwater input at this site. The concentrations measured range from 0.5 ug/l. in May and June to 6.5 ug/l. in July 2001 at station E5. Total Nitrogen levels are not exceptionally low, being more on the level with nutrient concentrations typical of Wet Open Coastlines and Estuaries (according to State Standards). There are many potential sources of nitrogen in groundwater including animal feces, fertilizers, cesspool systems, and decayed plant material. The nearshore marine environment also adds to these sources with fish and invertebrate wastes and decaying plankton or benthic algae. Nitrate plus nitrite concentrations impacting this site are not as high as in the other two bays. Groundwater inflow at this location does not appear as significant as either Kawela or Turtle Bays and in combination with high nearshore turbulence, does not allow concentrations of these nutrients to build to significant elevations.

Total nitrogen levels are lower than both Kawela Bay and Turtle Bay, but still slightly above State Water Quality Standards for Wet Open Coast. There does appear to be a long-term trend toward increasing total nitrogen in the water during the past 22 years, but the source of this increase is unknown.

Total phosphorous (TP) levels are well below State Water Quality Standards and show no long term trends over the past 22 years. The monthly sampling conducted in 2001 appears to show a slight trend of increasing TP levels during summer months, but the concentrations typically stay below the 20 ug/l state standard except for individual very nearshore samples. The slight increase in summer TP concentrations during 2001 is correlated with both an increase in turbidity and an increase in chlorophyll-a concentrations.

A meter near the shore just west of the East Main Drain outlets into Kuilima Bay recorded physical water quality data on an hourly basis for one year in 2001. One month of this data is shown in Figure 5-5 as data interpretive graphic with colors representing measured values. Examination of the graphic shows a turbidity event beginning on January 12 with a storm and large wave event followed an outflow from the drain to the ocean. The period of turbid water lasted five days with significant outflow from the stream occurring over a period of three days until water subsided and the ocean closed the stream outlet with sand from adjacent beaches.

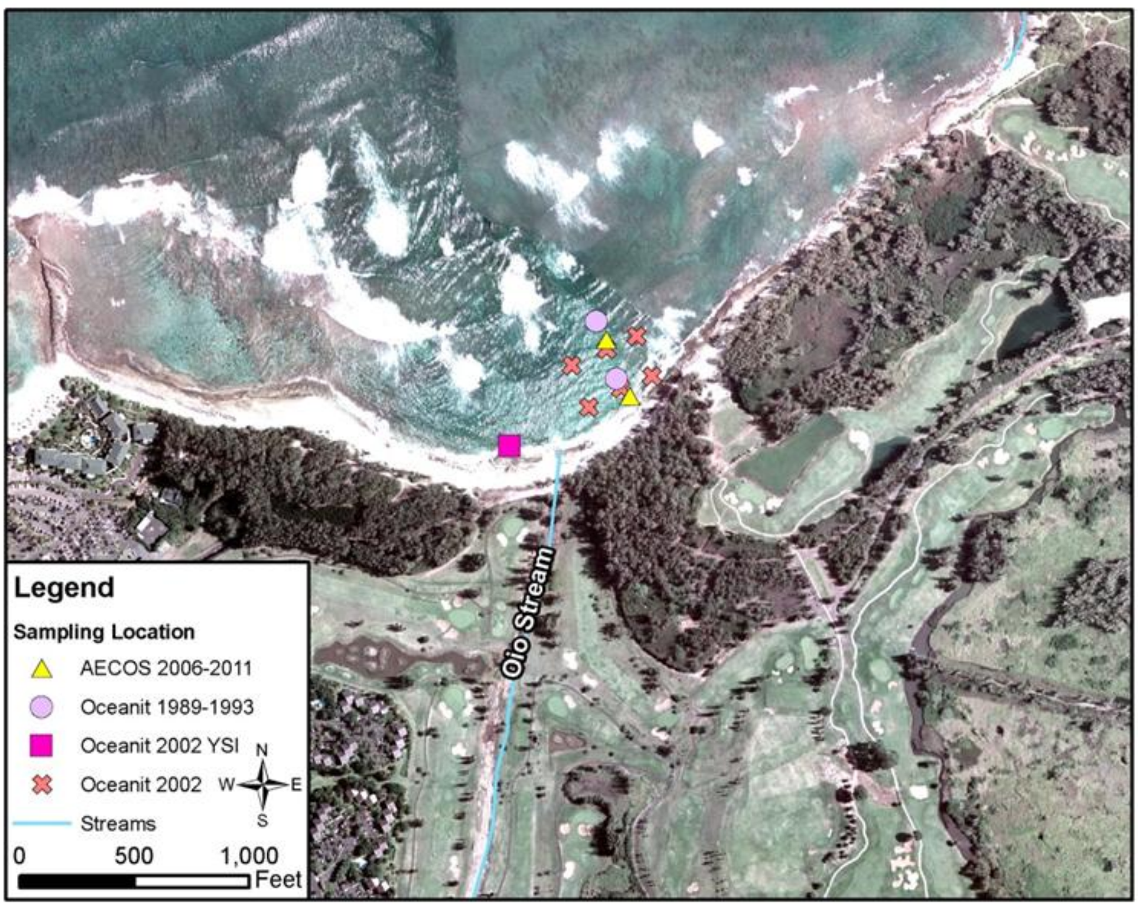
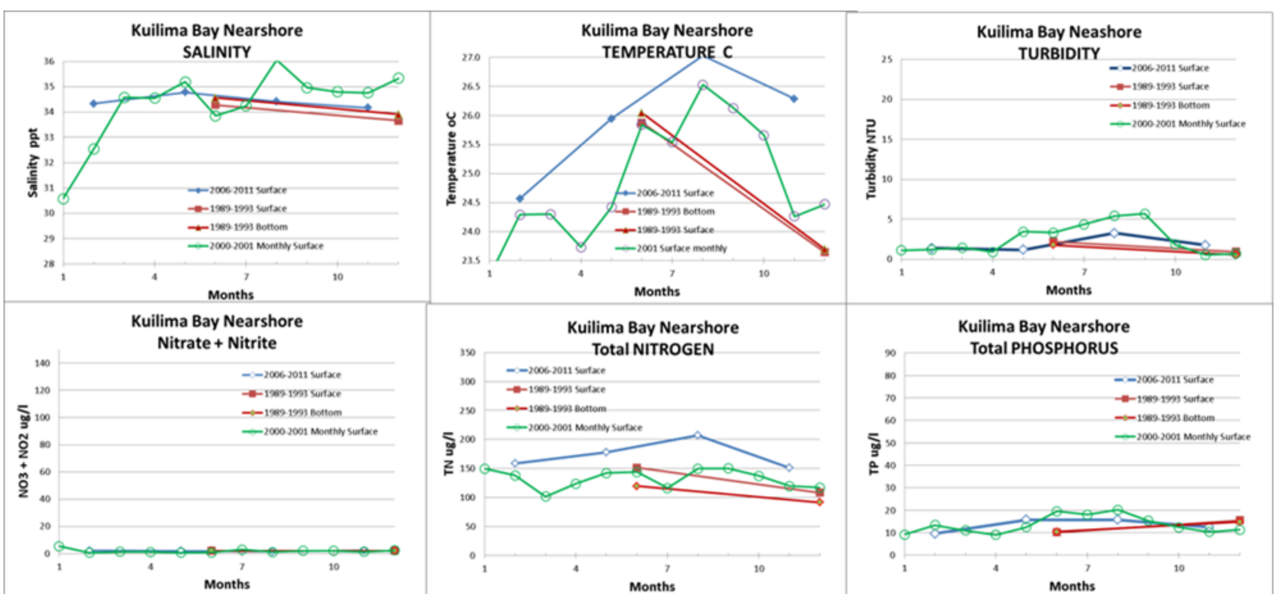


Figure 5-3. Location of water quality samples during three survey periods in Kuilima Bay

Table 5-1. Summary of water quality from three surveys over 22 years at Kuilima Bay

Kuilima Bay		Temp.	Diss. Oxygen	pH	Salinity	Turbidity (lab)	Total Susp. Solids	Ammonia	Nitrate + Nitrite	Total Nitrogen	Total Phosphorus	Chlorophyll a	Silicates
		(° C)	(mg/L)		(ppt)	(NTU)	(mg/L)	(ug N/L)	(ug N/L)	(ug N/L)	(ug P/L)	(ug/L)	(ug/L)
1989-1994													
	E1-1 surface	24.81	6.0		34.09	1.4			3.06	123.09	12.2		
	E1-2 - mid-water	24.71	6.3		34.43	1.0			1.99	102.36	12.1		
Each Value	E2-1 - surface	24.71	6.5		34.29	0.7			2.11	98.34	9.9		
Geo Mean of	E2-2 - mid-water	24.62	6.4		34.45	0.7			2.7	97.18	12.1		
10 semi-annual samples													
	Average	**24.71**	**6.30**		**34.32**	**0.91**			**2.46**	**105.24**	**11.59**		
2002													
Each GM of	Near Shore (10 ft)	25.12	7.5	8.08	33.63	2.4	7.76		4.06	154.0	15.92	0.93	
33 samples	Off Shore (300 ft)	25.11	7.5	8.17	35.43	1.7	5.05		2.84	123.5	11.72	0.47	
	Average	**25.11**	**7.5**	**8.1**	**34.53**	**2.0**	**6.4**		**3.4**	**138.7**	**13.8**	**0.70**	
2006-2011													
Each GM of	Nearshr Surface	25.94	6.48	8.20	34.44	1.7	9.5	1.61	2.10	172.6	13.2	0.66	415
21 samples	Offshore Surface	25.65	6.61	8.17	34.47	1.3	7.3	1.39	3.51	156.6	10.6	0.38	356
	Offshore Bottom	25.58	6.87	8.18	34.42	1.3	8.0	1.21	3.34	165.1	11.9	0.43	323
	Surface Only	**25.80**	**6.55**	**8.19**	**34.45**	**1.50**	**8.39**	**1.50**	**2.80**	**164.58**	**11.94**	**0.52**	**385.77**
Open Coast	Wet Season					0.50	20	3.5	5	150	20	0.30	
State WQ Std	Dry Season					0.20	10	2.0	4	110	16	0.15	

* Measured constituents with a geometric mean greater than the State WQ Open Coast Wet season standard are noted in blue



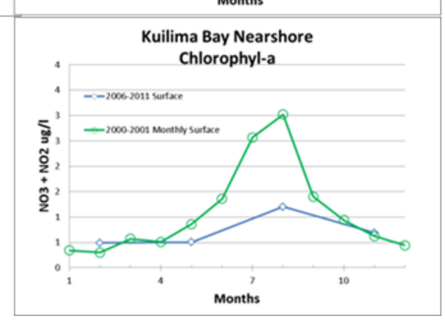


Figure 5-4. Graphic display of annualized geometric mean data from three studies conducted in Kuilima Bay since 1989

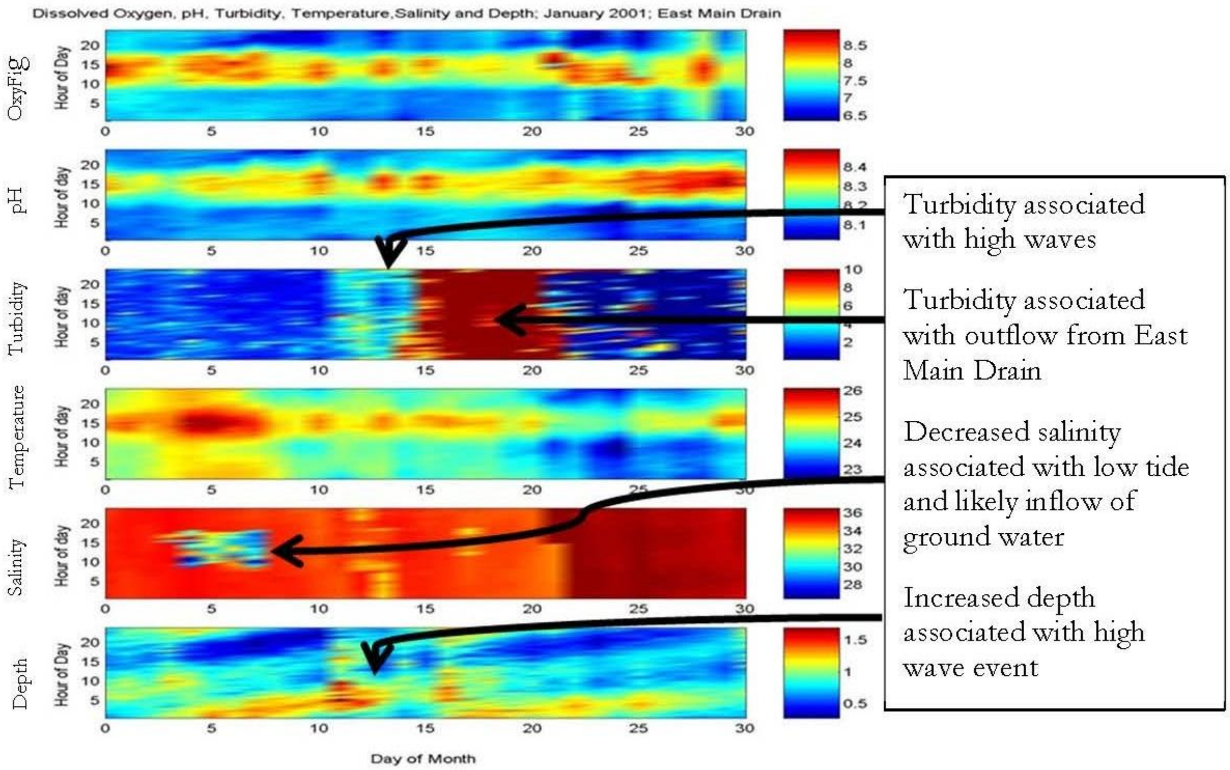


Figure 5-5. Water quality interpretive graphic from Kuilima Bay, January 2001

Examination of Figure 5-5 is critical as it shows how daily and sometimes hourly changes in water quality can be significant factors. With the possible exception of a slight increase in total nitrogen concentrations, there do not appear to be any significant changes in water quality during the 22-year period of measurement at this site. The concentration of total nitrogen in Kuilima Bay is lower than in either Turtle Bay or Kawela Bay.

5.4 Marine Biological Resources

5.4.1 Benthic Surveys: Fish, Coral, and Algae

The nearshore benthic habitat changes with distance from the abrupt shoreline out to the reef crest. The intertidal zone consists of the beach-rock surface. Where the surface has been protected by sand it forms a ledge sloping towards the sea with vertical broken edges and cracks exposed to the ocean. The cracks and biological borings of the exposed surface support the growth of intertidal mollusks and, deeper, boring echinoderms. Where the cracks are too narrow for fish to graze they commonly support a growth of bright green Ulva seaweed, which is often considered to be an indicator of fresh water intrusion. At the bottom of the bench and extending 100 to 200 feet from shore is a relatively flat seascape six to 12 feet deep with at least 50 percent cover of fine to coarse sand and rubble with exposed hard substrate covered with a fine algae turf. Further from shore the fine sand is replaced by coarse sand and the depth begins to decrease with increasing incidence of raised shelves and reef rubble supporting more algae and an occasional small coral. The most prevalent algae was *Halameda sp, Acanthophora sp.* and *Martensia sp.* Farther than 300 feet from the beach, the back side of the reef is approached, with the water generally shallowing, and the surface relief beginning to show more complexity, more reef rubble, occasional reef boulders and a greater predominance of coralline and fleshy algae and more common corals on the uplifted surfaces. The crest of the reef, at about 450 to 500 feet offshore, displays a complex highly variable reef top within two to six feet of the surface without obvious finger and groove formations but irregular 10-foot-deep channels between reef patches. The most visibly prevalent corals are lobe coral (*Porites. lobata*) and cauliflower corals (*Pocillopora meandrina*).

Benthic surveys were conducted over 100-foot long transects laid parallel to shore 25 feet, 100 feet and 150 feet off shore. A continuous string of 50 photographs was taken along one side of the transect line and the results tabulated by percent benthic substrate type, and then by percent of biological cover over the substrate (Table 5-2). These surveys are in good agreement with those conducted in 1989-1994 and again in 2002 by Oceanit and characterize these nearshore areas as being relatively low relief, highly mobile sand and gravel sediments, little habitat for fish (except at the shoreline), and low percent cover of either coral or fleshy algae.

The characteristics of the benthic habit improves markedly as one moves away from the shore to the inner extent of the active reef about 300 to 400 feet off shore. The reef is highly irregular with a profusion of sand patches, ledges, and uplifted reef sections supporting a healthy growth of corals.

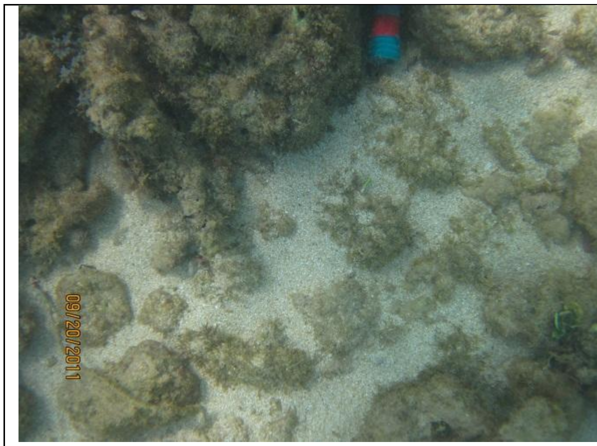
Figure 5-6. Much of the benthic substrate immediately off the East Main Drain in Kuilima Bay is dominated by sand and rubble with little vertical substrate

		1			2			3	
	Kuilima Bay Nearshore			Kuilima Bay Midshore			Kuilima Bay Offshore		
	March	Sept	% cover	March	Sept	% cover	March	Sept	
RESULTS SUMMARY CHART	# Points	# Points	%	# Points	# Points	%	# Points	# Points	%
SUBSTRATE (only)	47	254	30.1	156	136	28.9	175	127	30.2
CORAL	0	0	0.0	1	0	0.1	0	0	0.0
OTHER INVERTEBRATES	0	0	0.0	0	0	0.0	0	0	0.0
CORALLINE ALGAE	19	4	2.3	10	9	1.9	24	12	3.6
TURF ALGAE	402	210	61.2	308	280	58.3	280	277	55.7
NATIVE ALGAE	25	30	5.5	29	70	9.8	12	82	9.4
INVASIVE ALGAE	0	0	0.0	0	1	0.1	0	0	0.0
CYANOBACTERIA	0	0	0.0	0	0	0.0	0	0	0.0
UNKNOWN	0	0	0.0	0	0	0.0	0	0	0.0
TAPE, QUADRAT, SHADOW	7	2	0.9	5	4	0.9	9	2	1.1
TOTAL POINTS	500	500	100	509	500	100	500	500	100
	Kuilima Bay Nearshore			Kuilima Bay Midshore			Kuilima Bay Offshore		
	March	Sept	% cover	March	Sept	% cover	March	Sept	% Cover
CATEGORIES			%						
BENTHIC SUBSTRATE									
Benthos (BENTH, HARD)	274	187	47.0	78	287	37.0	285	355	63.0
Boulder (BOULD)(ROCK)	28	0	2.9	3	0	0.3	0	0	2.8
Cobble (COB)	14	8	2.2	1	4	0.5	4	4	1.8
Rubble (RUB)	19	6	2.5	2	25	2.7	15	8	2.7
Gravel (GRAVEL)	7	3	1.0	1	6	0.7	3	7	1.4
Coarse Sand (CSAND)	147	8	15.8	415	165	58.8	193	122	26.9
Fine Sand (FSAND)	0	280	28.5	0	0	0.0	3	0	0.0
Mud (MUD)	0	0	0.0	0	0	0.0	0	0	0.0
Substrate Total	489	492	100.0	500	487	100.0	503	496	98.6

Table 5-2. Benthic survey results from two surveys over three transects within Kuilima Bay, 2011

				Kuilima Bay				
			E1		E2		E3	Total
		March	Sept	March	Sept	March	Sept	Fish
Surgeon Fish	Acanthurus leucopareius							
	Acanthurus nigrofuscus							
	Acanthurus triostegus				5			5
	Acanthurus xanthopterus							
Butterflyfish	Chaetodon auriga							
Goat fish	Mulloidicthys flavolineatus							
Box fish	Canthigaster jactator	1	1				1	3
	Canthigaster amboinensis							
	Ostracion meleagris							
Wrasses	Coris flavowittata							
	Coris venusta	4	2	1	5	3	2	17
	Labroides phthirophagus							
	Stethojulis balteata							
	Thalassoma duperrey	1			1			2
	Thalassoma purpureum							
	Thalassoma trilobatum				1			1
Damselfish	Plectroglyphidodon imparipennis	1				1		2
	Plectroglyphidodon johnstonianus							
	Abudefduf abdominalis							
	Stegastes marginatus							
Triggerfish	Rhinecanthus rectangulus	1						1
	Total Species Count	5	2	1	4	2	2	7
	Total Number Fish	8	3	1	12	4	3	31

Table 5-3. Fish transect results from two surveys of three transects in Kawela Bay, 2011

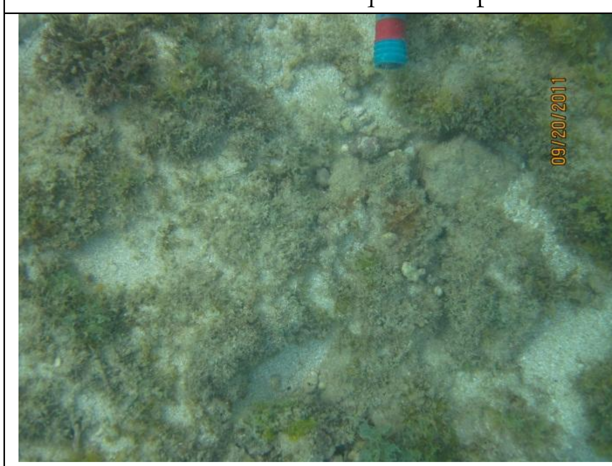


KUILIMA BAY Nearshore quadrant photo

KUILIMA BAY Nearshore close up detail

KUILIMA BAY Midshore quadrant photo

KUILIMA BAY Midshore close up detail



KUILIMA BAY Offshore quadrant photo

KUILIMA BAY Offshore close up detail

Figure 5-7. Representative photos from three transects in Kuilima Bay in shallow water

6. IMPACT ANALYSIS FROM PROPOSED DEVELOPMENT COMPONENTS AND RECOMMENDATIONS FOR MITIGATION

This analysis accounts only impacts from the proposed development to coastal living marine resources (fish, coral, invertebrates, turtles, seals), coastal water quality, and coastal currents and waves. It is accurate to the extent that we understand the elements proposed in the development and the coastal ecosystem disclosed through the studies of various researchers as cited. Potential nearshore impact to the marine ecosystem from any shore-side development includes:

- short-term construction impacts (primarily sediment from runoff or dewatering)
- nutrient enrichment or pollution of nearshore waters from
    - agriculture, horticulture, hotel grounds, or golf course fertilization
    - R2 water (treated sewage) golf course irrigation
    - commercial herbicide application
- changes in ground water or surface water flow patterns
- impacts related to improved shoreline access and higher human population
    - unintentional takes of ESA species (primarily sea turtles and monk seals) that frequent the coastline
    - increased fishing pressure
    - increased potential for ESA/fishing gear entanglement
    - lights that disorient juvenile turtles

The first stage of avoiding adverse impacts is to recognize where these potential impacts may lie, and to then design to avoid, minimize, or mitigate for unavoidable impacts. The baseline survey serves as both a point of reference to gage any future impacts and as a source of information for project designers to incorporate all possible means to avoid, minimize or mitigate adverse impacts.

Because the site is riddled with sub-surface caves, any dewatering that needs to occur as part of any construction activity should carefully control effluent water and not direct it to unlined dug pits where it will likely find a direct route to the shoreline.

Along the Kuilima shoreline, there are three primary surface outfalls to the nearshore waters and several focused points of groundwater input. Balancing the flow between these outfall points as discussed in the North Shore flood assessment reports will be key to minimizing adverse impacts to nearshore ecosystems. Results from our analyses indicate that storm runoff may presently be over-allocated to Kawela Bay, and significantly under allocated to the West Main Drain in Turtle Bay. Engineering to modify these flows could have a significant positive impact upon the nearshore environment. Specifically, restoring the Kawela Stream to its original alignment outfalling to the West Main Drain would have a new, large positive impact on Kawela Bay with minimal adverse impact in Turtle Bay.

Improving access to the shoreline will lead to a greater probability of interactions between people and sea turtles or monk seals, both of which are on the Federal endangered species list. Any human interaction that causes an endangered species to alter its behavior may be considered as a “take” by Federal agencies. While this may seem extreme, NOAA recognizes that minimal interaction with turtles and seals is not likely to result in permanent harm (at least not for the seals or turtles) and is primarily concerned with overt interactions and conflicts with fishing gear. Probably the best way to mitigate this impact is through a public education program that advises beach goers of their stewardship responsibility towards these creatures. Federal wildlife managers have expressed concern that lighting from the expanded Turtle Bay Development may disorient juvenile turtles (and fledgling seabirds). Consideration should be given to a development-wide lighting design that minimizes light impact towards the beaches and ocean.

Improving access to the shoreline will likely lead to an increase in fishing pressure and an equal increase in illegal or destructive fishing practices. In addition to providing educational material about stewardship, the Turtle Bay Development management should work closely with State agencies charged with fisheries management and with concerned fishermen from this ahupua'a to investigate the initiation of marine protected area status for the coastline to include closed, rotational, or restricted fishing areas, seasons, or other methods of stewardship.

The potential for increased ground water nutrient input should be addressed through appropriate vegetation management planning (integrated fertilizer and pest management plans), and may also include extension activities directed at farm operators located up-slope of the development. Development of a nutrient budget and tracking of fertilizer applications over time are keystones to good long-term management. Controlling sediment influx from winter storms through upslope detention (desilting) basins and appropriate vegetation of bare exposed slopes could greatly reduce the adverse impact of these winter storms to the nearshore ecosystem.

The other potential large source of nutrients to groundwater, and thereafter to nearshore coastal waters is human sewage. The Turtle Bay Development operates a sewage treatment plant with lagoon treatment and effluent recycled as R2-water for irrigation of the golf course. A review of the operation of this plant is beyond the scope of this report, but is under study by others as part of the resort expansion plan. At the new shoreline park in Kawela Bay, special consideration should be given to public restroom facilities as any groundwater generated by this system will enter the bay at a point with minimal circulation, dilution, or offshore transport. Shoreline residential lots both east and west of the development treat sewage either with individual cesspool or septic systems. In 2005 all large capacity cesspools were required by the EPA to be upgraded and the State no longer gave permission to construct individual home cesspools. But individual residential cesspools are still in use in many coastal areas and these likely contribute to nearshore nutrient enrichment. In areas where coastal circulation is limited (i.e. Kawela Bay) the number and type of individual waste treatment systems should be enumerated and consideration should be given to mechanisms whereby individual residential cesspool or septic systems could be upgraded thereby reducing adverse impact to a common resource.

7. SUMMARY

There are a variety of ways in which coastal developments could adversely impact public marine resources if appropriate measures are not taken to avoid or mitigate these impacts. The goal of this report has been to describe the variety and quality of the marine resources in the nearshore area along the project coastline, understand how these resources may have changed over time and uncover potential threats to these resources from the present and planed development.

Living marine resources along the very nearshore area of the Kuilima coast appear relatively unchanged or improved over the past 22 years. The benthic surveys were restricted to very nearshore waters, less than about three-hundred feet from shore, and were not intended to characterize the quality of the offshore coral reef system nor the health of recreational fisheries. The status of recreational and commercial fisheries is challenged around the entire state and is beyond the scope of this survey. The intent of the surveys was to characterize benthic resources adjacent to storm water and stream outfalls as these locations are the most sensitive to potential impacts from land based pollution. The study was divided between the three principle bays along the shoreline Kawela Bay, Turtle Bay, and Kuilima Bay.

Kawela Bay encompasses a large (~80 acre) relatively shallow bay consisting primarily of a back-reef lagoon with minimal wave impact or influence from coastal currents. While large corals are present in deeper sand channels on both sides of the bay, the majority of the fixed benthic substrate is shallow and is dominated by a wide variety of macro algae. It is likely that the macro-algae grows well within the bay because of decreased impact from large waves, the relatively high concentration of nutrients (particularly phosphorus) in the bay, and the shallow extent of the bay. Analyses of the benthic surveys showed Kawela Bay to have the highest near-shore coral counts (1.25 percent cover) and a moderate number of fish. Both fish and coral counts could be artificially low, however, because of very poor visibility along one of the transects located in the eastern highly turbid portion of the bay. The east near-shore portion of the bay is challenged by low circulation and the presence of large quantities of very fine silt making it very difficult for corals to grow. Inflow from Kawela Stream during large storm events has a long-lasting and adverse impact on water quality in the bay. Removal of this stream flow from this bay and restoration of its flow to Turtle Bay would likely have a large positive impact on Kawela Bay's ecosystem.

Turtle Bay is unique in that the shoreline along the western half of the bay is separated from the fringing reef by a deep (to 10 foot) lagoon. This lagoon exits the western portion of the bay in a 400-foot wide channel through the solid fringing reef and functions to channel wave-induced flow from over the reef back to the open ocean. While this natural rip-tide can pose a serious hazard to swimmers, it also functions to keep nearshore water quality high. The benthic transects in the nearshore area off the West Main Drain at the extreme west end of Turtle Bay produced the most diverse habitat with modest coral cover (0.2 percent) and highest fish counts. The channel through the reef, however, is uniform rubble and sand offering minimal habitat and an excellent pathway through the reef for runoff.

In Kuilima Bay the sand beach rests on top of a lithified limestone beach-rock bench, often with an abrupt drop-off at the shoreline into three- to eight-feet of water. The street ʻŌʻio stream enters the bay through a man-made breach in the beach-rock shoreline. The nearshore area within about 300 feet from the mouth of the ʻŌʻio stream is habitat limited and often impacted by coral sand sediments, but the offshore reef is very diverse and offers a variety of habitats for coral and fish. The offshore reef is neither broad nor shallow along this shoreline and this allows significant wave energy to strike the shoreline. A persistent long-shore current from east to west produces good water exchange along this shore. Within 300 feet from the mouth of the ʻŌʻio the coral cover was the lowest (0.03 percent) of the three bays and the substrate had the least complexity to offer cover for fish and invertebrates. Not surprisingly fish counts in nearshore Kuilima Bay were the lowest of the three bays (Table 7-1).

	Kawela Bay		Turtle Bay		Kuilima Bay	
	# Fish	# Sp.	# Fish	# Sp.	# Fish	# Sp.
Surgeon Fish	20	3	18	3	5	1
Butterflyfish	3	1	0	0	0	0
Goat fish	0	0	0	0	0	0
Box fish	5	3	1	1	3	1
Wrasses	29	3	89	6	20	3
Damselfish	7	3	32	4	2	1
Triggerfish	1	1	10	1	1	1
Totals	65	14	150	15	31	7

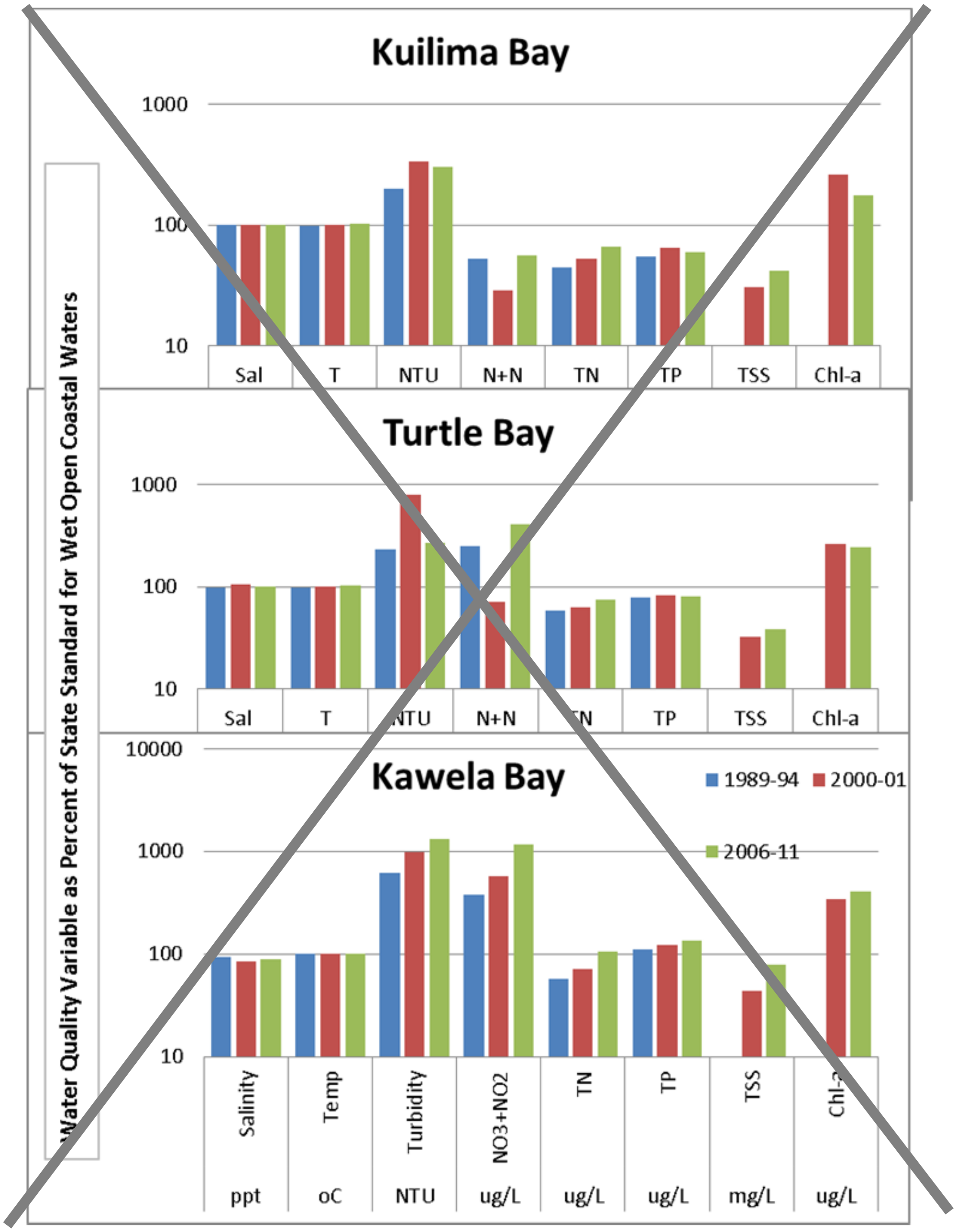
Table 7-1 Differences in Fish Counts between Bays along project shoreline.

A large potential impact to the marine resources along this shore will be the planned increase in human presence. In Kawela Bay the average number of people at the bay at any given time increased from seven people in the early 1990's to about 20 people in 2011. These numbers are expected to increase all along the coast with the increased density of development and improved public access. Resource managers have expressed concern that unfettered access to this shoreline may cause ecological harm through increased fishing and harvest as well as from unintentional damage due to trampling of shallow water habitats or impacts to endangered species. This later concern is more specific to Kawela Bay where a public beach park will likely result in a dramatic increase in beach use, and the shallow water habitat is susceptible to impact from walking. Any beach park at this location should incorporate educational signage to encourage stewardship from beach users.

Surveys of turtles (only in Kawela Bay) showed a 50 percent increase in population since the early 1990's. Analyses of NOAA turtle stranding data from this shoreline indicate that the turtles are larger as compared to two decades ago. Similarly the turtle survey data and NOAA database indicate that there has been an increase in the number of Hawaiian monk seals along this shoreline since 1985.

While increases in these large marine animals is a good thing, because they are both on the Federal Endangered Species List, it is important that the developer create public education programs to ensure that visitors and residents treat these species with due respect.

Water quality along the project shoreline has been monitored since 1989. There do not appear to be any significant long-term changes in water quality off the project shoreline. A graphical summary comparing water quality trends in all three bays between the three sampling periods over the past two decades is presented in Figure 7-2. For ease of comparison each water quality parameter is expressed as a percentage of a given standard. Apparent increases seen within Kawela Bay (turbidity, TN, NO3+NO2) are consistent with changes in sampling sites over the years (See Section 3.3).



~~**Figure 7-1. Summary of nearshore water quality off Turtle Bay Resort development site comparing data taken during three major sampling events (1989-1994 / 2000-2001 / 2006-2011). Variables are expressed as percent of State Water Quality Standard for Wet Open Coastal waters. Standard valuesfor Salinity (34 ppt), Temperature (25o C) and TSS (20 mg/L) are not State Standards.**~~

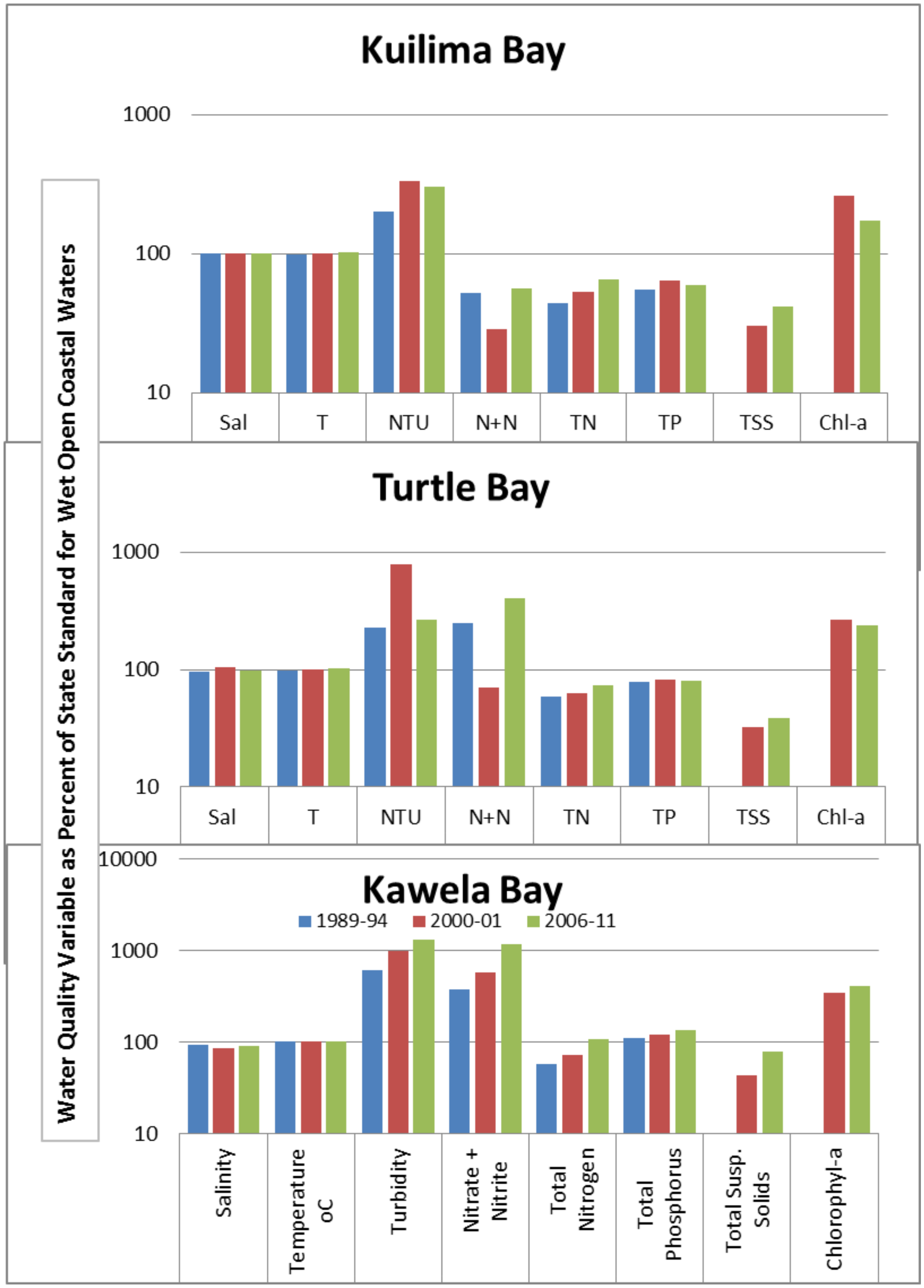


Figure 7-1 (Revised). Summary of nearshore water quality off Turtle Bay Resort development site comparing data taken during three major sampling events [1989-1994 (blue) / 2000-2001 (red) / 2006-2011 (green)]. Variables are expressed as percent of State Water Quality Standard for Wet Open Coastal waters. Standard values for Salinity (34 ppt), Temperature (25^{o} C) and TSS (20 mg/L) are not State Standards.

Water quality has been found to vary predictably with daily cycles, season, wave height, and the inflow from storm runoff through the four runoff outfall locations. During and shortly after runoff events State water quality standards for turbidity, total nitrogen, and total phosphorus are typically exceeded in the nearshore water of each bay. During prolonged periods when there is no stream outflow the waters of both Turtle Bay and Kuilima Bay are usually within State water quality standards, but the waters of Kawela Bay typically do not meet these standards. In Kawela Bay total nitrogen and total phosphorus did not meet state standards. These nutrients likely inflow with the large flux of groundwater and become concentrated due to the high residence time of water in the bay. Turbidity in Kawela Bay usually does not meet State standards, particularly in the eastern portion of the bay. Turbidity is likely the result of both sediment input from Kawela Stream and phytoplankton growth associated with the inflow of nutrient rich ground water. Nitrogen is commonly high in groundwater inflow, but the high concentration of phosphorus is unusual. Potential sources of the high groundwater phosphorus concentration include septic waste systems from adjacent homes, and fertilizers from up-slope agriculture.

With one possible exception, the proposed development does not include any physical modifications to the shoreline (sea walls, dredging, filling, boating facilities) that would directly impact nearshore marine resources or greatly alter their use. The one possible exception is the potential for altering the location, drainage area, or runoff characteristics of the four drainage outlets entering the three bays across the project coastline. This report has identified the influx of nutrients and sediments into the nearshore as an existing problem causing frequent violation of State water quality standards. The problem is a function of site geology and efforts of prior land managers (golf course, military, plantation) to control floodwaters by channelizing and re-routing natural stream flows to the ocean. An ideal drainage would provide floodwaters an opportunity to drop heavy sediments, and then discharge into the ocean at a location that maximizes mixing and offshore transport while minimizing sediment and nutrient transport over shallow benthic substrates and coral reefs. Drainage characteristics of the three principle outlet points (considering the Kuilima and West Main Drain outlets as one) are summarized in Table 7-2 below.

Table 7-2. Drainage Characteristics

	Kawela Stream Kawela Bay	West Main Drain Turtle Bay	East Main Drain Kuilima Bay
Distance to 10-foot depth contour	1800 ft	200 ft	100 ft
Distance to 30-foot depth contour	3000 ft	1000 ft	2500 ft
Ocean currents to disperse inflow	Minimal	Strong, off shore	Strong, long shore
Wave energy to mix inflow	None	Moderate	Strong
Adverse impact to coral reefs	High	Low	Moderate
Residence time in nearshore areas	Very Long	Very short	Short
Present Drainage Area	1.4 sq. mi	0.4 sq mi	4.8 sq. mi.

Under present conditions, the drainage outlet with least likely adverse impact on nearshore marine resources, West Main Drain, receives runoff from the smallest drainage area. A review of historical information suggests that the natural outlet for Kawela Stream is near the West Main Drain. Watershed restoration to reduce sediment and nutrient loads in the three principal stream outlets could have very positive impacts to water quality along this shoreline. Consideration of re-routing the upland flow from Kawela Valley to the West Main Drain would greatly improve water quality in Kawela Bay while likely having little or no adverse impact to the nearshore ecosystem within Turtle Bay at the West Main Drain.

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APPENDIX A

Summary Data on Observed "People Activities" Obtained During Turtle Surveys

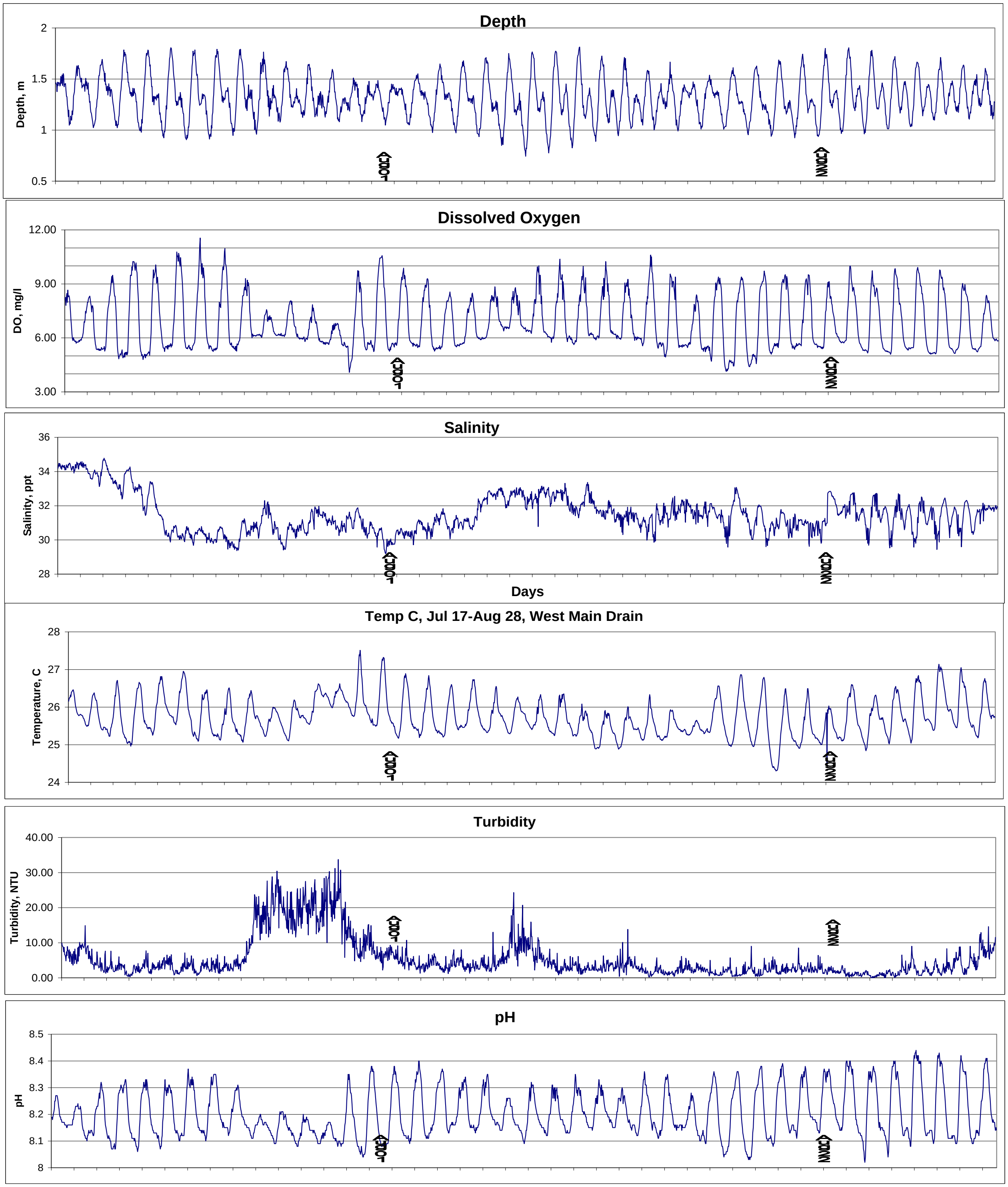
	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Average All		Winter	Summer
	1990	1991				1992				1993				1990-1993		2011	2011
Average Daily Total People at Kawela Bay	**25.4**	**20.0**	**18.8**	**24.5**	**32.8**	**23.4**	**11.8**	**13.3**	**14.0**	**33.8**	**25.3**	**24.3**	**18.2**	**22.0**		59.6	60.6
Beach Activities (total)	20.0	14.3	12.6	17.3	27.0	19.6	8.6	11.3	13.2	25.8	17.0	18.8	16.4	17.1		39.8	45.4
• Playing, walking on beach	17.0	9.7	10.4	9.5	22.3	15.8	6.2	8.8	9.6	19.6	14.7	13.8	15.4	13.3		35.2	41.2
• Shorefishing	3.0	4.7	2.2	7.8	4.8	3.8	2.4	2.5	3.6	6.2	2.3	5.0	1.0	3.8		4.6	4.2
Water Activities (total)	5.4	5.7	6.2	7.3	5.8	3.8	3.2	2.0	0.8	8.0	8.3	5.5	1.8	4.9		19.8	15.2
Swimming	2.0	1.7	1.8	1.8	1.8	2.2	2.0	0.8	0.2	5.6	4.3	4.0	0.6	2.2		8.0	3.2
• Snorkelers	0.0	0.0	0.0	0.0	0.0	0.4	1.4	0.5	0.0	2.8	1.0	1.5	0.0	0.6		2.8	1
• Swimming/Playing in Water	0.8	0.3	1.8	1.8	1.8	1.0	0.6	0.3	0.2	2.8	3.3	2.5	0.0	1.3		5.2	2.2
• Divers	1.2	1.3	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.3		0.0	0
Boating/Surfing	3.4	4.0	4.4	5.5	4.0	1.6	1.2	1.3	0.6	2.4	4.0	1.5	1.2	2.7		11.8	12.0
Surfing	1.0	2.7	2.2	3.0	3.0	1.2	0.2	1.3	0.6	0.6	0.3	1.0	0.6	1.4		3.6	11.2
• Standup	0.0	1.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1		2.2	4
• Surfing	0.2	0.0	0.8	2.3	0.5	0.2	0.0	0.5	0.6	0.6	0.0	1.0	0.6	0.6		0.8	7
• Boogie Boards	0.0	0.0	0.0	0.8	1.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.2		0.6	0.2
• Wind Surfers	0.8	1.7	1.2	0.0	1.3	1.0	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.5		0.0	0
Kayaking	0.0	0.0	1.4	0.0	0.3	0.0	0.2	0.0	0.0	0.0	2.7	0.3	0.6	0.4		8.2	28.6
• Kayak	0.0	0.0	1.4	0.0	0.3	0.0	0.2	0.0	0.0	0.0	2.7	0.3	0.6	0.4		7.6	28.6
• Kayak fishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.6	0
Boating	2.4	1.3	0.8	2.5	0.8	0.4	0.8	0.0	0.0	1.8	1.0	0.3	0.0	0.9		0.0	0.2
• Canoe	2.4	0.0	0.0	0.0	0.5	0.4	0.8	0.0	0.0	1.8	0.0	0.0	0.0	0.5		0.0	0
• Boat fishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0
• Boat	0.0	1.3	0.8	2.5	0.3	0.0	0.0	0.0	0.0	0.0	1.0	0.3	0.0	0.5		0.0	0.2

APPENDIX B

Example Plot of In-situ Water Quality Data

Off of West Main Drain for one Month, 2002

Compare to Figure 4-6 in main report



YSI DataSonde Water Quality Data from Shallow Water in Turtle Bay off the West Main Drain, Kahuku, O‘ahu. From July 17 to August 28, 2002. Compare to Data Visualization Graph – Figure 4-6.

APPENDIX C

Water Quality Summary Data

Monthly Average Water Quality at Turtle Bay, West Main Drain Stream Mouth

Month	Day	Turbidity In-Situ	Turbidity Lab	TSS	N+N	TN	TP	Chl_a	Temp	DO	pH	Sal
Jan	16	54.4	1.08	3.1	12.2	123	9.2	0.54	23.9	7.2	7.81	32.2
Feb	21	25.2	1.28	5.2	4.4	127	10.5	0.59	23.2	7.0	8.58	35.5
Mar	15	3.8	1.43	2.9	4.1	119	10.5	0.41	24.9	5.0	8.22	35.4
Apr	30	4.0	1.90	4.7	9.8	123	14.2	0.63	24.6	7.6	8.25	34.9
May	24	4.3	2.01	9.3	9.8	204	12.2	0.69	25.8	8.9	8.22	36.6
Jun	30	5.6	1.63	4.1	8.8	138	12.7	0.65	25.5	4.8	8.29	34.5
Jul	17	20.9	6.19	22.2	4.8	182	20.3	1.68	26.1	7.1	7.80	34.2
Aug	20	1.8	1.82	6.7	5.2	138	16.7	0.71	26.1	10.8	7.81	35.2
Sep	30	53.5	4.41	10.6	7.0	153	18.3	1.37	26.1	8.6	8.06	38.0
Oct	31	34.8	2.59	16.1	3.0	125	18.3	0.75	25.8	7.1	8.04	36.0
Nov	21	69.8	2.05	7.2	5.3	136	17.5	0.85	25.2	7.6	8.15	29.1
Year Averag		**25.3**	**2.4**	**8.4**	**6.8**	**142.6**	**14.6**	**0.81**	**25.2**	**7.4**	**8.1**	**34.7**
GeoMean												
All 6 Sites		**3.9**	**2.0**	**6.3**	**3.4**	**137.9**	**13.7**	**0.66**	**25.1**	**7.5**	**8.1**	**34.6**
Nearshore		**18.4**	**2.4**	**7.8**	**4.1**	**154.0**	**15.9**	**0.93**	**25.1**	**7.5**	**8.1**	**33.6**
Offshore		**0.9**	**1.7**	**5.0**	**2.8**	**123.5**	**11.7**	**0.47**	**25.1**	**7.5**	**8.2**	**35.4**
Storm Averages												
		332.5	**332.5**	**180.2**	**1859.3**	**2974.3**	**529.8**	**0.58**	**22.7**	**6.1**	**7.6**	**14.8**

Salinity at Turtle Bay, West Main Drain Stream Outlet (*ppt)

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	/----------Averages----------\ All	Nr Shore	Off Shore
			Year 2002						
Jan	30.69	32.83	30.85	32.78	32.98	32.92	32.2	31.5	32.9
Feb	34.73	35.54	35.52	35.60	35.75	35.66	35.5	35.3	35.7
Mar	35.01	35.47	35.45	35.24	35.57	35.39	35.4	35.3	35.4
Apr	34.38	34.92	35.20	34.75	35.21	35.23	34.9	34.8	35.1
May		36.56	36.11	36.63	36.78	36.89	36.6	36.3	36.8
Jun			33.96	34.74	34.86	34.45	34.5	34.0	34.7
Jul	34.18	34.45	32.80	34.65	34.62	34.51	34.2	33.8	34.6
Aug	34.99	35.19	34.87	35.42	35.49	35.53	35.2	35.0	35.5
Sep	37.42	38.09		38.21	38.14	38.12	38.0	37.8	38.2
Oct	35.39	35.74	36.07	36.32	36.32	36.28	36.0	35.7	36.3
Nov	31.98	25.10	19.10	35.44	34.08		29.1	25.4	34.8
Average	36.38853	37.1187	37.03615	37.44278	37.44538	37.47	**34.7**	**34.1**	**35.4**
Geometric Mean							**34.6**	**33.6**	**35.4**
Standard Deviation							**2.3**	**3.3**	**1.4**

* ppt= parts per thousand

In-Situ Turbidity at Turtle Bay, West Main Drain Stream Outlet *

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	/----------Averages----------\ All	Nr Shore	Off Shore
			Year 2002						
Jan	52.90	194.70	73.93	1.85	0.78	1.98	54.4	107.2	1.5
Feb	14.41	6.93	125.81	2.13	0.44	1.34	25.2	49.1	1.3
Mar	8.76	10.98	2.78	0.10	0.10	0.10	3.8	7.5	0.1
Apr	6.60	8.06	1.19	3.01	0.67	4.46	4.0	5.3	2.7
May		14.04	7.16	0.10	0.10	0.10	4.3	10.6	0.1
Jun	2.89	4.81	19.48	0.59	0.96	5.01	5.6	9.1	2.2
Jul	17.53	12.03	81.40	3.57	3.58	7.27	20.9	37.0	4.8
Aug	1.68	1.58	2.98	0.64	1.90	2.12	1.8	2.1	1.6
Sep	49.72	9.60	261.21	0.10	0.10	0.10	53.5	106.8	0.1
Oct	91.05	38.46	70.94	4.70	1.39	2.01	34.8	66.8	2.7
Nov	53.17	206.50	145.69	2.37	1.11	9.83	69.8	135.1	4.4
Average							25.3	48.8	2.0
Geometric Mean							**3.9**	**18.4**	**0.9**
Standard Deviation							24.5	48.5	1.6

* Turbidity = NTU Units

Suspended Solids (mg/l) at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	/----------Averages----------\ All	Nr Shore	Off Shore
			Year 2002						
Jan	4	2.9	2.8	3.2	2.3	3.2	3.1	3.2	2.9
Feb	6.8	6.2	4.8	5.4	3.9	4.3	5.2	5.9	4.5
Mar	2.9	3.2	3	3.4	2.5	2.3	2.9	3.0	2.7
Apr	5	4.4	6.7	4.6	3.5	4	4.7	5.4	4.0
May	11.1	11.8	10.9	9.7	8.3	4.0	9.3	11.3	7.3
Jun	7.1	5.5	6.4	1.9	2.1	1.7	4.1	6.3	1.9
Jul	27.2	20.3	35.3	18.7	14.3	17.2	22.2	27.6	16.7
Aug	5.5	6.8	12	2.6	4.8	8.6	6.7	8.1	5.3
Sep	16.5	11	10.6	5.2	9.9	10.3	10.6	12.7	8.5
Oct	8.5	6.3	60	10	5.8	6	16.1	24.9	7.3
Nov	9.3	6.6	7.4	6.6	7.8	5.7	7.2	7.8	6.7
Average							8.4	10.6	6.2
Geometric Mean							**6.3**	**7.8**	**5.0**
Standard Deviation							6.0	8.3	4.1

Nitrate plus Nitrite at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	/----------Averages----------\ All	Nr Shore	Off Shore
			Year 2002						
Jan	44	6	5	10	4	4	12.2	18.3	6.0
Feb	24	0.5	0.5	0.5	0.5	0.5	4.4	8.3	0.5
Mar	10	2	0.5	8	2	2	4.1	4.2	4.0
Apr	36	4	5	5	4	5	9.8	15.0	4.7
May	47	1	1	3	2	5	9.8	16.3	3.3
Jun	40	2	2	5	2	2	8.8	14.7	3.0
Jul	14	2	2	3	3	5	4.8	6.0	3.7
Aug	21	1	1	4	2	2	5.2	7.7	2.7
Sep	18	1	2	6	7	8	7.0	7.0	7.0
Oct	6	3	3	2	2	2	3.0	4.0	2.0
Nov	20	3	2	2	2	3	5.3	8.3	2.3
Average							6.8	10.0	3.6
Geometric Mean							**3.4**	**4.1**	**2.8**
Standard Deviation							3.0	5.1	1.8

Total Nitrogen(mg/l) at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	/----------Averages----------\ All	Nr Shore	Off Shore
			Year 2002						
Jan	217	108	90	113	106	103	122.8	138.3	107.3
Feb	151	119	136	115	103	137	126.8	135.3	118.3
Mar	183	121	106	114	92	99	119.2	136.7	101.7
Apr	151	126	156	106	99	102	123.3	144.3	102.3
May	329	181	188	174	161	190	203.8	232.7	175.0
Jun	167	143	149	117	108	145	138.2	153.0	123.3
Jul	187	179	201	176	167	184	182.3	189.0	175.7
Aug	177	120	162	122	115	129	137.5	153.0	122.0
Sep	210	167	131	139	137	136	153.3	169.3	137.3
Oct	176	146	113	104	103	107	124.8	145.0	104.7
Nov	179	161	121	115	117	125	136.3	153.7	119.0
Average							142.6	159.1	126.1
Geometric Mean							**137.9**	**154.0**	**123.5**
Standard Deviation							27.2	29.0	26.6

Total Phosphorous (mg/l) at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	Averages All	Averages Nr Shore	Averages Off Shore
			Year 2002						
Jan	8	7	8	10	11	11	9.2	7.7	10.7
Feb	13	11	10	10	10	9	10.5	11.3	9.7
Mar	9	9	18	10	9	8	10.5	12.0	9.0
Apr	14	13	28	10	10	10	14.2	18.3	10.0
May	18	14	11	11	9	10	12.2	14.3	10.0
Jun	20	14	15	10	7	10	12.7	16.3	9.0
Jul	23	22	31	15	15	16	20.3	25.3	15.3
Aug	19	17	24	14	11	15	16.7	20.0	13.3
Sep	23	21	18	16	17	15	18.3	20.7	16.0
Oct	23	27	17	17	13	13	18.3	22.3	14.3
Nov	22	20	17	16	14	16	17.5	19.7	15.3
Average							14.6	17.1	12.1
Geometric Mean							**13.7**	**15.9**	**11.7**
Standard Deviation							3.8	5.3	2.8

Chlorophyl-a (mg/l) at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	Averages All	Averages Nr Shore	Averages Off Shore
			Year 2002						
Jan	1.39	0.35	0.31	0.61	0.24	0.34	0.5	0.7	0.4
Feb	1.4	0.66	0.49	0.57	0.16	0.23	0.6	0.9	0.3
Mar	0.86	0.48	0.31	0.38	0.19	0.26	0.4	0.6	0.3
Apr	1.18	0.58	0.69	0.5	0.42	0.38	0.6	0.8	0.4
May	1.59	0.78	0.68	0.46	0.32	0.29	0.7	1.0	0.4
Jun	1.27	0.74	0.59	0.5	0.46	0.32	0.6	0.9	0.4
Jul	1.76	1.46	2.87	0.79	1.23	1.97	1.7	2.0	1.3
Aug	1.24	0.7	1.02	0.34	0.42	0.52	0.7	1.0	0.4
Sep	2.15	1.92	1.41	0.98	0.87	0.9	1.4	1.8	0.9
Oct	1.38	0.72	0.85	0.42	0.59	0.53	0.7	1.0	0.5
Nov	1.27	1.33	0.75	0.78	0.49	0.49	0.9	1.1	0.6
Average							0.8	1.1	0.5
Geometric Mean							**0.7**	**0.9**	**0.5**
Standard Deviation							0.4	0.5	0.3

Temperature (C) at Turtle Bay, West Main Drain Stream Outlet

Month	Station K1	Station K2	Station K3	Station K4	Station K5	Station K6	Averages All	Averages Nr Shore	Averages Off Shore
			Year 2002						
Jan	23.72	23.97	23.95	24.02	24.00	23.99	23.9	23.9	24.0
Feb	23.44	22.88	23.36	23.36	23.33	23.32	23.2	23.2	23.3
Mar	25.04	24.67	24.55	24.83	24.59	24.79	24.9	24.8	24.7
Apr	24.72	24.58	24.75	24.67	24.36	24.30	24.6	24.7	24.4
May		25.81	25.72	26.05	26.06	25.43	25.8	25.8	25.8
Jun	25.42	25.54	25.56	25.36	25.40	25.24	25.5	25.5	25.3
Jul	26.17	26.03	26.09	25.89	25.94	26.06	26.1	26.1	26.0
Aug	26.25	25.88	25.43	25.31	25.59	25.59	26.1	25.9	25.5
Sep	26.10	26.16	25.63	26.20	26.17	26.13	26.1	26.0	26.2
Oct	25.67	25.85	25.80	25.88	25.90	25.86	25.8	25.8	25.9
Nov	25.28	25.18	25.15	25.14	25.29	25.09	25.2	25.2	25.2
Average							25.2	25.2	25.1
Geometric Mean							**25.1**	**25.1**	**25.1**
Standard Deviation							1.0	1.0	1.0

pH (pH units) at Turtle Bay, West Main Drain Stream Outlet

	Station	Station	Station	Station	Station	Station	/----------Averages----------\		
Month	K1	K2	K3	K4	K5	K6	All	Nr Shore	Off Shore
			Year 2002						
Jan	7.48	7.67	7.79	8.03	7.98	7.93	7.8	7.6	8.0
Feb	8.59	8.57	8.22	8.51	8.46	8.44	8.6	8.5	8.5
Mar	8.22	8.22	8.25	8.38	8.30	8.28	8.2	8.2	8.3
Apr	8.27	8.24	8.24	8.24	8.15	8.12	8.3	8.2	8.2
May		8.22	8.24	8.19	8.24	8.22	8.2	8.2	8.2
Jun	8.31	8.27	8.26	8.26	8.27	8.21	8.3	8.3	8.2
Jul	7.78	7.81	7.84	7.95	7.95	7.90	7.8	7.8	7.9
Aug	7.84	7.78	7.78	7.98	7.97	7.87	7.8	7.8	7.9
Sep	8.06	8.05	8.01	8.10	8.08	8.07	8.1	8.0	8.1
Oct	7.98	8.10	8.11	8.14	8.14	8.12	8.0	8.1	8.1
Nov	8.04	8.26	8.33	8.41	8.38	8.28	8.2	8.2	8.4
Average							8.1	8.1	8.2
Geometric Mean							**8.1**	**8.1**	**8.2**
Standard Deviation							0.3	0.3	0.2

Dissolved Oxygen (mg/l) at Turtle Bay, West Main Drain Stream Outlet

	Station	Station	Station	Station	Station	Station	/----------Averages----------\		
Month	K1	K2	K3	K4	K5	K6	All	Nr Shore	Off Shore
			Year 2002						
Jan	7.23	7.03	7.04	7.27	7.19	7.30	7.2	7.1	7.3
Feb	7.10	6.88	7.45	7.18	7.22	7.22	7.0	7.1	7.2
Mar	5.23	4.78	4.60	4.50	4.29	4.55	5.0	4.9	4.5
Apr	7.78	7.47	7.12	8.36	8.49	8.58	7.6	7.5	8.5
May		8.92	9.19	8.47	8.51	8.12	8.9	9.1	8.4
Jun	8.37	7.36	7.40	8.10	7.45	7.23	4.8	7.7	7.6
Jul	7.22	7.06	7.11	6.57	6.80	6.96	7.1	7.1	6.8
Aug	11.21	10.41	10.43	11.97	12.50	11.73	10.8	10.7	12.1
Sep	8.84	8.37	9.59	7.28	7.44	7.61	8.6	8.9	7.4
Oct	7.14	6.96	6.65	6.66	6.72	6.63	7.1	6.9	6.7
Nov	7.44	7.69	7.89	7.52	7.56	8.27	7.6	7.7	7.8
Average							7.4	7.7	7.6
Geometric Mean							**7.5**	**7.5**	**7.5**
Standard Deviation							1.8	1.6	1.9

Turbidity at Kuilima Bay East Main Drain Site (NTU)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	1.19	-	-	1.70	-	**1.45**		
April	0.86	1.12	0.94	0.61	0.96	0.89	**0.90**		
May	3.62	5.08	4.02	2.92	2.68	2.38	**3.45**		
June	3.64	5.36	5.26	2.44	1.83	1.42	**3.33**		
July	-	-	-	-	-	-	**--**		
August	7.80	4.02	5.18	5.36	6.10	4.03	**5.42**		
September	6.39	6.20	6.26	6.22	4.94	4.12	**5.69**		
October	1.52	2.03	2.24	2.45	1.46	1.46	**1.86**		
November	0.66	0.61	0.44	0.47	0.47	0.57	**0.54**		
December	0.50	0.69	1.45	0.44	0.60	0.44	**0.69**		
Year 2001									
January	1.41	0.97	1.35	0.68	0.89	1.37	**1.11**	Nearshore	Offshore
February	0.82	0.97	2.43	0.96	0.75	1.35	**1.21**	E1-3	E4-6
Geometric Mean	**1.78**	**1.82**	**2.23**	**1.47**	**1.46**	**1.42**	**1.675**	**2.15**	**1.60**

State Standard Wet = 50% Geo Mean[1,2] .5 NTU;
Open Coast = 10% Not to Exceed[1,2] 1.5 NTU.

Total Suspended Solids at Kuilima Bay East Main Drain Site (mg/l)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	4.00	-	-	2.00	-	**3.00**		
April	3.00	2.90	3.20	2.30	1.90	2.40	**2.62**		
May	11.50	13.80	10.00	7.10	6.30	6.90	**9.27**		
June	7.30	12.00	22.30	5.10	6.10	5.30	**9.68**		
July	2.92	7.71	38.10	3.03	1.88	0.85	**9.08**		
August	28.80	7.79	8.00	6.58	4.66	6.13	**10.33**		
September	11.14	10.77	15.74	10.51	9.12	11.19	**11.41**		
October	4.27	8.04	4.46	3.29	3.21	6.19	**4.91**		
November	4.91	4.27	3.00	5.88	5.84	5.58	**4.91**		
December	6.01	6.87	9.62	8.62	10.88	6.46	**8.08**		
Year 2001									
January	3.88	3.84	5.54	4.91	4.11	5.58	**4.64**	Nearshore	Offshore
February	8.11	9.67	7.78	10.78	12.56	7.44	**9.39**	E1-3	E4-6
Geometric Mean	**6.54**	**6.86**	**8.60**	**5.55**	**4.72**	**4.99**	**6.066**	**7.55**	**4.73**

Nitrate + Nitrite at Kuilima Bay East Main Drain Site (ug N/L)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	1.00	-	-	2.00	-	**1.50**		
April	0.50	0.50	2.00	1.00	1.00	2.00	**1.17**		
May	0.50	1.00	0.50	0.50	1.00	0.50	**0.67**		
June	0.50	0.50	1.00	0.50	2.00	1.00	**0.92**		
July	1.85	2.22	3.35	3.71	4.46	2.93	**3.09**		
August	2.51	0.46	0.51	0.56	1.49	2.12	**1.27**		
September	4.72	1.58	1.23	1.69	1.74	1.86	**2.14**		
October	1.54	1.66	2.19	2.30	2.41	3.05	**2.19**		
November	1.00	1.00	1.00	1.00	1.00	3.00	**1.33**		
December	2.00	2.00	4.00	2.00	3.00	2.00	**2.50**		
Year 2001									
January	3.00	4.00	9.00	5.00	5.00	7.00	**5.50**	Nearshore	Offshore
February	0.50	0.50	1.00	0.50	0.50	1.00	**0.67**	E1-3	E4-6
Geometric Mean	**1.26**	**1.09**	**1.59**	**1.23**	**1.75**	**1.94**	**1.444**	**1.21**	**1.57**

State Standard Wet = 50% Geo Mean[1,2] 5 ug/l;
Open Coast = 10% Not to Exceed[1,2] 14 ug/l.

Total Nitrogen at Kuilima Bay East Main Drain (ug N/L)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	106.00	-	-	97.00	-	**101.50**		
April	163.00	125.00	122.00	109.00	110.00	113.00	**123.67**		
May	154.00	147.00	148.00	135.00	131.00	138.00	**142.17**		
June	169.00	131.00	188.00	132.00	126.00	115.00	**143.50**		
July	119.57	128.51	141.19	102.64	102.64	102.64	**116.20**		
August	166.11	149.76	155.35	152.62	127.65	146.30	**149.63**		
September	174.20	145.10	136.20	164.90	154.60	125.50	**150.08**		
October	220.80	116.60	121.00	132.40	112.20	118.70	**136.95**		
November	136.00	127.00	107.00	120.00	120.00	107.00	**119.50**		
December	128.00	117.00	126.00	102.00	126.00	103.00	**117.00**		
Year 2001									
January	195.00	140.00	146.00	126.00	110.00	179.00	**149.33**	Nearshore	Offshore
February	157.00	134.00	139.00	132.00	125.00	139.00	**137.67**	E1-3	E4-6
Geometric Mean	**159.73**	**129.94**	**137.63**	**126.71**	**119.31**	**124.36**	**132.097**	**139.65**	**121.19**

State Standard Wet = 50% Geo Mean[1,2] 150 ug/l;
Open Coast = 10% Not to Exceed[1,2] 250 ug/l.

Total Phosphorous at Kuilima Bay East Main Drain Site (ug P/L)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	12.00	-	-	10.00	-	**11.00**		
April	8.00	8.00	8.00	10.00	10.00	10.00	**9.00**		
May	13.00	15.00	15.00	10.00	10.00	12.00	**12.50**		
June	20.00	20.00	21.00	30.00	14.00	12.00	**19.50**		
July	16.52	24.61	31.16	11.51	12.09	12.47	**18.06**		
August	26.19	24.28	24.66	14.44	17.93	13.74	**20.21**		
September	17.67	16.71	15.74	14.69	14.10	12.86	**15.30**		
October	12.42	12.31	13.60	12.27	11.88	11.68	**12.36**		
November	13.00	12.00	10.00	9.00	9.00	9.00	**10.33**		
December	8.00	13.00	16.00	13.00	10.00	8.00	**11.33**		
Year 2001									
January	9.00	9.00	11.00	9.00	8.00	9.00	**9.17**	Nearshore	Offshore
February	16.00	13.00	13.00	14.00	13.00	11.00	**13.33**	E1-3	E4-6
Geometric Mean	**13.61**	**14.15**	**15.13**	**12.65**	**11.39**	**10.92**	**12.882**	**14.93**	**11.89**

State Standard Wet = 50% Geo Mean[1,2] 20 ug/l;
Open Coast = 10% Not to Exceed[1,2] 40 ug/l.

Chlorophyll-a at Kuilima Bay East Main Drain Site (ug/l)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	0.81	-	-	0.33	-	**0.57**		
April	0.97	0.54	0.54	0.32	0.36	0.32	**0.51**		
May	1.08	1.26	1.05	0.73	0.60	0.46	**0.86**		
June	1.38	1.87	3.07	0.90	0.47	0.49	**1.36**		
July	4.63	4.39	14.00	1.23	1.30	1.30	**4.48**		
August	5.24	4.87	3.24	1.56	2.19	1.03	**3.02**		
September	1.39	1.30	1.42	1.47	-	-	**1.40**		
October	1.15	0.83	1.24	0.60	0.70	1.14	**0.94**		
November	0.68	0.75	1.04	0.41	0.43	0.42	**0.62**		
December	0.47	-	0.64	0.37	0.32	0.40	**0.44**		
Year 2001									
January	0.35	0.54	0.38	0.28	0.25	0.26	**0.34**	Nearshore	Offshore
February	0.32	0.33	0.32	0.27	0.27	0.26	**0.30**	E1-3	E4-6
Geometric Mean	**1.07**	**1.11**	**1.25**	**0.61**	**0.51**	**0.51**	**0.790**	**1.46**	**0.64**

State Standard Wet = 50% Geo Mean[1,2] 0.3 ug/l;
Open Coast = 10% Not to Exceed[1,2] 0.9 ug/l.

Salinity at Kuilima Bay East Main Drain Site (ppt)

Month	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Average		
Year 2000									
March	-	34.61	-	-	34.54	-	**34.58**		
April	34.70	34.71	34.56	34.70	34.00	34.61	**34.55**		
May	35.19	35.19	35.19	35.19	35.19	35.19	**35.19**		
June	33.82	33.71	33.75	34.01	33.84	33.95	**33.85**		
July	33.46	34.79	34.64	34.29	34.12	34.18	**34.25**		
August	35.94	35.85	36.13	36.23	36.19	35.98	**36.05**		
September	34.42	34.27	35.21	35.28	35.28	35.28	**34.96**		
October	34.03	33.42	35.36	35.34	35.31	35.32	**34.80**		
November	34.98	32.56	35.18	35.34	35.31	35.19	**34.76**		
December	35.16	35.13	35.38	35.45	35.48	35.45	**35.34**		
Year 2001									
January	21.25	21.48	35.05	35.30	35.26	35.13	**30.58**	Nearshore	Offshore
February	34.68	20.75	34.84	35.03	35.02	34.91	**32.54**	E1-3	E4-6
Geometric Mean	**33.13**	**31.72**	**35.02**	**35.10**	**34.96**	**35.01**	**34.11**	**34.68**	**35.00**

State Standard = None

Water Quality During Storm Outflow Events in Kuilima Bay off the East Main Drain.

Turbidity at E. Main Drain Site (NTU)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	158.17	-	-	9.11	-	-	**37.96**	**83.64**
Jan. 30, '02	-	-	-	14.80	-	-	146.00	**14.80**	**14.80**
May 6, '02	404.00	-	-	-	-	-	59.20	**404.00**	**404.00**
Geometric Mean	**404.00**	**158.17**		**14.80**	**9.11**		**92.97**	**61.00**	**79.38**

State Standard Wet = 50% Geo Mean[1,2] .5 NTU; Open Coast = 10% Not to Exceed[1,2] 1.5 NTU.

Total Suspended Solids at E. Main Drain Site (mg/l)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	211.60	-	-	11.44	-	-	**49.20**	**111.52**
Jan. 30, '02	-	-	-	15.70	-	-	66.00	**15.70**	**15.70**
May 6, '02	266.70	-	-	-	-	-	77.50	**266.70**	**266.70**
Geometric Mean	**266.70**	**211.60**	**-**	**15.70**	**11.44**	**-**	**71.52**	**59.06**	**77.58**

Nitrate + Nitrite at E. Main Drain Site (ug/L)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	13.00	-	-	9.00	-	-	**10.8**	**11.0**
Jan. 30, '02	-	-	-	73.00	-	-	296.00	**73.0**	**73.0**
May 6, '02	89.00	-	-	-	-	-	13.00	**89.0**	**89.0**
Geometric Mean	**89.00**	**13.00**	**-**	**73.00**	**9.00**	**-**	**62.03**	**41.27**	**41.50**

State Standard Wet = 50% Geo Mean[1,2]5 ug/l; Open Coast = 10% Not to Exceed[1,2] 14 ug/l.

Total Nitrogen at E. Main Drain Site (ug/L)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	83.00	-	-	72.00	-	-	**77**	**78**
Jan. 30, '02	-	-	-	303.00	-	-	960.00	**303**	**303**
May 6, '02	1050.00	-	-	-	-	-	411.00	**1050**	**1050**
Geometric Mean	**1050.00**	**83.00**	**-**	**303.00**	**72.00**	**-**	**628.14**	**290.81**	**291.06**

State Standard Wet = 50% Geo Mean[1,2]150 ug/l; Open Coast = 10% Not to Exceed[1,2] 250 ug/l.

Total Phosphorous at E. Main Drain Site (ug/L)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	137.00	-	-	55.00	-	-	**86.8**	**96.0**
Jan. 30, '02	-	-	-	86.00	-	-	525.00	**86.0**	**86.0**
May 6, '02	417.00	-	-	-	-	-	70.00	**417.0**	**417.0**
Geometric Mean	**417.00**	**137.00**	**-**	**86.00**	**55.00**	**-**	**191.70**	**146.01**	**151.00**

State Standard Wet = 50% Geo Mean[1,2]20 ug/l; Open Coast = 10% Not to Exceed[1,2] 40 ug/l.

Chlorophyll-a at E. Main Drain Site (ug/l)

Storm Event	Station E1	Station E2	Station E3	Station E4	Station E5	Station E6	Stream	Geometric Mean	Average
Nov. 27, '01	-	4.50	-	-	0.99	-	-	**2.11**	**2.75**
Jan. 30, '02	-	-	-	0.85	-	-	0.66	**0.85**	**0.85**
May 6, '02	-	-	-	-	-	-	-	**-**	**-**
Geometric Mean	**#NUM!**	**4.50**	**-**	**0.85**	**0.99**	**-**	**0.66**	**1.34**	**1.53**

State Standard Wet = 50% Geo Mean[1,2]0.3 ug/l; Open Coast = 10% Not to Exceed[1,2] 0.9 ug/l.

APPENDIX D:

Ground Water Flow Calculations

Groundwater Discharge Calculations -								
	Distribution of groundwater between shallow coastal caprock and deep basal discharge.							
Estimating Caprock Annual Water Budget for Kahuku at Turtle Bay								
We will use Giambelluca (1986) estimates of water budget for the PH area to estimate proportional recharge, ET, groundwater recharge								
Assume	1000 mm rainfall area, "Natural" land use so		61 mm runoff, 800 mm ET, 139 mm recharge					
Mean Annual Rainfall	40	in	or	3.33	ft		feet coastline:	19000
Caprock study area	2.296	sq miles	or	64,008,806	sq ft		miles of coastline	3.60
Recharge	6.1%	%						
ET	80.0%	%						
Runoff	13.9%	%						
Total Rainfall	1,608,754,668	gal						
Annual recharge	98,134,035	gal						
Annual ET	1,287,003,734	gal						
Annual Runoff	223,616,899	gal						
Total Rainfall	4.408	mgd	or	1.22	mgd/mile			
Recharge mgd	0.269	mgd		0.07	mgd/mile			
ET mgd	3.526	mgd						
Runoff mgd	0.613	mgd		0.17	mgd/mile			
Assume that 20% of the Basal GW flow discharges into the caprock								
So 20% x 3.3 mgd =	0.66	mgd per mile						
	16.7	cubic feet per day per linear foot of coast.						
Total GW flow through caprock		**0.735**	**mgd/mile**					
This groundwater discharges into the ocean.								

APPENDIX D:

CULTURAL IMPACT ASSESSMENT

D

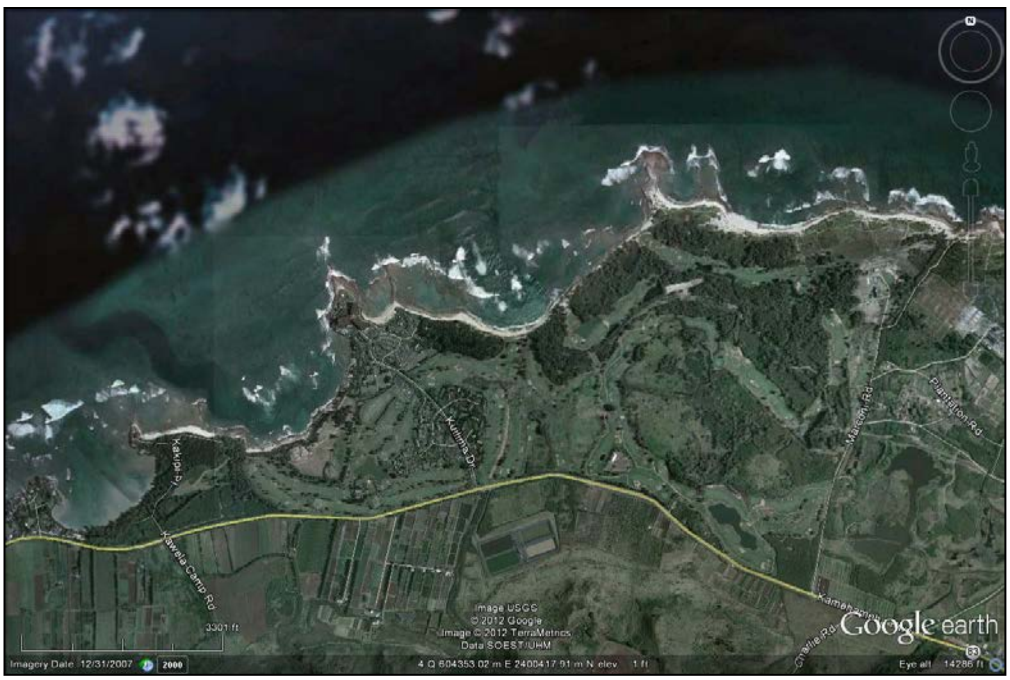
Pacific Legacy

Historic Preservation

FINAL

CULTURAL IMPACT ASSESSMENT OF THE TURTLE BAY RESORT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT LANDS DISTRICT OF KO‘OLAU LOA, O‘AHU ISLAND HAWAI‘I

[TMK 5-6-003:001 por., 010 por., 016 por., 017 por., 026 por., 033, 040-044, 046 por., 048, -049; 5-7-001:001, 001, 016, 017, 020, 022, 030, 031, 033; 5-7-003:072; and 5-7-006:001, 002, 022, 023]



Pacific Legacy: Exploring the past, informing the present, enriching the future.

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FINAL

CULTURAL IMPACT ASSESSMENT
OF THE
TURTLE BAY RESORT
SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT LANDS
DISTRICT OF KOʻOLAU LOA, OʻAHU ISLAND
HAWAIʻI

[TMK 5-6-003:001 por., 010 por., 016 por., 017 por., 026 por., 033, 040-044, 046 por., 048, -049; 5-7-001:001, 001, 016, 017, 020, 022, 030, 031, 033; 5-7-003:072; and 5-7-006:001, 002, 022, 023]

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ABSTRACT

Pacific Legacy, Inc., under contract to Lee Sichter LLC for Replay Resorts, conducted a Cultural Impact Assessment (CIA), as part of the Supplemental Environmental Impact Statement (SEIS) for the Turtle Bay Resort, LLC (TBR) for the proposed expansion. TBR SEIS Lands, which are the subject of this CIA, consist of 767.714 acres located in *makai* portions of the following *ahupua*ʻ*a* (traditional Hawaiian land division): ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku in the District of Koʻolau Loa, Oʻahu Island, Hawaiʻi. The SEIS Lands include Turtle Bay Resort properties located in the following TMKs: 5-6-003:001 por., 010 por., 016 por., 017 por., 026 por., 033, 040-044, 046 por., 048, -049; 5-7-001:001, 001, 016, 017, 020, 022, 030, 031, 033; 5-7-003:072; and 5-7-006:001, 002, 022, 023 that include approximately 11.3 acres of Marconi Road right-of-way, but exclude the existing Turtle Bay Hotel, the Kuilima Estates, and the Ocean Villas.

TBR SEIS Lands are known for their natural resources and *wahi pana* (storied places). Many localities on TBR SEIS Lands have intriguing traditional place names that allude to the richness of marine and terrestrial resources as well as *mo*ʻ*olelo* (stories) attributed to the area. Upholding the richness of the area are numerous Land Commission Awards applied for and awarded as well as descriptions of these properties as being highly cultivated in a variety of crops. These lands are also steeped in Native Hawaiian legend and associated with many gods, goddesses, and other fabled beings as well as mystical and historical events.

In recognition of the area's rich *mo*ʻ*olelo* and traditional land uses, great lengths were taken to contact and invite as many local *kūpuna* (elders) and cultural informants as possible from varied backgrounds and interests on the subject of traditional, customary, and contemporary use of TBR SEIS Lands and surrounding areas. Concerted attempts were made to identify and locate persons knowledgeable about traditional practices that took place in the past or that are currently taking place on or near SEIS Lands, as recommended by the Office of Environmental Quality Control (OEQC) Guidelines. Earlier CIA reports written about the Kahuku area, OEQC list of Cultural Assessment Providers, Office of Hawaiian Affairs (OHA), Neighborhood Boards No. 27 & 28, numerous North Shore civic clubs, and other North Shore community associations were consulted for a listing of *kūpuna,* cultural practitioners, and cultural informants willing to share their *mana*ʻ*o* (knowledge and opinion).

A total of 16 interviews were conducted between 4 May and 11 April 2012. All interviewees had a personal association with TBR SEIS Lands and/or surrounding areas, many of whom were highly recommended by various sources in the community. Most informants are active in the local community and well respected for their leadership, expertise in Hawaiian cultural practices, and knowledge of the project area and its history. The results of all interviews, with the exception of one interview, are submitted in this CIA.

As a result of archival research and community consultations, it was found that TBR SEIS Lands and surrounding areas contain an array of cultural resources that are currently being used for traditional cultural practices, including marine food sources, medicinal plants, plants used in crafts, wood for woodcarving, and salt for various uses. Further, the land and sea are currently used for a variety of traditional and non-traditional sports and recreational activities. The presence of *iwi kūpuna*, or human burials, as well as archaeological sites on the property has also been established, which continues to be a point of concern in the community in terms of past and/or potential disturbances related to the resort. Furthermore, supernatural and/or divine phenomenon in the project area experienced by a few informants and acknowledged by others, suggests that there is still cultural significance and spiritual connection for those with ancestral ties to the land.

In examining TBR's five proposed development options, consisting of the Proposed Action, Full Build-Out (Alternative), Resort Residential Only (Alternative), Conservation Partner (Alternative), and No Action (Alternative) Plans, each option will have some future impact to cultural resources and activities on the property - save for the No Action Plan. The more extensive the build-out and density of the resort, the more potential for project related impacts. However, none of the cultural resources or activities identified in this report as potentially being impacted by the development options occur only on this property. Thus, the development is not expected to significantly obstruct the continuation or enhancement of cultural practices on a regional level. Yet, narrowing project related impacts to a local level reveals that impacts would be significant to local stakeholders, including Native Hawaiian and non-Native Hawaiian cultural practitioners.

Therefore, it is recommended that TBR embrace the role of *konohiki* (*ahupuaʻa* regent) of "Tomorrow's Ahupuaʻa;" to proactively *mālama* (care for) the *ʻāina* (land), *kai* (ocean) *iwi kūpuna* (ancestral remains), *kaiāulu* (local community), and *ʻoihana Hawaiʻi* (traditional Hawaiian practices). Recommendations to do so are as follows:

- **Consult** with the ʻAha Kiole Advisory Committee (AKAC) to ensure that Tomorrow's Ahupuaʻa is in keeping with Hawaiian tradition. Furthermore, TBR, as *konohiki*, should consult with local *kūpuna* for guidance, specifically, in identifying the needs and concerns of the *kaiāulu*.

- **Implement** a *mauka-makai* (upland to ocean) and inter-*ahupuaʻa* resource distribution system to make Tomorrow's Ahupuaʻa concept a leader in cultural and natural resource management. TBR should prioritize commerce for resort operations between themselves and local agriculturists, horticulturalist, aquaculturists, craftsmen, tradesmen and other goods or service providers over providers of goods and services from outside areas when economically viable.

- **Initiate** an integrated Marine Resources Management Plan, with the goal of creating an enforceable management program. It is advised that TBR be guided by the *mana'o* of a committee comprised of local *kūpuna* with expertise in marine based cultural practices as well as marine wildlife management groups and appropriate governmental agencies. TBR and/ or committee(s) could host town hall meetings to facilitate open discourse with the local community regarding the precious marine resources and how to mitigate potential impacts to TBR's coastal waters. A program such as this would also be consistent with the ancient *kapu* (control) system that helped to maintain the balance between the human population and resources within the *ahupua'a* in ancient times. It was, perhaps, the most important role of the *konohiki*.

- **Organize** multi-media and multi-faceted Education Programs including designated learning area(s) and/or ethnobotanical garden(s) on TBR SEIS Lands as venue(s) for teaching and sharing cultural practices, which center on values of *e mana'o pono aku* (respect) and *kuleana* (responsibility) to the *'āina, kai,* and *kaiāulu*. Programs such as these could also educate the local community and resort visitors about the importance of coastal resources to a traditional Native Hawaiian lifestyle. TBR should work with the local *kūpuna* and cultural practitioners to teach a variety of Hawaiian cultural practice workshops to help preserve cultural practices and values as well as allowing non-Hawaiian peoples the opportunity to learn from their host culture. This learning center should not set a stage for the objectification of cultural practitioners or reduce the cultural practices to tourist entertainment.

- **Submit** an Archaeological Monitoring Plan (AMP) prior to the commencement of construction to *mālama* the history and archaeological resources of these lands. If significant archaeological sites are encountered during ground disturbing activities during development, a cultural interpretive display is recommended using artifacts (to the extent possible and feasible), archival photos, artistic renderings, as well as traditional and/or oral accounts to represent the area of origin.

- **Continue** to consult with the Kahuku Burial Committee (KBC) over the best treatment of *iwi kūpuna* that have already been displaced and *iwi kūpuna* that may be disturbed in the future. A Burial Treatment Plan (BTP), using the *mana'o* of the KBC is planned to be submitted for review to the State Historic Preservation Division (SHPD) as well as the O'ahu Island Burial Council (OIBC).

- **Respect** the spiritual connections that people have with the ʻ*āina*, as it is documented and widely known as a *wahi pana* (legendary place), where *nā kūpuna* (ancestors) lived and worshiped, and is known as the final resting place for the ancestors of many local people. Therefore, it is recommended that any major event or construction related activity be preceded with a traditional Hawaiian Blessing ceremony performed by a *kahuna* (priest or priestess) or *kahu pule* (minister/preacher).

- **Provide** alternative access routes for contemporary cultural activities during and after project related construction, should current routes be blocked.

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Frontispiece: Area of the Turtle Bay Resort (courtesy of Google Earth).

1.0 INTRODUCTION

As part of the Supplemental Environmental Impact Statement (SEIS) for Turtle Bay Resort, LLC (TBR), Pacific Legacy, Inc. conducted a Cultural Impact Assessment (CIA) under contract to Lee Sichter LLC for Replay Resorts, Inc. The subject area, heretofore referred to as "SEIS Lands" are situated on nearly 767.714 acres of land located *makai* of Kamehameha Highway and are positioned approximately 13 miles east of Haleʻiwa, four miles west of Kahuku, and 21 miles north of Wahiawā (Figure 1) (TMK 5-6-003:001 por., 010 por., 016 por., 017 por., 026 por., 033, 040-044, 046 por., 048, -049; 5-7-001:001, 001, 016, 017, 020, 022, 030, 031, 033; 5-7-003:072; and 5-7-006:001, 002, 022, 023). These lands are situated in the *kula* and *makai* portions of the following *ahupuaʻa*: ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku in the District of Koʻolau Loa, Oʻahu Island, Hawaiʻi. However, under the proposed Comprehensive Plan these *ahupuaʻa* have been condensed into three major *ahupuaʻa*, consisting of: Ahupuaʻa o ʻŌpana-Kawela (ʻŌpana 1, ʻŌpana 2, and Kawela), Ahupuaʻa o Hanakaʻoe (ʻŌʻio 1 and Hanakaʻoe), and Ahupuaʻa o Kahuku (ʻŌʻio 2, Ulupehupehu, Punalau, and Kahuku). The SEIS Lands include Turtle Bay Resort properties located in the following that include approximately 11.3 acres of Marconi Road right-of-way, but exclude the existing Turtle Bay Hotel, the Kuilima Estates, and the Ocean Villas (Figure 2; Sichter 2011:vi).

According to the *Turtle Bay Resort Environmental Assessment & Supplemental Environmental Impact Statement Preparation Notice* (SEISPN) (Sichter 2011:15), the Proposed Action, referred to in that document as "Revised Master Plan," is an expansion project that has a reduced density outcome, roughly 60% less density from the density proposed in the original expansion project as formalized under the 1985 Unilateral Agreement. This Proposed Action concentrates higher density development in Hanakaʻoe Ahupuaʻa, which is the resort's existing core area, with two new hotel sites and a new community Gathering Place in proximity to the existing Turtle Bay Hotel. The sites originally proposed for hotel development in the *ahupuaʻa* of ʻŌpana-Kawela (to the west) and Kahuku (to the east) will be developed with resort-residential units and limited to much lower density developments. At ʻŌpana-Kawela, density will be reduced by over 75% of what is allowable under existing zoning. Similarly, the Kahuku Ahupuaʻa is planned for affordable community housing and resort-residential units with 65% less density than is allowed under existing entitlements. The result is the concentration of development in the central core of the SEIS Lands and the general preservation of a rural character to the east and west. Furthermore, the Proposed Action provides for two hotel sites, rather than the five approved in the current land use entitlements and the number of hotel units is reduced from 2,500 to a range between 625 and 1,000. By implementing greater voluntary generous shoreline setbacks, this development concept achieves public access to the entire shoreline intended in the Unilateral Agreement and further enhances the pedestrian experience, affording unencumbered coastal access (Sichter 2011).

The original EIS for the Turtle Bay Expansion was written in 1985 and approved; however, not all components of the expansion plan were implemented. Development was to resume in 2005, but was blocked by a lawsuit ending in a court order to supplement the EIS with additional studies including a CIA, as any EIS prepared prior to 1997 was not required to provide a CIA. The main objective of a CIA is to promote and protect cultural beliefs, practices, and resources of Native Hawaiians, other ethnic groups, as well as other collective groups associated with the subject area and surrounding areas (OEQC 2011:3-4).

1.1 Project Background

In 1969, INSCON, a Del E. Webb Corporation and Prudential Insurance Company joint venture, signed an agreement with Campbell Estate to build a resort at Kuilima Point, consisting of a 500 room hotel, a 368 unit condominium complex, and an 18-hole golf course (Group 70 1985:7-8). The Hotel and first golf course was completed in 1972, followed by Kuilima Estates a couple years later. At that time, the resort was managed by the Del E. Webb Corporation until Kuilima Development Company (KDC) took over in 1976. Resort management was then contracted to the Hyatt Corp and renamed Turtle Bay Hilton. Years later, the second golf course was completed.

In 1977, the City and County of Honolulu issued an official General Plan outlining O‘ahu’s growth, which allowed for further resort expansion in several areas including Kuilima. Subsequently, KDC began a program to upgrade the existing hotel amenities and infrastructure as well as a reassessment of undeveloped KDC lands in the resort vicinity for potential development. In 1985, the Mayor of Honolulu approved a “Development Plan Land Use Amendment Map” illustrating the proposed usage of resort lands (Group 70 1985:8). An Environmental Impact Statement (EIS) for the proposed Kuilima Resort Expansion was then created for KDC to rezone resort properties to agree with the Ko‘olau Loa Development Plan’s Land Use Map and apply for a Special Management Area Use Permit (Group 70 1985:1). The proposed expansion plan consisted of adding hotels, resort condominiums, a commercial area, an Arnold Palmer golf course, a club house, public beach parks, a private beach park, a wildlife park, five public right-of-ways to the shoreline, an equestrian area, a wildlife preserve, and associated infrastructure and existing golf course improvements.

According to the 1985 EIS, a new visitor population, averaging nearly 4,800 persons per day, would be expected to use the expanded and upgraded resort (Group 70 1985:1). Impacts were predicted by this study to negatively affect the lessees of 39 east Kawela Bay parcels and six agricultural parcels. Adverse effects also included occasional golf course and marsh flooding, dust and noise from construction, loss of agricultural lands, as well as increases in traffic, potable water consumption, solid waste, marsh drainage input, electrical power plant emissions, and demand for public protection from the County. However, the study envisaged the proposed expansion to provide benefits to the community, such as resort jobs, increased ocean access, business, and economic growth (Group 70 1985:2).

The resort was granted all needed discretionary permits and approvals to put the expansion plan into action in the late 1980s and early 1990s. In 2005, arrangements were made to resume development, as until this point, the extent of development was solely the 18-hole golf course and a provisional site for the stable. However, development was blocked by a lawsuit brought forth by several opposition groups, ending in a court order mandating the resort to supplement the EIS with additional studies before continuing with the development. Supplemental studies included traffic and marine life studies as well as a CIA, due to the fact that any EIS prepared prior to 1997 was not required to provide a CIA.

1.2 PURPOSE

In keeping with Articles IX and XII of the state constitution, the goal of a CIA is to promote and protect cultural beliefs, practices, and resources of Native Hawaiians as well as other ethnic groups and collective groups (OEQC 2011: 3-4). The general purpose of this CIA is to protect and preserve all cultural practices and resources within the SEIS Lands and surrounding areas that may be impacted by the Proposed Action (Sichter 2011). To do so, cultural practices, features, and practitioners must be identified and assessed for potential impacts by the Proposed Action and alternative options. Finally, recommendations are provided to mitigate the potential impacts.

In the State of Hawaiʻi, under Chapter 343 HRS, and Act 50, SLH 2000, a CIA is required as part of the EIS process, and has the stated purpose to:

> 1) require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and
>
> 2) amend the definition of "significant effect" to include adverse effects on cultural practices.

According to these guidelines, types of cultural practices and beliefs may include those relating to subsistence, commercial, residential, agricultural, access-related, recreational, as well as religion and spirituality. The guidelines further state that cultural resources subject to a CIA may include: "traditional cultural properties or other types of historic sites, both manmade and natural, including submerged cultural resources, which support such cultural practices and beliefs" (OEQC 2011:4). To determine the effects of the proposed development on cultural practices, resources, and beliefs, the following tasks are undertaken:

1) identify and consult with individuals and organizations knowledgeable about cultural practices that may have taken place in the area;
2) conduct archival research about traditional practices that may have been conducted in the area;

3) describe the cultural practices that took place within the potentially affected area;

4) assess the impact of the proposed development on the cultural practices that may have taken place within the potentially affected area; and;

5) prepare a report on the findings resulting from the above investigations.

Appendix A provides a copy of the Guidelines for Assessing Cultural Impacts, adopted by the State of Hawaiʻi Environmental Council in 1997 and amended in 2000 (OEQC 2011).

Additionally, this CIA is in accord with Ka Paʻakai, which is the Hawaiʻi Supreme Court's analytical framework designed to protect Native Hawaiian rights over cultural, historical or natural resources (*Hawaiʻi Land Use Commission v. Ka Paʻakai*, 94 Hawaiʻi at 52, 7 P.3d. at 1089). This framework was designed to ensure that traditional and customary Native Hawaiian rights are preserved and protected by suggesting the following guiding principles:

1) To identify and define the scope of 'valued cultural, historical or natural resources' in the project area, including the extent to which traditional and customary native Hawaiian rights are exercised in the project area.

2) The extent to which those resources – including traditional and customary native Hawaiian rights – will be affected or impaired by the proposed action;

3) The feasible action, if any to be taken to reasonably protect native Hawaiian rights if they are found to exist.

1.3 METHODS

According to the Office of Environmental Quality Control (OEQC) Guidelines for Assessing Cultural Impacts (OEQC 2011), it is recommended that preparers of CIA implement the following protocol:

1. identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or *ahupuaʻa*;
2. identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;
3. receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;

4. conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;
5. identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and
6. assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

These methods were strictly adhered to in the subject assessment. A rigorous effort was made to identify and locate persons knowledgeable about traditional practices that took place in the past or that are currently taking place in the SEIS Lands and broader geographical area that could potentially be impacted by the expansion project. In addition to prior CIA reports written about the Kahuku area (Collins and Nees 2006; Hammatt 2008), the State Office of Environmental Quality Control (OEQC) and Office of Hawaiian Affairs (OHA) were consulted for a listing of Cultural Assessment Providers. Various Neighborhood Boards, civic clubs, and other North Shore community associations were also contacted to obtain cultural informants. Appendix C provides a listing of potential cultural informants and their detailed contact history. Of the 68 individuals recommended by others informants or identified through research as potential cultural informants, contact information was found for 52 individuals and organizations, all of which were solicited for participation. While no response was received from 15 of those asked to participate, 37 individuals responded and 16 interviews were secured.

A total of 16 individuals representing a variety of cultural practices of the SEIS Lands and surrounding areas were interviewed for this CIA, the testimonies of 15 are represented in this report. Transcripts of interviews were not attempted in this assessment; however, audio recordings of numerous interviews were obtained and are kept on file at Pacific Legacy office in Kailua, Hawaiʻi.

2.0 PROJECT AREA DESCRIPTIONS

SEIS Lands are located on the northern tip of Oʻahu and roughly spread from the mid-point of Kawela Bay to Marconi Road. These lands are bound by the Pacific Ocean to the north and the Kamehameha Hwy. to the south and situated on nearly 767.714 acres of land *makai* of Kamehameha Hwy. and are positioned approximately 13 miles east of Haleʻiwa, four miles west of Kahuku, and 21 miles north of Wahiawā (Figure 1). These lands are situated in the *kula* and *makai* portions of the following *ahupuaʻa*: ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku in the District of Koʻolau Loa, Oʻahu Island, Hawaiʻi. However, under the current Proposed Action these *ahupuaʻa* have been condensed into three major *ahupuaʻa*, consisting of: ʻŌpana-Kawela (ʻŌpana 1, ʻŌpana 2, and Kawela), Hanakaʻoe (ʻŌʻio 1 and Hanakaʻoe), and Kahuku (ʻŌʻio 2, Ulupehupehu, Punalau, and Kahuku). SEIS Lands are comprised of all lands covered by the 1985 EIS and approximately 11 acres adjacent to the existing hotel, the Marconi Road right-of-way (ROW) lands, as well as a former *kuleana* of approximately 4 acres at the northeastern edge of the Turtle Bay lands (Figure 2), However, the OEQC Guidelines recommend that the "broader geographical area" be the subject unit (OEQC 2011).

2.1 GEOLOGY, HYDROLOGY, AND SEDIMENTS

Several geological processes including shield-building volcanism, subsidence, weathering, erosion, sedimentation, followed by rejuvenated volcanism created the island of Oʻahu. Generally, the island is made up of heavily eroded remnants of the Pliocene era Waiʻanae and Koʻolau shield volcanoes. The SEIS Lands are located at the foot of the Koʻolau Mountains, which were created by shield-building volcanism about 2.2 to 2.5 million years ago (Lau and Mink 2006). These mountains are mostly comprised of Koʻolau Basalt, a shield lava as well as basalt from later volcanic stages (Juvik and Juvik 1998).

Topography, stratigraphy, and hydrology of the general subject area result from a series of complex geological processes. Koʻolau Basalt lava flows ranging from 1.8 to 3 million year old underlie the majority of the vicinity. After these basalts were laid, they were subject to periods of erosion as well as periods of deposition of eroded upland sediment that occurred in the area. In the mid-to-late Quaternary period (ca 120,000 years ago), mean sea levels rose globally over seven meters higher than what they are today, permitting a coral reef system to build up along the coast in the area that now lies inland of the current coastline. After the sea level receded, these coral reefs were exposed and over time encapsulated in alluvium, becoming the *karstic* limestone of the Kahuku Plain (Ku et al. 1974; Stearns 1978; Gillespie et al. 2004 *passim*). These deposits of terrestrial and marine sediments along the coast form a relatively impermeable wedge of sedimentary material known as caprock, which extends from Punaluʻu to Kahuku Point (Group 70 2009: 2-7, 2-9). Generally, most high elevation water in Koʻolau Loa is controlled by volcanic dikes that prevent groundwater from flowing freely to coastal areas from the upper elevations of the watershed (ibid.:2-9). The Kahuku area contains several large marshes, which are a result of seepage that arises at the caprock. There is also a dike zone between Kawela and Waiale‘e upland watersheds all the way to the coast that limits the percolation of water to coastal areas west of the Turtle Bay Resort property (ibid.:2-9).

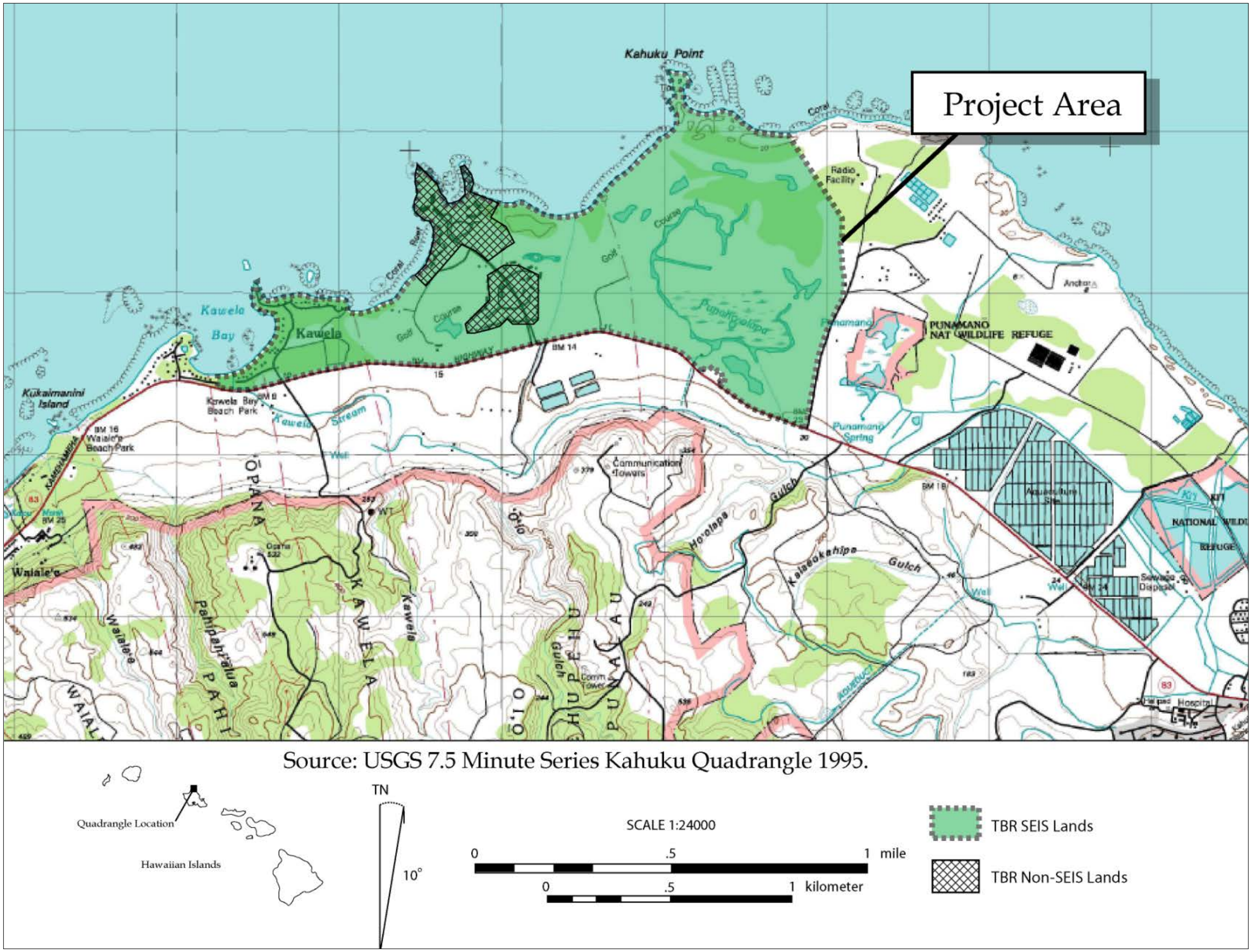

Figure 1. Project location.

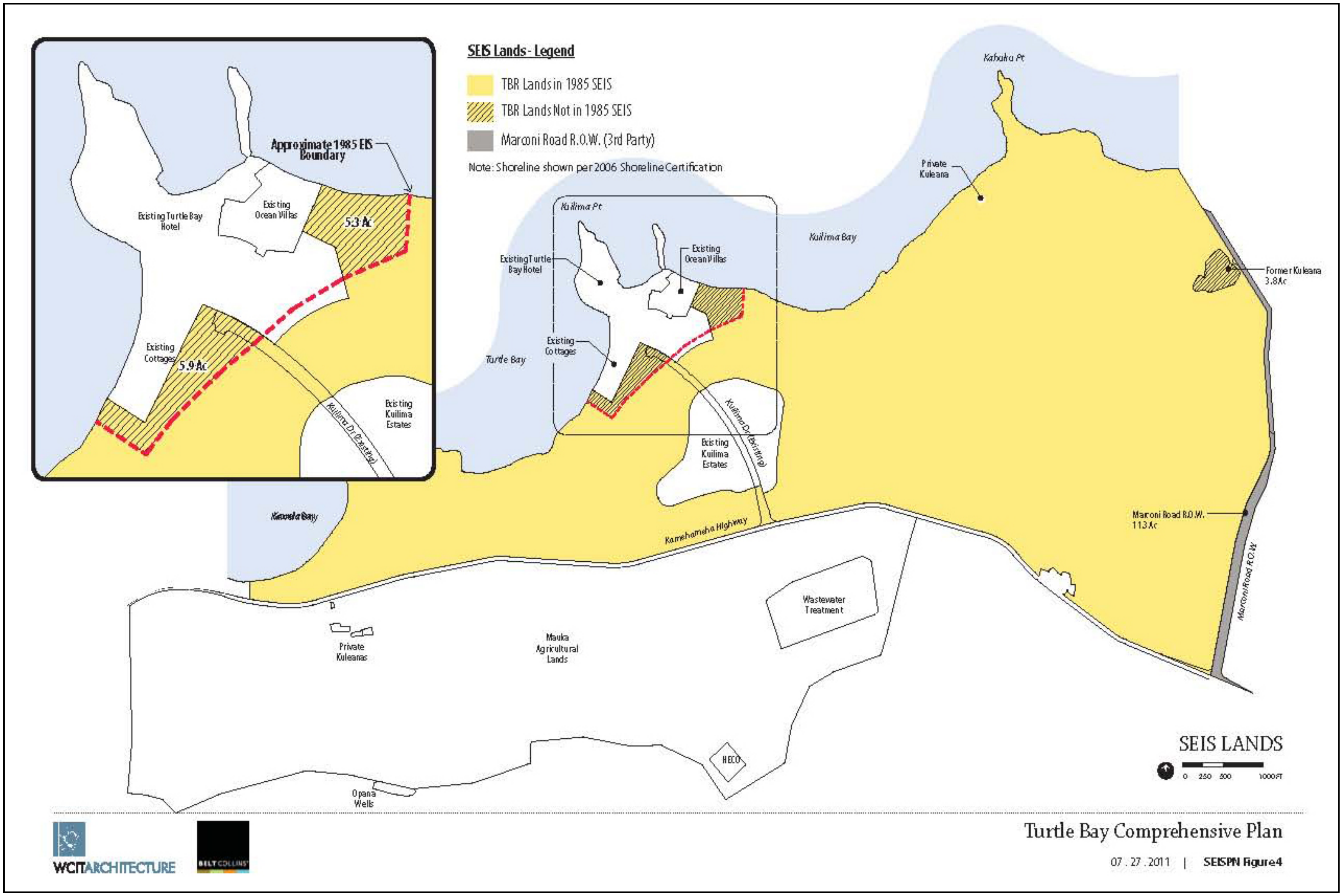

Figure 2. Turtle Bay Resort SEIS Lands (courtesy of WCIT Architecture).

The SEIS Lands are flanked on the south by the northern foothills of the Koʻolau Range. Three prominent peaks are identified along the ridge *mauka* of the project area. Coulter (1935) lists Puʻu Kauweweole (Lāʻie quad.; 21.40n 158.01w), Puʻu Kī (Lāʻie quad.; 21.40n 157.59w), and Kawela Mountain (Lāʻie quad.; 21.40n 158.00w).

According to the United States Department of Agriculture (USDA) and Natural Resources Conservation Service (NRCS) *Custom Soil Resource Report for Island of Oahu, Hawaii: Turtle Bay Resort* (USDA/NRCS 2011a:10), the SEIS Lands, *makai* of Kamehameha Highway, is composed primarily of Jaucas sand (JaC; 0 to 15% slopes), followed by Pearl Harbor clay (Ph), Waialua silty clay (WkA; 0 to 15% slopes), Kaloko clay (Kfa), Coral outcrop (CR), Lahaina silty clay (LaC; 7 to 15% slopes), Beaches (BS), and a minor amount of Mokuleia loam (Ms), Mokuleia clay loam (Mt), Kaena clay (KaB; 2-6% slopes), and Waialua silty clay (WkB; 3-8% slopes)(Figure 3). The customized USDA/NRCS reports for the SEIS Lands are available upon request.

2.2 CLIMATE

While seasonal variability is relatively mild, the climate of the Hawaiian Islands exhibits warm temperatures, dry conditions, and persistent trade winds that originate from the northeast during the summer season (May through September). Hawaiʻi's winter season (October through April) is typically characterized by cooler temperatures, elevated precipitation, and variable winds, including Kona (southerly) winds and storms (Juvik and Juvik 1998).

The climatic conditions of the subject area are characteristic of lowland and coastal areas of Oʻahu's windward side, having relatively consistent temperatures as well as persistent northeast trade winds. While the annual average maximum temperature is 81 degrees Fahrenheit (°F), the Kahuku area has daily maximum temperatures in the range from the high 70s (˚F) during the winter to the low-to-mid 80s (˚F) during the summer. Average temperature lows range from the mid-to-high 60s (˚F) during the winter to the low-to-mid 70s (˚F) during the summer, with an annual minimum temperature of 70 °F (WRCC 2011).

In general, rainfall is heaviest in October and April for the entire state of Hawaiʻi. However, rainfall averages are greatly affected by terrain. Further, great variation in rainfall can occur over small distances with extreme topographical changes. In the subject area, rainfall is relatively moderate, with a median annual rainfall of approximately 36 inches. Approximately two-thirds of the rainfall in the subject area occurs between October and April. Annual rainfall also varies significantly from year-to-year in the area (WRCC 2011).

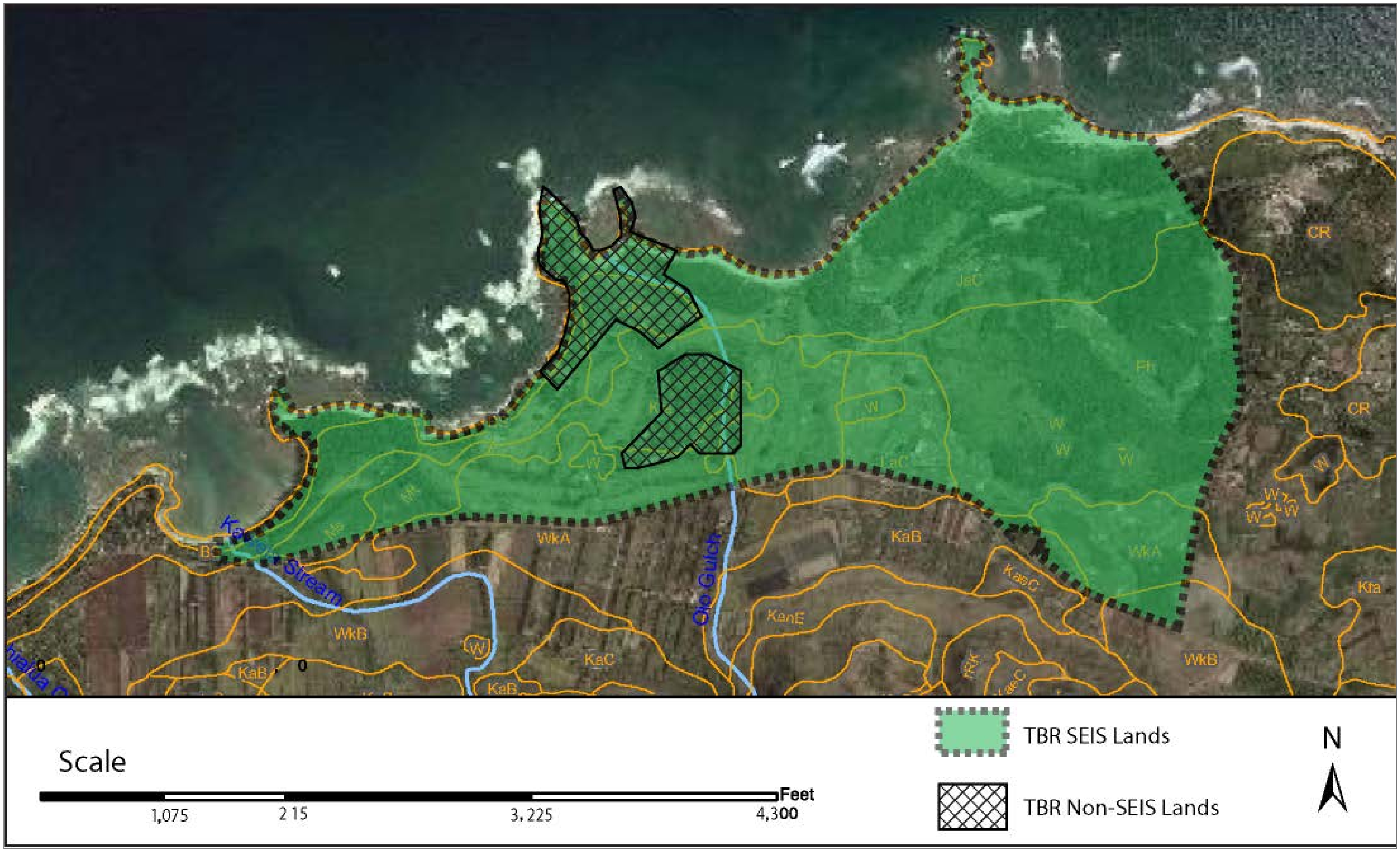

Figure 3. Soil map of TBR SEIS Lands (soil data courtesy of USDA).

2.3 Vegetation

There are several distinct ecosystems in the subject area, each having a distinct array of flora (Group 70 1985). Starting at the west end of the property, the coast of Kawela and Turtle Bays are dominated by mature ironwood trees (*Casuarina equisetifolia*) and *hau* (*Hibiscus tiliaceus*), with some coconut palms (*Cocos nucifera*), *naupaka* (*Scaevola* spp.), and various exotic plants. On the *mauka* side of the Kawela Bay portion of Turtle Bay Resort is overgrown with California grass (*Urochloa mutica*) and elephant grass (*Pennisetum purpureum*), but also contains a number of juvenile *koa haole* (*Leucaena leucocephala*) (AECOS 2006). Further east along Kamehameha Highway are the golf course grounds, which are heavily landscaped with exotic grasses, shrubs, and trees. *Makai* of the golf course are the horse ranch grounds and the land fronting Turtle Bay, which are also heavily landscaped with ironwood, palms, various lawn grasses, and exotic plants. The resort grounds, located in the *makai*/central portion of the project area, are very manicured and landscaped in a variety of ornamentals, including both exotic and native Hawaiian plants. Exotic plants include date palms (Phoenix spp.), oleander (*Nerium oleander*), bougainvillea (*Bougainvillea* spp.), wedelia (*Wedelia trilobata*), and plumeria (Apocynaceae spp.). Native and Polynesian introduced plants include *naupaka* (*Scaevola spp.*), *hala* (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), *hau* (*Hibiscus* spp.), and at one time *wiliwili* (*Erythrina sandwicensis*), prior to the gall wasp infestation, which killed all of the resort's *wiliwili* trees. Further to the east are dune lands that are home to beach *naupaka* (*Scaevola taccada*), *koa haole* (*Leucaena leucocephala*), Christmas berry (*Schinus terebinthifolius*), and lantana (Lantana spp.). The coastal dunes contain tree heliotrope (*Heliotropium foertherianum*), *hinahina (Heliotropium anomalum)*, *koko* (*Euphorbia degeneri*), beach morning glory (*Ipomoea pes-caprae*), *pōhuehue* and *pōhinahina* (*Vitex ovata*), as well as seashore dropseed (*Sporobolus virginicus*), many of which are native species. The *mauka*/east area is Punahoʻolapa Marsh, which is largely outlined with Indian pluchea (*Pluchea indica*) and Christmas berry (*Schinus terebinthifolius*). The interior marshlands are dominated by bulrush (*Scirpus validus*), native sawgrass (*Cladium leptostachyum*), and other exotic grasses. On the far east coast are patches of ironwood groves, intermingled with golf course grounds and coastal dunes with respective flora.

2.4 Current State of Project Area

SEIS Lands can generally be described as disturbed, being subject to intermittent development and redevelopment for nearly two centuries (Figures 4 and 5). The coastal areas *makai* of the sand dunes fronting the bays are much less disturbed by man, but have experienced a variety of natural disturbances, such as storm surges and the 1946 tsunami.

Kahuku Ranch was located in the vicinity of the SEIS Lands in the 1870s, the remains of which have been found in the Punahoʻolapa Marsh vicinity. The ranch was succeeded by the Kahuku Sugar Plantation by the 1880s. During the plantation era, construction of the Oʻahu Railway and Land Company's (OR&L Co.) railroad began in 1889 and was completed in 1899, connecting Kahuku to other areas of the island. The OR&L Co. ROW is shown on historic maps passing through the center of SEIS Lands and a portion of Punahoʻolapa Marsh. Several small plantation camps were also situated near Kawela Bay and Kuilima Point.

Various construction activities carried out by the U.S. Military during World War II forever changed the landscape in the vicinity of Kahuku Point. The military erected numerous barracks, bunkers, communication towers, runways, revetments, and other buildings for potential air attacks or coastal invasions.

Following the war, the construction of private beach cottages spread along the coast, primarily in the Kawela Bay vicinity, on leased lands. In 1972, the Kuilima Development Company (KDC) opened the current Turtle Bay Hotel, which included 81 beach cottages, as well as an 18-hole golf course, clubhouse tennis courts, swimming pools, and numerous outbuildings. Shortly thereafter, KDC constructed the Kuilima Estates condominium/townhome residential complexes. In the next decade, the residential cottages near Kawela Bay were demolished and construction of a new multi-story hotel was initiated. The hotel's construction never made it past the foundation phase and the remains of the foundation lie in place to this day. The second 18-hole golf course was developed in 2002 (Figure 5).

2.5 TURTLE BAY RESORT REVISED MASTER PLAN

The TBR Revised Master Plan involves additional modifications to the subject area to deal with the needs and resources of the TBR property with the added goal of honoring traditional Hawaiian values. The Revised Master Plan is molded around the concept of "Tomorrow's Ahupuaʻa," which, according to Sichter (2011:7) is based upon "… the successes and challenges, the elements found within each *ahupua*ʻ*a*, and the needs and resources that are available…" as well as the following traditional Hawaiian concepts:

> … understanding and maintaining lands from *mauka* to *makai*; recognizing and stewarding the unique elements and resources of each *ahupua*ʻ*a* in order to strive for self-sustenance; and creating a management framework inspired by the traditional *ahupua*ʻ*a* to care for the lands, resources, people, and culture.
> …
> *Tomorrow's Ahupua*ʻ*a* focuses not only on the lands within the Comprehensive Plan area, but also the interconnected *kula* and *mauka* lands. This broader approach opens up opportunities to make strategic and interrelated improvements throughout the lands of the Comprehensive Plan (Sichter 2011:6).

Under the Revised Master Plan, TBR also proposes to reconfigure the nine *ahupua*ʻ*a* of ʻŌpana (1 & 2), Kawela, Hanakaʻoe, ʻŌʻio (1 & 2), Ulupehupehu, Punalau, and Kahuku into three: ʻŌpana-Kawela, Hanakaʻoe, and Kahuku (Figure 6). This change is in keeping with the ever-changing configuration of *ahupua*ʻ*a* throughout the recorded history of the area (Figures 7-14).

Figure 4. Aerial view of Turtle Bay Resort Lands in 2007 (courtesy of Google Earth).

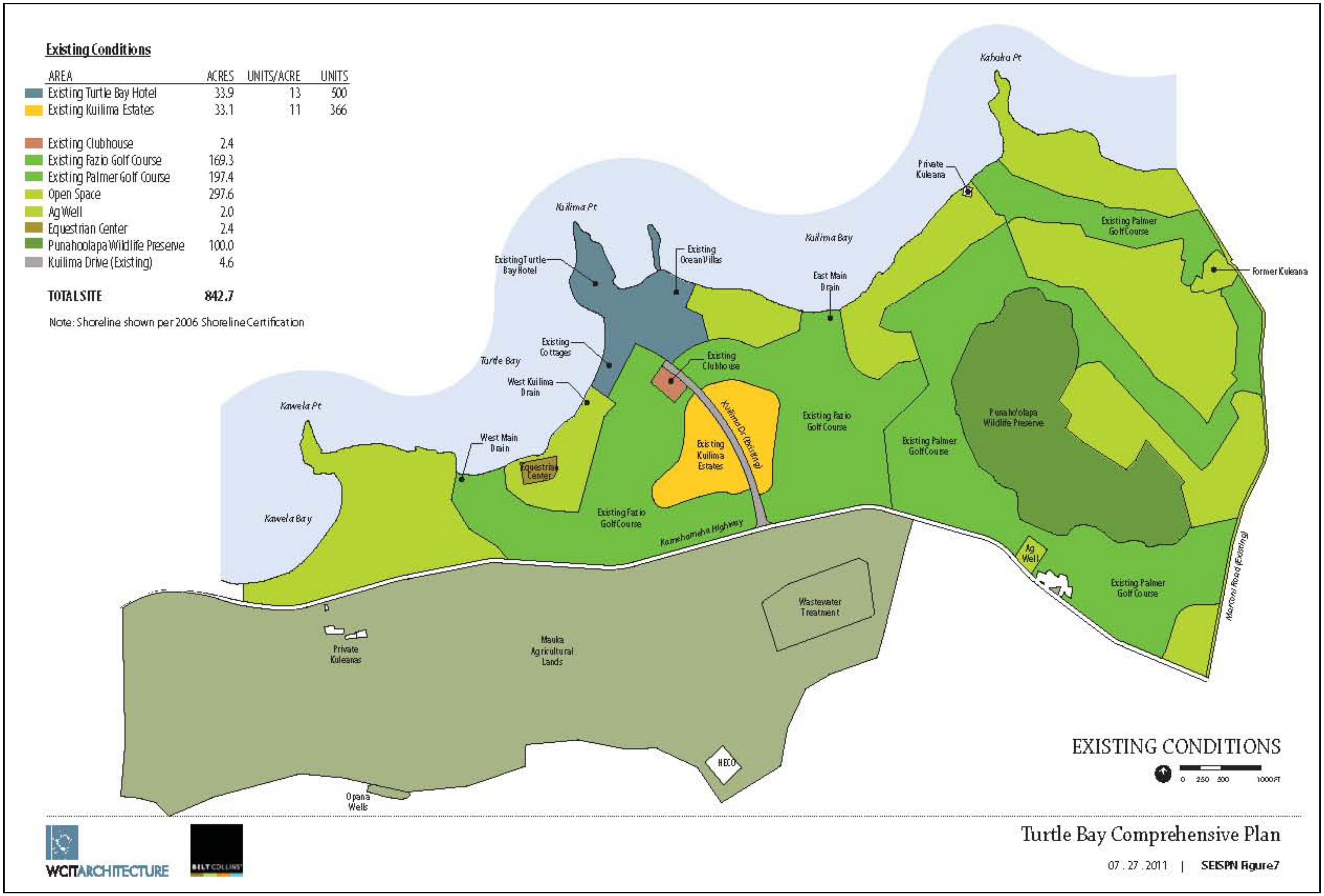

Figure 5. Existing conditions on Turtle Bay Lands (courtesy of Lee Sichter LLC).

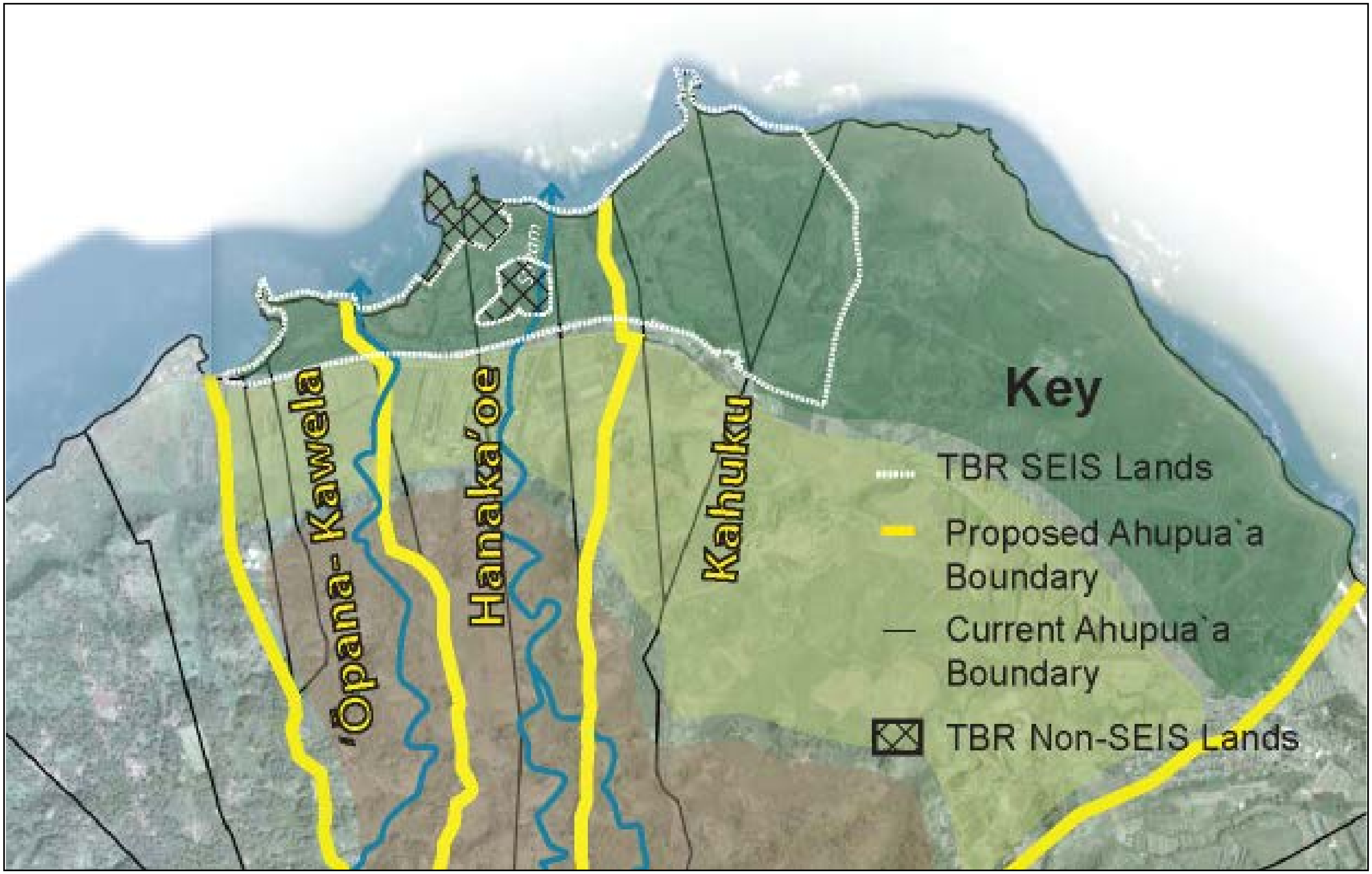

Figure 6. Proposed *ahupua'a* configuration for TBR lands (adapted from Sichter 2011: Figure 5).

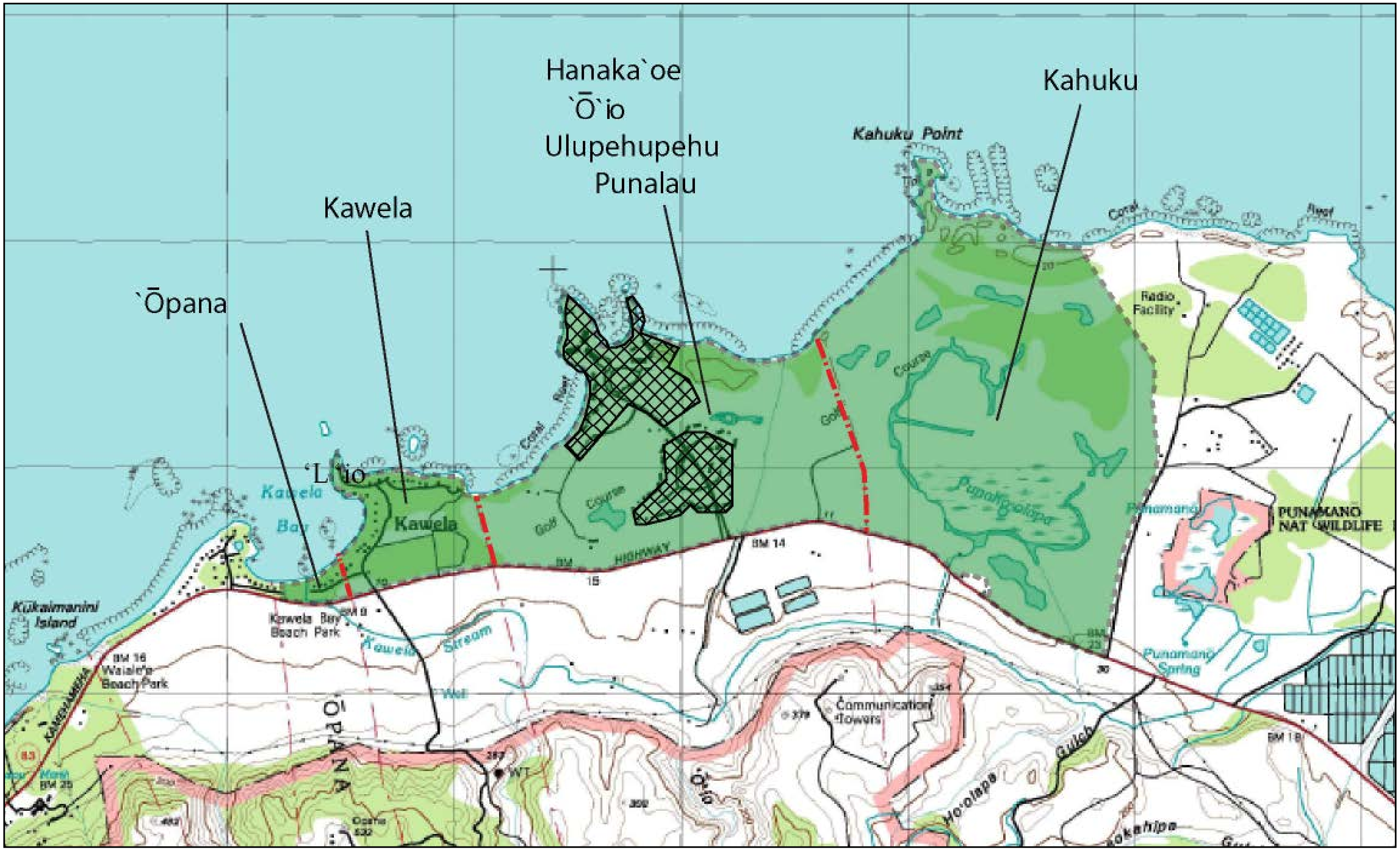

Figure 7. Current configuration of *ahupuaʻa* in TBR lands (adapted from USGS Kahuku Quadrangle Map).

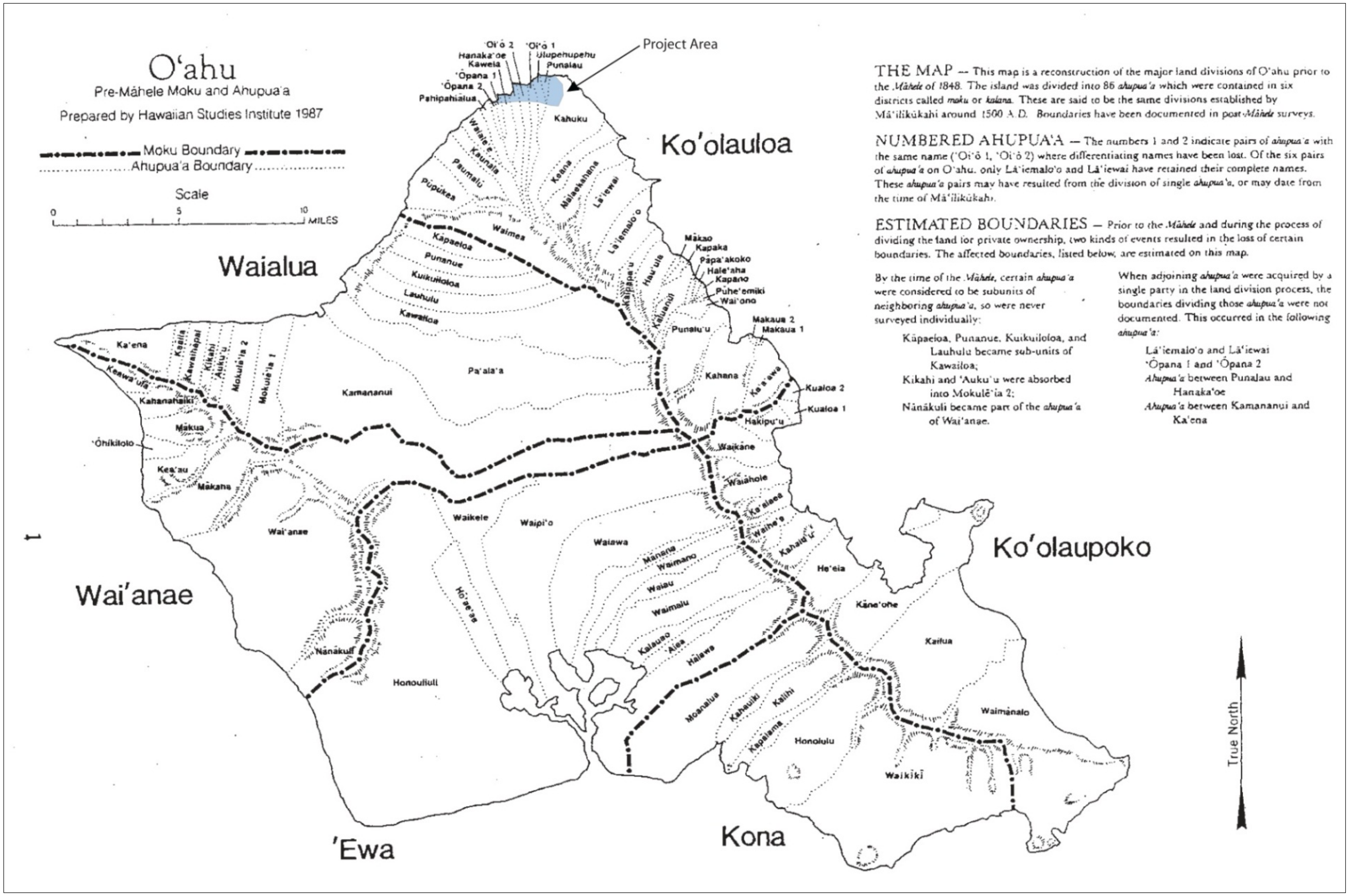

Figure 8. Map of O'ahu, showing pre-Mahele *moku* and *ahupua'a* (courtesy of Hawaiian Studies Institute 1987).

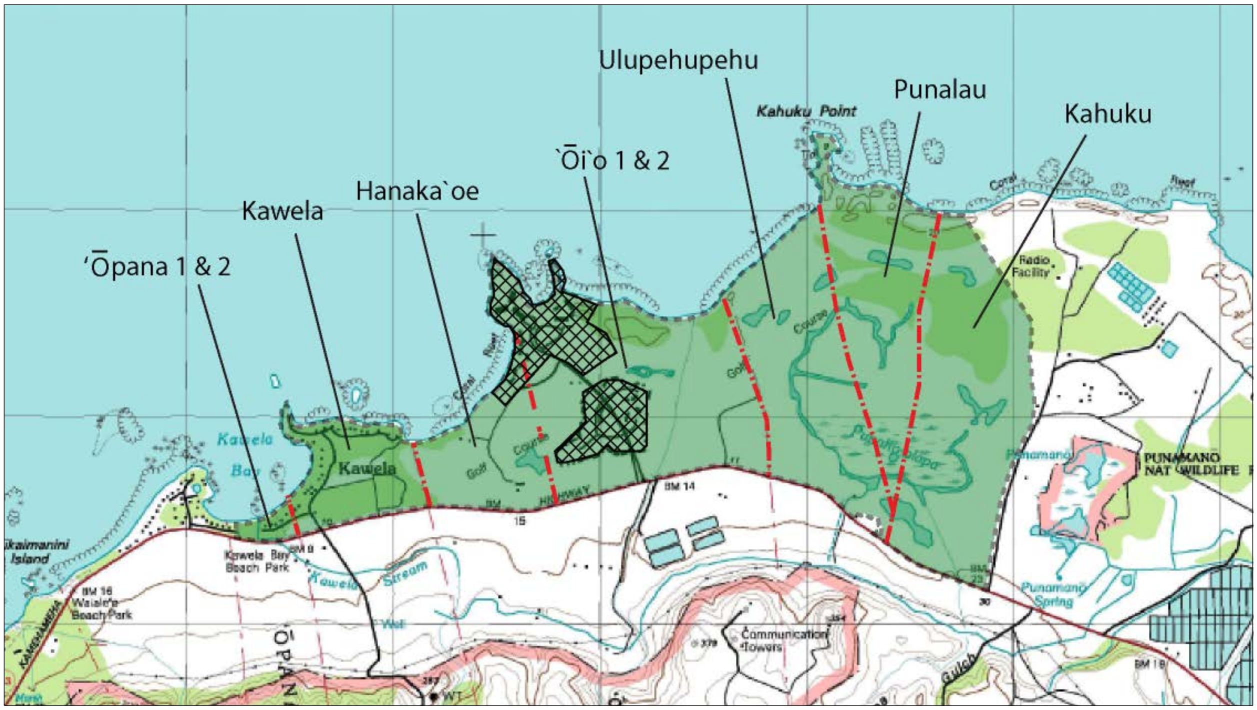

Figure 9. Hawaiian Studies Institute (1987) arrangement and spelling of *ahupuaʻa* in SEIS Lands (adapted from USGS Kahuku Quadrangle Map).

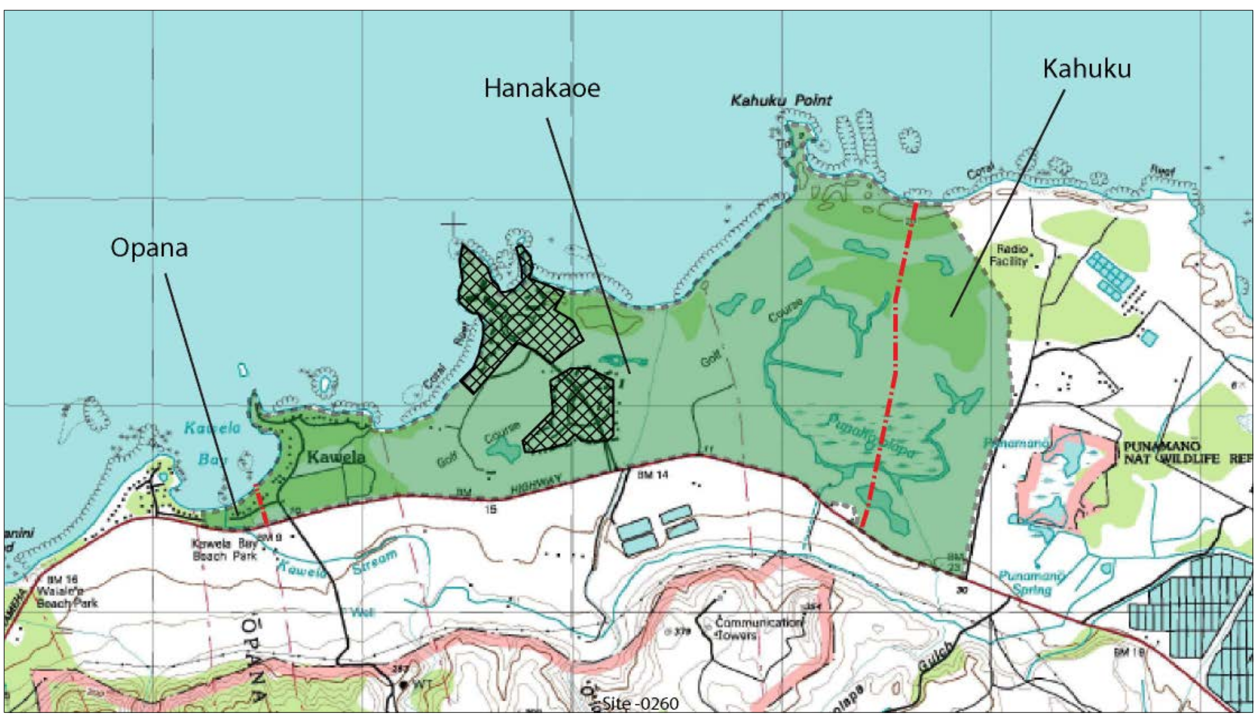

Figure 10. Sterling and Summers (1978) arrangement and spelling of *ahupuaʻa* in SEIS Lands (adapted from USGS Kahuku Quadrangle Map).

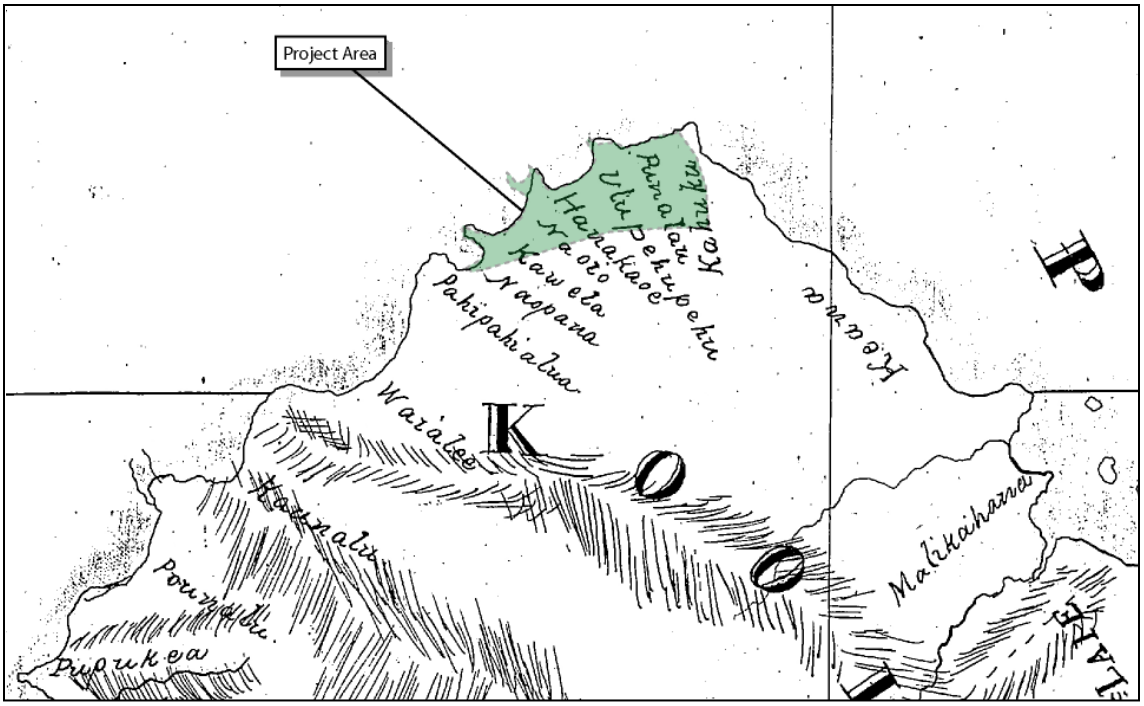

Figure 11. Portion of 1833 Emerson Map of O'ahu with approximate project area location.

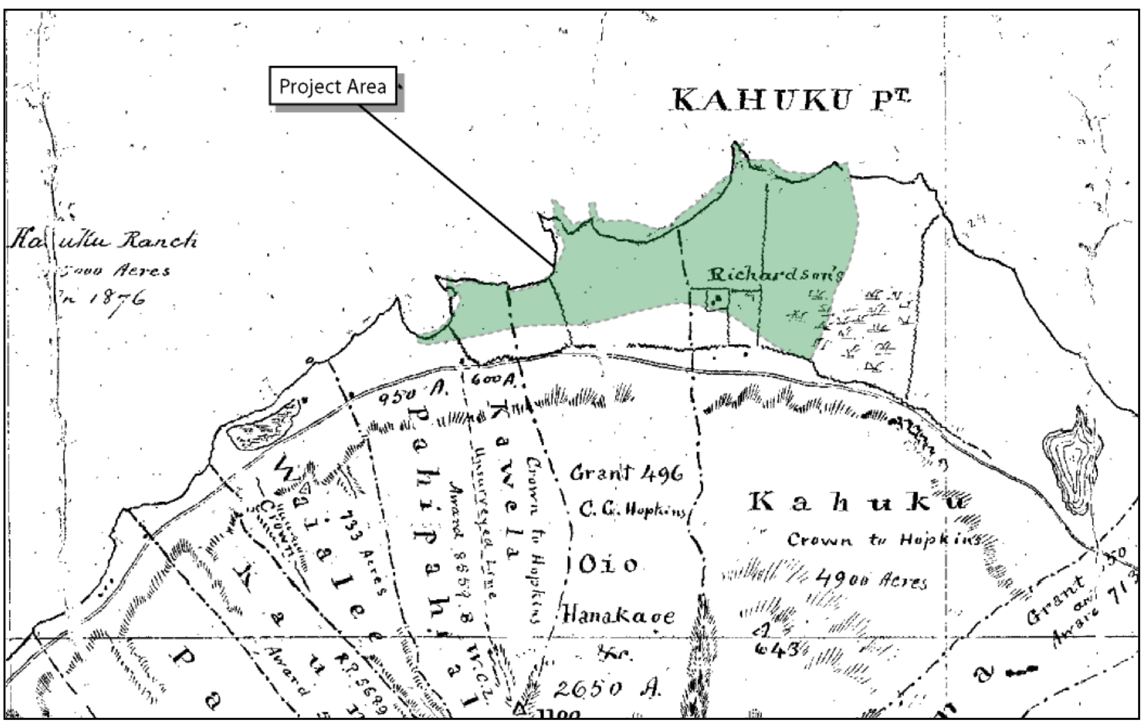

Figure 12. Portion of 1878 Lyons O'ahu Government Survey map of with approximate project area location.

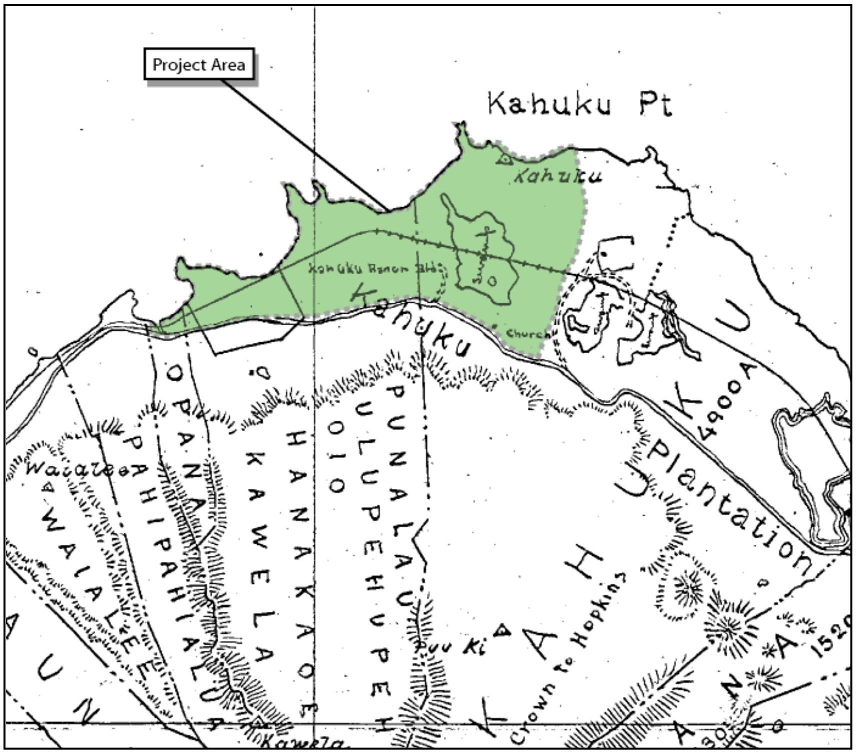

Figure 13. Portion of 1906 Donn map of O‘ahu with project area location.

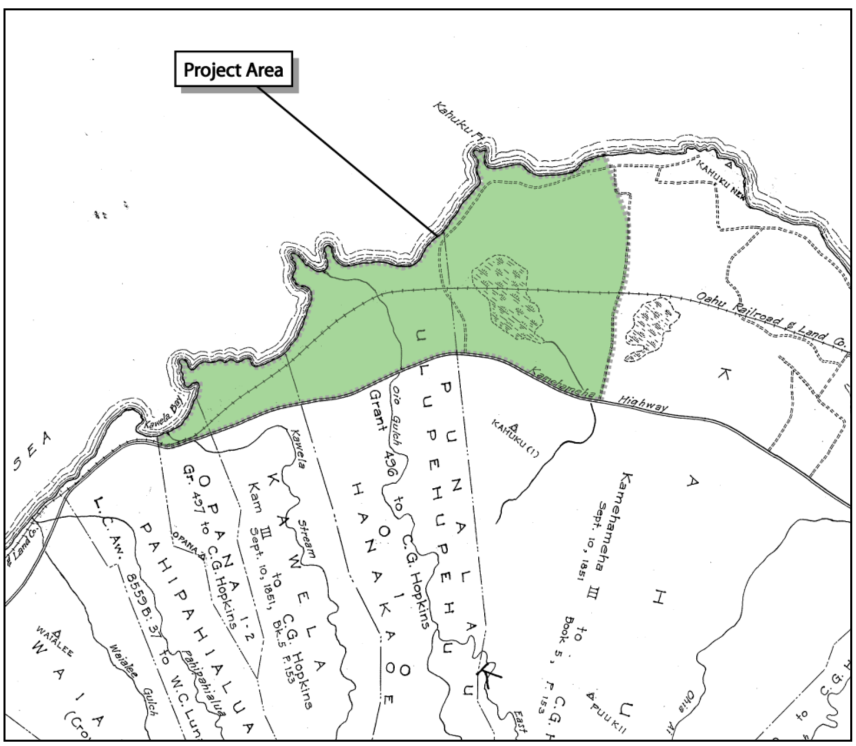

Figure 14. Portion of 1933 King map of Kahuku Forest Reserve with project area location.

3.0 ARCHIVAL RESEARCH SUMMARY

This section is a synthesis of records documenting traditional and mythological accounts associated with the SEIS Lands and surrounding areas as well as Historical documentation and archaeological record. The names and locations of *ahupuaʻa* used in this section of the report are largely derived from information in the *Oʻahu Pre-Mahele Moku and Ahupuaʻa* map created by Kamehameha School's Hawaiian Studies Institute in 1987 (Figure 8). According to this map, SEIS Lands span an area that incorporates the *makai* sections of nine *ahupuaʻa*, including: ʻŌpana 1(1and 2), Kawela, Hanakaʻoe, ʻŌʻio (1 and 2), Ulupehupehu, Punalau, and Kahuku. However, as evidenced by numerous historic maps, there have been many configurations and spellings of these *ahupuaʻa* (Emerson 1833; Lyons 1878; Donn 1906; King 1933; Sterling and Summers 1978, Hawaiian Studies Institute 1987, and USGS 1998 Kahuku Quadrangle Map; Figures 8-14). At the end of this section, traditional accounts will be discussed by individual *ahupuaʻa* as defined by the Hawaiian Studies Institute in 1987 pre-Mahele map. Interestingly, some *ahupuaʻa* in this area, specifically Kahuku, are extensively covered in traditional accounts and/or *moʻolelo*, while some are barely mentioned at all.

The subject *ahupuaʻa* are located within the district, or *moku*, of Koʻolau Loa, within which the SIES Lands are located, extends from the *ahupuaʻa* of Kaʻaʻawa on the central east side of Oʻahu, rounding the northern tip of the island to Pūpūkea. In *Sites of Oʻahu* (Sterling and Summers 1978:142), writer for *Ka Nūpepa Kuokoa*, S. M. Kaui, holds that Koʻolau Loa District stretches from Keahu-o-Hapuʻu to the Point of Kaʻōʻio, which is between Kualoa and Kaʻaʻawa. The name of this district, Koʻolau Loa, as spelt by Pukui et al. (1974:117) literally translates to "long Koʻolau" (ibid.), Koʻolau being the windward mountain range that runs along the entire eastern side of Oʻahu.

3.1 PRE-EUROPEAN CONTACT CULTURAL LANDSCAPE

In general, traditional and mythological accounts from pre-European contact Hawaiʻi represent a belief system explaining all aspects of the physical universe and spirit realm, the origin and nature of mankind, and the history of the community, as well as collectively remembering the heroic adventures, exceptional feats, and cautionary tales of the ancestors. These traditional accounts are contained in the hearts and minds of cultural practitioners and customarily passed on through oration. Throughout the passage of time, figures transcend earthly legends into the cosmic, divine, and fearsome realm of the gods that is only separated from the mundane world by a thin veil and have the power to interact with and cast influence on the mundane. To this day, a sense of respect, reverence, and fear is still held on to by cultural practitioners and those indoctrinated in these traditions, as it is believed that the very landscape is imbued with the *mana* (life force or supernatural energy) of the divine.

3.1.1 Traditional Names of Topographical Features

The natural landmarks within the project area possessed Hawaiian names in the pre-Contact era, which were based on distinguishing characteristics, *mo'olelo*, or traditional use of the area. These traditional names are seldom used to refer to these landmarks in the modern era.

> … I was born in the Marconi area on May 10, 1887. My maiden name was Kainanui, and my father was a former chief of the village. The only good swimming area at Kahuku was Kalokoiki, the cove next to the hotel. All of the old-timers went there. The point the hotel is on is called Kuilima Point now, but Kuilima is an inland name for the plains area around the highway bridge that says "Kuilima." The correct name of the point is Kalaeokaunu. The smaller point on the other side of the cove is Kalaeokamanu. I composed a song entitled "Kuilima" that mentions some of the special places in Kahuku, including Kalokoiki, but it hasn't been recorded. *Kuilima* means "to walk hand-in-hand." (John Clark 2003:201)

A map distinguishing the locations of these and other coastal landmarks by their traditional names is provided in Figure 15.

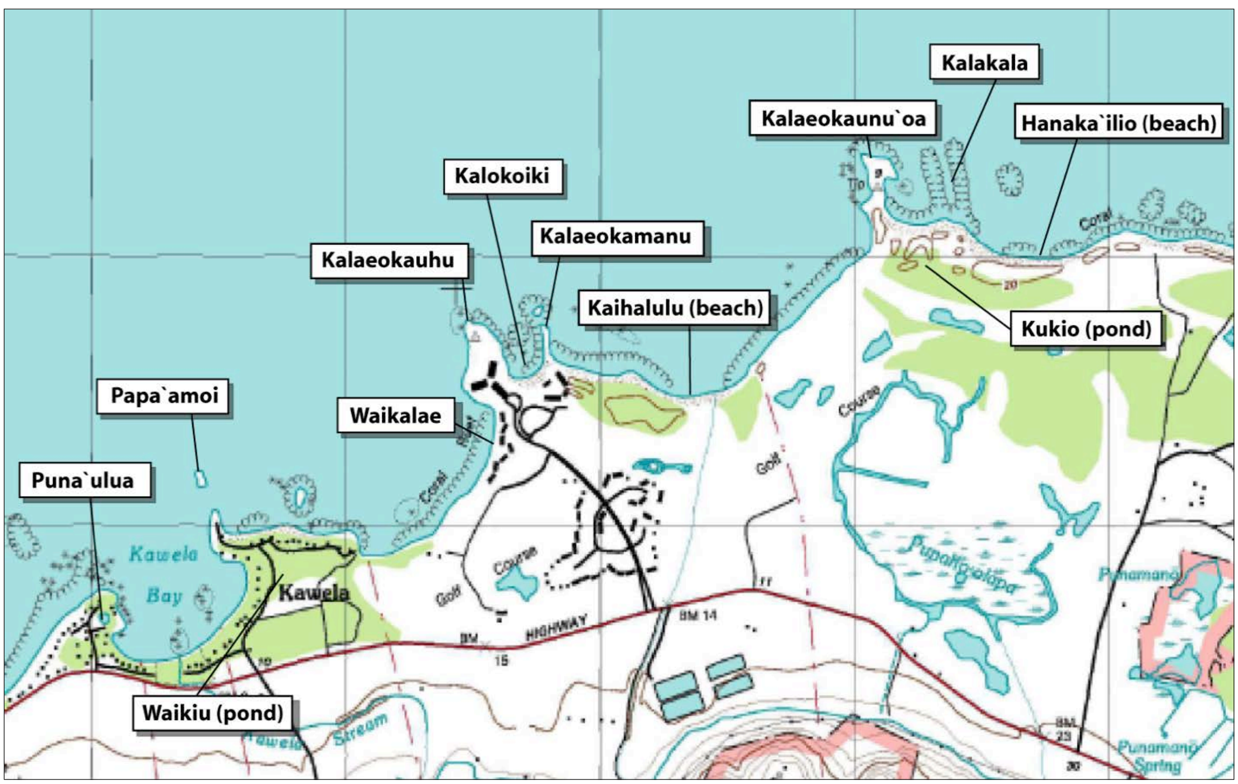

Figure 15. Traditional names of landmarks on the Turtle Bay Resort property.

3.1.2 The Natural World

Conversely, the mundane, or lifeways and land use, of pre-European contact Hawaiians are also part of the cultural landscape and are interpreted through archaeological research in conjunction with oral histories and recorded traditional accounts. Handy and Handy (1972) provide some commentary on general land use patterns of ancient Hawaiians that are applicable to the general Kahuku area. As marine resources represent the main source of protein in the traditional Hawaiian diet, Handy and Handy (ibid.) suggest that upland agriculture was typically preceded by or correlated with the productiveness of an area's coastal fishing grounds. *Mauka* lands were intensively developed in areas where coastal fishing grounds were easily accessed. On O'ahu, sweet potatoes were cultivated to supplement taro, the main starch of the Hawaiian diet, when soils were too sandy or dry to grow taro. Further, sweet potato cultivation, typically grown inland, appeared to correlate with high population densities in general.

Traditionally in Hawai'i, environmental zones were perceived and determined by various natural features and resource criteria (Handy and Handy 1991:54-56). The following describes the terrestrial environmental zones:

1. *Ko Kaha Kai*: Land by the sea, or coastal region providing marine resources (fish and other marine animals, seaweed and salt). "Kaha was a special term applied to areas facing the shore but not favorable for planting.
2. *Kula*: The plains or sloping lands (without trees) above the coastal region.
   a) *Kula kai:* Seaward plains.
   b) *Kula uka*: Inland or upland slopes (towards the mountains).
3. *Kahawai:* The place (having) water. The area beyond or intersecting the *kula* lands. This upland zone provided suitable agricultural sites and abundant naturally occurring resources which were used for religious, domestic, and economic purposes.
4. *Wao:* Wilderness
   a) *Wao kanaka:* Region of man. Lower forest, providing hard wood (*koa*) for spears, utensils, and logs for canoes; *lau hala* (pandanus leaves) for thatch and mats; *māmaki* for bark cloth (*tapa*); *kukui* (candlenut) for oil; wild yams, roots, and sandalwood.
   b) *Wao akua*: Region of deities. …remote, awesome, seldom penetrated, source of supernatural influences, both evil and beneficent.
   c) *Wao ma'ukele*: Rain forest. Here grew giant trees and tree ferns (*'ama'u*) under almost perpetual cloud and rain.

The Turtle Bay Resort is located in the following environmental zones: *Ko Kaha Kai*, and *Kula Kai*. Numerous traditional accounts, *mo'olelo*, and Land Claim Native Testimonies allude to the cultivation of lands, varying in intensity, from *kula* to *wao* (Hall 1839; Fornander 1917; Thrum 1919; Handy 1940, 1972; Sterling and Summers 1978; Silva 1984; Maly and Maly 2003).

Traditionally in ancient Hawaiian culture, marine zones were also distinguished by various natural features and resource criteria. The following describes the marine environmental zones (Handy and Handy 1991:56-57):

1. Neritic zone: Near-shore waters, extending from the upper reaches of the tidal edge to about 200m in depth. Contains the most resources for human use. (Midden remains from Hawaiian sites show a preponderance of species from neritic habitats [Jeffery Clark 1986:34]). Corresponding to the Hawaiian marine habitats of:
    a) *Kai puʻe one*: (heaps [of] sand) the sandy edge of the sea, inshore dunes, or outer sand bar;
    b) *Kai poʻi*: (sea-breaking) out to where the wave breaks;
    c) *Kai kohola*: the lagoon, the shallow sea inside the reef;
    d) *Kai pualena*: the yellowish sea, where the streams flow in and roil the waters;
    e) *Kai ʻele*: the dark sea; and
    f) *Kai uli*: the deep blue-sea.

2. Pelagic zone: the open ocean, waters lying beyond or exceeding the depth of 200 meters.
    a) *Kai-pōpolohua-mea-a-Kāne:* the far reaches of the open sea (Jeffery Clark 1986:34).

Marine environments were subject to the traditional resource management system as well, supported by the *kapu* (religious law) system in ancient Hawaiʻi, which preserved *lōkahi* (balance) on many levels between humans and these resources. Various marine resources were key to pre-Contact era Hawaiian lifeways for various uses, such as *iʻa* (fish), *he iʻa mea iwi mawaho* (shellfish), *heʻe* (squid/octopus), *limu* (seaweed), *paʻakai* (salt), *ʻākoʻakoʻa* (coral), *pōhaku* (stones), *manu* (bird), and *honu* (turtle). These resources were used for sustenance, tool making, medicine, trade, architecture, and ceremony. *Paʻakai* was one of the most important marine resource for its many applications, including food preservation, seasoning, medicine, and ceremonial use (Malo 1898:132; Brigham 1908; Westervelt 1915).

3.1.3 Traditional Hawaiian Land Divisions

The pre-Contact economy of the Hawaiian Islands was based upon agricultural production that worked within a tiered system of land divisions (Lyons 1875; Malo 1951; Handy and Handy 1972; Kirch 1985; AKAC 2010). In 1875, Curtis J. Lyons, the distinguished surveyor published an article in *The Islander* on land issues, which identified the *ahupuaʻa* as the principal subdivision in a *moku*. In this article, he states:

> ...Its name is derived from the *Ahu* or altar; (literally, pile, *kuahu* being the specific term for altar) which was erected at the point where the boundary of the land was intersected by the main road, *alaloa,* which circumferenced each of the islands. Upon this altar at the annual progress of the *akua makahiki* (year god) was deposited the tax paid by the land whose boundary it marked, and also an image of a hog, *puaa,* carved out of kukui wood and stained with red ochre. How long this was left on the altar, I do not know, but from this came the name, *ahupuaʻa,* of the pile of stones, which title was also given to the division of land marked thereby…(Lyons 1875:103-104).

The islands are divided into several sections called *moku* (districts), in which are particular subdivisions referred to as *ʻokana* (a portion) or *kalana* (a division) (Lyons 1868:67-68; Malo 1951:16-17). According to Curtis J. Lyons (1868) in *Nūpepa Kuakoa*, these units are further divided into *ahupuaʻa*, which are the main units of traditional Hawaiian land division. Within *ahupuaʻa* are *ʻili*, followed by *ʻili paʻa, ʻili kūpono, ʻili lele, lele, moʻo, moʻo ʻāina, paukū, kīhāpai, kōʻele,* and *kuleana* (Pukui and Elbert 1986). However, in some cases, the *ʻili kūpono* or *kū* were a type of sovereign *ʻili* within an *ahupuaʻa* that were not made to pay tribute to the chief (Thrum 1890:106). Within the *paukū* are dry land patches, referred to as *kōʻele*, *hakuone*, and *kuakua* (cultivated specifically for the chief; listed from smallest to largest). In general, high elevations or mountains are called *mauna,* but mountains or mountain summits located centrally on the island are termed *kuahiwi*, while the peaks or ridges on top of the *kuahiwi* are called *kualono.* In 1868, Lyons continues to describe the geography of the typical *ahupuaʻa* as well as the Hawaiian names for these geological features, stating:

> The place where trees are small below the fern belt is termed kuahea (hillock section); below it is the wao (wild place), also called waonahele (wilderness) and wao eiwa (ninth wilderness). The place where trees grew taller below the wao eiwa is the wao maukele, and a little below it again is the waoakua (spirit region) ; next below that is where voices increase and, hence, called wao kanaka (people's sphere), because there the people cultivate food. Below that is apaa, and next is ilima (where this plant of the Sida genus is found), and below it is pahu (stake or land mark). Below pahu is kula (open country) adjoining habitations, and seaward of the village is the shore, where it joins the sea. Such was the island divisions by the ancient people of Hawaii.
>
> …Places that stand high up in this and that locality are called puu (mounds or peaks) ; if they stand in a row they are a lalani puu, or pae puu (a line or range of peaks or hills)…High places of the earth lying narrow is a lapa (ridge), or kua lapa (shoulder ridge). If the ridges are many they are called olapalapa (rough protuberances). Deep places lying lengthwise are called kahawai, awawa, or owawa (streams, valleys or ditches). Lengthy, solitary places are called alanui (roads), and kuamoo (paths), and if it continues circuiting the island it is a highway. In places where the path is steep it is called piina or hoopiina (ascending path), kooku (hill slope), and auku (up hill road). Descending paths are termed ihona, alu, kalua, and hooihona, and the place where men would rest is oioina (a resting place). Places where water flows continually are streams (kahawai). Inland places are kumu (source) and seaward places are called nuku (point or outlet). Where water is led to places of cultivation, that is called an auwai (watercourse) ; where the water joins the sea is a muliwai (river) ; waters borne within the land are lokos (lakes or ponds) (C.J. Lyons 1868 as cited in Thrum 1921:67-68).

Perhaps the ancient Hawaiians created names for an array of topographical features and slight variations within the *ahupuaʻa* as a way to help keep the dynamic *mauka-makai* economic structure organized.

3.1.4 Life in the Ahupuaʻa

With great variations of geological features, each *ahupuaʻa* had its own dynamic resource management system that was based on traditional customs upheld by the *kapu* system, or ancient religious law. The *ahupuaʻa* typically extended form the coast to the nearest mountain top or ridge and resources from the land and sea were equally distributed within the *ahupuaʻa*. Lyons (1875) describes the geographic nature of the *ahupuaʻa* as well as the movement of resources from mountain to sea and vice versa, stating:

> The Ahupuaa ran from the sea to the mountain, theoretically. That is to say the central idea of the Hawaiian division of land was emphatically central, or rather radial. Hawaiian life vibrated from *uka,* mountain, whence came wood, kapa, for clothing, olona, for fish line, ti-leaf for wrapping paper, *ie* for rattan lashing, wild birds for food, to the *kai,* sea, whence came *ia*, fish, and all connected therewith. Mauka and makai therefore fundamental ideas to the native of an island (Lyons 1875: 104).

The *ahupuaʻa* was also an important socio-political unit in the pre-Contact era, each unit with its own hierarchy. Kirch (1985) holds that *moku* were independent chiefdoms, divided into a number of radial land divisions, referred to as *ahupuaʻa,* with subdivisions of *ʻili* and *moʻo* within. According to Kirch (1985),

> Each ahupuaʻa was controlled by a lesser chief, who in turn appointed one or more stewards to oversee production, organize work parties, collect tribute, and in other ways represent the chief. Ahupuaʻa were economically self-sufficient to some degree, although differences in the local resource base (agricultural land, water resources, stone for tools, and so on) resulted in differences in the production patterns of individual land sections. Within the ahupuaʻa, there were yet smaller sections and divisions, especially the ʻili and moʻo, which were held and worked by extended households or groups of commoners.

According to Handy and Handy (1972), for the purpose of taxation, the chief political subdivision of the pre-Contact era was the *ahupuaʻa,* which was generally under the management of the *konohiki* (steward or caretaker). The term *ahupuaʻa* itself is derived from the fact that each coastal *ahupuaʻa* boundary was marked with an altar (*ahu*) which held a carved wooden effigy of a pig (*puaʻa*) head during the Makahiki festival, when harvest tributes (taxes) were offered to the god of rain. Handy and Handy (1972) refer to the lower chief who represented the *ahupuaʻa* as *aliʻi ʻai ahupuaʻa*, which translates to English as "chief who eats the ahupuaʻa" (1972:48). Yet, according to Malo (1951:142) the *konohiki* was tasked with collecting levies from the *makaʻāinana* (commoners; literally "people that attend the land") of the *ahupuaʻa* for the king and of the *aliʻi ʻai ahupuaʻa.* The word *konohiki* is defined by Pukui and Elbert (1986) as the, "Headman of an ahupuaʻa land division under the chief; land or fishing rights under control of the konohiki; such rights are sometimes called konohiki rights" (1986:166). Thrum (1924) wrote that the *konohiki* was a local representative or steward of the landlord owner whose privileges and duties were, "…practically those which go with that position in any land and in common with his brethren today in Russia or Ireland he had his failings and was not always popular among his fellows…" (1924:60).

Handy and Handy (1972) liken the *ahupua*ʻ*a* tenure system to western share cropping, where "sharing between the chief and tenant was comprehensive and reciprocal in benefits" (1972:48). Kirch and Sahlins (1992) delve further into the social dynamics of the *ahupua*ʻ*a* in their historical ethnography, *Anahulu: The Anthropology of History in the Kingdom of Hawaii, Volume One*. Kirch and Sahlins (1992:17) state the following about variations in land use in the ancient *ahupua*ʻ*a*:

> Economically more highly valued, the coastal areas were also generally preferred for chiefly residence. Here were the most extensive wet taro lands, offshore and onshore fish ponds, as well as access to the sea and the fishing and surfing that in Hawaii were sports of kings. Still, the uplands were also necessary for the Hawaiian existence. In addition, to things mentioned by Lyons, people were specifically dependent on the uplands for the timber and thatching of their houses; the materials for their canoes, bowls, weapons, images, agricultural tools, and other objects using hardwoods; rope, line, fishnetting; lighting (form candlenuts); pasture for domestic animals (in the nineteenth century); various fruit trees; and more (Kirch and Sahlins 1992:19).

Thus, resources needed for daily life were best grown in or collected from the habitats that they were best suited for and likely distributed, through trade, gifting, or taxes, from *mauka* to *makai* or vice versa within the *ahupua*ʻ*a*. Further evidence of this is found in the archaeological record, where most upland habitation features in the area contain significant amounts of marine shell and fish bone in midden deposits, which suggests that people inhabiting the *mauka* areas of the *ahupua*ʻ*a* had a steady diet of marine resources (Jensen 1989; Williams and Patolo 1998).

3.1.5 Moʻolelo of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku Ahupuaʻa

Each *ahupua*ʻ*a* in the SEIS Lands has a traditional background from the pre-Contact era. Ancient *mo*ʻ*olelo* for each *ahupua*ʻ*a* helps to explain their traditional names, what kinds of natural resources were found within, what stories and mythological figures are associated with them, as well as the chronicles and conflicts may have occurred there. These facets of the cultural landscape help to provide a connection for modern day cultural practitioners to the land and their ancestors who dwelt in these *ahupua*ʻ*a*. In addition, traditional *mo*ʻ*olelo* about each *ahupua*ʻ*a* is integral to understanding the cultural, historic, and spiritual significance of these lands.

ʻŌpana Ahupuaʻa

ʻŌpana Ahupuaʻa (1 and 2) are the western most of the nine *ahupuaʻa* making up the project area. The Hawaiian Studies Institute 1987 map of Pre-Mahele Oʻahu shows ʻŌpana as a "numbered *ahupuaʻa*," which indicates that the differentiating names have been lost for the two subdivisions ʻŌpana 1 and 2 (The Hawaiian Studies Institute 1987).

In Pukui et al. (1974), the name ʻŌpana is suggested to be related to *ʻōpā*, which means "to squeeze." According to Andrews (1922:663), Opana, spelled without any diacriticals, translates to "arrow pierced" and is said to be a "name applied to several localities."

According to Handy (1940) a small spring-watered terrace named Kawela extended from the edge of ʻŌpana into Hanakaʻoe, which was used to grow taro. Further, ʻŌpana is one of two areas used for taro cultivation in the stretch from Kahuku Point to Waimea Bay (Handy 1972). Just outside of ʻŌpana Ahupuaʻa on the west side of Kawela Bay is a small freshwater fishpond, referred to as Kāpī or Punaulua (Site 258 in Sterling and Summers 1978:147). However, John Clark (2003:311) states that Punaulua is freshwater spring located on the west shore of Kawela Bay that is connected to the sea by an underwater passage that attracts *ulua* (*Caranx* sp.); hence, the name. This is further upheld by Judge Rathburn, where he states: "…there were no terraces along the Hanakaʻoe, Oio, or Kaalaea stream bed in this ahupuaʻa [Hanakaʻoe]; the only terraces were those watered by the springs mentioned under Opana" (as cited in Sterling and Summers 1978:148). Thus, fresh spring water was available in this locality for agriculture in ancient times and also created an estuarine coast that attracted the prized *ulua*.

There are several legends associated with this *ahupuaʻa*, that include the gods Kāne and Kanaloa. McAllister (1933) states that Kāne and Kanaloa lived in ʻŌpana for a period to utilize a horseshoe-shaped rock alignment just outside of Kawela Bay, known as Papaamui, to catch fish (as cited in Sterling and Summers 1978:147). Another story took place well before European Contact at the fresh-water fishpond near ʻŌpana and Kawela Bay referred to as Kāpī or Punaulua. In this chronicle, the god Kāne approached a mass of people gathered at a beach near the Punaulua Pond to catch what they thought were *ʻōʻio* (bone fish). Kāne kindly informs the people that the fish were *puhi* (eel) rather than *ʻōʻio*. The people, not recognizing Kāne as a god, challenge him in a wager and net all of the fish, which turn out to be *puhi*. Later in the story, as the people wondered who this mysterious man was, Kāne accompanied the group up into the mountains and struck a stone in a serene valley, known as Waikāne, creating a fresh-water spring (ibid.:147-148).

Kawela Ahupuaʻa

Adjacent to the east of ʻŌpana 1 and 2 is Kawela Ahupuaʻa, according to the Hawaiian Studies Institute Oʻahu Pre-Mahele Moku and Ahupuaʻa Map published in 1987. However, in Pukui et al. (1974:99-100) Kawela is not listed as an *ahupuaʻa*, but listed as a bay, land section, gulch, and stream in the Kahuku quadrangle. Further, Sterling and Summers (1978) do not include Kawela as an *ahupuaʻa* in the map of Koʻolau Loa.

According to Pukui et al. (1974:99-100) Kawela translates as "the heat" and was traditionally applied to the coast stretching from Pahipahiʻālua Ahupuaʻa to Kawela Ahupuaʻa. Within Kawela Ahupuaʻa is a spring-fed terrace with the same name (Site 259), which is said extend from ʻŌpana into Hanakaʻoe in Sterling and Summers (1978:147). However, in maps that include pre-Mahele *ahupuaʻa* such as Kawela, this terrace would be located within Kawela Ahupuaʻa. Also within this a coastal pond traditionally named Wākiu, which translates as "northwest wind sound" (John Clark 2003:385). According to John Clark (2003:282), the small reef island located east of Kawela Bay is called Pāpaʻamoi, which translates as scorched thread fish. McAllister's (1933:152) writes about horseshoe shaped rocks named Papaamui located in the same area as the place where Kāne and Kanaloa collected fish. These two localities are likely the same and according to pre-Mahele maps, placed off the coast of Kawela Ahupuaʻa.

In the tradition of Laukaieie, recorded in 1895 by Mose Manu, the celebrated adventurer, Makanikeoe, travelled from Waipiʻo Uka to Waialua before stopping at Kawela during his tour of various springs of Oʻahu (Maly and Maly 2003), which indicates that the spring at Kawela was a significant one for the area. The Waikāne Stone (Site 259) is located on the border of Kawela and Hanakaʻoe Ahupuaʻa and is said to be a large stone located at the foot of the *pali* next to the stream bed on the mountain side of Kawela Bay in Hanakaʻoe. This is the stone that Kāne struck to make the water flow forth freely (McAllister 1933 as cited by Sterling and Summers 1978:148). Thus, a spring provided fresh water for the agricultural terraces in Kawela. Handy (1940:88) upholds the presence of an agricultural terrace named Kawela, which is described as stretching from ʻŌpana to Hanakaʻoe.

Further, McAllister (1933) states that, "Near the beach and in line with Waikane was a fishing shrine called Pahipahialua" (ibid.:148), indicating that the *makai* lands of Kawela Ahupuaʻa were used for ceremonial purposes.

Hanakaʻoe Ahupuaʻa

Although in Sterling and Summers (1978) Hanakaʻoe Ahupuaʻa is one of the only *ahupuaʻa* in the area of concern as well as the largest *ahupuaʻa*, little in the form of traditional accounts are recorded. Further, the exact location of the *ahupuaʻa* boundaries are vague on the 1987 Hawaiian Studies Institute pre-Mahele Oʻahu map, making the task of attributing stories and landmarks to Hanakaʻoe or its adjacent *ahupuaʻa* difficult.

According to Andrews (1922:630), Hanakaʻoe (without the diacriticals) translates to "do you work" and is simply a land section in Koʻolau Loa, Oʻahu. Although, Pukui et al. (1974:40) agrees that Hanakaʻoe (without the diacriticals) is a land division and Sterling and Summers (1978:148) agree that it is an *ahupuaʻa*, neither source offers up an English translation for the meaning. There are other points of interest on the coast and interior of Hanakaʻoe Ahupuaʻa._The most prominent point of the project area was known as Kalaeokaunu, or "the point of the altar," in ancient times (John Clark 2003:101). This point, now called Kuilima Point, is where the Turtle Bay Hotel sits. Another landmark is the sandy beach west of the Turtle Bay Hotel, traditionally known as Waikalae, which translates as "water [of] the point"(ibid.:375).

Handy and Handy (1991:462) hold that there were not sufficient flat lands in Hanakaʻoe for taro cultivation under the old system. Further, Judge Rathburn held that "…there were no terraces along the Hanakaoe, Oio, or Kaalaea stream bed in this ahupuaʻa [Hanakaʻoe]; the only terraces were those watered by the springs mentioned under Opana" (as cited in Sterling and Summers 1978:148). Bordering on Kawela and Hanakaʻoe Ahupuaʻa is the Waikāne Stone (Site 259) is said to be a large stone located at the foot of the *pali* next to the stream bed on the mountain side of Kawela Bay in Hanakaʻoe. This is the stone that Kāne struck to make the water flow forth freely (McAllister 1933 as cited in Sterling and Summers 1978:148). Therefore, fresh spring water was available for the agricultural terraces of Kawela. McAllister (1933) also revealed that, "Near the beach and in line with Waikāne was a fishing shrine called Pahipahialua" (ibid.:148), which suggests that the lands of coastal Kawela Ahupuaʻa were used for ceremonial as well as subsistence purposes.

ʻŌʻio Ahupuaʻa

Not much information exists about this *ahupuaʻa*, however, it existed as an *ahupuaʻa* with two sections, ʻŌʻio 1 and ʻŌʻio 2, in pre-Mahele times according to the Hawaiian Studies Institute 1987map of pre-Mahele Oʻahu. ʻŌʻio 1 and ʻŌʻio 2 are also listed as *ahupuaʻa* in Koʻolau Loa under the Crown, Government, and Fort Lands section of the 1905 *Revised Laws of Hawaii (*Frear et al. 1905:1220*)*.

According to Andrews (1922:662), Oio (with no diacriticals) is a land section in Koʻolau Loa, Oʻahu and translates as a "procession of ghosts." ʻŌʻio, in its varied spellings, is often used synonymously with the Night Marchers. Beckwith (1970) explains the Night Marchers in *Hawaiian Mythology*, stating:

> Family ties in the afterworld remain unbroken, and all Hawaiians believe in the power of spirits to return to the scenes they knew on earth in the form in which they appeared while they were alive. Especially is this true of the processions of gods and spirits who come on certain sacred nights to visit the sacred places, or to welcome a dying relative and conduct him to the aumākua world. "Marchers of the night" (Huakaʻi-pō) or "Spirit ranks" (ʻoiʻo) they are called. Many Hawaiians and even some persons of foreign blood have seen this spirit march or heard the "chanting voices, the high notes of the flute, and drumming so loud as to seem beaten upon the side of the house." Always, if seen, the marchers are dressed according to ancient usage in the costume of chiefs or of gods. If the procession is one of gods, the marchers move five abreast with five torches burning red between the ranks, and without music save that of the voice raised in chant. Processions of chiefs are accompanied by aumākua and march in silence, or to the accompaniment of drum, nose-flute, and chanting. They are seen on the sacred nights of Kū, Lono, Kāne, or Kanaloa, or they may be seen by day if it is a procession to welcome the soul of a dying relative. To meet such a procession is very dangerous. "O-ia" (Let him be pierced) is the cry of the leader and if no relative among the dead or none of his aumākua is present to protect him, a ghostly spears man will strike him dead. The wise thing to do is to "remove all clothing and turn face up and feign sleep. (Beckwith 1970:164)

In another, more recent account of Night Marchers in the area, a retired U.S. Army soldier recounts several stories about supernatural phenomenon in Hawai‘i, one of which states:

> …Another Army tale comes from a man known to Grant only as C. Taylor, who relayed a story about "choking ghosts" in the 1940s at an airfield in Kahuku. Taylor wrote that the barracks were unknowingly built over a night marcher trail. The night marchers, spirits of ancient Ali‘i (Hawaiian royalty), Hawaiian warriors, and others, have special trails they walk each night on the island. According to other stories Grant collected, they could allegedly kill, assault, or cause illness to those who slept, sat, or stood on their path when they were marching (Wong 2008:B3).

Oio (with no diacriticals) is also mentioned in the 1826 Chamberlain account, "Unstable Land" as being the start of the unstable land that once floated freely off the coast of O‘ahu, typically referred to simply as Kahuku (as cited in Sterling and Summers 1978:149).

Other points of interest on the coast and interior of ‘Ō‘io Ahupua‘a also held traditional names prior to being renamed by its new inhabitants. Kalaeokamanu, which translates as "the point of the bird," is the smaller of two points in the central coast of the project area, just east of Kalaeokaunu (now Kuilima Point) on which the current Turtle Bay Hotel is located (John Clark 2003:148). Between the two points is a cove containing a calcareous sand beach, whose traditional name is Kalokoiki, which literally means "the small pond," but is more commonly referred to as the Keyhole (ibid.:154,188). Also within ‘Ō‘io Ahupua‘a is Kalokoiki Beach, located about 2000 feet east-southeast of, which literally means "roaring sea" (ibid.:142).

Ulupehupehu Ahupua‘a

Situated between ‘Ō‘io 1 and 2 and Punalau Ahupua‘a is Ulupehupehu Ahupua‘a, according to the Hawaiian Studies Institute O‘ahu Pre-Mahele Moku and Ahupua‘a Map published in 1987. Although there is little written about this *ahupua‘a*, it is referred to as an *ahupua‘a* relinquished by Leliohoku to the King as government land in the 1848 Mahele Book records. Further, it was one of three *ahupua‘a* that were sold as part of Hanaka‘oe Ahupua‘a (Nakamura 1981:5-6). Yet, in Sterling and Summers (1978) Ulupehupehu is not listed as an *ahupua‘a*.

In Andrews (1922:671), Ulupehupehu means "swollen breadfruit" and is considered a land section rather than *ahupua‘a*. Within the *ahupua‘a* are several other landmarks that have traditional names, such as Kauhala, which has no diacriticals nor translation to English according to John Clark (2003:167), but is the name of a beach and fishing spot located just southwest of Kahuku Point. Also, Punapālaha (‘slippery spring") is the name of an area just southwest of Kahuku Point where the rocks are made smooth and slippery from the seepage of fresh water (John Clark 2003:311).

Although listed as a site within Kahuku Ahupuaʻa in Sterling and Summers (1978:149), Puʻuʻala Heiau (Site 260) appears to be located just east of the border of Hanakaʻoe and Kahuku Ahupuaʻa in Sterling and Summer's map of Koʻolau Loa District (ibid.), which places the *heiau* roughly within Ulupehupehu Ahupuaʻa according to the Hawaiian Studies Institute (1987) map of Oʻahu Pre-Mahele Moku and Ahupuaʻa. McAllister disclosed that Puʻuʻala Heiau was purported to be situated on the ridge overlooking Kahuku Ranch, but saw no evidence of any structure on the ridge (as cited in Sterling and Summers 1978:149). This site was mentioned again in the Legend of Kamaakamahiʻai, where the story's hero, Keauaʻula, met people playing sports, such as spear throwing and *moa* sliding, and invited him to join them (ibid.). Hence, there are references to an area in or near *mauka* Ulupehupehu that suggest it was used for ceremonial and recreational purposes.

Punalau Ahupuaʻa

There is little written about this *ahupuaʻa*, yet it is referred to in the 1848 Mahele Book records as an unassigned Government, Crown, or Konohiki *ahupuaʻa*. Punalau was one of three *ahupuaʻa* that were sold as part of Hanakaʻoe Ahupuaʻa (Nakamura 1981:5-6). Furthermore, the *ahupuaʻa* was mentioned in a mid-19th Century table of nautical positions as another name for Kahuku Point in *A Directory for the Navigation of the Pacific Ocean* (Findlay 1851:646).

Punalau is a place name for at least two locations, although neither location is on Oʻahu. In Andrews (1922:668) Punalau is the name of land section in Molokaʻi and means "leaf coral." In Pukui et al. (1974:194) it is a place name of several localities in Maui and Molokaʻi, with a different translation ("many springs") and the use of a hyphen between "Puna" and "lau." The names of several landmarks in this *ahupuaʻa* are still known, but not commonly used. The northernmost point on Oʻahu most often referred to as Kahuku Point, was once called Kalaeokaunaʻoa, which literally translates to "the point of the tube snail" (John Clark 2003:148). These shellfish (*kaunaʻoa*) attach themselves to coral and stone and are renowned for being sharp and painful, even life-threatening, to step on (Pukui and Ebert 1986:138). Another point of interest is Kūkiʻo ("standing pools") Pond, located approximately 300 feet south-southeast of Kalaeokaunaʻoa also known as Kahuku Point, which places it in the *ahupuaʻa* of Punalau (Andrews 1922:653; McAllister 1933 as cited by Sterling and Summers 1978:149-150; Hawaiian Studies Institute 1987). Pukui et al. (1974:121) translates Kūkiʻo Pond as, "settled dregs."

According to Native Hawaiian testimonies recorded in land claims and claims to fishing rights, Punalau Ahupuaʻa did contain several features indicating the utilization of natural resources during the Mahele. Punalau was noted as containing a fish pond known as Puekahi and three unnamed shore fisheries, which suggests that inhabitants of this small *ahupuaʻa* likely had access to significant marine resources before European contact (Maly and Maly 2003:282; Silva 1984:19). In land register claims for the area, Punalau was said to have ten taro patches, ten kula plots, gardens of sweet potato, banana, and *noni*, stands of coconut, breadfruit, and canoe trees, as well as eight house lots (Silva 1984:19). Thus, Punalau contained adequate terrestrial resources to support at least eight households during the Mahele and likely supported near to that amount in the pre-Contact era. In addition, McAllister (1933) states that Kūkiʻo Pond is located 300 feet south of Kahuku Point, which is well within the 1987 Hawaiian Studies Institute pre-Mahele boundaries of Punalau Ahupuaʻa. He further indicates that the pond was larger in earlier times, surrounded by a large Hawaiian community, and contained a wide variety of fish (as cited in Sterling and Summers 1978:149-150).

Kahuku Ahupuaʻa

The name Kahuku appears to be used not only as the name of an *ahupuaʻa* and village, but as a district or place name for the area roughly between ʻŌʻio and Keana Ahupuaʻa. Of the seven *ahupuaʻa* represented in the project area, Kahuku has the most extensive traditional and mythological background.

According to Pukui et al. (1974:67) Kahuku literally translates as "the projection" and is the name of a village, land division, northernmost point, golf course, ranch, schools, forest reserve, as well as surfing beach on Oʻahu. Several other landmarks within the *ahupuaʻa* have traditional names, such as Punamanō, the spring-fed wetland which translates as "shark spring" John Clark (2003:310). Hanakaʻīlio ("work [of] the dog") is a sandy beach located between Kalaeokaunaʻoa and Kalaeuila Points (2003:92). Kalakala ("rough" or "craggy") is the name of the two semi-submerged linear outcrops of limestone that roughly parallel Kahuku Point to the east (ibid.:149).

Traditional accounts of natural resources and environmental conditions are relatively abundant for the *ahupuaʻa* of Kahuku. Traditional land use in Kahuku is also made apparent through legend. The landscape of Kahuku appears to have had several configurations, from the pre-European contact era to the present. During Hawaiian settlement prior to the arrival of Europeans, many parts of the landscape were used for traditional agriculture, habitation, and ceremony, varying from intense to moderate. In the initial Contact period, a good portion of the land lay fallow due to severe population decline and was overgrown in some areas with exotic plant species. Thus, there are several conflicting accounts of what the landscape was like and how it was used prior to European contact. Several themes are tied to Kahuku's landscape, including its abundance of *hala,* or pandanus, and its importance to ancient Kahuku's cultural identity.

Fresh water springs were mentioned in several traditional accounts of the Kahuku area. For instance, in the tale of Makanikeoe, the celebrated adventurer, Makanikeoe stopped at Punahoʻolapa, "a deep spring on the plain of Kahuku," where he found the spring that the legendary kapa anvil fell into and ended up in Waipahu, at ʻEwa (Maly and Maly 2003:91). Subsequently, Makanikeoe "crawled along another path" arriving at another Kahuku spring known as Punamanō (ibid.). A lone rock here, Kū's Rock Spring, was said to give forth pure spring water (Sterling and Summers 1978:153). Further, Handy (1940:88), disclosed that a spring, referred to as Kaainapele Spring, was located *mauka* of the Kahuku Ranch house.

Agricultural terraces were also said to exist in northern Kahuku in the pre-European contact era, which was made possible with the presence of natural springs (Handy

1940:88). There is some debate, however, on the origin of these terraces, where some informants claim that the terraces pre-date European contact and were used in the late 19th Century by the Chinese for rice paddies and some claim that the terraces were built by the Chinese for this purpose (ibid.). On the district of Koʻolau Loa in general, Hall (1839) states that, "…much taro land now lies waste, because the diminished population of the district does not require its cultivation," which upholds the abandonment of taro patches in various locations in Koʻolau Loa due to population decline (as cited in Sterling and Summers 1978:148).

The presence of fish and fishing practices of pre-Contact Kahuku are recalled in legends. In the legend of Kaneaukai, as told by Thrum (1976:254) from April through July, schools of mullet, or ʻ*anae-holo*, and surgeonfish, or *kala,* move from Maui to Waimea, passing by Kahuku. Further, in the tale, *Two Fish from Tahiti*, Westervelt (1915:138-140) alludes to *kapu* being placed on the catching and eating of certain species of reef fish associated with the Tahitians that fell victim to cannibalism in this story. The story of Punamanō Spring in Kahuku eludes to locals net fishing at the beach at night, which is telling of traditional fishing methods used in Kahuku (Sterling and Summers 1978:150). The story of Kūkiʻo Pond holds that the pond was once much larger and had contained a variety of fish. This story suggests that these natural ponds were utilized as brackish water fish ponds in ancient times.

Numerous proverbs, prayers, and *mele* about Kahuku in general elude to its abundance of *hala*, or pandanus trees. Pukui (1983:248) recites the proverb, *Nani i ka hala ka ʻōiwi o Kahuku*, which translates to, "the body of Kahuku is beautified by hala trees." In Fornander's translation of the prayer of Kualiʻi, Kahuku is described as a *hala* tree (Fornander 1917:28). Thrum (1919) also associates pandanus with Kahuku in his translation of Comparison of Kualiʻi, in the following lines:

> …Not like the paua [clam or abalone] which cuts the pandanus,
> To weave its blossoms at the social gatherings,
> That was the knife to cut Kahuku's pandanus.
> [He is] Not like these.
> (Thrum 1919:459)

This *mele* compares Kualiʻi with a host of euphemisms that often call upon various localities and objects often associated with them. In a section titled: "Various Heathen Prayers," Fornander (1920:46-51) translates an untitled prayer with a line that states: "He hala o Kahuku…" which Fornander interprets as, "Full of pandanus is Kahuku…" (1920: 50). Intending to win back the affections of his wife, Halemano, composed a chant that referring to the *hala* trees of Kahuku, stating:

Ku au nana I laila,	I stood and gazed, then
Haloiloi Kuu waimaka e uwe,	Tears filled my eyes causing me to weep.
Nani na hala ka oiwi o Kahuku,	How beautiful are the hala, native trees of Kahuku.
I ka lawe a ka makani he mikioi	As they are being fanned by the Mikioi wind.
	(Elbert 1965:281)

Another tearful sentiment about the *hala* of Kahuku comes from the tragic tale of Kaopulupulu, who's failed prophecy sealed his death warrant in the time of Kahahana. According to Thrum (1912:210):

> …In the morning, ascending a hill, they turned and looked back over the sea-spray of Wailua to the swimming halas of Kahuku beyond. Love for the place of his birth so overcame Kaopulupulu for a time that his tears flowed for that he should see it no more (as cited in Silva 1984:C-4).

Further, Apuakehau wrote in the Hawaiian newspaper, *Kuokoa*, in 1922 that "the first Kahuku" was covered by a *hala* grove (as cited in Sterling and Summers 1978:149). The association of *hala* with Kahuku is even repeated in the traditional Hawaiian myth of Pele and Hiʻiaka (Silva 1984). In this portion of the myth, while Hiʻiaka is in Kahuku (Kahipa), she rebukes two bad-mannered individuals, Puna-heʻe-lapa and Pahi-pahi-alua, who did not pay her the proper respects by stating:

> We enter the fragrant groves,
> Hala groves whose heads make a calm,
> Wild growths by the sea of Kahuku,
> But what, indeed are your halas?
> Shall their murmur forbid you speech?
> Make you dumb to my salutation?
> I make this kindly entreaty
> To you who sit in the grove.
> (Emerson 1915:97-8 cited in Silva 1984:C-5)

Silva (1984) adds that Emerson (1915) gathered that there was some word play in the chant, where the word "*hala*" stood for the pandanus tree as well as a fault or a sin. As late as the late 1820s, Chamberlain holds that the Kahuku area was "beautified with lauhala and some other trees" in his manuscript, "Trip Around Oahu in 1826" (as cited in Sterling and Summers 1978:149).

The wearing of *hala*, in the form of plaited *lau* (leaves) *hala* or *leis* made of the *hala* fruit/seed was a way in which the people of Kahuku represented their homeland. In the tale of Kalelealuaka, the strong and brave young warrior who fought for King Kakuhihewa, went to Kahuku and fashioned wreaths of pandanus fruit and sugarcane to disguise himself. He then was able to convince the King's marshal, who was disabled, that he was from Kahuku and that he would carry the marshal to his destination. As a reward, the marshal granted Kalelealuaka the district of Koʻolau for his services (Thrum 1976:100). Cummins (1913) also calls the Kahuku area as "land of the hala tree" and stated that people should not leave Kahuku for Waimea or Waialua without a wreath of Hala-fruit (as cited in Sterling and Summers 1978:149).

Kahuku was infamous for several other landmarks that stand out in Kahuku's cultural and physical landscape. Some legends explain the occurrence of these distinctive natural features, such as the tale relayed by Pukui et al. (1974:67) where, Lono-ka-ʻeho (Lono the stone), who is described as a chief with eight stone foreheads, severed Kahuku

Point from the island. Emerson (1909) translates the verses of a *hula* that describes a few of these landmarks of Kahuku in a rather colorful way. He preludes the translation with the quip, "Whether there is any connection between the name of the hula—breast-beating—and the expression in the first verse of the following mele is more than the author can say." The verses for this *hula* are translated by Emerson into English as:

> 'Tis Kahipa, with pendulous breasts;
> How they swing to and fro, see-saw!
> The teeth of Lani-wahine gape—
> A truce to upper and lower jaw!
> From Lihue we look upon Ewa;
> There swam the monster, Miko-lo-lou,
> His bowels torn out by Pa-pi'-o.
> The shark was caught in grip of the hand.
> Let each one stay himself with wild herbs,
> And for comfort, turn his hungry eyes
> To the rustling trees of Lei-walo.
> Hark! The whistling-plover—her old-time seat,
> As one climbs the hill from Echo-glen,
> And cools his brow in the breeze.
> (Emerson 1909:206)

Emerson goes on to say that, "The thread of interest that holds together the separate pictures composing this mele is slight. It will, perhaps, give to the whole a more definite meaning if we recognize that it is made up of snapshots at various objects and localities that presented themselves to one passing along the old road from Kahuku, on O'ahu, to the high land which gave the tired traveler his first distant view of Honolulu before he entered the winding canyon of Moana-lua" (ibid.). He adds that Kahipa is the name of a fabled female character, which was then applied to a locality in Kahuku where the mountains resemble two female breasts. Further, he describes Lani-wahine as, "A benignant *mo'o*, or water-nymph, sometimes taking the form of a woman, that is said to have haunted the lagoon of 'Uko'a, Waialua, O'ahu" (ibid.).

Another tale of the distinguished promontory, referred to as Kalaeokahipa is as follows:

> Nawai-o-lewa is on the northwest side of the rocky brow of Kalaeokahipa and now only one breast is left to move in the gusty winds of Kuhuku-lewa. The other was broken off by that supernatural son of Ku and Hina…Between Kaleaokahipa and Nawaiolewa, just above is a small round opening to a secret cave…The small secret cave belonged to Kaalae-huapi (Red head mud hen) and others in the first Kahuku that was covered by a hala grove (J.K. Apuakehau, Kuokoa, June 29, 1922 in Sterling and Summers 1978:152).

Sterling and Summers (1978:151-2) list numerous historic references to Kalaeokahipa, most enlisting the use of the word "breast(s)"to describe the peak(s).

Also of note are the harsh currents and surf of Kahuku's coasts, which are mentioned in *The Birth Chant of Princess Bernice Pauahi Bishop,* as translated by Ahuena Taylor, which follows:

> …Who builds the heat, the oven, until the long fires
> Become like a wild sea.
> From "Kama" to "Waialua."
> And comes close the head lands of "Kahuku,"
> And the hawk-like scratching sea of "Kahuku,"
> The night was spent at "Waialua,"
> For a voice was at the sea of "Ewa."
> Listening for the response.
> Respond! Oh Heavenly one…
> (Kanahele 2002: 223-226)

This chant lends a rather rough image to the coast of Kahuku.

Kamakau (1964) tells of a famous hiding cave, referred to as Pohukaina, thought to be a considerable distance *mauka* of the Turtle Bay Resort area. This cave, which had an entrance in Kahuku, is described by Kamakau:

> The mountain peak of Konahuanui was the highest point of the ridgepole of this burial cave "house," which sloped toward Kahuku. Within the cave are pools of water, streams, creeks, and decorations by the hand of man (*hana kinohinoh*'*ia*), and in some places level land (Kamakau 1964:38)

The great cave of Pohukaina is also said have been the refuge and storage place of "much wealth" for O'ahu's chiefs (ibid.).

Although Kahuku lacked physical evidence of taro terraces along Kahuku Stream, informants interviewed by Handy and Handy in 1991 claimed that there was taro cultivation in ancient times (Handy and Handy 1972).

Hawaiian legend holds that Kahuku was once a floating island blown here and there by the trade winds and is recounted by many sources in several different ways. Pukui (1983) writes of the traditional proverb, *Kahuku 'āina lewa,* which translates as "Kahuku, an unstable land…" and later writes that, "O'ahu, according to legend, was once two islands that grew together. Kahuku is the part that bridges the gap" (Pukui 1983:144). Yet, there are many variations to this legend. In one version, the people of Kahuku grew tired of the moving island bumping against O'ahu, so they fastened Kahuku to O'ahu with fishhooks. McAllister (1933:155) retells this story in great detail:

> A story is told that Kahuku was once a land afloat, wafted about by the winds, drifting over the ocean. Just how it came to Oahu is not told, but old Hawaiians point out to Polou, the place where Kahuku is fastened to Oahu. Formerly it was possible to dice into the pool and when a depth of 40 fathoms was reached, a shelf of rock was found upon which to rest.

> Forty fathoms deeper Punakea (white line from coral) was reached and on looking toward Malaekahana, the hook by which Kahuku was made fast could be seen. This hook was intricately fashioned of Kawila (Alphitonia excelsior). Seaward of the Waialee Industrial School, in another pool of water, known as Kalou, is the spot where Kahuku is attached to Waialee… (McAllister 1933:155).

In addition, when McAllister (1933) relays the story about Kāne and Kanaloa, one line repeats the common tale that Kahuku was not attached to Oʻahu in ancient times, stating that "Kane and Kanaloa lived in the vicinity of the ridge (Kalaiokahipa ridge); but that was at the time when the Kahuku plain was still under water, and the waves lapped about Kaliokahipa" (as cited by Wong-Smith 1989:A-2).

Silva (1984) lists several stories of how Kahuku was reattached to Oʻahu. One colorful account holds that the floating island of Kahuku belonged to the *menehune*, stating as follows:

> Ka-hu-ku section of Oʻahu was once a separate island…It was an islet whose people were the Mene-hune, or Dwarfs as they are called today. Many stories are told about the miraculous feats performed by the Little People of ancient Hawaiʻi. It is known, that they always worked from just after sunset until just before dawn.
>
> Legend tells us that Kahuku was a floating island situated several miles out to sea. For a long time, the people of Oʻahu had planned to make the island part of their land, for they saw it come close to Oʻahu's shores. The floating island of the Menehune did not have any fresh water springs because there were no high mountains covered with verdure and trees to capture the rains. So, the Little Folk used to paddle their islet into the bays of Oʻahu at night to haul water from the springs of the large island.
>
> One day, a resident of Kahuku suggested that all the people gather together to make strong hooks of whalebone and attach them to a stout rope made of sacred olonā fibers. This was done.
>
> The Menehune came to take water as usual, then the residents of Oʻahu attached the large hooks to the floating isle while the Menehune started to paddle off again, but they could not move their islet or free it from the ivory hooks and olonā ropes.
>
> Today, many people who travel Kahuku section of Oʻahu and see the many islets seeming to float off shore, and hear the sea singing its songs, they say, 'Listen to the Menehune grumbling while they try to move their island that used to float!'
>
> The rumbling and grumbling is heard only at night, for that is the time for the Menehune to be working at Kahuku. (Paki 1972:53 as cited in Silva 1984:2-3)

Another account of Kahuku being an island was provided by Silva (1984), which also links the locality with a legendary princess, named Lāʻieikawai, and reads as follows:

> Kahuku District, according to legend, was once a floating island blown about by the winds. As it banged against Oʻahu, it made noises which disturbed the old women guarding the princess Laieikawai. The old women grappled the island with fishhooks and attached it securely to Oʻahu. Polou pool on the sea side of the Kahuku mill is one spot where the hook was fastened. The other end was fastened at Kūkiʻo pond 300 feet inland at Kahuku Point (Boswell 1958:68 as cited in Silva 1984:2).

Other versions provide a political motive for uniting the two islands. A portion of the tale of "The Hole of Kahipa and Nawaiuolewa" was told to Mary Pukui by a one-hundred and five year old woman named, Kanui, who described how two ruling chiefs united Kahuku with Oʻahu. In this tale, "the two were brother and sister. In order to make it one, the two sat down and hooked their fingers together and drew them together. The hole marks the place where they sat (Kamakau Part II, Moolelo o Hawaii, Note 4, Chap 12, as cited by Sterling and Summers 1978:151). Kamakau (1991:38-9) holds that Oʻahu was a floating island, rather than Kahuku. However there are some consistencies with the previously mentioned versions. He writes:

> According to traditions of some people, Oʻahu was said to have once been a floating land, *he ʻāina lewa o Oʻahu*. The Kahuku side was a wide open gap (*puka hāmama*) and this was called *Ka Puka o Kahipa a me Nawaiuolewa*, "The opening of Kahipa and Nawaiuolewa." The piece of land that closed it up was called Kahuku, and the hooks that made fast the piece of land and joined it to the island were called Kilou and Polou (Kamakau 1991:38-39).

Another variation of the story told holds that there was an underground canal or tunnel where the two islands joined. In 1828, Levi Chamberlain, a missionary accountant, tells of a 5-7 mile long by 1-2 mile wide underground canal leading from the sea inland at the convergence of the two islands (Chamberlain 1957:35-36). He reiterated the following in regards to this legend:

> The natives tell a marvelous story respecting the origin of this destrict [sic], which they say floated in from the sea, and attached itself to the ancient shore of the island, that there was a subterranean communication between the sea and the ancient shore, by which a shark used to pass, and make depredations up on the land. The basis of the tract, which is from five to seven miles in length, and from one to two miles in breadth, appears to be of coral; and it was evidently redeemed from the sea, as a good deal of land, in many places along the shore around the whole circuit of the island, evidently has been (Chamberlain 1957:35-6).

McAllister (1933) relays a story about a secret underwater passage way marked by two stones off of Kahuku Point that led to another land referred to as Ulukaa or Kahuna Moku. The story is as follows:

> Two stones known as Kahoa in water about 250 ft. from the beach just opposite from Kalaehila heiau, Kahuku Point. Many years ago a woman who lived on this beach was frequently seen to swim to these stones and disappear. At times she would be gone for as much as a week. Sometimes she was seen to put her clothes in a watertight calabash and swim away. When she returned she usually wore a kou lei. It was finally discovered that this was the entrance to another land, known as Ulukaa or Kahuna Moku (as cited by Silva 1984:A-5).

The theme of an underground canal is echoed in Thrum's (1911) "Legend of the Tapa Log," which largely takes place in Punahoolapa Marsh, located in the southeast corner of the Turtle Bay Resort property and currently a wildlife preserve. Thrum's story is as follows:

> A kapa-beating log of peculiar sound, unlike any other known on the island, which was placed in its waters at the close of the kapa-making season to keep it smooth and free from cracks that would impart an impression to the cloth in its manufacture, was missed, and, believing it to have been stolen, search was made all through the Koolau, Waialua and other districts 'til at last it was found in use at Waipahu. Recognizing it by its resonant tone, it was claimed by the searching owner, and right thereto by those in possession was vigorously maintained. To test the truth of ownership as claimed, the 'Ewa people accompanied the claimant back to Kahuku to visit the scene and witness a test of the underground stream theory. A bundle of ti leaves were gathered, which was wrapped together and consigned to the waters of Punahoolapa. In the course of a few days they were lost to sight, whereupon the party set out for 'Ewa, and after careful watching, as predicted, the bundle of ti leaves came forth on the bosom of the waters of the Waipahu stream. The kapa log was thereupon recognized as the rightful property of the Kahuku claimant (Thrum 1911:130 as cited in Sterling and Summers 1978:149).

Associated with Kahuku's underground canal are several legends of man-eating sharks, where a shark once traversed to consume people (Chamberlain 1957:35-36). In Handy (1922:111), Manō-niho-kahi (shark with one tooth) is a man who had the power to shape-shift into a shark. This version of the tale presents him as normal looking, except for the shark mouth on his back that he always covered with a cloak of *tapa*. When Manō-niho-kahi found out that people, specifically women, were going to the sea to fish or collect *limu*, he would rush out to where they were and bite them with his single shark tooth, killing them. When the killings became too regular, the chief of the region and his *kahuna* gathered all of his people and ordered them all to disrobe. When Manō-niho-kahi refused to take off his *tapa* cloak, he was stripped, revealing the shark mouth on his back. At once, he was put to death, ending the streak of deaths of women in those waters. Another, albeit less gruesome, tale about man-eating sharks associated with Kahuku is told by McAllister (1933), where a shark was caught and kept as a pet in Punamanō marsh, which is located just east of Turtle Bay Resort lands. The story, as reiterated from an informant's testimony is as follows:

> One time when the people of Kahuku were fishing they caught a small shark. Putting him in a calabash of water they carried him to their houses near the beach. Here he was cared for and put in larger and larger calabashes as he grew bigger. Finally haven outgrown even the largest calabash that could be found, it was decided to place him in one of the pools of brackish water which came to be known as Punamanō. A man and woman living near the pool became guardians. They had lived in their grass huts with a breadfruit tree near the pool and taro and potato patches near the mountains for several years when the brother of the woman came to live with them. Sometime after, the man and his wife went to the mountains to gather taro and potatoes. The brother, who was staying at home, thought that he would like to have some food prepared when the sister and her husband returned. He climbed the breadfruit tree and gathered several, throwing the fruit into the water instead of on the ground, where it would have been bruised in the fall. After picking enough for a few days he descended the tree and gathered most of the fruits from the bank. Two had floated to the middle of the pond and he could not reach them. Now this man knew of the shark that lived in the pool, but he had frequently bathed in the pool and no thought of fear crossed his mind as he swam to the breadfruit. He did not know, however, that his sister and her husband had warned the shark not to allow anyone to steal breadfruit when they were gone. When the sister and her husband returned they could not find brother. Neither was the shark to be found, but they saw the breadfruit floating in the pool and the reddish color to the water. They guessed what had occurred. For nearly a mile they followed the bloody trail until they came to a spring known as Punahoolapa. Not only was the brother never seen, but the shark has never been seen to this day (as cited in Wong-Smith 1989:A-7).

In this case, it appears that the shark was simply looking out for its keeper's interests. Kuapuu (1861) wrote a very similar account of the Punamanō man-eating shark in the *Ka Hae Hawaii* newspaper (as cited in Sterling and Summers 1978:151).

Other supernatural beings and demigods associated with Kahuku are mentioned in Beckwith (1940). On a quest to find his brother, Lono-ka-ehu brought his "great dog" or the dog-man, Kū-ʻīlio-loa (Kū long dog), to Oʻahu from Kahiki. In the search, Kū-ʻīlio-loa "pierced the hill Kāne-hoa-lani at Kualoa, cleft Kahuku and Kahipa apart, and broke Ka-pali-hoʻokuʻi at Kailua" according to Beckwith (1940:321). She later describes Kū-ʻīlio-loa as "a dog with a human body and supernatural power, ʻa great soldier and famous warrior,ʼ who terrorizes Kahiki" (Beckwith 1940:321).

Kahuku is also a place where the manifestation of ancient *kapu* law had become a permanent part of the landscape in the form of two stone outcrops. According to Beckwith (1970:48), Kamakau mentioned the story of two stones in the cave of Ke-ana at

Kahuku that are said to be the bodies of two boys who disobeyed their mother's injunction to keep silence during a thunderstorm. Kāne-hekili, the god of thunder, is associated with several gods whose names are also suggestive of the phenomenon experienced during thunderstorms, such as Kāne-wawahi-lani (Kāne breaking through heaven) and Ka-uila-nui-maka-keha'i-i-ka-lani (Lightning flashing in the heavens). The gods in their humpbacked forms can be seen flying through the air during storms with Na-kolo-i-lani, who are the humpbacked brothers of Pele. According to the ancient *kapu* laws, all containers should be turned bottom side up and people should lie face down without any outcry, for silence is the law of Kāne-hekili (Beckwith 1970:48).

Another well known *mo'olelo* is the Legend of Kamapua'a, a supernatural being and a deity attributed to agriculture, rain, and fertility (Elbert 1965:200-1; Maly and Maly 2003:9). While he had the ability to shape-shift into multiple bodily forms (*kino lau*), Kamapua'a was most noted for his pig-like appearance. In one of his many exploits, Kamapua'a was caught stealing chickens from Olopana, the head chief of O'ahu at the time. To catch Kamapua'a, Olopana enlisted the residents of Kahuku, who capture him, bind him to a pole, and carry him towards Punalu'u. Upon seeing this, his grandmother, Kamaunuaniho, recited a chant that gave him the power to kill the captors from Kahuku.

In *The Hawaiian Romance of Laieikawai,* the people of Waianae on O'ahu offered their version of the story, which mentions the high chief who ruled Kahuku named, Kaho'ali'i. In this account, Kaho'ali'i instructs his son to, "Fly about O'ahu while I chew the '*awa;* before I have emptied it into the cup return to me and rehearse to me all that you have seen" (Beckwith 1918:30). The tale goes on to list the places his son passed on his journey. Further, Kahuku is mentioned in the chant of Kuali'i as one of the major landmarks of O'ahu for those travelling to the island from Kaua'i (Beckwith 1918:30).

In the tale, *Two Fish from Tahiti*, Westervelt (1915:142-144) recounts two great canoes filled with men from Tahiti, referred to as two "fish," journeyed to O'ahu. The purpose of the journey was to "find the wonderful fire-land of Hawaii about which they had been taught in the stories of returned travelers…" and "…find an appropriate location for a settlement. Possibly they planned to make a permanent home or hoped to meet some good community into which they might be absorbed" (Westervelt 1915:140). Upon their arrival on the shores of Makapu'u, the travelers found an "unfriendly coast" and decided to separate and circle the island, with one canoe going north and one going south. Westervelt continues:

> The boat which sailed toward the north found no good resting-place until it came to the fishing-village of Hauula…Evidently there, was dissension and at last a battle. The whole story is summed up by the Hawaiian legend in the saying: "The fish from Tahiti was caught by the fishermen of Hauula. They killed it and cut it up into pieces for food." Thus the visitors found death instead of friendship, and cannibalism was thereby veiled by calling the victims "fish" and the victory a "catch…"

…The second fish from Tahiti had gone on southward in its journey around the island of Oahu. It passed the rough and desolate craters of Koko Head on the eastern end of the island. It swam by Diamond Head and the beautiful Waikiki Beach. Either the number of the inhabitants was so large that they were afraid to make any stay or else they preferred to make the complete circuit of the island before locating, for they evidently made only a very short stay wherever they landed, and then hurried on their journey. By the time they reached Kaena, the northwestern cape of Oahu, they were evidently anxious concerning their missing companions. Not a boat on the miles of water between Kaena and Kahuku, the most northerly point on the island. The legend says that the fish changed itself into a man and went inland to search the coast for its friend, but the search was unsuccessful. It was now a weary journey from point to point, watching the sea and exploring all the spots on the beach where it seemed as if there was any prospect of finding a trace of their expected friends. Where a break in the coral reef permitted their boat to approach the land they forced their way to shore. Then when the thorough search failed again, the boat was pushed out over the line of white in rolling breakers to the great sea until at last the Tahitians came to Kahuku.

Now they appeared no longer as "fish," but went to the village at Kahuku as men. They made themselves at home among the people and were invited to a great feast. They heard the story of a battle with a great fish at Hauula and the capture of the monster. They heard how it had been cut up and its fragments widely distributed among the villages on the northwest coast. Evidently provision had been made for several great feasts. The people of Kahuku, although several miles distant from Hauula, had received their portion. The friendly strangers must share this great gift with them. But the men from Tahiti with heavy hearts recognized the fragments as a part of their companion. They could not partake of the feast, but by kindliness and strategy they managed not only to decline the invitation, but also to secure some portions of the flesh to carry down to the sea. These were thrown into the water, and immediately came to life. They had the color of blood as a reminder of the death from which they had been reclaimed. Ever after they bore the name "Hilu-ula," or "the red Hilu."

Then the "fish" from Tahiti went on around to Hauula. They went up to the tabu land back of Hauula. They pulled up the tabu flags. Then they dammed up the waters of the valley above the village until there was sufficient for a mighty flood. The storms from the heavy clouds drove the people into their homes. Then the Tahitians opened the flood-gates of their mountain reservoir and let the irresistible waters down upon the village. The houses and their inhabitants were swept into the sea and destroyed. Thus vengeance came upon the cannibals.

The Tahitians were "fish," therefore they went back into the ocean to swim around the islands. Sometimes they came near enough to the haunts of fishermen to be taken for food. They bear the name "hilu." But

> there are two varieties. The red hilu is cooked and eaten, but never eaten without having felt the power of fire. The trace of the cannibal feast is always over its flesh. Therefore it has to be removed by purification of the flames over which it is prepared for food. The blue hilu, the natives say, is salted and eaten uncooked. Thus the legend says the two fish came from Tahiti, and thus they became the origin of some of the beautiful fish whose colors flash like the rainbow through the clear waters of Hawaii (ibid.:142-144).

This account calls attention to the political control of resources, *kapu* systems, variations in conduct with outsiders as well as warfare and cannibalism in pre-European contact Kahuku and Hauʻula.

3.1.6 Supplemental Legendary and Historical Background

Two previously written reports (Silva 1984; Wong-Smith 1989) provide excellent summaries of the legendary and historical background of the project area. As a component of the 1985 Kuilima Resort Expansion Revised Environmental Impact Statement, Silva (1984) compiled mythological and historical records for the *ahupuaʻa* of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku (Group 70:1985). Another noteworthy historic research document was composed by Wong-Smith (1989) on the lands of Kahuku. This document was intended as a component of the Archaeological Inventory Survey, Punamanō and Malaekahana Golf Courses (Jensen 1989). Both Silva (1984) and Wong-Smith (1989) manuscripts are provided in Appendix B.

3.2 POST EUROPEAN CONTACT CULTURAL LANDSCAPE

3.2.1 European Contact

At European Contact and shortly thereafter, the general Kahuku area was commented on by several maritime officials, with observations that point to a drastic change in land use from initial contact in the mid 1780s to the mid 1830s.

Approximately two weeks after the death of British Captain James Cook, Charles Clerke took over the helm of the H.M.S. Resolution. As the ship rounded the northern point of Oʻahu, Captain Clerke provided the first post-Contact account of the Kahuku area. Clerke wrote On February 28, 1779:

> SUNDAY 28th. . . Winds E^{t}erly [Easterly]. fresh breezes with open Cloudy Weather. Run round the N^{o}ern [Northern] Extreme of the Isle which terminates in a low Point rather projecting; off it lay a ledge of rocks extending a full Mile into the Sea, many of them above the surface of the Water; the Country in this neighborhood is exceedingly fine and fertile; here is a large Village, in the midst of it is run up a high Pyramid doubtlessly part of a Morai. I stood into a Bay just to the Westward of this point the Eastern Shore of which was far the most beautifull [sic] Country we have yet seen among these Isles, here was a fine expanse of

> Low Land bounteously cloath'd with Verdure, on which were situated many large Villages and extensive plantations; at the Water side it terminated in a fine sloping, sandy Beach. . . (Beaglehole 1967:I:572 in Silva 1984:C-10).

This description paints a pleasant picture of Kahuku, with a thriving community and large ceremonial structures. At about the same period, H.M.S. Resolution Lieutenant, James King, described this northern tip of Oʻahu, writing:

> WOA'HOO. . . We saw this Island the beginning of last year, but only just as a high lump, We this Time sailed along its NE & NW sides but say nothing of its Soern [Southern] part. What we did see of this Island was by far the most beautiful country of any in the Groupe; particularly the Neck that Stretches to the N^{o} ward [Northward] and its NW side. Nothing could exceed the verdure of the hills, nor the Variety which the face of the Country display'd. It /s north-eastern/ parts were cliffy, & rugg'd to the Sea side, but the Valley look'd exceedingly pleasant, near the N point we were charmed with the narrow border full of Villages, & and Moderate hills that rose behind them (Beaglehole 1967:I:610 in Silva 1984:C-10-11).

This is yet another testimony to the beauty and lushness North Shore during the early Contact period. In contrast, Captain George Vancouver visited the northern tip of Oʻahu later in 1794, discovering that the Kahuku coast had significantly changed in terms of cultivation and population, writing:

> …In every other respect our examination confirmed the remark of Capt. King excepting that in point of cultivation or fertility, the country did not appear in so flourishing a state, nor to be so numerously inhabited, as he represented it to have been at that time, occasioned most probably by the constant hostilities that had existed since that period (Vancouver 1798, Vol.3:71).

Wong-Smith (1989) suggests that regular hostilities and the scourge of Western diseases caused the severe decline of the Hawaiian population in Kahuku. It was likely Captain Cook's 1778 expedition that brought venereal disease to Hawaiʻi and spread rapidly between the initial and secondary contact events (Lind 1938; Kuykendall 1938; Beaglehole 1967). By the time the first missionaries conducted a census of the islands in the early 1820s, they estimated that the entire population had been reduced by nearly a third (Schmitt 1968:10 in Wong-Smith 1989:A-10) . This population crash created a wasteland out of the once verdant fields and lively villages of Kahuku.

3.2.2 Historic Era

The focus of this section will remain on events that greatly shaped the modern character of the Turtle Bay Resort area as well as any occurrences that help paint a picture of what Hawaiian cultural practices were like during this period (see Figures 16-18).

Cultural Practices

Although the spread of Western ideals and lifestyles was rampant at this time, there are several instances of Hawaiian traditional practices taking place in Kahuku. *Hula* and *mele* performances held in Kahuku in 1844 and 1849 were described by Emerson (1998). The first performance, a *hula*, called the Hula O-Niu, which took place in 1844 was described by Emerson (1998) as such:

> The so-called hula *o-niu* is not to be classed with the regular dances of the halau. It was rather a popular sport, in which men and women capered about in an informal dance while the players engaged in a competitive game of top-spinning. The instrument of sport was made from the lower pointed half of an oval coconut shell, or from the corresponding part of a small gourd. The sport was conducted in the presence of a mixed gathering of people amid the enthusiasm and boisterous effervescence which betting always greatly stimulated in Hawaii.
>
> The players were divided into two sides of equal number, and each player had before him a plank, slightly hollowed in the center—like the board on which the Hawaiians pounded their poi—to be used as the bed for spinning his top. The naked hand, unaided by whip or string, was used to impart to the rude top a spinning motion and at the same time the necessary projectile force—a balancing of forces that called for nice adjustment, lest the whirling thing reel too far to one side or run wild and fly its smooth bed. Victory was declared and the wager given to the player whose top spun the longest.
>
> The feature that most interests us is the singing, or cantillation, of the oli. In a dance and game of this sort, which the author's informant witnessed at Kahuku, Oahu, in 1844, one contestant on each side, in turn, cantillated an oli during the performance of the game and the dance (Emerson 1998:248).

The later performance, a *mele* about Kāne, recorded by Emerson (1998) took place in 1849 was viewed by King Kamehameha III's during his circuit around the island of Oʻahu. Emerson (1998) wrote:

> The author has already hinted at the form and character of the entertainments with which hula-folk sometimes beguiled their professional interludes. Fortunately the author is able to illustrate by means of song the very form of entertainment they provided for themselves on such an occasion. The following mele, cantillated with an accompaniment of expressive gesture, is one that was actually given at an awa-drinking bout indulged in by hula-folk. The author has an account of its recital at Kahuku, island of Oahu, so late as the year 1849, during a circuit of that island made by King Kamehameha III. This mele is reckoned as belonging to the ordinary repertory of the hula; but to which particular form of the dance it was devoted has not been learned…(Emerson 1989:129-130)

The fact that this performance was part of King Kamehameha III's circuit and recorded with such detail and contemplation by Emerson (1998), suggests that this unnamed *hula hālau* was no ordinary one. It is possible that this Kahuku *halau* has a long, but unrecorded history.

Land Court Awards

Private land ownership was established in Hawaiʻi with the Mahele ʻĀina, also known as the Great Mahele of 1848. Crown and *aliʻi* lands were awarded in 1848 and *kuleana* titles were awarded to the general populace in 1850 (Chinen 1958). Awarded lands in this process are referred to as Land Commission Awards (LCAs). Over time, government lands were sold off to pay government expenses. The purchasers of these lands were awarded Grants or Royal Patent Grants (Chinen 1958). LCA's offer the native and foreign testimonies recorded during the claiming process, which shed light on what the land use of the area was in the early historic period. This information can be used to predict the types of resources may still be present in the project area.

According to Silva (1984) a total of 88 Land Court Awards (LCA) are known to have awarded out of 101 claims in the *ahupuaʻa* of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku, 30 of which are located within the Turtle Bay Resort property (Table 1). Details and maps of each LCA as well as the Native Register records and Foreign Testimonies for each LCA as compiled by Silva (1984) are provided in Appendix B. Silva (1984) has also compiled a detailed listing of LCA parcels in the project area, complete with quantities of traditional features attributed to agriculture, horticulture, irrigation, aquaculture, fishing, salt collecting, and habitation (Table 2 and Appendix B). The totals in Table 2 reflect all of the LCA features in each *ahupuaʻa*, not just the LCA's that are located in the project area. As each *ahupuaʻa* was traditionally self-sustained, the very sustainability hinged upon the balance and fitness of *mauka*, *kula*, and *makai* resources for the flow of resources from *mauka* to *makai*, and vice versa. Thus, examining the components of an *ahupuaʻa* individually may create a skewed understanding of what resources were available at this time period.

Figure 16. Loebenstein 1890 Kahuku Plantation Map, Kawela Bay with LCAs defined (courtesy of Hawai'i State Survey Office – Reg. No. 1506 - 4).

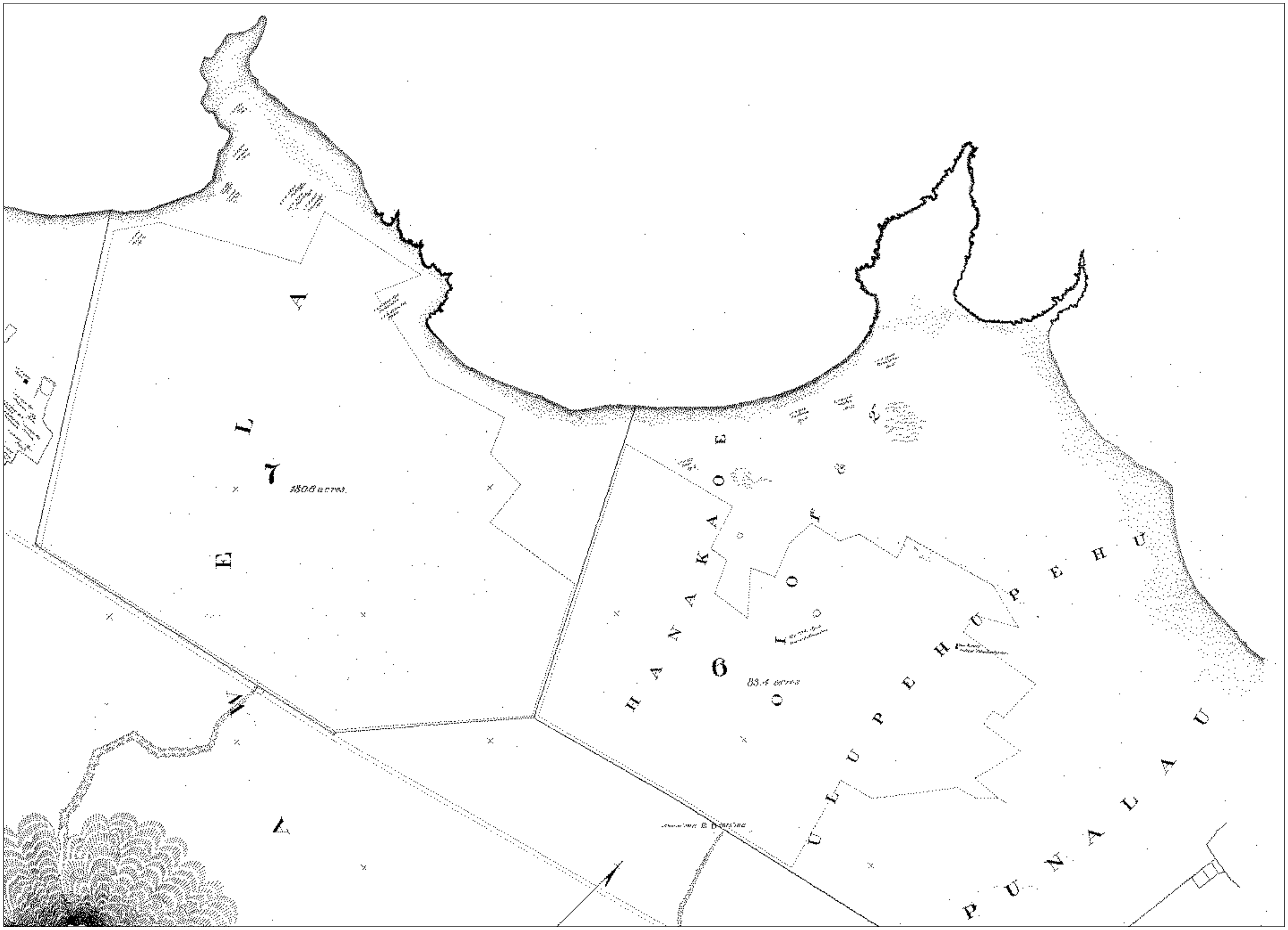

Figure 17. Loebenstein 1890 Kahuku Plantation Map, Kawela and Kuilima Points (Reg. no. 1506 - 3A).

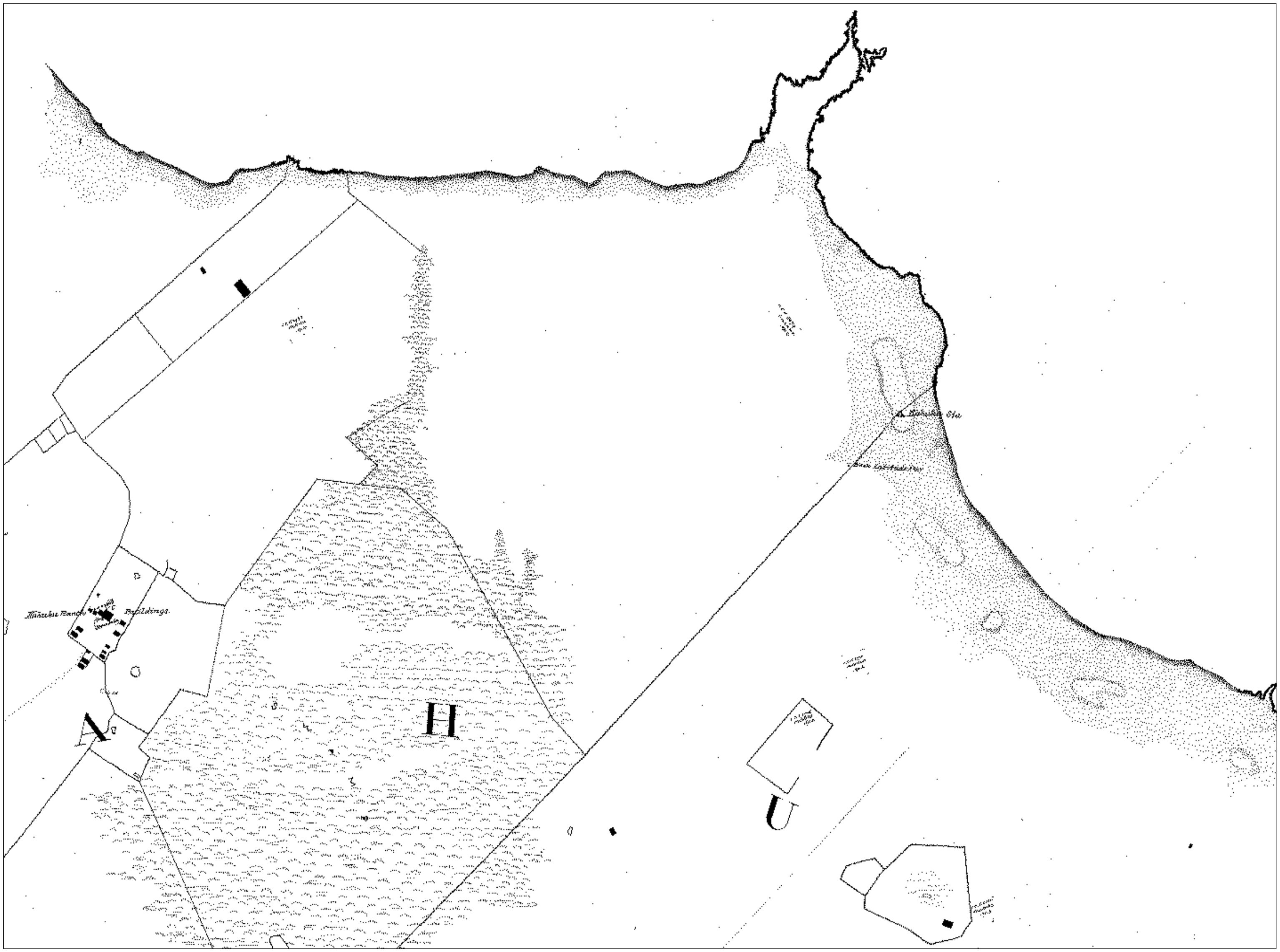

Figure 18. Loebenstein 1890 Kahuku Plantation Map, Kahuku Point (Reg. no. 1506, map 3B).

Table 1. Land Court Awards (LCA) within the Turtle Bay Resort Project Area

LCA Parcel No.	Ahupuaʻa	In or Near TBR	Awardee	Native Register No.
2897:2	ʻŌpana		Kookoo	v.3:683
2734:3	ʻŌpana	Yes	Paukoa	v.3:612
2835:2	ʻŌpana	Yes	Kuheleloa	v.3:657
2897:2	Kawela	Yes	KooKoo	v.3:683
2837:2	Kawela	Yes	Kamakai	v.3:658
3815:1	Kawela	Yes	Pailalau	v.4:176
2784	Kawela	Yes	Moo	v.3:634
5850	Kawela		Kawi	v.3:663
2770:2	Kawela	Yes	Makaino	v.3:628
2878:2	Kawela		Kekua	v.3:676
2734:3	Kawela		Paukoa	v.3:612
2838:2	Kawela		Kauwahi	v.3:658
2724:3	Kawela	Yes	Paku	v.3:608
2835:3	Kawela		Kuheleloa	F.T. v10:157
2682	Kawela		deceased	v.3:588
2837	Hanakaʻoe		Kamakai	v.3:658
3815	Hanakaʻoe	Yes	Pailalau	v.4:176
235 M	Hanakaʻoe		Kaili	F.T. v11:239
2744:2	ʻŌ'io	Yes	Pakanaka	v.3:617-8
2936:2	ʻŌ'io	Yes	Kauaihikai	v.3:701
2716:2	ʻŌ'io	Yes	Hoolau	v.3:601-2
2935	ʻŌ'io		Kekauli	v.3:700
2698:2	Ulupehupehu	Yes	Waanui	v.3:595-6
2781:1	Punalau	Yes	Manukeokeo	v.3:632-3
2913:2	Punalau	Yes	Kekua	v.3:600-1
2861:2	Punalau		Kaohele	v.3:667-8
2869	Punalau		Kaopupahi	v.3:671
2864:2	Punalau		Ioeua Kiha	v.3:669
2909	Punalau		Kamalama	v.3:668-9
2892:2	Punalau		Kainalu	v.3:681
2885	Punalau		Kupihea	F.T. v10:181
2771	Punalau		Maulua	v.3:629
2928:2	Kahuku	Yes	Kauihawale	v.3:697
2679:2	Kahuku	Yes	Umeume	v.3:679
2775:2	Kahuku	Yes	Malailua	v.3:630
2698:1,3	Kahuku	Yes	Waanui	v.3:595-6
3809	Kahuku		Lokea	v.4:174
2706:2	Kahuku	Yes	Holoaia	F.T. v10:186
4341:2	Kahuku	Yes	Kaukaha	v.4:266
2779:2	Kahuku	Yes	Makilo	v.3:632
3958:2	Kahuku	Yes	Nauluhao	v.4:200
2738:3	Kahuku	Yes	Palu	v.3:614
2960:2	Kahuku	Yes	Luiki	v.3:591-2
2880:2	Kahuku		Kauaihikai	v.3:675
2861:1	Kahuku	Yes	Kaohele	v.3:667-8
2744:1	Kahuku	Yes	Pakanaka	v.3:617-8
2868:2	Kahuku	Yes	Kapaiaala	v.3:670
2850	Kahuku	Yes	Kupau	

Table 2. Quantification of Features within LCA by Ahupuaʻa

ʻŌpana Ahupuaʻa (1 and 2)	
7	Taro patches, some is cultivated *kula* lands
1	Cultivated *kula* plot
1	Cluster *hala* trees
Kawela Ahupuaʻa	
28	Taro patches
11	Houselots
10	Upland gardens planted with noni, sweet potatoes, gourds, bananas, sugar cane, and *wauke*
17	Kula plots and gardens planted with *wauke*, noni, *ulu*, sweet potatoes, sugar cane, bananas, and ʻ*ōhiʻa*
1	Fishery
2	Watercourses
1	Salt land
5	Clusters of *hala* trees
1	*Ulu* tree
Hanakaʻoe Ahupuaʻa	
1	Fishery
1	Salt bed
1	Salt pool
1	Hala grove
	Several gardens and *kula* plots planted with noni, onions, and sweet potatoes
1	Cultivated upland plot
ʻŌʻio Ahupuaʻa	
15+	Gardens and *kula* plots planted w/ʻ*awa*, taro, banana, noni, *wauke*, sugar cane, sweet potato, gourd, and edible fruits
36	Koa canoe trees
5	Houselots
4	Taro patches
3	Groves of *hala*
3	Salt bed lands
1	Sweet potato patch cultivated upon cliffs
4	Cultivated upland plots planted with banana, ʻ*awa*, sugar cane, *wauke*, sweet potato, and gourd
Ulupehupehu Ahupuaʻa	
15+	*Kula* plots and gardens planted w/ *wauke*, sweet potato, gourd, banana, edible fruits
7	koa canoe trees
2	Cultivated upland plots planted w/ *wauke*, banana, and orange trees
1	Banana plantation
1	Cluster of hala
1	Houselot
Punalau Ahupuaʻa	
10	Taro patches
1	Fishpond named Puekahi
10	*Kula* plots and gardens planted w/ sweet potato, banana, noni, *ulu*
4	Cultivated upland plots
8	Houselots
4	Coconut trees
3	Shore areas/fisheries
2	Koa canoe trees

Kahuku Ahupuaʻa	
162	Taro patches
39	*Kula* plots and gardens planted w/ ʻ*awa*, banana, *wauke*, gourd, sweet potato, sugar cane, noni, watermelon, *pili* grass
7	Cluster of *hala*
6	Salt lands
4	Koa canoe trees
2	Fishponds
10	Houselots
1	Sweet potato patch cultivated upon cliffs
1	Watercourse bank
3	Cultivated upland plots
1	Brackish spring
1	Wooded upland area of ulu, ʻōhiʻa, kukui, koa, ti leaf, noni, etc.

Rights to Ocean Resources and Fishing Rights

Not only were Land Court Awards granted in the Turtle Bay Resort area, the rights to ocean resources and fishing rights were also granted. Maly and Maly (2003) offer a good explanation of this new system:

> In pre-western contact Hawaiʻi, all ʻ*āina* (land), *kai lawaiʻa* (fisheries) and natural resources extending from the mountain tops to the depths of the ocean were held in "trust" by the high chiefs (*mōʻī aliʻi ʻai moku*, or *aliʻi ʻai ahupuaʻa*). The right to use of lands, fisheries, and the resources therein was given to the *hoaʻāina* (native tenants) at the prerogative of the *aliʻi* and their representatives or land agents (often referred to as *konohiki* or *haku ʻāina*). Following a strict code of conduct, which was based on ceremonial and ritual observances, the people of the land were generally able to collect all of the natural resources, including fish—and other marine and aquatic resources—for their own sustenance, and with which to pay tribute to the class of chiefs and priests, who oversaw them.
>
> Shortly after the arrival of foreigners in the islands, the western concept of property rights began to infiltrate the Hawaiian system. While Kamehameha I, who secured rule over all of the islands, granted perpetual interest in select lands and fisheries to some foreign residents, Kamehameha, and his chiefs under him generally remained in control of all resources. Following the death of Kamehameha I in 1819, and the arrival of the Calvinist missionaries in 1820, the concepts of property rights began to evolve under Kamehameha II and his young brother, Kauikeaouli (Kamehameha III), who ruled Hawaiʻi through the years in which private property rights, including those of fisheries, were developed and codified.
>
> Kamehameha III formally defined the ancient fishing rights and practices of the Hawaiian people in the Constitution and Laws of June 7, 1839, and reconfirmed them on November 9, 1840 (Hawaiian Laws, 1842; Hawaiian Laws compiled from between the years of 1833 to 1842).
>
> By the Law respecting fisheries, Kamehameha III distributed the fishing grounds and resources between himself, the chiefs and the people of the land.

> The law granted fisheries from near shore, to those of the deep ocean beyond the sight of land to the common people in general. He also specifically, noted that fisheries on coral reefs fronting various lands were for the landlords (*konohiki*) and the people who lived on their given lands (*ahupua*ʻ*a*) under the *konohiki* (Maly and Maly 2003:v-vi).

According to Maly and Maly's (2003) review of documented fisheries and fishing rights recorded during the Mahele ʻĀina, a total of 20 claims are known to have existed in the *ahupua*ʻ*a* of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku. Due to the fact that the entire coastline of each of these *ahupua*ʻ*a,* save for Kahuku, is located in the Turtle Bay Resort property, a large percentage of these claims are located within coastal or offshore waters of the project area (Table 3). As no maps for these claims have been found, it is unclear how many claims for the *ahupua*ʻ*a* of Kahuku are in the project area. Nonetheless, it would be fair to count the remaining *ahupua*ʻ*a* claims in as being on shore or offshore of the project area.

Table 3. Fisheries and Fishing Rights Granted for Turtle Bay Area

Helu	Claimant; Location; and Resource Claimed:
2770	Makaino at Kawela, Oʻahu. An ocean fishery.
2850	Kawi at Kawela, Oʻahu. One pond.
3815	Pailalau at Kawela, Oʻahu. A fishery and salt bed at Hanakaʻoe.
2885	Kupihea, Punalau and Kahuku, Oʻahu. An ocean fishery.
2771	Maulua at Punalau, Oʻahu. A fish pond named Puekahi.
2782	Makole at Kahuku, Oʻahu. An aina paakai (salt bed); and two fish ponds at Amo.
2785	Makakiekie at Kahuku, Oʻahu. A fishery called Kaiohana and a fish pond.
2787	Makaokalai at Kahuku, Oʻahu. A fish pond named Kumuhahane; a pond called Kahukupunawai; and an aina kai (salt bed) named Hanumaha.
2932	Kailiuku at Kahuku, Oʻahu. A fish pond at Waihinalo.
2702	Waialua at Kahuku, Oʻahu. A salt making pond at Mahukini.
2704	Haui at Kahuku, Oʻahu. A fish pond named Kuhiwa.
2705	Hao at Kahuku, Oʻahu. A small fish pond on the kula land.
2732	Pukawale at Kahuku, Oʻahu. The ocean fishery called Keekee.
2758	Napoe at Kahuku, Oʻahu. Two fish ponds at Punalau.
3723	Male at Kahuku, Oʻahu. Two fishponds at Ahamau.
3813	Pakui at Kahuku, Oʻahu. An ocean fishery and salt making land.
3951	Niau at Kahuku, Oʻahu. An ocean fishery at Kakaako (Kahuku).
4374	Kuapuu at Kahuku, Oʻahu. The fishery of Pauwela.
4390	Kupaihea at Kahuku, Oʻahu. An ocean fishery.
4449	Kaaikaula at Kahuku, Oʻahu. An ʻ*āina pa*ʻ*akai* and ocean fishery.

<u>Religious Developments</u>

Western religions in Kahuku during the late 1800s were jostling to gain the loyalty of the community. In the 1878 *Annual report of the Hawaiian Evangelical Association*, Kahuku Church, which eventually merged with Hauʻula Church, was one of the last Hawaiian speaking Evangelical churches on the island (Hawaiian Evangelical Association 1878:2). This church is later described in this report as "one of the feeble churches," to the point that, "its pastor has been called to Waianae, and installed over that church…It would be well for this church to unite with some stronger one…" (Hawaiian Evangelical Association 1878:10).

<u>The Kahuku Ranch</u>

According to Rechtman (2009), prior to Campbell's ownership, Charles Gordon Hopkins obtained the *ahupua'a* of Kahuku in 1851 the as part of Grant No. 550 and founded a ranch at Kahuku. At about the same time, transportation infrastructure was being assembled, including a road that would soon circle the island (Figure 19; Kuykendall 1938 in Rechtman 2009). Also in the late 1800s, the O'ahu Railway and Land Co. ran a line up to Kahuku from Honolulu via the Pali – with the terminus of the line running from Waianae (Honolulu Star-Bulletin 1941:155). This line was lauded for opening up new economic opportunities to windward districts of O'ahu (ibid.:158).

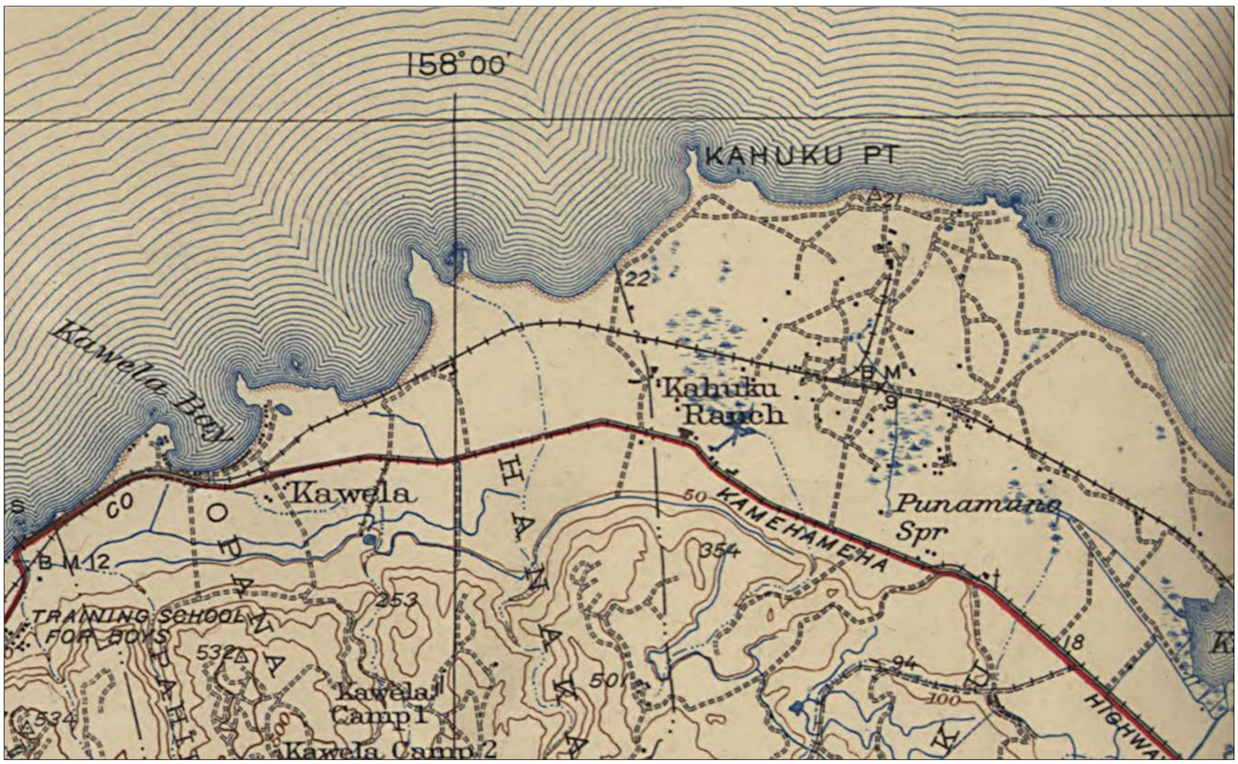

Figure 19. 1938 O'ahu Map with Kahuku Transportation Routes (courtesy of USDI).

The result of these developments were not all positive, as suggested by Emerson (1928), where he writes that the tyranny of the new land owners had caused the Native population of Kahuku to suffer, on which he elaborates:

> Kahuku had passed from control of its chief to that of an Englishman. The pastures of his big ranch extended along the shore for 12 miles, reaching inland to the mountain chain, and he was so autocratic that the natives could not own a dog, or pasture a cow or horse, without his consent. The depredations of herds and flocks on their small homesteads became unbearable, but they appealed in vain for their beloved *hala* trees and patches of vegetables. . . There was no

> redress, however, and with the fading of the forests the people also disappeared and the once populous district of Kahuku became a lonely sheep and cattle ranch (Emerson 1928:135-136 as cited in Rechtman 2009).

The 25,000 acre property in Kahuku that would become Kahuku Ranch had passed through a series of hands before it was purchased by James Campbell for $63,500 cash in the mid 1870s. Campbell then stocked this ranch with 3,000 head of cattle as well as a number of sheep and horses he hoped would reach 30,000 (Silva 1984:C-16).

<u>The Kahuku Plantation</u>
By the late 1890s, Campbell had leased a large portion of his ranch lands to James B. Castle, which would become the Kahuku Plantation. The plantation proved to be innovative both socially and economically. In the early 1900s, the Hawaiian Sugar Planters' Association became a recognized organization that aimed to improve general working and living conditions of plantation workers. Kahuku Plantation became a pioneer in the movement, providing a day-care center for the working mothers beginning in 1905 (Thrum 1921:116). The plantation had also developed a new fuel-saving device that burnt waste molasses, creating an ash that was then used as a high grade fertilizer (ibid.). By the mid-1930s, the plantation was cultivating nearly 4,500 acres and had 1,137 people under its employ (O'Hare and Hammatt 2006:21). With its heyday long over, the Kahuku Plantation shut its doors in 1971, causing the greater Kahuku area to experience economic instability for years.

<u>Military Presence in Kahuku</u>
Prior to any U.S. military bases were constructed, the American Marconi Company set up a wireless operation in Hawaiʻi in 1902, building their transpacific receiving station at Kahuku in 1915. In 1942, the Kahuku Airfield was constructed as an auxiliary airfield, with several runways, ancillary bunkers, and emplacements (O'Hare and Hammatt 2006:21). Pilots from Wheeler Air Force Base were trained to fly a variety of aircraft on this airfield. By the late 1940s, Kahuku Field was abandoned and the lands once leased by the military were returned to the landowner. In According to Nakamura (1981), the inland and mauka areas of Kahuku Ahupuaʻa were leased to the U. S. military for training purposes in the mid-1950s.

4.0 THE ARCHAEOLOGICAL RECORD

A total of eighteen archaeological studies have been conducted in various areas within the Turtle Bay Resort property. Presented in the following section is a summary of the findings for these reports. A list of the reports and their locations in chronological order is provided in Table 4 and map of the project area with all of the study areas and known archaeological sites is provided in Figure 20.

Table 4. Previous Archaeological Investigations in the Turtle Bay Resort Project Area

Authors	Year	Report Title and Publisher	Project Location	Findings
McAllister	1933	*Archaeology of Oahu.* (BPBM)	Island-wide survey	Site 50-80-02-0262; Kūkiʻo Pond
Dye	1977	Archaeological Reconnaissance Survey of Prudential Insurance Company Lands Near Kuilima-Hyatt Resort, Kahuku, Oʻahu. (SHPD)	263 hectares surrounding the Kuilima Resort	Sites 50-80-02-6410 and -6411, these sites later expanded to include more features
Bath	1984	Subsurface Archaeological Reconnaissance Survey for the Kuilima Resort Expansion Project: Lands of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku, Koʻolau Loa, Oʻahu. (PHRI)	Current Turtle Bay Resort (TBR) project area	7 new sites identified (T-1 to T-7; no SIHP #s.); sites T-1, -2, -4, -6, and -7 were tested ; sites -6410 and -6411 also tested
Neller	1984	An Archaeological Reconnaissance Survey of a Dune Burial Site Near Kahuku Point, Oʻahu. (SHPD)	East of Kahuku Point	Burial; added to Site 50-80-02-6411
Davis et al.	1986	Preliminary Report Upon Completion of Fieldwork: Intensive Survey and Test Excavations Site 50-OA-2912, Punahoʻolapa Marsh, Kuilima Resort Expansion Project, Land of Kahuku, Koʻolau Loa, Island of Oʻahu. (PHRI)	Punahoʻolapa Marsh	Site 50-80-02-6412
Walker et al.	1987	Data Recovery Plan (DRP) Kuilima Resort Expansion Data Recovery Program: Kuilima Resort, Lands of Kahuku, Kawela, and ʻŌpana, Koʻolau Loa, Island of Oʻahu. (PHRI)	Current TBR project area	No Findings
Walker et al.	1988a	Intensive Survey and Test Excavations Site 50-OA-2899, Kahuku Point Archaeological Area, Kuilima Resort Expansion Project, Lands of ʻŌpana, and Kawela, Koʻolau Loa, Island of Oʻahu. (PHRI)	Kawela Bay: west end of current TBR project area	Site 50-80-02-6410
Walker et al.	1988b	Intensive Survey and Test Excavations Site 50-OA-2911, Kahuku Point Archaeological Area Kuilima Resort, Expansion Project. (PHRI)	Kahuku Point: east end of current TBR project area	Site 50-80-02-6411
Jensen	1989	Archaeological Mitigation Program, Phases I & II, Monitoring and Burial Treatment Plans, Kawela Bay Mitigation Project, Lands of ʻŌpana, Kawela, and Kahuku, Koʻolau Loa District, Island of Oʻahu. (PHRI)	Current TBR project area	No Finds
Neller	1989	Human Remains from Kahuku Point, Oʻahu. (SHPD)	West of Kahuku Point	Burial; added to Site 50-80-02-6411

Authors	Year	Report Title and Publisher	Project Location	Findings
Kennedy	1992	Treatment of Inadvertent Burial Discovery at Turtle Bay Hilton, TMK: 5-7-01:13, Hanakaʻoe Ahupuaʻa, District of Koʻolau Loa, Island of Oʻahu. (PHRI)	Kuilima Point Burial Area	Burial; Site 50-80-02-4488
Maly	1992	Kuilima Development Company: Burial Treatment Plan, Lands of ʻŌpana, Kawela, Hanakaʻoe, ʻŌʻio, Ulupehupehu, Punalau, and Kahuku. (PHRI)	Current TBR project area, various locations	16 Burials; Sites 50-80-02-6410, -6411, and -6423
Kalima	1993	Kawela Bay Mitigation Project Osteological Analyses. (PHRI)	Kawela Bay and east edge of TBR project area	10 burials; Sites 50-80-02-6410 and -6423
Kennedy	1996	Treatment of Inadvertent Burial Discovery at Turtle Bay Hilton, TMK: 5-7-01:13, Hanakaʻoe Ahupuaʻa, District of Koʻolau Loa, Island of Oʻahu. (PHRI)	Kuilima Point	Site 50-80-02-4488
Carson et al.	1999	FINAL Treatment of Inadvertent Burial Discovery at Turtle Bay Hilton, TMK: 5-7-01:13, Hanakaʻoe Ahupuaʻa, District of Koʻolau Loa, Island of Oʻahu. (PHRI)	Kuilima Point	Site 50-80-02-4488
Borthwick et al.	2001	Archaeological Monitoring Report for a Golf Course Construction and Improvement Project at the Turtle Bay Resort Golf Club, Kahuku, Ulupehupehu Ahupuaʻa, Oʻahu, Hawaiʻi. (CSH)	*Mauka* of Kahuku Point (Golf Course 2)	No Findings
Corbin	2003	Archaeological Mitigation Kuilima Resort Expansion Project, Lands of Kahuku, Kawela and ʻŌpana, Koʻolau Loa District, Island of Oʻahu (PHRI)	Current TBR project area	No Findings
O'Hare and Hammatt	2006	Archaeological Mitigation Plan for the Turtle Bay Resort Land Use Master Plan Project, Kahuku, Punalau, Ulupehupehu, ʻŌʻio 1 and 2, Hanakaʻoe, Kawela, and ʻŌpana Ahupuaʻa, Koʻolau Loa District, Oʻahu Island (CSH)	Current TBR project area	No Findings
Collins and Nees	2009	A Cultural Impact Assessment for the Proposed Replacement of Kawela Stream Bridge, ʻŌpana Ahupuaʻa, Koʻolau Loa District, Oʻahu. (PCSI) Report included an Archaeological Assessment (disclosing results of a reconnaissance survey)	Kawela Bay Bridge area, bordering TBR project area	No Findings

4.1 Early Archaeological Studies

The earliest systematic archaeological study performed in the vicinity of the Turtle Bay Resort project area is the 1930 island-wide survey conducted by Gilbert McAllister (1933). In *Archaeology of Oahu*, McAllister identifies several historic sites in or near the project area, including Kūkiʻo Pond (Site 262) located within the project area as well as Kāpī or Punaulua Fishpond (Site 258) just west of the project area, and the Waikāne Stone/Pahipahialua *koʻa* (Site 259) *mauka* of Kawela Bay, and Puʻuala Heiau (Site 260) purportedly located on a ridge that overlooks Kahuku Ranch.

4.2 Recent Archaeological Investigations

The Turtle Bay Resort (TBR) has been the subject of numerous archaeological investigations between 1977 (Bishop Museum) through 2006 (Paul H. Rosendahl, Inc. [PHRI]) that have been documented in 21 separate reports. This work has been summarized for the purposes of developing an archaeological mitigation plan in 2006 (Cultural Surveys Hawai‘i) for the then proposed master plan for development. Three main areas have been subjected to archaeological study – Kawela Bay, Kahuku Point, and Punaho‘olapa Marsh. An additional 14 sites were also investigated. The archaeological investigations in these areas are summarized below.

<u>Kawela Bay</u>

Intensive Survey

- 140 auger tests excavated
- 36 controlled test units
- 2 human burials encountered
- 11 radiocarbon dates obtained
- Area C contained the most subsurface features
- Area D yielded the highest density of artifacts and midden

Mitigation / Monitoring

- 42 controlled test units
- 212 subsurface features (hearths, postholes, trash pits, and dog burials)
- Traditional Hawaiian portable artifacts
- Shell and bone midden
- 9 radiocarbon dated obtained
- Marsh east of Kawela Bay tested and determined to be a modern feature

<u>Kahuku Point</u>

Intensive Survey

- 105 auger tests excavated
- 38 controlled test units
- 3 human burials encountered
- 8 fire pits exposed in dune faces
- 19 radiocarbon dates obtained
- 44 subsurface features uncovered
- 160 artifacts collected
- Substantial midden collected

Mitigation / Monitoring

- 21 auger tests excavated (*makai* of hole 16 in Golf Course)
    - Glass and metal fragments throughout two identified sand layers in auger holes

- 2 controlled test excavations (near 17th green of Golf Course)
    - Subsurface features (hearths, postholes)
    - Traditional portable artifacts (flaked and ground stone)
    - 7 radiocarbon dates obtained

Punahoʻolapa Marsh

Mitigation / Monitoring

- 25 auger tests excavated
- 3 trenches excavated for sampling
- 10 radiocarbon dates
- 50 pollen samples sent to two palynologists
- Dated vegetation history developed for the area

Other Sites on the Turtle Bay Resort Property (6413 – 6426)
A total of 14 additional archaeological sites were investigated to varying extents during monitoring activities by PHRI. Site areas were determined, some sites were only surface collected, and others had controlled excavations. Artifacts and midden were collected and an additional 22 radiocarbon dates were obtained.

In summation, a substantial amount of archaeological work has been conducted in the TBR property, including:

- 19 archaeological sites have been recorded to some degree;
- 291 auger tests excavations conducted;
- 121 controlled excavations (1x1 m; 2x1 m; and trenches) conducted;
- 78 radiocarbon dates obtained;
- 50 pollen samples analyzed; and
- Substantial midden and artifact collections were made.

There are a few problems and/or shortcomings with the previous archaeological investigation history. For instance, the archaeological data has been presented in 21 separate reports, with no synthesis. An apparent shortcoming of the previous archaeological studies is that they did not contain specific significance assessments of the archaeological sites that were recorded (O'Hare and Hammatt 2006:80). In addition, while 78 radiocarbon dates were obtained, it is probable that these were done without identifying the species of charcoal prior dating; this lack of species identification can produce erroneous results.

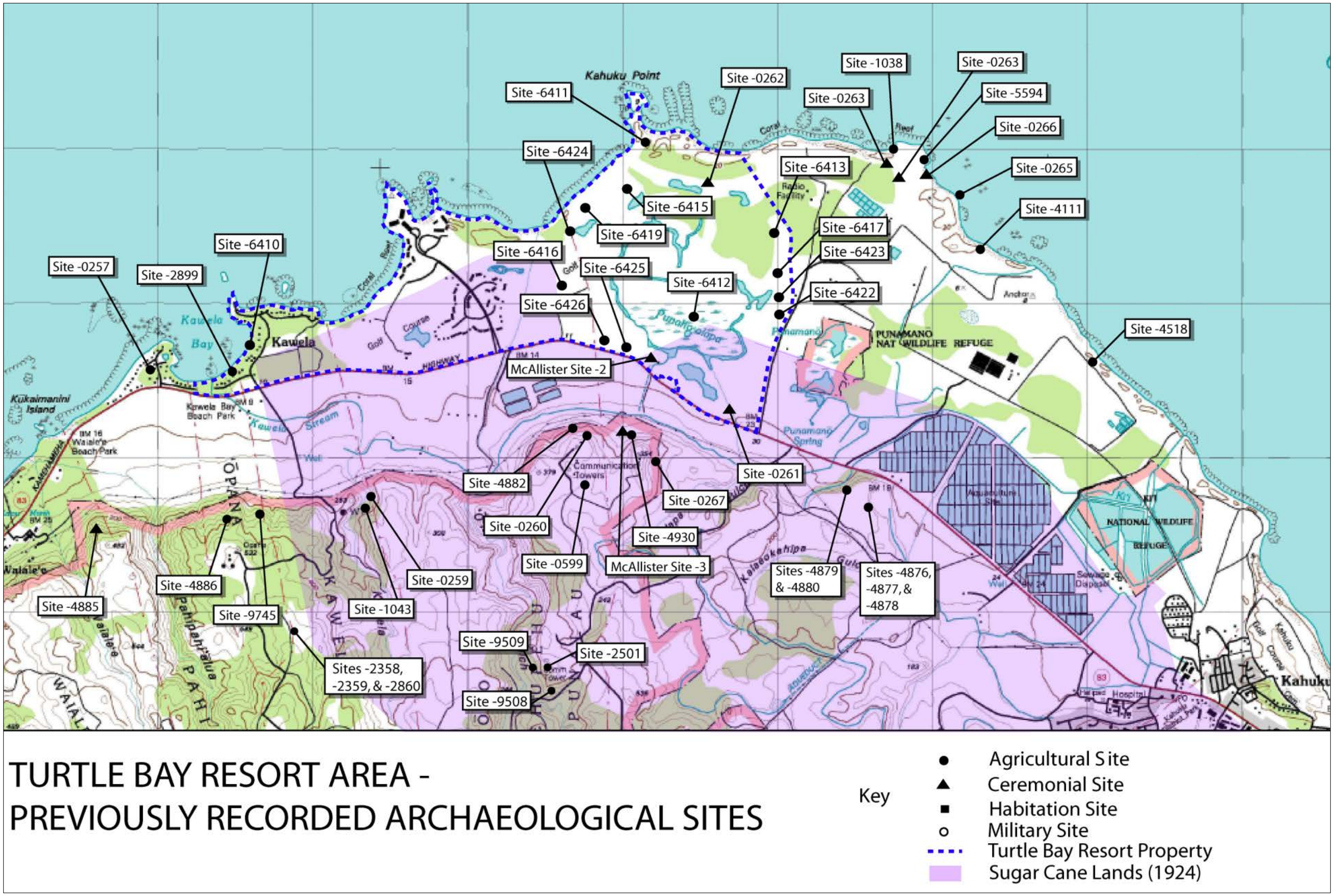

Figure 20. Previously recorded archaeological sites in the Turtle Bay Area.

4.3 Concurrent Archaeological Investigations

Turtle Bay Resort, in recognition of altered circumstances since previous archaeological studies were performed, has elected to commission a Supplemental Archaeological Inventory Survey (SAIS) as part of its Supplemental Environmental Impact Study (SEIS). This supplemental investigation was independently and concurrently proceeding at the time of the subject CIA.

On 2 February 2012, Haun & Associates concluded fieldwork for the supplemental archaeological inventory survey for the Turtle Bay Resort Development. Surface and subsurface surveys were performed in accordance with the Supplemental Archaeological Inventory Survey (SAIS) Plan, which was reviewed and accepted by the State Historic Preservation Division (SHPD; Haun *et al*. 2011).

According to the SAIS post-field report (Haun 2012), surface sites were identified in Test Areas E and F, while no surface sites or features were encountered in Test Areas A-D and G (Figure 21 and Table 5). The Test Area E survey yielded the remnants of seven World War II era concrete structures and an intact section of the Kahuku Point Airfield. Seven World War II era concrete structural remnants as well as a single potential pre-Contact agricultural mound and a previously identified historic wall were encountered during the survey of Test Area F.

Surface surveys were also performed in the Kahuku Point Preserve area and the length of forested areas adjacent to Kawela Bay. Twelve World War II remnants were discovered at Kahuku Point, consisting of 11 concrete military structures and 1 large earthen revetment related to the airfield. The Kawela Bay area survey yielded a World War II era pillbox, located at the northern end of Kawela Bay.

In addition to the pedestrian survey, Haun & Associates performed a total of 345 trench excavations, which consisted of 321 systematically positioned trenches and 12 discretionary trenches. A total sum of 1,958.5 meters (1.21 miles) of trench was excavated for the Turtle Bay Resort Development SAIS. Trenches varied in length from 3 to 23 meters, with an average length of 6.05 meters. In addition to backhoe testing, ten stratigraphic profiles were drawn in Test Area C within previously excavated sand borrow pits.

Test Areas A, F, and G bore no cultural deposits during subsurface investigations. The dearth of cultural materials was tentatively interpreted by Haun (2012) as being the result of the "extensive historic agricultural and WWII-era military activity in these areas" (Haun 2012:2). However, an intact human burial was discovered in Backhoe Trench B-6-2. Human remains were encountered in Test Area C, which consisted of a single "secondarily deposited human metatarsal" (foot bone) found on the surface of Sand Pit 6 (Haun 2012:2). No cultural deposits were encountered in Area C during subsurface testing. Three subsurface cultural deposits were discovered in Test Area D, including a single a human burial. Furthermore, five subsurface cultural deposits were encountered in Test Area E.

The full results of the Turtle Bay Resort Development SAIS will be presented in the Turtle Bay Resort Final SEIS.

4.4 IWI KŪPUNA

Iwi kūpuna are the ancestral skeletal remains of Native Hawaiians. These remains are highly revered by contemporary Hawaiians. It is believed that, upon death, the *nā iwi* of a person become the repository of the *mana* (power, authority) they possessed in life. The method of Hawaiian burials varied with an individual's rank, changed through time, and differed from one area to another. Coastal properties, especially where there are areas of sand, were common grounds for Native Hawaiian burials. Traditionally, the *kuleana* (responsibility, privilege) of caring for *nā iwi* was a sacred task. In general, today's Native Hawaiians strongly believe that *iwi kūpuna* should not be disturbed and rest in the original place of burial.

The TBR SEIS Lands have had many owners and withstood many developments, which has made it difficult for the proper treatment of *iwi kūpuna.* Further, as a Burial Treatment Plan (BTP) was not required by law until the late 1980s, the treatment of *iwi kūpuna* was discretionary until that time. In most cases, inadvertently discovered *iwi kūpuna* were removed from TBR Lands and held in a State Historic Preservation Division repository until a suitable location for reinterment near to the original burial location was decided. Over the years, some *iwi kūpuna* have been discovered on the TBR SEIS Lands. The archaeological documentation of *iwi kūpuna* was summarized by Haun (2011:68), where the discovery, recordation, and treatment of *iwi kūpuna* (ancestral skeletal remains) has been compiled for the project area from 1984 to 1993 (Bath *et al*. 1984; Neller 1984, 1989; Walker *et al*. 1988a, 1988b; Sullivan 1990; Kennedy 1992; Carson *et al*. 1996, 1999). Haun (2011) provides the history and details of *iwi kūpuna* that have been previously discovered in the project area.

Traditionally, the *kuleana* (responsibility) to *mālam*a (take care of) the *iwi kūpuna* was in the hands of the descendents and/or the *konohiki.* In accord with these traditional values, the Kahuku Burial Committee (KBC) was formed. KBC, comprised of individuals and families who have lineal and cultural connections to the land as well as cultural practitioners, have accepted the *kuleana* to *mālama nā i iwi kūpuna* that have been and may potentially be discovered on the TBR SEIS Lands. Initially, the KBC formed in response to *iwi kūpuna* that had been exposed in the Kahuku area over the years and not properly cared for. Since its initial formation, the KBC continues to be entrusted with the decision making process over the proper treatment of disturbed and displaced *iwi kūpuna* by the general community of Kahuku and surrounding *ahupua'a*. Distinguished members of the KBC are well respected *kūpuna* and cultural practitioners with ties to area, by blood and *hānai* (traditional Hawaiian practice of adoption), such as Richard and Lynette Paglinawan, Pua Colburn, Ralph Makaiau, Nova-Jean McKenzie, Buddy Ako, Warren Soh, and Carol Anamizu and several other prominent *kūpuna* of the greater Kahuku area.

Several years ago, TBR consulted with the KBC over *iwi kūpuna* encountered on TBR property with the main goal of proper treatment of *iwi kūpuna* and privacy of the descendents. From that period on, KBC has met regularly for several years with TBR, deliberating over the most culturally appropriate treatment for *iwi kūpuna* that have been discovered and may be discovered on the TBR SEIS Lands. Great care is taken during these deliberations to consider what is appropriate for each *iwi kūpuna* that may be discovered to ensure that the treatment is *pono* (righteous) for each *iwi kūpuna.* Furthermore, KBC has committed to identifying potential permanent reinterment locations within ʻŌpana-Kawela, Hanakaʻoe, and Kahuku Ahupuaʻa which would be consistent with the traditional Hawaiian values where *iwi kūpuna* were generally buried in the *ahupua*ʻ*a* that their ʻ*ohana* lived in.

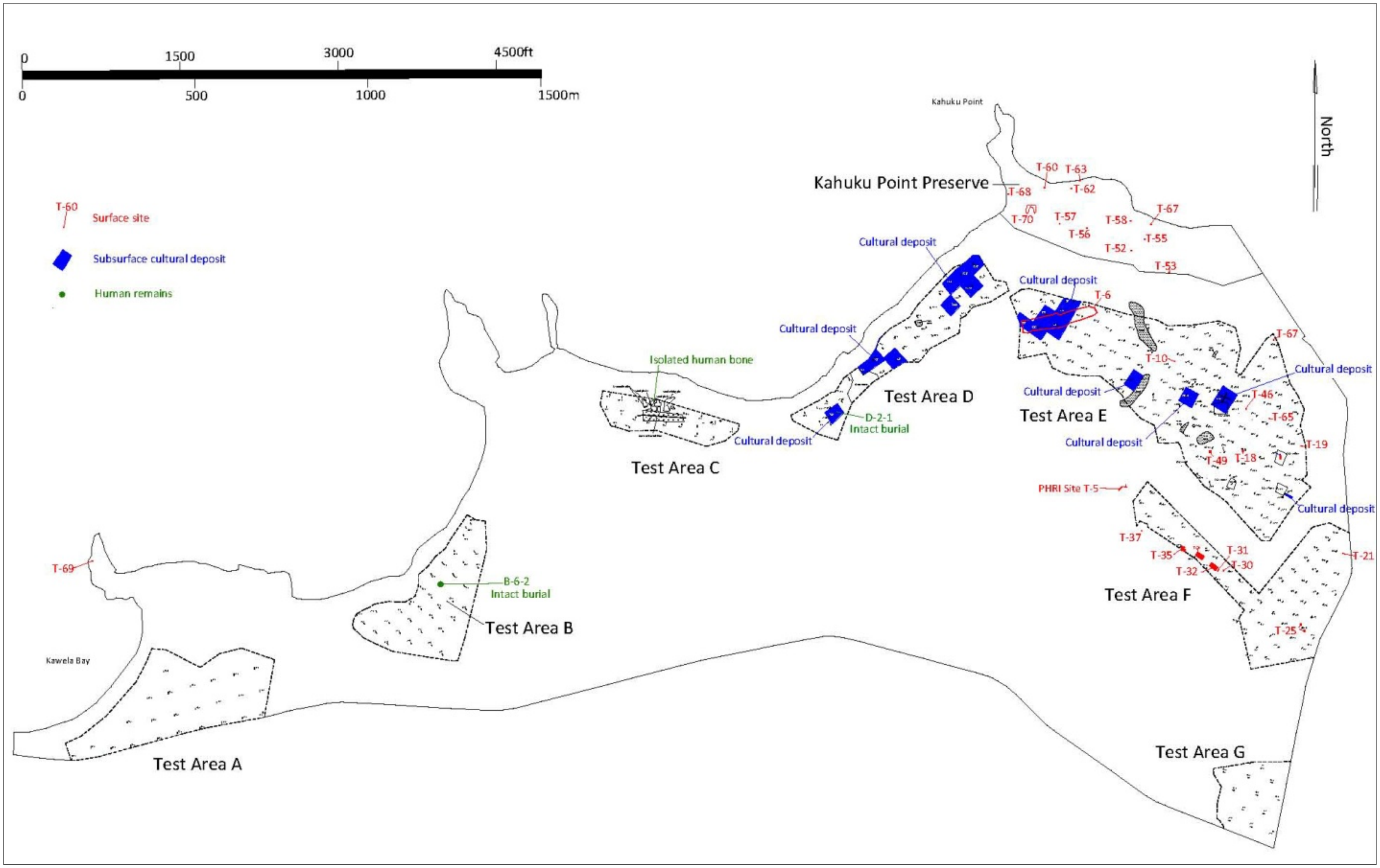

Figure 21. Map of recent archaeological findings (Haun 2012:Figure 1).

5.0 CONTEMPORARY USE OF THE LAND & SEA

As cultures are neither static, nor impervious to outside influence, SEIS Lands and surrounding lands and waters are currently used for Hawaiian traditional practices, traditional practices from abroad, modern practices, modern versions of traditional practices, and any manner of combination or hybrid of these practices. Thus, the lines between traditional cultural practices as they existed in ancient times and how they are practiced in modern times have become obscured. This section attempts to provide a summary of traditional Hawaiian and contemporary cultural activities associated with the subject area as they are practiced in the modern era.

5.1 HAWAIIAN TRADITIONS

An array of traditional activities are currently being practiced on the coast of SEIS Lands and surrounding areas.

<u>Fishing and Marine Resource Gathering</u>
Fishing as well as the collecting of shellfish and *limu* (seaweed) were crucial activities in maintaining the traditional Hawaiian diet. While pig, dog, chicken, and wild birds were sources for protein in the diet, fish and shellfish were the main protein sources (Titcomb 1977). According to John Clark (2003), the Turtle Bay Resort coastline contains several popular and/or traditional fishing sites, including:

- <u>Kauhala</u>. Located on the eastern extreme of what is now referred to as Kuilima Bay, next to Kahuku Point (John Clark 2003:167).
- <u>Ono Ledge (also known as "The Ledge")</u>. This ledge follows the 240-foot marine contour line between Kahuku and Kaʻena Points. Trolling for *ono,* or wahoo, is common here (John Clark 2003:272).

Fishing in these waters has numerous forms, including: pole, throw-net, netting, trapping, spearing. While a significant portion of fishermen and women are local, a diverse group of people come from near and far to fish using traditional methods in these waters.

<u>Swimming and Diving</u>
ʻ*Au or* ʻ*aukai* (swimming) for sport, referred to as *heihei* ʻ*au*, is a ancient Hawaiian tradition according to anthropologist, Stewart Culin (1899:211), where males were known to race each other in competition and at times for prizes or wagers. Diving for sustenance has long been a tradition in Hawaiʻi. John Clark (2003) also lists a number of popular and traditional sites within the Turtle Bay Resort coastline to swim and dive, including:

- <u>Kahuku Ledge</u>. Located three-quarters of a mile off of Kahuku Point at 70 foot marine contour line and parallel to shore. Popular diving ledge (John Clark 2003:139).

- Kalokoiki (also known as Keyhole). A sandy beach and protected cove between Kalaeokaunu (Kuilima Point) and Kalaeokamanu (John Clark 2003:385).
- . A swimming pond and beach located east of Kawela Bay (John Clark 2003:385).
- Wild Beach. Located between Kawela Bay and Kuilima Point. The name refers to the irregular or "wild" wave patterns during high surf. Swimming and diving (John Clark 2003:390).

Surfing

He'e nalu (surfing, literally 'wave sliding') and *kaha nalu* (body surfing) are also longstanding Hawaiian traditions (Finney 1959). According to Pukui and Korn (1973:36), in ancient Hawai'i, surfing was a way of life and a "discipline for heroes."

The *papa he'e nalu* (surfboard) was also an important possession in ancient times. Pukui and Korn (1973) maintain that "Both males and females regarded surfboards as prized pieces of property and selecting their names required much thought"(Pukui and Korn 1973:36). Culin (1899:212) describes the *papa he'e nalu* of the historic era as made of wood from the *wiliwili* (*Erythrina corallodendrum*), '*ulu* (breadfruit; *Artocarpus altilis*), or *koa* (*Acacia koa*) trees. He adds that the boards measured up to six feet long and a little over a foot wide, occasionally flat, but often slightly convex on top and bottom. These boards were typically stained black and after each use, it dried and rubbed down with coconut oil then wrapped in cloth and suspended in the owner's house (Culin 1899:212).

According to John Clark (2003), the Turtle Bay Resort coastline contains several surf breaks, including:

- Gordieland. Located off the north point of Kawela Bay (John Clark 2002:81).
- Marconi. Located between Kahuku Point and Kalaeuila, or High Rock (John Clark 2003:238).
- John Jack. Located adjacent to Kahuku Point (John Clark 2003:129).
- Wilds. Located between Kawela Bay and the Turtle Bay Hilton Hotel (John Clark 2003:390).

Canoeing

Canoe racing, or *he'e wa'a*, was also observed as a traditional Hawaiian sport in the late 1800s (Culin 1899:211), that has continued to be practiced today in waters off of TBR's coasts. In the historic period, "Two or more canoes race, usually out to sea, the course being a mile or a mile and a half out and around a flag buoy and return…" (Culin 1899:211). Paddlers, with outriggers ranging from single rider to crew size, continue this ancient tradition. One access location for canoe paddling is Kalokoiki (also known as Keyhole). People are permitted to launch larger outrigger canoes, but the access is small and crowded.

5.2 CONTEMPORARY ACTIVITIES

While Turtle Bay Resort provides an array of recreational activities for its patrons, the vast coastline and public access areas allow the local community to perform cultural practices as well as recreate on the resort's property. A number of popular and/or traditional activity areas are located along the Turtle Bay Resort coastline. Traditional activities include surfing, swimming, diving, and paddling. Other marine activities that not attributed to traditional Hawaiian practices, but are now popular are snorkeling and kayaking. Horseback riding, biking, segway riding, jogging, walking for recreation and fitness, hiking, group fitness classes, and golfing are activities that are currently occurring inland on the property.

Marine Activities

With such an extensive and varied coastline, in terms of water access, water conditions, presence or absence of reef or sand, etc., there are a plethora of marine sports and recreational activities that occur on TBR's coasts. Throughout the coastline, TBR visitors can be observed on any given day participating in the following activities, some of which are also performed by traditional cultural practitioners:

- fishing
- collecting
- swimming
- snorkeling
- scuba diving
- free diving
- body surfing
- skim boarding
- body boarding
- surfing
- kite surfing
- wind surfing
- stand-up paddle surfing
- paddling
- kayaking
- canoeing
- sailing
- motor boating
- collecting tropical fish
- sunbathing
- picnicking
- taking photographs or video
- wildlife viewing
- walking/jogging

Some areas are key access areas for various marine sports and recreational activities. The cove known as Kalokoiki and Keyhole, between Kalaeokaunu (Kuilima Point) and Kalaeokamanu is available for canoes and kayaks to enter. In regards to wildlife viewing, endangered species such as the *honu* (sea turtle) and ʻ*īlioholoikauaua* (seal) are known to frequent the area. This is upheld in the transcripts for UNITE HERE v. City and County Of Honolulu (Hawaiʻi State Supreme Court 2010), which states:

> …Baker's report "summarize[d] all documented sightings of Hawaiian monk seals in the area of Turtle Bay resort, between Kawela Bay and Kahuku Point," as well as all monk seal births at or near the project site. Since the early 1980s, monk seal sightings at and around the project area were sporadic. Sightings were reported in 1984 and 1991. The record indicates no sightings between 1985 and 1989 nor between 1997 and 1999. In 2001, monk seal sightings at or around the project area began to increase, with three sightings in 2001 and 2002, six in 2003, nine in 2004, twenty-one in 2005 and fifty four in 2006. According to Baker's report, "[sixty-nine] of [the] 101 [documented] seal sightings [since 1984] are attributable to [eleven] known individual[seals]," "[f]ive of [which] are adult females who are documented to have given birth and nursed their pups on remote beaches on Kauaʻi, Molokaʻi, Hawaiʻi, Niʻihau, Rabbit Island, and Oʻahu." As of this report:

> [a] single birth has been recorded in [the project] area. A pup was born on Kaihalulu Beach, on the Kahuku side of the resort, on June 1, 2006, and the mother and nursing pup are currently in the area as of July 3, 2006, along the beach or in nearshore waters. The nursing period generally lasts [five to seven] weeks. Although not in the immediate area of interest, a second birth was documented at nearby Waiale'e Beach Park on March 15, 1991.
>
> The plaintiffs also referenced three water quality reports administered by Kuilima in 1989 that summarized observations of green sea turtles over periods of five days during daylight hours only. These reports indicated that, in July 1989, no more than three turtles were observed simultaneously in one time interval. The October 1989 report estimated a maximum of nine turtles in the bay during morning hours. In December 1989, there was an average of about ten turtles in the bay during early morning hours and three or four turtles in the bay during the mid-day and afternoon hours (Hawai'i State Supreme Court 2010:i).

While viewing these endangered species has become a popular activity for tourist as well as locals, these animals have, in the past, cultural significance to Native Hawaiians as a food source and in the case of *honu*, an *aumākua* for some families and individuals as well as a source material for a variety of traditional tools (Maly and Maly 2003; Kittinger et al. 2011).

<u>Terrestrial Activities</u>
Turtle Bay Resort offers several recreational activities on land for its patrons, including horseback riding, biking, segway riding, jogging, walking for recreation and fitness, tennis, hiking, and golfing. Weddings and memorials often take place on the property as well. In addition, film makers from near and far have used the property for films, television shows, and commercials.

6.0 COMMUNITY CONSULTATIONS

The purpose for oral interviews is to acquire information from *kūpuna* and local knowledgeable individuals about the background and contemporary cultural use, if any, of the subject property that could be adversely affected by the proposed Turtle Bay Expansion project.

Concerted attempts were made to identify and locate persons knowledgeable about traditional practices that took place in the past or that are currently taking place in the Turtle Bay area and potentially impacted by the expansion project. In addition to prior CIA reports written about the Kahuku area (Collins and Nees 2006; Hammatt 2008), the State Office of Environmental Quality Control (OEQC) and Office of Hawaiian Affairs (OHA) were consulted for a listing of Cultural Assessment Providers. Various Neighborhood Boards, civic clubs, and other North Shore community associations were also contacted to obtain cultural informants. Appendix C provides a listing of potential cultural informants and their detailed contact history. Of the 68 individuals recommended by others informants or identified through research as potential cultural informants, contact information was found for 52 individuals, all of which were solicited for participation. While no response was received from 15 of those asked to participate, 37 individuals responded and 16 interviews were secured. Many of those who responded to interview requests did not wish to be interviewed, but recommended other, more knowledgeable individuals or community groups to interview. One cultural informant, Cathleen Piʻilani Mattoon, wrote a letter on behalf of the Koʻolau Loa Hawaiian Civic Club outlining the organization's concerns with the development rather than opting to participate in an interview (Appendix F).

A total of 16 interviews were conducted between 4 May and 11 April 2012. All interviewees had a personal association with the Turtle Bay Resort area, most of which were repeatedly recommended by various sources in the community. Most informants are active in the local community and well respected for their leadership and knowledge of the project area and its history. Table 5 provides a list of the consulted parties, their association with the Turtle Bay Resort project area, and form of interview.

During the typical interview, a basic questionnaire (Appendix D) was used as a guide to solicit interviewees' knowledge of the area and biographical information. Maps of the Turtle Bay project area were used to further assist the interview process and gain specific information about locations of resources and/or cultural practices. After the interview, an interview summary was created. The interview summary was then shared with the interviewee for review, which allowed them the opportunity to correct, add, and/or delete information in their testimony. These interviews were occasionally supplemented with subsequent personal and telephone conversations with informants for clarification and additional information. When the interview summary met their approval, the interviewee was asked to sign an Oral History Release Form. Copies of release forms are provided in Appendix E. Summaries of the resulting interviews follow.

Table 5. List of Participating Cultural Informants

Name(s)/Title	Association	Form of Interview
Ralph Makaiau, Kupuna	Senior Project Manager of Turtle Bay Development; Native Hawaiian area descendent; Kahuku Burial Committee	Person-to-person, at Turtle Bay
Nova-Jean McKenzie, Kupuna	Kuleana land owner in Turtle Bay property; Native Hawaiian area descendent; Kumu of Hawaiian Studies, Retired	Person-to-person
John Colburn, Kupuna	Native Hawaiian area descendent; Kuleana land owner (east of Turtle Bay property)	Person-to-person, joint with Pua Colburn
Pua Colburn, Kupuna	Kahuku Burial Committee, member; Kuleana land owner (east of Turtle Bay property)	Person-to-person, joint with John Colburn
Junior Primacio, Kupuna	Fourth Generation Kahuku Village resident; Former plantation worker; Koʻolau Loa Neighborhood Board, Chair on Agriculture and Parks and Recreation Committees	Person-to-person, joint with Gladys Pualoa-Ahuna
Gladys Pualoa Ahuna, Kupuna	Seventh-generation resident of Lāʻie; Member of Koʻolau Loa Neighborhood Board	Person-to-person, joint with Junior Primacio
Carol Anamizu, Kahuna Lāʻau Lapaʻau	Former resident of Kuleana east of project area; collects traditional Hawaiian medicinal plants within the Turtle Bay property; Native Hawaiian cultural practitioner	Part I: Person-to-person, Part II: tour of traditionally used plants in TBR; Part III person-to-person
Butch Helemano, Kahu	Native Hawaiian area descendent and cultural practitioner; Master Hawaiian wood carver; collects plants and wood within the Turtle Bay property; Former resident of Turtle Bay	Person-to-person
Raymond “Buddy” Ako, Kupuna	Community Liaison for Turtle Bay Resort Development; Longtime employee of Turtle Bay Resort; Former resident of Kahuku; educated in Kahuku	Over-the-phone
Dawn Wasson, Kupuna	Educator of Hawaiian traditional practices; collects medicinal plants within the Turtle Bay property; Former resident of Kahuku	Person-to-person
Robert Nakata, Reverend, Kupuna	Former Hawaiʻi State Senator; member of Koʻolau Loa Neighborhood Board and other civic associations	Person-to-person
Mark Kahuokapono Manley	Commercial Fisherman; Native Hawaiian Cultural practitioner; Long-term resident of Kawela Bay; combines modern and traditional fishing methods	Person-to-person
Wayne Gemeno	Fisherman; fishes on Turtle Bay coast regularly for 50+ years; Plantation descendent	Person-to-person, at Turtle Bay
Kylie Matsuda	Managing Director, Kahuku Farms; Inc. Fourth generation at Kahuku Farms; plantation descendent	Person-to-person, withdrawn
Josanda Napeahi	Recreation and Security Officer at Turtle Bay Resort, eleven years; Native Hawaiian cultural informant	Person-to-person, at Turtle Bay
Marshall Pawn	Recreation and Security Officer at Turtle Bay Resort, seven years; Lifelong resident of Hauʻula; cultural informant; plantation descendent	Person-to-person, at Turtle Bay

6.1 KŪPUNA TESTIMONY

In this Cultural Impact Assessment, a total of nine *kūpuna* were interviewed, some of which are also cultural practitioners who currently use cultural resources gathered from the Turtle Bay resort property. In this assessment, *kūpuna* refers to individuals who are respected as elders of the community.

6.1.1 Mr. Ralph Makaiau

Ralph Makaiau, the Senior Project Manager of Turtle Bay Development, was born and raised in Kahuku and has been active in numerous Kahuku community and cultural associations for many years, including the Kahuku Burial Committee. Mr. Makaiau was interviewed by Kimberly Mooney of Pacific Legacy on Friday afternoon, 6 May 2011, at the Turtle Bay Resort Development office conference room on the Turtle Bay Resort Grounds.

Born to Emma E. and Ralph K. Makaiau, Sr. in September of 1948 at Kahuku, Mr. Makaiau has solid genealogical ties to the Turtle Bay Resort project area. He is related to several of the families that occupy the remaining *kuleana* lands located within and adjacent to the resort property. Uncle Ralph is also a life-long resident of Kahuku as well as an employee of Turtle Bay Resort since the days that it was named Kuilima - outlasting numerous owners and visions of what the resort would be like upon its completion. Hence, Uncle Ralph has a deep, life-long understanding of the subject area.

Mr. Makaiau's understanding of the cultural significance of the property has largely been obtained through his own experiences, observations of his parents' cultural practices, stories from others Kahuku natives, and archival research. Uncle Ralph explained that his grandfather had received the word to learn western ways and was part of the missionary migration to Utah. As was the case with most of his grandfather's contemporaries, their ability to speak the Hawaiian language was suppressed and the passing down of Hawaiian traditions and stories was frowned upon as well. Consequently, much of Uncle Ralph's knowledge on Hawaiian traditions of the area is admittedly not handed down to him by his immediate family in oral tradition. Much of his knowledge of the subject area's cultural background has been obtained from historic records and testimonies housed in the Bishop Museum and in published materials. However, Uncle Ralph recalls that his parents were avid practitioners of Hawaiian traditions, regardless of their missionary upbringing in Iosepa, Utah. For them, it was a way of life – not stories.

Through his ancestral and personal connections to the land, Mr. Makaiau feels confident working at the Turtle Bay Resort and participating in discussions regarding the development of the resort. However, one particular childhood experience helped to substantiate his connection to the land, according to Uncle Ralph. He recalls when he was about ten years old going to Kahuku Point one night with his father. As they stood on the point, Uncle Ralph remembered his father swiftly covering his head and face with a cloth, telling him to stay still and to be quiet. Then, without warning, a horrendous wind overcame them. His father began to speak very loudly in Hawaiian; cursing against the wind. Suddenly, the wind stopped, and everything was still. He said his father never told him what had happened or what he said, but he felt at peace with the land ever since. His feelings were that his father was able to communicate with the spirits of the land and his father told them that they were not going to leave the land. Uncle Ralph's commanding oration of the story brought me into his experience, making my own hairs 'stand on end'.

From his earliest memories of the land that is now owned by Turtle Bay Resort, Mr. Makaiau recalls that the Kawela Bay area was largely managed by the Kahuku Sugar Plantation. These fields were extensive and spread across the property from east to west and relatively near to the coast. He remembers visiting his aunt who resided at Kawela Bay in one of the homes rented by plantation workers. These homes no longer exist, being demolished in the early 1980s. Further to the east, towards the hotel, Uncle Ralph recalls the other plantation settlement, Camp #3, that was largely wiped out by the tsunami of 1946. Uncle Ralph indicated on a late historic aerial photograph of the project area the extent of the air strips of Kahuku field, which took up a significant amount of land area within the eastern portion of resort property. He did not recall any archaeological or ancient structures anywhere on the property. Further, he remembers much of the land being used for the cultivation of sugar and corn, but that these agricultural endeavors were never that profitable. Traditionally, Uncle Ralph interprets from the written history that the general area of Kahuku was mainly used by *ali'i* for recreation.

In regards to cultural resources occurring on the property, Mr. Makaiau, states that the coastal areas still provide local cultural practitioners, mostly fishermen, with traditional food resources. He maintains that the entire coastline has been frequented by those fishing for a wide variety of fish and shellfish using lure, net, spear, trap, and bait. He also knows of some who collect *pipipi (Nerites spp.*), '*opihi* (*Cellana spp.*), and *limu* (various edible seaweed). In the past, cultural practitioners had requested permission from him to gather *lau hala* (pandanus leaves), which are used in various crafts, such as *haku leis*, hats, mats, and baskets. Several general groups have requested permission to gather these leaves, including Hawaiian, Tongan, and Samoan cultural practitioners. However, he has not been asked for permission to gather the *lau hala* leaves for some time. While he reasons that unauthorized gathering of this cultural resource could still be going on, he suggests that the gathering activity may have diminished due to the inferior quality of the leaves. Another cultural resource that has historically been collected from the property is salt. Uncle Ralph stated that there are natural salt pans located just east of Kahuku Point. These salt pans provided *pa'akai* (salt) seasonally, which could be used for curing or seasoning foods as well as ceremonial purposes. He says he doesn't know if anyone is currently collecting salt from this location.

Uncle Ralph admits that multiple burials have been encountered on the property during resort related construction in the past. However, he does not know the exact locations where these burials were inadvertently discovered. Mr. Makaiau states that in the initial construction phases of the Kuilima Resort, when burials were inadvertently discovered, SHPD would come out to document and collect the human remains, subsequently storing them in their offices in Honolulu. By the early 1980s, SHPD decided that the human remains needed to be reinterred at Kahuku. All of these collected human remains have been reinterred in a safe location near the property. Uncle Ralph is not privy to the location of any other burials within the property, but suspects that they may exist within original (primary) sand dunes along the coast.

Mr. Makaiau recalls several stories dealing with supernatural events occurring on the property that he heard from relatives and others who grew up in the area. He says that many people have seen a glowing orb or "fire ball" in marshy areas, which people interpret as an omen or being from the spirit world. Though he admitted to never have witnessed this phenomenon, he says it can be explained with science: the marsh could have developed gaseous conditions and the glowing "fire balls" are the gasses being released into the air. It is understandable, he acknowledged, for people to see it as a mystical event. Another common claim is that Night Marchers have been witnessed on the property. According to legend, Night Marchers are the ghosts of ancient warriors that march as if heading to battle. To this he states that he's never encountered them, but he suggests that contrary to Pukui et al. (1976:169) the *ahupua'a* and stream name, 'Ō'io (bonefish), is wrong as it is not a location abundant with the species. Rather, he suggests that the spelling is 'Ōi'ō or 'Oi'o, which is translated by Pukui and Elbert (1986) as, a "Procession of ghosts of a departed chief and his company. More commonly called *huaka'i pō*."(Pukui and Elbert 1986:280). What Mr. Makaiau appears to imply is that the place name had at some point been corrupted and the area in which the *ahupua'a* and stream are located was associated with this supernatural phenomenon. Thus, the area on which the Turtle Bay Resort sits has and continues to be a place of mystery and myth.

Ultimately, Mr. Makaiau confirms that there is a long and rich cultural history for the area in which the Turtle Bay Resort is located. He also expressed that the coastlines of the Turtle Bay Resort are locations that many traditional cultural resources are currently utilized by cultural practitioners – mainly consisting of marine resources for consumption. He stated that the resort has incorporated public access to the coast in its current design and additional beach access areas in the new plans. In regards to cultural resources located inland, Mr. Makaiau was not aware of any traditional activities occurring at the present time, although in the past he had granted permission for people to gather *lau hala* for cultural practices. Uncle Ralph also acknowledges that there is the possibility that burials may still exist in the property, but indicated that they would likely be limited to the primary, or original sand dunes located near the coast. On the proposed expansion, Uncle Ralph feels that there is a desperate need to create local jobs for the community of Kahuku and sees that the Turtle Bay Resort expansion is one way to do so.

6.1.2 Mrs. Nova-Jean McKenzie

Kumu Nova-Jean McKenzie is heir to the last remaining *kuleana* parcels within the Turtle Bay Resort property. During most of her childhood, Mrs. McKenzie resided at her family's Kahuku home, until it was washed away by the tsunami of 1946. Though her family moved to 'Aiea/Pearl City after the tsunami, Kumu McKenzie regularly camped, fished, and gathered marine resources on the *kuleana* – and continues to do so to this day. Mrs. McKenzie is a retired teacher of Hawaiian Studies from Pearl City High School and is a member of the Kahuku Burial Council. Kumu McKenzie was interviewed by Kimberly Mooney of Pacific Legacy at her Waianae home on 25 August 2011.

Nova-Jean Laulipookanahele "Laulipo" Reis McKenzie was born in ʻAiea, Oʻahu on 30 November 1938. At the age of one year old, her biological father died and, subsequently, Nova-Jean was *hānai* (given) to her *tutu* (grandmother), Harriet Fernandez, who at the time was recently widowed and alone. Nova-Jean was raised by her grandmother as an only child, not having much to do with her mother or siblings. Being brought up in relative isolation from the rest of the family gave her the opportunity to receive her grandmother's *moʻolelo* and *manaʻo* about the history of the land, her family, and ancient Hawaiian traditions. Further, her grandmother spoke to her mainly in Hawaiian, allowing her to retain a fluency in the language that is rare in her generation.

Kumu McKenzie recalls many details of the general area from her formative years at the family's *kuleana*, which she thinks came to her grandmother through ancestral lines going back to Kauihaiwali (also spelled Kauihaiwale) who was originally awarded the *kuleana*. Mrs. McKenzie holds that long before the resort, her *kuleana* was accessed by a foot trail and when her grandmother got her 1939 Plymouth, she had a dirt road put in. Her earliest recollection of the area around the *kuleana* was that it was all flat land with scant trees – very different than what it looks like today, covered with ironwoods and the golf course. She says that after the tidal wave of 1946, the *naupaka* was wiped out and all replaced with ironwood. The tidal wave also took out the family house on the *kuleana* land, which was never rebuilt. On lands around her family's *kuleana*, she recalls *loʻi* and thinks there must have been *ʻulu* prior to the tidal wave, but could not remember exactly where. According to Kumu McKenzie, Kahuku was nearly all agricultural land throughout her childhood, aside from the lands being used by the military.

Before, during, and after World War II, military lands near Kahuku Point were used for a variety of purposes. In wartime, the lengthy airstrip was actively used for take-offs and landings of military planes. Further, the military base at Kahuku in wartime was a bustling center of activities, with many structures, tents, roads, and equipment. Kumu McKenzie remembers her grandmother making coffee for the troops and, in return, they would give her some of their rations such as ham, peaches, and pears in army green cans. After the war, the military dismantled much of its infrastructure and left the rest to the elements. Soon, small habitation shacks were erected on leased land by fishermen along the old airstrip. Years later, the airstrip was used for drag racing by non-military personnel. Before the resort was built, the family *kuleana* was accessed by taking Marconi Road and then driving down the airstrip, which led to her driveway. She also remembers that the Army Corps of Engineers (ACE) had excavated a massive pit in the sand adjacent to the east of her property during wartime for a gun turret, which was never erected, and eventually abandoned the pit and large stockpile of sand after the threat of invasion was long gone. While these features are not as prominent as they were in those days, with the pit being filled partially in with eroded sands of the mound, they are still notable features of the landscape near Kahuku Point.

Many marine resources were more abundant when Kumu McKenzie was young. There were numerous shacks, as she recalls, that fishermen lived in near her property, especially along the old military airstrip. While these fisher folk held leases, they were forced out eventually. She remembers having a Filipino boarder, named Entise, who was allowed to live in a shed on the property in turn for catching fish and lobster for her *tutu*. Her *tutu* would then cook these foods for the three of them. Mrs. McKenzie recollects a hole in the reef between Kahuku Point and her property that Entise would dive for the lobster. When she was young, a cove near her property had plenty of *pipipi* (*Nerita* spp.) and *ʻopihi* (*Cellana* spp.). However, now there are only a few secret locations near her property that these shellfish thrive, which will remain undisclosed in this assessment to prevent over-exploitation of these rare resources. Also in abundance during her childhood were several *limu* varieties that she recalls her grandmother eating a lot of. She says in general *limu* along her coastline is rare nowadays. However, Kumu McKenzie holds that the *papa* (reef) is where her family has always been able to gather *paʻakai* (salt). To collect *paʻakai* in this location, the weather and surf have to be perfect. The surf has to be high enough to produce enough *ʻehu kai* (sea spray) to settle into the numerous *puka* (holes) and there has to be enough sun to bake the salt pans, which evaporates the water quickly, leaving the salt. These natural salt pans have remained a consistent source for sea salt. To the best of her memory, no fishponds or modifications to the coast line have ever existed near her *kuleana*.

In regards to plant gathering for traditional use, Kumu McKenzie holds that *hinahina* (*Heliotropium anomalum*) was always plentiful in the dune areas. However, people would collect the plants by yanking them out by the roots, which ended up nearly destroying the entire colony of *hinahina*. Further, ATV traffic and trampling has also compromised the plants' survival. Typically, the plant is gathered for making a *lei poʻo* (head *lei*). The *hinahina* is also utilized for medicinal purposes, but the exact application of the plant is not known to Kumu McKenzie. As with the *pipipi* and *ʻopihi*, the location of the remaining *hinahina* shall remain undisclosed to help protect what is left. However, she is concerned about people discovering and exploiting the *hinahina* when Turtle Bay constructs one of its planned public parks that is to be built near this plant habitat. Kumu McKenzie was not taught *lāʻau lapaʻau*, but she does recall a homemade black salve or ointment stored in an unmarked tin that her grandmother rubbed on her open wounds, referred to as *palakana* by her grandmother; however, the ingredients were never divulged to her. In her recollection, the salve was smooth and black, as if it were wax based and contained charred plant material.

Kumu McKenzie remembers some of the fauna that was present in the general area of Turtle Bay lands. She recalled seeing *pueo* or owl (*Asio flammeus sandwichensis*) in the area and that they were left alone, as they were *ʻaumākua* (ancestral guardians) for many families from the area. Kumu McKenzie also calls to mind that *puaʻa* (pig) were hunted in the *mauna* (mountainous area), *mauka* of Kamehameha Highway. Though not a traditional Hawaiian activity, some locals used to hunt pheasant, an introduced species, and large doves in the area that is now Turtle Bay Resort property in historic times. She recollects her uncle using a rifle to hunt the pheasant, which were used for food and for feathers. Pheasant were plentiful in her younger years, but are no longer found in the area.

Kumu McKenzie reminisced about Kawela Stream, which she referred to as a creek, that she frequented as a child to capture *ʻōpae* (shrimp). Her grandmother would stop by her Aunty Maka's bakery, located across the street from Kawela Bay, at five oʻclock in the morning on her monthly drive to Honolulu to collect her late husband's pension. On these mornings, her *tutu* always picked up a list of things that Aunty Maka needed from town, such as fish and *limu kohu* (*Asparagopsis taxiformis*). While her grandmother and Aunty Maka enjoyed their breakfast, which typically consisted of a Saloon Pilot cracker (also known as hard tack) that had been soaked in a bowl of hot coffee and topped with butter, young Laulipo would ask to go down to the creek next to the property to catch *ʻōpae* (shrimp). Kumu McKenzie recalls that the creek was full of *ʻōpae* and that she had good fun catching those shrimp with her little net. In those days, she remembers the area being less treed and more open; although low lying vegetation shaded the creek. Some years later, a relatively large house was built near this creek, which was eventually torn down, and she wondered if the creek was altered or destroyed with the construction or demolition of this house.

To Kumu McKenzie's best knowledge, there are a set of dunes located near Kahuku Point that are primary dunes and are known to contain human burials. During the years that Prudential had leased the land to an All Terrain Vehicle (ATV) track operation, the ATV's had disturbed the dunes to the point that burials were being exposed. Subsequently, the human remains were collected and the ATV operation was shut down. Before that incident, Kumu McKenzie, or Laulipo as she was called in those days, recalls that her *tutu* used to tease her about the burials. Her grandmother would tell her to visit the people that live by the dunes, to which a little Laulipo would reply, "there's nobody that lives there…" and her *tutu* would counter, "yes, they come out at night…they carry their *kukui hele pō* [lantern]…" Young Laulipo exclaimed, "*Tutu*, there's no house down there…" to which her grandmother would laugh and say, "but they are there at night…you go down there." Thus, it appears as though Kumu McKenzie's grandmother was aware of the burials in the dunes, before any were exposed. Further, her grandmother believed that the area was visited by Night Marchers, thought to be the ghosts of ancient warriors marching as if heading to battle.

Regarding ceremonial use of the land, Kumu McKenzie held that when it came to the ancient Hawaiian religion, her grandmother would always tell her that, "it was all in the past" and to "look forward". Her grandmother never wanted her to know the remaining *kāhuna*, and that the old religious beliefs were *pau* (finished). Thus, Kumu McKenzie admits that she knows little of that aspect of the old ways. While she has never felt a sense of foreboding or had any deep spiritual experience there, she acknowledges that some people have had those experiences in that area.

Today, Kumu McKenzie believes that people, mostly locals, access these coastal areas to collect shellfish, *limu*, and to fish from the Turtle Bay Resort area and from Marconi Road. Many of these fishermen still employ the use of throw nets. There are also local divers and pole fishermen who frequent the area. The tourists from the resort primarily enjoy walking along the coastline to get exercise, beach comb, and sightsee. She was also aware that some cultural practitioners frequent the area near her *kuleana* to collect plants for various cultural practices.

In regards to the proposed expansion, Kumu McKenzie is supportive of the project and sees it as progress that will happen eventually. Her only concern is that of her *kuleana* and access to her *kuleana*. For her, selling is not an option. That land is very dear to her and her family and wants only to be ensured that she will not be forced out and will always be able to get to the property by car. While she has managed to hold on to and make regular visits to her *kuleana*, her relationship with the resort in the past has been trying to say the least. According to Kumu McKenzie, former Turtle Bay Resort owners and administrations have made access, use, and maintenance of her *kuleana* land extremely difficult - likely to force her to relinquish ownership of her ancestral land. The less-than-neighborly conduct had escalated to a point where a former resort administrator told her she could only access her property by way of the ocean, which forced her to challenge the resort in court. The court ruled in favor of Kumu McKenzie, mandating that Turtle Bay grant her access to her property from Kamehameha Highway. Since this ruling, Mrs. McKenzie has not had any major problems with the resort and has a positive impression of the current administration's treatment of her and her property rights. She maintains that most of the people who are against the resort expansion forget that they too came to the area as *malihini* (foreigners or newcomers) and had built upon undeveloped lands, just as the resort plans to do. Now that these people are established in the area, they simply do not want anyone else to come.

6.1.3 Mr. and Mrs. John and Pua Colburn

Mr. and Mrs. Colburn have a very long history and deep family ties to Kahuku. They come highly recommended by many Kahuku residents as being knowledgeable on the history of the area as well as its cultural significance. The Colburns were interviewed on 14 June 2011, by Kimberly Mooney of Pacific Legacy at their *kuleana* residence, which was at one time part of the Kahuku Army Airfield and is located approximately 450 meters east of the Turtle Bay Resort property.

The Colburns raised, have lived, worked, played, and raised a family in the Marconi area of Kahuku. John Francis Colburn was born on Mauna Loa, Molokaʻi, on 22 November 1930 to Mr. Appiani Colburn and Madeline Juanita Fernandez Colburn. During his childhood, Uncle John relocated with his family to Oʻahu. Uncle John lived in many places on Oʻahu, but spent much of his formative years in the Marconi area on the family *kuleana* land, which is one of the last remaining of 96 original *kuleana* properties in Kahuku that was passed down from his maternal grandfather. This property had at one time been obtained by the military for the airfield. Prior to the military base, James Campbell, the famed Irish entrepreneur, had been able to acquire most of the *kuleana* lands in Kahuku, save for the Fernandez family's and a few other families' *kuleana* lands. Campbell then leased those lands to the military. However, after the tsunami of 1946, his mother was able to bargain with the military to regain possession of the land. Uncle John has had possession of the land ever since, currently occupying one of the old military barracks that had been converted into a cozy house and using old storage facilities for outbuildings. Puakehauokalani Colburn was born May of 1936 to Richard and Phyllis Saffery Nascimento in Honolulu, where she spent most of her life, but has spent the last 30 years of her life living in Kahuku. Aunty Pua is a retired professional from the transportation, travel, travel, and tourism industries as well as food service industries. Uncle John is a retired transportation and construction contractor. Aunty Pua currently serves on the Kahuku Burial Committee and has been a member since its inception.

Knowledge of the cultural landscape goes back to ancient times for the Colburns. They attested that Kahuku was known as the land of *hala* (*Pandanus odoratissimus*). According the Colburns, when a young man was to go into town in the pre- and early European Contact era, he was expected to wear a *lei pāhale* (hat lei) or *lei ʻāʻī* (neck lei) made of *lau hala* or *hala* seed. However, from his earliest recollections of the land over sixty years ago, Uncle John said that Kahuku was nearly void of *hala* due to military, plantation, and ranch related disturbances. The Colburns also asserted that there was once a *heiau* somewhere in the Marconi area, possibly *makai* of the Colburn residence that was likely bulldozed by the plantation or military before they had moved there. Aunty Pua and Uncle John were never able to relocate the *heiau*. However, they maintain that some unexplained mechanical failures had befallen mechanical equipment during the construction of the oyster farm near to where the *heiau* once stood, suggesting that the land on which the *heiau* once stood still possesses *mana* or supernatural power. Only after the area was blessed by a *kahu* would the machinery work.

According to the Colburns, the Marconi and Turtle Bay area was owned by three Hawaiian families, one of which was the Kainanui Family. By the time Uncle John was an adult, the matriarch of the family was Emily Kainanui Blanchard who passed away in the 1980s. At over a hundred years old, Ms. Blanchard still had all of her faculties and was able to elaborate on what the lands were like before the plantation. She recalled that on her property, which is where her heirs currently live, including the Ah Quin and Lopez families, her family had their own *loʻi* in their backyard that was fed by a natural spring. Ms. Blanchard also said that natural springs could be spotted in the area by the presence of bulrushes. She recalled how beautiful the area was before the military came in and bulldozed everything, including the native plants, *loʻi,* and archaeological sites.

Uncle John's first memories of the project area are of the early 1940s, during the war and when the plantation and ranch were still in operation. The Turtle Bay Resort area was largely agricultural lands, with all lands between the OR&L train tracks and Kamehameha Highway were planted in sugar cane. Lands *makai* of the train tracks were not planted in sugarcane, but were planted in *haole koa* for cattle feed. The Colburns recalled that women had to go out and collect the seed pods from the *haole koa* trees and Judge Rathburn would scatter them throughout the fields on horseback as a method of propagation. Also during the plantation era, the coastline was controlled by the plantation. Unless you lived in a coastal camp or *kuleana* property, the coast was *kapu* to those who did not have permission from the plantation to gather food and fish.

In regards to cultural resources in and around the Turtle Bay Resort, the Colburns were aware of several plant resources that are actively being collected and those that were collected until recent times. Before the gall wasp had wiped out the entire stand of Turtle Bay Resort *wiliwili* trees (*Erythrina sandwicensis*), people were known to gather the colorful seeds of the *wiliwili* to make *lei*. While the Colburns are not aware of anyone gathering *lau hala* from the Turtle Bay property, they have been growing several varieties of *hala* on their property, but the red variety, *hala ʻula,* has particularly coveted leaves that the Colburns allow their niece to gather for cultural practices. Other plants that grow in the general area that are used for cultural practices are *hinahina* (*Argyroxiphium sandwicense*), *naupaka* (*Scaevola* spp.), and *ʻākulikuli kula* or wild portulaca (*Portulaca oleracea*). The flowers of *hinahina* are traditionally used for *lei* making and leaves are used for *lāʻau lapaʻau* (herbal medicine). The *niu* (*Cocos nucifera*) was also a valued cultural resource in the project area with its many uses. Aunty Pua informed me that one of the applications was to chew the coconut meat and spit its juices upon the water, which casts an oily sheen on the water to aid visibility while in fishing.

According to the Colburns, coastal resources in Turtle Bay and Marconi area have severely declined in the last decade. Although the turtle populations have recovered, they believe that the turtles are not in the best of health because of dwindling food sources and unclean waters. Further, the Colburns believe that the general biological balance of the coast has been disrupted, as some species, such as the turtle have gotten more protection than other marine fauna and flora. For instance, Aunty Pua states that *limu,* a very important part of the traditional Hawaiian diet, has become very rare along the Kahuku coast. Also, fish populations and coral have declined because people are not fishing with sustainable methods. Some fishermen use long nets that catch fish and other marine creatures indiscriminately. Other fishermen use harmful chemicals, also known as "juice" to stun or kill the fish for easier collection, but this method kills the entire ecological unit in the process and takes many years for reef to recover. Also, many people generally over fish the area, taking more than their fair share as well as taking adolescent fish and pregnant lobster. Traditionally, marine resources were taken to suit the immediate dietary needs of the family or community and efforts were made to ensure the health of the reefs and its inhabitants. In regards to other coastal activities, such as surfing or paddling, Aunty Pua maintained that the Turtle Bay Resort coast was never a popular surf spot, as the waters were much too rough for most of the year.

The Colburns are also members of the Kahuku Burial Committee, as Uncle John is one of the heirs to adjacent *kuleana* lands and is therefore recognized as a descendant of those whose remains could be encountered during project construction. It is important to the Colburns to find a peaceful and final resting place within the property and to provide the descendants access to pay respects to their ancestors.

Regarding the proposed Turtle Bay Resort expansion and its impacts on cultural resources, the Colburns do not see the proposed project negatively affecting their lands or cultural practices that occur on their lands. They voiced support for the expansion and welcomed any jobs that might be generated by the development. Furthermore, the Colburns added that Turtle Bay Resort currently provides beach access as well as public parking on the property.

6.1.4 Mr. Junior Primacio and Mrs. Gladys Pualoa-Ahuna

Mr. Primacio and Mrs. Pualoa-Ahuna were interviewed together at Tita's Place Restaurant in Kahuku on 22 June 2011.

John "Junior" Primacio was born in January of 1932 to Mr. and Mrs. John Primacio of Kahuku and is a fourth-generation resident of Kahuku Village. Now retired, Uncle Junior worked on the sugar plantation, served for some time in the U.S. military in Vietnam, and later took the position of General Manager with the Kahuku Housing Corporation. Mr. Primacio has given over 40 years of public service in the Koʻolau Loa District, dealing with land and resource management, community affairs, workers rights, and planning. He has served on the Koʻolau Loa Neighborhood Board as Chairman of the Committee on Agriculture as well as the Committee on Parks and Recreation. He was also a Unit Chairman for the International Longshore and Warehouse Union.

Gladys Kualei Puakalehua Pualoa-Ahuna, a seventh-generation resident of Lāʻie, was born to Mr. Peter McRae Enos and Mrs. Sophia Nainoa Keʻa on January 24, 1929. Aunty Gladys is now retired, but served as post master for the United States Postal Service in Lāʻie and continues to be active in community service. She is a member of the Lāʻie Community Association, and Koʻolau Loa Neighborhood Board as well as the president and co-founder of the Lanihuli Hawaiian Civic Club in Lāʻie. She has conducted missionary work in New Zealand, the Cook Islands, and in Lāʻie at the Polynesian Cultural Center for the Church of Jesus Christ of LDS.

Uncle Junior has extensive knowledge of the Turtle Bay Resort project area, which stems from his life-long residency in Kahuku as well as his service on the Kuilima North Shore Strategy Planning Committee since the initial phases of the development. From his earliest recollections, prior to the development of the hotel, the land that the hotel is situated on was pasture lands with cattle and there was a small plantation camp for workers, referred to as Camp Three. Uncle Junior recalls about twenty small, single-family dwellings making up the camp. All homes had single-wall construction, running water, electricity, and cesspools. Most homes had gardens containing vegetables and fruits to supplement the families' diets.

While his home was not located in one of the plantation camps in the project area, he was very knowledgeable about early plantation life in Kahuku from the stories of his parents, grandparents, and fellow plantation workers. In general for the area, he maintains that by the turn of the century, most of the plantation workers had been in Kahuku long enough to be established in the community, but not to a degree that they were united. As the plantation recruited from many different countries with different cultures and languages, the workers tended to gravitate towards others with their shared mother-tongue and culture. The pay of a plantation worker was also relatively meager, although they were provided a shelter and other necessities such as kerosene. Yet, many workers came from areas where these simple benefits were marked improvements from what was available to them in their homelands, so they were grateful for these things and made the best of their situation. Many families, including his, had many children and had to find alternative ways to ensure that their kids had enough to eat and/or save money to put them through college. When his father was not working at the plantation, he hunted and fished. His father would then trade what he caught with other plantation workers for vegetables. This is how his family and most others survived. Further, he said that the Hawaiians that used to live in the mountains would come down and also trade their goods, like mountain apples or meat, for fish.

Aunty Gladys also remembered what life was like for the plantation workers. She remembered how the Filipino families grew their own vegetables from their homeland, such as *talong* (a variety of eggplant), beans, and bitter melon. The Hawaiians would grow their own *kalo* (taro) and made their own *poi*. She recalls that many households would raise their own meat and dairy cows, slaughter their own pigs, raise their own chickens, and catch their own fish – and in those days they had a lot of fish.

In regards to current cultural resources located in and around the property, Aunty Gladys and Uncle Junior were not aware of the specific plants that are gathered in the area, but recommended Carol Anamizu as a known cultural practitioner who regularly visits the area to collect plants for *lāʻau lapaʻau.* Furthermore, both agree that an array of marine resources is available on the coast of Turtle Bay Resort, which has provided sustenance for the local community, as it has from time immemorial. The two also noted that many feel that these waters are not as plentiful with fish, shellfish, or *limu* as they were in the past. Uncle Junior and Aunty Gladys recommended I speak with Sam Ah Quin, Ahi Logan, and Buddy Ako regarding fishing and marine resource gathering on the coast of Turtle Bay Resort property.

Uncle Junior's aspirations for the development have always been to provide jobs for local people laid off by the plantations as well as their children and to stimulate the local economy. Both insist that these sentiments are echoed by many in the community who are too humble to speak up about it. Uncle Junior states that several factions in the community, such as the newer home owners of North Shore, and outside organizations, such as Keep the Country Country Organization, have been against the development since day one. However, he has some concerns about management of the *mauka* lands that have been slated for agricultural use. He hopes that when the Land Trust takes over the property, they will preserve it for agriculture and manage it responsibly.

Many of the same sentiments were supported by Aunty Gladys. She maintains that the people of Lāʻie, along with Hauʻula, have always been supportive of Kahuku – more than other nearby *ahupuaʻa* in the district. In fact, Lāʻie has had similar opposition against their proposed Lāʻie Hotel Redevelopment that Aunty Gladys supports for the same reason that she supports Turtle Bay's expansion – jobs. However, upon hearing from Uncle Junior that Turtle Bay was planning on significantly scaling back the number of rooms, she expressed that she was glad to hear that they were doing so and called it a "step in the right direction." She also added that Turtle Bay should add rental units to the proposed resort staff affordable housing for the younger workers who might not be in a position to buy a home.

6.1.5 Mrs. Carol Anamizu

Mrs. Carol Anamizu has been recommended by many cultural informants as a cultural practitioner who is highly knowledgeable on plants used for traditional Native Hawaiian healing (*lāʻau lapaʻau*) and still frequents the Kahuku area to collect medicinal plants as needed and when in season. Until a few years ago, she and her late husband worked and resided on a 17-acre *ti* farm near to the project area for over 30 years. She maintains her property in Kahuku. Mrs. Anamizu continues to give lectures on *lāʻau lapaʻau* at the Kahuku Public Library. Mrs. Anamizu was interviewed 6 September 2011. During the interview, Mrs. Anamizu proposed that she host a tour of the *lāʻau* plants at a later date. Mrs. Anamizu was able to conduct the tour on 8 March 2012 to show me Turtle Bay Resort's various *lāʻau.* Pictures of these *lāʻau* are provided in Appendix G. A final interview with Mrs. Anamizu was conducted on 11 April 2012.

While Mrs. Anamizu, or Aunty Carol, was born in 1952 on the Island of Molokaʻi to the Briones Family, she moved to Kahuku in the early 1980s with her late husband, Douglas, who was born and raised in the area. Together, the Anamizu's established Anamizu Farms, Inc., which specialized in plants used in traditional Hawaiian practices, focusing on *ti* and medicinal plants. Anamizu Farms, which is adjacent to the Turtle Bay Resort, also became a venue where the Anamizu's taught wayward teens of the area as well as students from Kahuku Elementary and Kamehameha Schools traditional farming methods and the many uses of these *laʻau.* The Anamizu's have hosted several conferences on the subject at their farm as well. Although Aunty Carol is no longer farming, she continues to practice *lāʻau lapaʻau* and lecture on the subject.

Aunty Carol's knowledge of *lāʻau lapaʻau* is extensive and was passed down from her grandmother to her mother; from her mother to her; and now from Aunty Carol to her daughter. She maintains that the tradition is based on ancient concepts, where the elements of earth and ocean need to be represented in the medicine and be balanced within the patient. Each medicinal formula is tailored to the patient, using ingredients representing the *ʻāina* and the *kai,* since she states, "…the beginning of sickness is on the land – the ending is in the ocean." According to Aunty Carol, *lāʻau* represents only 20% of the healing process and the remainder consists of prayer and divine forces. Aunty Carol carefully integrates *lāʻau lapaʻau* with Western methods, though she prefers to treat only those who are not taking pharmaceuticals with traditional Hawaiian medicines.

Aunty Carol uses a plethora of plants and trees in her *lāʻau lapaʻau*, many of which can be found in and around the Turtle Bay Resort property. According to Aunty Carol, the naturally occurring *lāʻau* that still can be found on the property coastline are beach *naupaka* (*Scaevola sericea*) and *hinahina* (*Heliotropium anomalum*). Beach *naupaka* is traditionally used in a directly applied poultice for broken bones. *Hinahina* has several applications. Medicinally, a tea is prepared with *hinahina* to flush the system. *Hinahina* is also traditionally used in *lei* making. Several traditionally used plant species likely found on the property prior to the resort construction have been reintroduced to the property in the form of landscaping, such as *hau* (*Hibiscus tiliaceus*), *niu* (*Cocos nucifera*), *kou* (*Cordia subcordata*), *hala (Pandanus odoratissimus*), and *lauwa*ʻ*e* (*Phymatosorus scolopendria* or *Microsorium scolopendria*). The *hau* has many uses, which is probably why it was brought to the islands by the first Hawaiians. According to Aunty Carol, the flowers were made into a tea to drink and the sap of the inner bark was applied directly to the birthing canal to aid in childbirth. The *niu* (coconut), brought to the islands as well, is a tree with scores of uses, including subsistence, construction, and craft. The wood of the *kou* tree, also introduced to the islands by humans, was traditionally used for woodcarving. The *hala* was also an important plant to Hawaiians, especially those of Kahuku, for various traditional crafts and other applications. The fern known as *lauwa*ʻ*e* has several uses as well, including a tea mixed with ʻ*alaea* (red dirt) for nausea and ornamentation/decoration.

Many of Aunty Carol's medicines come from the ocean and shoreline, most of which can be found on the coast of Turtle Bay Resort lands. She uses a variety of shellfish, fish bone, *limu,* and *pa*ʻ*akai* as ingredients to cure her patients. The *pipipi* (*Nerita picea*), *kūpe*ʻ*e* (*Nerita polita*), *wana* (sea urchin; Echinoidea spp.), and ʻ*a*ʻ*ama* crab (*Grapsus grapsus tenuicrustatus*) are shellfish used in various traditional medicines. For instance, the ʻ*a*ʻ*ama* crab is used as an organ cleanser for *kūpuna.* Also, *pipipi* and *kūpe*ʻ*e* are boiled in water to make a broth in which the appropriate *lā*ʻ*au* and/or *limu* is added. Dried fish bone and *wana* endoskeletons can be pulverized into powder that can be added to poultices for various ailments. According to Aunty Carol, powdered *wana* endoskeletons mixed with *pa*ʻ*akai* and appropriate *lā*ʻ*au* are used to remove skin tabs (acrochordons).

Obviously, the coastline of Turtle Bay Resort has been integral to maintaining the traditional diet with an array of subsistence marine resources. Aunty Carol holds that there are many fish species that the Turtle Bay Resort coasts are renowned for, especially the *moi* or threadfish (*Polydactylus sexfilis*), *pāpio* (juvenile Carangidae spp.), *manini* (*Acanthurus triostegus*), *kala* (Teuthidae spp.), and *weke* (Mullidae spp.). Aunty Carol knows of several local families that frequent the area to throw net for subsistence. According to Aunty Carol, shellfish species still collected on the coast for subsistence are the *pipipi*, *kūpe*ʻ*e*, ʻ*opihi* (Patellidae spp.), as well as various crabs, spiny lobster, and slipper lobster (Decapoda spp). *Limu* is yet another important element in the traditional Hawaiian diet. Aunty Carol maintains that several types of *limu* grow on the property coastline, including *limu kohu* (*Asparagopsis taxiformis*), *limu manauea* (*Gracilaria coronopifolia*), and *huluhulu waena* (*Grateloupia filicina*). She adds that most of these marine resources have become scarce since the resort has opened.

In general, the Turtle Bay Resort property and coastal waters have changed dramatically from the historic period to the present, according to Aunty Carol. She holds that there were vast *hala* groves above Kamehameha Highway before cattle was brought into the area, which ate and trampled the *hala*. This *hala* grove was a major source for *lau hala* (*hala* leaves) used for weaving traditional mats, baskets, blankets, pillow, and many other crafts by people near and far. She also stated that the coast of the Turtle Bay Resort was once clean and contained many resources such as *lāʻau*, *limu*, shellfish, fish, and *paʻakai* that were integral to the traditional diet, crafts, medicine, and ceremony. Today, she no longer gathers *lāʻau* from TBR's coastline as she has reservations about possible pollutants from beach goers. She also disclosed that neither she, nor any of her close colleagues, collect *lāʻau* on Turtle Bay's inland property due to the possibility of contamination, which makes it unsuitable for medical use or ingestion. However, according to Aunty Carol, the resort has incorporated many species of plants used in traditional cultural practices and she thinks it's possible that other practitioners collect *lāʻau*.

Regarding the proposed Turtle Bay Resort expansion, Aunty Carol fears that the increased occupancy of the hotel will intensify the impacts on the environment, particularly the marine environment and ground water. She questions whether the resort will sufficiently address the increase in sewage produced by the hotel's expansion and if the sewage system fails, she fears that the effluent may make it into the ocean and destroy fragile the reef ecosystem. Aunty Carol is also concerned over the increase in beach goers and how they will impact the already dwindling numbers of fish and other marine resources. Another trepidation of hers is that farmers leasing the proposed agricultural park planned for Turtle Bay Resort lands, just *mauka* of Kamehameha Highway, may employ chemical pesticides, herbicides, and fungicides that could enter the ground water and the ocean via runoff. If the expansion is to proceed, Aunty Carol supports the notion of the resort dedicating space for an ethnobotanical garden and cultural education center to help preserve and protect traditional Hawaiian cultural practices, such as traditional farming and *lāʻau lapaʻau*. In addition, as Aunty Carol is on the Kahuku Burial Committee, she has concerns over further disturbance to *iwi kūpuna* during the construction process.

6.1.6 Mr. Butch Helemano

Mr. Butch Helemano is the official *Kahu* (minister and regent) for Waimea Valley, as appointed by the Office of Hawaiian Affairs (OHA). He is well known for his contributions to Native Hawaiian history and cultural preservation, in addition to being a celebrated *mea puolo* (musician), *mea kākau* (writer), and *kahuna kālai kiʻi* (master woodcarver) of traditional and contemporary Hawaiian designs. Further, Kahu Helemano envisioned and established the public non-profit *Ka Aha Hui Naʻauao* (The Wisdom Organization) in 2006, which was designed to preserve and perpetuate ancient Hawaiian language and traditions, such as construction of dry stone and thatched structures, sacred image wood carving, as well as manufacture of weapons, tools, and fishing implements out of stone and wood. Kahu Butch Helemano was interviewed on 28 August 2011 at the site of his weekly traditional Hawaiian wood carving class in Waimea Valley.

Butch Kauihimalaihi Helemano was born September of 1950 in Honolulu and primarily raised in Kalihi. His ancestry is predominantly Hawaiian with familial ties to Hauʻula, Kahuku, Lāʻie, and Waimea. While Kahu Helemano now lives in Mililani, he has spent over 35 years living and working in the North Shore area, with 18 years of residency at

Turtle Bay. His children were raised in Turtle Bay and educated in the North Shore and his wife currently teaches at Sunset Elementary. He also has family who hold prominent positions at the Turtle Bay Resort hotel. Mr. Helemano himself maintains strong ties to the area as the manager of Dillingham Airfield, Kahu of Waimea Valley, and as a registered minister proceeding over ceremonies island-wide, but largely on the North Shore. Furthermore, Kahu Helemano has a long list of mentors and informants who are predominantly *kūpuna* from the North Shore.

Having strong ancestral ties to Kahuku and adjacent *ahupuaʻa* as well as 18 years of residency at Turtle Bay, Kahu Helemano has an intimate knowledge of the Turtle Bay property and its cultural significance. In his youth, he often visited family in Kahuku and spent a lot of time fishing and riding his horse on the property's beaches and surfing its waters. From his earliest recollection, the land was much more rural.

When asked about the history and mythology pertaining to Turtle Bay, Kahu Helemano prefaced the sharing of *moʻolelo* (stories) of the area with his *manaʻo* (belief/thoughts) that there is a misconception by outsiders that traditional Hawaiian *moʻolelo* are comprised of concepts, chronicles, and characters that only had cultural significance in the distant past. However, these stories are a major component of the living culture and are part of the framework that binds other elements of traditional Hawaiian culture. Thus, these stories are meant to be told and received in a current tense with the function of upholding cultural beliefs and practices.

Kahu Helemano maintains that there are many traditional stories and cultural features associated with this area. For example, he mentions the place name, Kuilima, which literally translates to the "joining of hands." He holds that this name is not only a reference to locals customarily walking hand-in-hand in ancient times, but also a way in which people of Turtle Bay were identified by others - as a community that shared a lot of *lōkahi* and *aloha*. The latter concept is the lasting legacy that comes from the *moʻolelo* and is passed on to the younger generations of Turtle Bay that they are also bound together by the tradition of *kuilima*. Another important element of the area's cultural landscape is that the Kahuku coast, specifically Kawela Bay, was the traditional resting and recreational place of the *aliʻi,* due largely to the many natural *pūnāwai* (fresh water springs) that exist in the area. Kahu Helemano adds that somewhere in this area was a *kahua pāʻani* (training ground) for the *lua* (a hand-to-hand fighting technique) fighters. The area was also traditionally recognized for its *pū hala*, or *hala* (*Pandanus odoratissimus*) groves. In addition, Kahu Helemano holds that the *moʻolelo* of the Night Marchers, or *huakaʻi pō,* who are the spirits of ancient chiefs and warriors marching in ghostly procession, as if to battle, is the most prominent story of the area. He maintains that the procession occurs four nights during the *mahina* and the procession is performed by these spirits for a particular reason. As the spirit marchers are manifestations of Kahu Helemano's ancestors, they are highly revered. Many terrible accidents have occurred in the Turtle Bay vicinity due to the development's disruption of the pathway used by the Night Marchers, according to the *kahuna pule*.

The traditional significance of the area, according to Kahu Helemano, was also the fecundity of its coasts and coastal waters. People from Kahuku depended heavily on fish for their diets. He holds that the area had many *ko'a* (fishing grounds) that belonged to chiefs and *konohiki* (guardian of the *ahupua'a*). One had to obtain permission from the chiefs or *konohiki* to fish in the *ko'a*. Some fish species that were abundant were the *kala* or unicorn/surgeon fish (Teuthidae spp.), *moi* or threadfish (*Polydactylus sexfilis*), *'ō'io* or bonefish (*Albula vulpes*), *'a'awa* or hogfish (*Bodianus bilunulatus*), *uhu* or parrot fish (Scaridae spp.), and the *'ula'ula* or red snapper (Lutjanidae spp.). Mollusks are represented by a variety of species, including the *he'e* or octopus (Octopodidae spp.) as well as shellfish such as *hā'uke'uke*, or shingle urchin (*Colobocentrotus atratus*), *wana* or typical sea urchin (Echinoidea spp.). In addition, crustaceans captured from the area are mainly *'ula*, spiny lobster (*Panulirus marginatus*) and *'a'ama* (*Grapsus grapsus tenuicrustatus*), and *lolo* or various sand crabs.

Kahu Helemano also maintains that there were many avian species in the area that were utilized by Hawaiians in the past. For example, wing bones of the *mōlī* or Laysan albatross (*Diomedia immutabilis*), once abundant along the entire coast, were used as *kākau* or tattooing needles. These birds, while graceful in flight, were an easy catch on land and were either killed by the blunt force of a staff or club, or by a thrown stone. Now these birds are federally protected and no longer used for cultural practices, such as tattooing.

According to Kahu Helemano, there also existed a variety of flora in the general Turtle Bay area used for traditional Hawaiian practices – some of which are utilized to this day. To his knowledge, *kou* (*Cordia subcordata*), typically planted around chiefly residences, were planted by his ancestors in the area. This wood is known for its workability as well as its durability in making an array of vessels such as cups, dishes, and calabashes. *Milo* (*Thespesia populnea*) could also be found in this area, for its use as a woodcarving medium. *Hau* (*Hibiscus tiliaceus*) was used to make outriggers for canoe because of its light weight and strength. Still used by woodcarvers in the area is the *kamani* (*Calophyllum inophyllum*), which is used to make bowls, at one time for the chiefs. Stands of *kamani* still exist near the stable area of the resort and Kawela Bay area. The *pū hala* (*Pandanus odoratissimus*), with its many uses and it representing the cultural identity of the people of Kahuku, would have been the most predominant tree in that area. Following in dominance would likely be the *niu* or coconut (*Cocos nucifera*) for its use as a staple food source as well as its many utilities. Plants that were mentioned were *naupaka* (*Scaevola* spp.), which is used for a variety of applications. The *pōhuehue* or beach morning glory (*Ipomoea pes-caprae brasiliensis*) and the *koali* or ivy-leaved morning glory *(Ipomoea indica)*, are medicinal plants that are also used for making cordage. These plants grow along the beaches of the project area, particularly on the eastern sandy beaches of Turtle Bay Resort. He adds that these plants and others used in Hawaiian traditional practices were abundant near the ranch, but they are nearly wiped out due to trampling from foot traffic and the fallen needles of the introduced ironwood trees, which have created an acidic mat that prevents native plants from reproducing. Kahu Helemano maintains that he and other cultural practitioners go to Turtle Bay area to collect these plants for ceremonies and crafts.

In regards to the Turtle Bay Resort expansion, Kahu Helemano shared his *mana'o* about several aspects of the development. A major concern of his is development for tourism in general, where he feels that the land and the Hawaiian culture are being desecrated. Places like Waikīkī, in its current state, are disheartening for him as a witness to the extremely fast and aggressive development projects as well as the acute exploitation of its natural resources and Hawaiian culture by the tourism industry. Kahu Helemano fears a second Waikīkī scenario in the North Shore. He notes, that this modern tragedy is further compounded by two conflicting principals, where a land owner's rights clash with the sentiments of the community. Yet, he feels that there must be a way that the two can come to compromise. The resort will inevitably expand, he holds. However, he hopes that the developers will find a way to expand in a way that the host community (i.e., Native Hawaiians) and the resort's neighbors will benefit or sustain little to no impact. Further, he would like to see some sincere effort by the resort to help perpetuate Native Hawaiian cultural practices. In regards to the bumper sticker, "Keep the Country Country" and other prominent slogans, the *kahu* holds that they are designed to keep the country pristine for rich property owners – not for Hawaiians. He is doubtful that most backers of this campaign would want most Native Hawaiians as neighbors. Therefore, he tends to distance himself from these groups. In summation, Kahu Helemano does not advocate for or against the resort's expansion, but feels that the resort should listen to the entire North Shore community – not just the rich.

6.1.7 Mr. Buddy Ako

Mr. Buddy Ako is currently the Community Liaison for Turtle Bay Resort Development and has spent most of his 73 years living, receiving an education, and working in Kahuku and Hau'ula. Mr. Ako participated in an over-the-phone interview on 1 February 2012 by Kimberly Mooney of Pacific Legacy.

Raymond "Buddy" A.H. Ako was born 7 July 1938 to James and Lei Ako in Honolulu. Until the age of eight years old, he was raised by his Chinese grandfather, Lau Ako, in Kāne'ohe, after which a young Buddy Ako moved from Kāne'ohe to Hau'ula to be raised by his mother and step-father. As Hau'ula was a relatively close community, Mr. Ako recalls learning about the natural world and Hawaiian traditions from several Hawaiian "uncles", including 'Aina Kamakee'aina, Joe A'alona, and Joseph Kalili. Although he lived in Hau'ula, Buddy attended Kahuku Elementary and High School from grades three to twelve. Between school and play, Mr. Ako spent most of his time in Kahuku, as the majority of his friends resided in Kahuku and he maintains that in those days there was much more for a kid to do in Kahuku than in Hau'ula. He fondly looks back on his many adventures in the mountains above Kahuku - hiking, picking feral pineapple from abandoned fields, swimming in reservoirs, and hunting doves and pheasant that he and his Kahuku friends would give to the Japanese farmers who tended small vegetable crops up *mauka*.

Although Mr. Ako did not spend too much time in the over 800 acres that are now owned by the Turtle Bay Resort, he remembers several locales within the property prior to the development. He recalled hanging out with a friend who lived at Kawela Bay, which was at that time a gated private community. In those days, local kids were not allowed in that area without being with a resident. He also had a friend who lived in the Kahuku Plantation Camp #3, which is where the Turtle Bay Resort Hotel now sits. In his best recollection, Camp #3 was simply an outlying camp that was made up of a good number of families from an array of ethnic groups. However, many of these families lost their homes during the 1946 tidal wave, which also took the life of a young girl who lived in the camp. The homes lost in the tidal wave were never rebuilt by the plantation, yet a handful of Camp #3 homes remained on Kuilima Point until the mid-1960s. He recalls the camp vacated sometime before 1969 when the area was bulldozed and the hotel was erected. Despite the construction of the new hotel, most of the land at that time was still planted in sugarcane. Mr. Ako had another friend in his younger years that lived in one of the last Kahuku Ranch homes, which was located in an area that is now part of the golf course. Much of what are now Turtle Bay lands east of the hotel were part of the World War II Air Base and *kapu* to Mr. Ako in his youth.

While he admits he was never too interested in fishing in general, Mr. Ako holds that people did not traditionally fish in other people's *ahupua'a* . Technically being from Hau'ula, he was not indoctrinated in fishing practices or locations in Kahuku. From living in Kahuku for over 24 years and his many years at Turtle Bay, Mr. Ako was knowledgeable on several traditional practices occurring along the coast of the resort. For example, he maintains that people continue to throw net along the coast from Kawela Bay to Kahuku Point, to catch mullet, *kala*, and *manini*, but tend to favor the waters *makai* of the stables. He was also aware that people caught *moi*, using rod and reel between Kahuku Point and Kuilima Point. Popular areas for locals and non-locals to fish for *moi* are often riddled with tubes carved into the reef and rock, sometimes reinforced with PVC pipe, to secure the base of the fishing rod. Additionally, fishermen catch a variety of fish off the general coastline by spear-diving. Another cultural practice that is longstanding is the gathering of *limu kohu* at low-tide along the coast, but most common west of the stables and in Kuilima Cove. In regards to shellfish, such as *pipipi*, '*opihi*, and *wana*, Mr. Ako holds that he doesn't think people are gathering these traditional resources on the coast of Turtle Bay Resort due to past over-harvesting and inaccessibility.

Mr. Ako, as head of community relations for the Turtle Bay Resort, has a positive view of the proposed expansion project and feels it was a good decision by Replay Resorts to downsize the original proposed expansion. As a background, he was a part of the community when the plantation ended operations and experienced the tangible effects of the economic vacuum when the mill shut down. According to Mr. Ako, nearly all of the *kuleana* lands and private land holdings were bought out by the Campbell Estate and the community had become dependent on the plantation for jobs as well as housing. Tourism became one of the only viable options to keep the families together and in Kahuku. This option was reluctantly embraced by the community, favoring growth over continued poverty. Now, after 40 years of resort operations, he is still trying to help maintain a positive relationship between the resort and the community, which hinges largely upon the balance between economic prosperity for the resort and the community. Although Turtle Bay Resort has been under the control of several different organizations, some more concerned with the local community than others, Mr. Ako feels as though the current developer is taking the project in a positive direction in terms of working with the community and developing responsibly.

6.1.8 Mrs. Dawn Wasson

Kupuna and Educator, Dawn Kahala Taotafa Wasson, has extensive knowledge of the Kahuku and Turtle Bay Resort area, having lived in and near to the locale for approximately 45 years. Aunty Dawn is also renowned as a cultural practitioner who collects plants for traditional Hawaiian use in the North Shore area, including the Turtle Bay Resort property. Ms. Wasson was interviewed by Kimberly Mooney of Pacific Legacy on Wednesday, 18 May 2011, at the Denny's restaurant in the Kāneʻohe Shopping Center. After several communications, the consultation with Ms. Wasson was concluded on 22 March 2012.

Aunty Dawn has a strong connection to the Turtle Bay Resort property, by means of personal experiences as well as having an extensive list of relatives, mentors, and informants associated with the area. She was born to the Keaweanahi family on 16 July 1944, in the town of Lāʻie, which is located ca. 5 miles south of the project area. In the early 1950s, she moved to the Kahuku area, where she remained for nearly 20 years. Ms. Wasson calls to mind many childhood memories of camping and fishing with her family in and around what is now the Turtle Bay Resort during weekends and school breaks. In 1972, Aunty Dawn became an employee of the Kuilima Resort Hotel, now known as the Turtle Bay Resort, staying with the hotel for two about years. In addition, Aunty Dawn regularly visits her relatives, the Ah Quin family, who has lived for many generations on lands just east of the Turtle Bay Resort property.

Ms. Wasson recalls that there were still plantation camps in the project area and that the land was largely agricultural during her childhood. However, she remembers an ancient wall near project area that may have been used as a boundary wall. In addition, she recalls the remnants of an ancient *heiau* east of the property that she holds was once a *luakini,* which is a type of *heiau* where human sacrifice occurred. While the *heiau* no longer stands, Aunty Dawn suggests that the hallowed ground has retained its *mana* and members of the community maintain a spiritual connection to the area. According to Aunty Dawn, the site of the hotel itself was once the location of an ancient *heiau*. She firmly believes that tragedy has befallen those responsible for the initial construction of the hotel, as spiritual retribution for desecrating the consecrated grounds. She stresses that the area is a *wahi pana* (place of legend) and therefore imbued with *mana*, which can manifest in the form of negative consequences for those who do not treat the land with respect.

Ms. Wasson imparted her deep knowledge of Hawaiian ethnobotany during the interview, being a practitioner of and an educator of traditional Hawaiian cultural practices. Aunty Dawn also shared that she gathers a variety of flora from the Turtle Bay area for an array of Hawaiian traditions including *lāʻau lapaʻau* (herbal healing), *nā mea hana lima* (handicrafts), and utilitarian applications. Typically, she collects *lāʻau* plants when they are in season and/or when a patient (*maʻi*) of hers is in need of a particular plant. Aunty Dawn divulged that many *lāʻau* plants are collected within the project area, but was opposed to disclosing the exact locations of these plants over concerns that these fragile and rare plants might be over exploited. Ms. Wasson disclosed that numerous plants used for traditional crafts and utilitarian applications are currently gathered from the Turtle Bay Resort property, mostly near the coastline. Utilitarian plants mentioned were *pōhuehue* (*Ipomoea pes-caprae* subsp. *brasiliensis*), *naupaka* (*Scaevola* spp.), *niu* (*Cocos nucifera*), *hau* (*Hibiscus tiliaceus*), and *hala* (*Pandanus odoratissimus*). According to Aunty Dawn, the most common use for *pōhuehue,* which is a vine, is to string-up freshly caught fish and was also used to heal broken bones. She also holds that the vine is used to summon waves when whipped upon the ocean. Ms. Wasson explained that juice from the crushed leaves of *naupaka* is used for cleaning glasses, goggles, and snorkeling masks. The *niu* was not only valuable for its edible fruit; the entire palm provided a plethora of traditional Hawaiian uses. Of particular utility near the coast, the oil from *niu malo*ʻ*o* (mature coconut meat) could be spat onto the surface of the sea water to clearly see fish or other marine resources beneath the surface. The *hau* also had many uses, according to Aunty Dawn. The ancient Hawaiians used *hau* bark to fashion sandals that would not damage the coral reef as well as fire starter, rope material, *lā*ʻ*au lapa*ʻ*au*, and material to make clothing. The logs of *hau* trees were also used as ʻ*ama* (outriggers) of canoes and floating markers on the ocean surface to indicate fishing *kapu*. The *hala* had many uses as well. The leaves, or *lau hala*, were used to plait into mats, blankets, baskets, and hats. The fruits were used as brushes, *leis*, sustenance. The roots were used in *lā*ʻ*au lapa*ʻ*au* (medicine) and a powder from its flowers was valued as a male aphrodisiac.

In accordance with the other informants, Ms. Wasson attests that the coastline of Turtle Bay Resort property is an important locale for traditional Hawaiian cultural practices. The *kai* of this area has remained a source for a wide variety of staples in the Hawaiian diet. For countless generations, people have come to Turtle Bay to *laulele* (throw net), *paeaea* or *kūpali* (pole fish), and *pana i*ʻ*a* (spear fish) as well as launch boats and canoes to fish off shore. Aunty Dawn adds that great variety of fish, shellfish, and *limu* (seaweed) are found in these waters, including: ʻ*anae holo* or ʻ*ama*ʻ*ama* (*Mugil cephalus*), ʻ*ō*ʻ*io* (*Albula vulpes*), *lai* (*Scomberoides* spp.), *hou* (*Thalasoma* spp.), ʻ*āweoweo* (*Priacanthus* spp.), *kūmū* (*Parupeneus porphyreus*), *ula pāpapa* (*Scyllarides squammosus*), *he*ʻ*e* (*Octopus vulgaris*), and *wana* (*Echinoidea* spp.).

In regards to the project, Ms. Wasson feels that Turtle Bay Resorts should pay proper mind to natural resources, traditional Hawaiian culture, and other North Shore problems, such as traffic, before creating plans for development. She believes that Turtle Bay has already exhibited bad stewardship of the lands, as there have been noticeable declines in *mauka-makai* resources. Aunty Dawn is against development if it is not done responsibly. Additionally, while Aunty Dawn acknowledges existing beach access areas of the Turtle Bay Resort, she stated that the resort should add a boat access area with a corridor at least 20-30 feet wide.

6.1.9 Reverend Bob Nakata

Reverend Robert Nakata was born on April 2, 1941 in Honolulu. His formative years were spent in Kahaluʻu and Windward Oʻahu. Currently, Reverend Nakata is the pastor of the United Methodist Church in Kahaluʻu, but has served as Hawaiʻi State Senator and Chair of the Committee on Labor and Environment as well as a community activist for the poor, working, and indigenous people of Hawaiʻi. He has been a member of several neighborhood boards and civic clubs in Koʻolau Loa and Koʻolau Poko Districts, including the Kahuku area. Reverend Nakata was interviewed by Kimberly Mooney of Pacific Legacy on Friday afternoon, 7 June 2011, at the United Methodist Church conference room in Kahaluʻu.

With his long history of public service and community activism in the North Shore area, Reverend Nakata is very familiar with the subject area. His memories reach back to the plantation era, where he recalls the project area to be rural with large scale sugar cane fields and irrigation ditches as well as families with household gardens growing a variety of fruits, vegetables, and chicken to supplement their diets. Fishing also played an active role in supplementing the local diet. He recalls that the narrow coastal plain was beautiful and had a relatively high rainfall. Flanking the coast were deep, heavily vegetated valleys.

Reverend Nakata also called to mind the history of politics and development in and around the subject area. The political debates in Koʻolau Loa and Koʻolau Poko Districts have often centered around the management or mismanagement of natural resources and infrastructure shared by the combined districts and, at times, shared with districts on the opposite side of the island. About 10 miles southeast of Turtle Bay, Reverend Nakata recalls an instance where the wells of Kahana and Punaluʻu Ahupuaʻa were so heavily taxed, they became brackish, a result of fresh water being naturally replaced in the water table with ocean water, which was a direct effect of increased demands for water elsewhere on the island. This, he portends, may be a consequence of the resort's expansion. A similar narrative, which ended on a positive note, was shared about the Waiheʻe Stream in Koʻolau Poko, near Reverend Nakata's childhood home. In this account, the Board of Water (BOW) performed tests on Waiheʻe Valley wells in the 1970s that effectively drained the water table to the extent that the Waiheʻe Stream ran dry, leaving his family's *loʻi* and other families' *loʻi* without a source for water. In retaliation, Reverend Nakata challenged the BOW in court and was able to get legislation passed to mandate that the BOW must leave 2.5 million gallons of water per day in Waiheʻe Stream at a specific measuring point along its length.

Another fear regarding the Turtle Bay Resort expansion is the destruction of archaeological resources and burials during resort construction activities. By doing independent research and utilizing the Freedom of Information Act, Reverend Nakata noticed discrepancies between archaeological recommendations for the project area and construction activities performed in 2005 while Turtle Bay Resort was under its previous ownership, Oak Tree Capital Management, LLC. His concern is that cultural resources such as archaeological sites and human burials may be damaged by the proposed development if they do not adhere to the mitigation plan. Reverend Nakata's synopsis of Turtle Bay's archaeological history is provided in Appendix F.

In regards to cultural resources, Reverend Nakata recalls that *ogo*, a specific type of edible seaweed or *limu* (*Gracilaria spp.*) has been collected from the shores of Turtle Bay Resort. However, he admitted that he was not the best person to comment on the presence or absence of cultural resources. Instead, Reverend Nakata referred me to Dawn Wasson and Didi Heron as better sources of information regarding cultural practices and resources occurring at Turtle Bay.

Reverend Nakata is a well known opponent to the expansion, especially regarding impacts to traffic, natural resources, and possible gambling that could accompany the expansion.

6.2 CULTURAL PRACTITIONER AND INFORMANT TESTIMONY

A total of two cultural practitioners and two cultural informants were interviewed for this assessment.

6.2.1 Mr. Mark Kahuokapono Manley

Mark Manley is a commercial fisherman of Native Hawaiian ancestry who was raised in the Kawela area of the North Shore. Mr. Manley was interviewed at his home near Kawela Bay on 17 June 2011 by Kimberly Mooney of Pacific Legacy, Inc.

Born in December of 1953 in Honolulu, Mr. Manley spent most of his formative years in Kawela and Kalihi. Currently, he operates a commercial fishing business on O‘ahu, frequently fishing off the coast of Turtle Bay Resort using a combination of traditional Hawaiian and contemporary fishing methods. He understands the unique subsurface topography of the coast, with its deep natural trenches, fresh water springs, shelves, and precipices that provide a variety of habitats for the diverse array of marine resources. He also knows the locations of local spawning grounds of various fish and takes care to *mālama* these important elements of the fragile ecosystem, one of which is Kawela Bay.

However, Mr. Manley has observed extreme changes to the coast and coastal waters of the Turtle Bay Resort property within the last decade. For instance, there is marked decrease of many fish, shellfish, and *limu* (various edible seaweeds) species, down to approximately five percent of the numbers seen 10 years ago. Further, he asserts that coral has been diminishing on the reefs around the resort. Another observation is that the coastal tides have been rising higher at Kahuku, especially at night.

Mr. Manley holds that he and others from Kahuku and outer areas employ a variety of traditional fishing methods to catch fish. Mr. Manley still fishes in the area by using a *ko‘a* (marked fishing area) 5-6 months out of the year (April-September), where his traps are relocated by triangulating with coastal markers, a method used by fishermen in Hawai‘i for time immemorial. A variety of fish and lobster are caught by using traps off the Turtle Bay Resort coast, including: *uhu*, parrot fish (Scaridae spp.); *ū‘ū,* menpachi or soldier fish (*Myripristis spp.*); *to‘au*, or blacktail snapper (*Lutjanus fulvus*); *palani*, a strong smelling surgeonfish (*Acanthurus dussumieri*); *manini,* or convict surgeonfish (*Acanthurus* *triostegus*); *weke,* or goatfish (Mullidae spp.); *puhi*, various eels (Anguilliformes spp.); ʻ*ula*, spiny lobster (*Panulirus marginatus*); and the *ula pāpapa*, or slipper lobster (*Arctides regalis*). All year round, he and other fishermen throw net, from shore and from boats, along the coast of Turtle Bay Resort's property. This method is used to catch many different types of fish, such as: *manini* (*Acanthurus triostegus*); ʻ*ama*ʻ*ama* and ʻ*anae*, types of mullet (Mugilidae spp.); *palani* (*Acanthurus dussumieri*); *nenue*, representing the rudder and pilot fish (*Kyphosus bigibbus* and *K. vaigiensis*); *pāpio*, the young *ulua* or crevally (Carangidae spp.) – rarely caught by netting; ʻ*ō*ʻ*io*, ladyfish or bonefish (*Albula vulpes*); and *āholehole*, or flagtail (Kuhliidae spp.). Diving, with spear and/or net, is another traditional method of catching fish, which is performed six months out of the year (April-September) in waters off Kahuku. Many different species of fish as well as *he*ʻ*e*, or octopus, could be caught in this manner. Others catch various crab by net and trap, such as ʻ*a*ʻ*ama* (*Grapsus grapsus tenuicrustatus*), *kuahonu,* also known as the *haole* crab (*Portunus sanguinolentus*), and *pāpa*ʻ*i kualoa,* also known as the *kona* crab *(Ranina ranina).*

From his many years as a fisherman in the North Shore, he is also very knowledgeable on where fish and shellfish can be found off the coasts of Turtle Bay property. Fish species, such as the *moi,* or threadfish (*Polydactylus sexfilis*), can be found just north of the Turtle Bay Hotel and off of the tip of Kahuku Point. Another popular fish, the *manini* (*Acanthurus triostegus*), can be found on the north end of Turtle Bay. The *āholehole* (Kuhliidae spp.) is often found just east of Kahuku point.

Mr. Manley is also knowledgeable on various plants and trees that have utility in Hawaiian tradition. He holds that wood from *milo* trees (*Thespesia populnea*) has been gathered from the Kawela Bay area of Turtle Bay's property. Mr. Manley uses *milo* to carve hooks needed to remove eels from his traps. This wood is also traditionally used as a woodworking material, such as knives and calabashes. Gathered from the same area are *lauwa*ʻ*e* fern (*Phymatosorus scolopendria* or *Microsorium scolopendria*), used for *luau* preparations and *naupaka* (*Scaevola* spp.*),* which has many traditional Hawaiian uses and can be found near Kahuku Point as well.

In regards to the proposed Turtle Bay expansion, Mr. Manley is against big expansion, but is for compromise. The only development that he supports would be if the expansion were to stay within the existing footprint of the hotel property. He feels as though the potential impacts to the ocean, water, and traffic need to be satisfactorily addressed before he can support the project. Mr. Manley is also very concerned about *iwi kūpuna,* or Hawaiian burials, being disturbed by the proposed development. He wants no added disruption of the *iwi kūpuna* whatsoever.

6.2.2 Mr. Wayne Gemeno

Sixty year old carpenter and avid fisherman, Wayne Gemeno, was born in Kāneʻohe and raised in Waialua/North Shore and currently resides near Waimea Bay. He has fished for sustenance, trade, gifting, recreation, and exercise off the coast of the Turtle Bay Resort since childhood – long before the resort was built. He is currently a member and prize-winning fisherman for the North Shore Pole Bendaz Casting Club and the Waialua

Casting Club. Mr. Gemeno was interviewed on 22 September 2011 in the main parking lot of the Turtle Bay Resort.

Mr. Gemeno has a long history of fishing at the Turtle Bay area. He recalls a time before the resort was built and all that existed in the area was the remains of the airfield and base. In his early fishing days there used to be a security gate fronting Kamehameha Highway and one would have to pay to park on the property before taking a trail to the beach. He also recalls that surfers also had to pay to park and hike into the property. In his recollection, people drove 4 x 4 vehicles through the property as well.

From his many years of fishing in these waters, Mr. Gemeno was able to name a wide variety of marine species that were once plentiful, but now are scarce. He holds that *mūheʻe* or squid (Loliginidae spp.), *ʻula*, spiny lobster (*Panulirus marginatus*); and the *ula pāpapa*, or slipper lobster (*Arctides regalis*) were once very common in the area. Fish such as: *āholehole* or flagtail (Kuhliidae spp.), *ūʻū* menpachi or soldier fish (*Myripristis spp.*), *ʻāweoweo* (Priacanthus spp.), *kūmū* or goatfish (*Parupeneus porphyreus*), and *kala* also known as unicorn fish and surgeon fish (Teuthidae spp.) were also quite abundant in these waters. In addition, an array of *limu* (edible seaweed), including *limu manauea* or *ogo* (*Gracilaria* spp.), *limu waiwaiʻole* or *limu wāwaeʻiole* (*Codium* spp.), and *limu ʻopihi* (*Grateloupia* spp., *Polyopes* spp., and *Gymnogrongus* spp.) was readily available along the coast in the past, yet are all but absent today.

In regards to the Turtle Bay expansion, Mr. Gemeno would like Turtle Bay to add more beach access and perform some reef restoration. His major concern is about the health of these coastal ecosystems and the over harvesting of these waters. He maintains that there must be a moratorium placed on gill and purse netting, which he suspects is clandestinely happening in waters off of Kahuku at night. He also proposes that the Turtle Bay Resort sponsor and/or uphold some fishing and marine resource gathering regulations that will aid coastal ecosystems to replenish themselves.

6.2.3 Ms. Josanda Napeahi and Mr. Marshall Pawn

Ms. Napeahi and Mr. Pawn are currently employed by Turtle Bay Resort as recreation and security officers at Kuilima Cove. Mr. Pawn's family, who are of Filipino and Hawaiian descent, hails from Hauʻula and has been fishing off of the Kahuku coast for generations and has worked at Turtle Bay Resort for several years. Ms. Napeahi, of Hawaiian ancestry, was born on the Big Island and has lived in Kahuku and worked at the Turtle Bay Resort for over 11 years. A joint interview was performed by Kimberly Mooney of Pacific Legacy at the security/information kiosk at Kuilima Cove on 10 June 2011.

Both Ms. Napeahi and Mr. Pawn work full-time observing, protecting, and policing vacationers and locals as they utilize the coasts of Turtle Bay Resort for a variety of activities. Many of these activities are cultural practices, such as: fishing, marine resource gathering, surfing, paddling, kayaking, diving, snorkeling, and swimming. Most of the locals are recognized by Josanda and Marshall as descendants of plantation workers and/or local Hawaiian families who have relied on these waters for sustenance for generations. These practitioners regularly disclose what they've caught or gathered and where the fish, mollusk, shellfish, and *limu* were acquired. Josanda and Marshall are also knowledgeable on a variety of methods used to obtain these marine resources, many of which are traditional Hawaiian methods. To their knowledge, these cultural practitioners take only what they need to feed themselves and their families. Thus, Mr. Pawn and Ms. Napeahi are very familiar with what types of marine resources are caught and gathered from the Turtle Bay area, how much is typically taken, where they were obtained, and the methods used to acquire them.

According to Marshall and Josanda, a wide variety of marine resources are regularly gathered from the coast of Turtle Bay Resort, with numerous distinct areas that are abundant with specific species. Beginning with the west side of Kuilima Point, ‘*opihi* or limpets (Patellidae spp.), and *hā‘uke‘uke*, or shingle urchin (*Colobocentrotus atratus*), are collected at and just below the waterline of the craggy, west-facing precipice of the point. On the east-facing precipice of Kuilima Point, *pipipi* (*Nerita picea*) are most abundant. In the area around Kahuku Point and Marconi Beach, *he‘e* or octopus (Octopodidae spp.), *kuahonu*, also known as the *haole* crab (*Portunus sanguinolentus*), ‘*ula‘ula* or spiny lobster (*Panulirus marginatus*); and the *ula pāpapa* or slipper lobster (*Arctides regalis*) are common. This area is also abundant in ‘*ū‘ū*, menpachi or soldier fish (Myripristis spp.), ‘*āweoweo* (Priacanthus spp.), *weke* or goatfish (Mullidae spp.), *manini* (*Acanthurus triostegus*), *kala* also known as unicorn fish and surgeon fish (Teuthidae spp.), and *uhu* or parrot fish (Scaridae spp.). However, both added that nowadays marine resources have declined to about 20-30% of what could be seen in these waters just ten years ago. Fish and shellfish sizes have decreased as well.

Methods used to catch these marine resources are varied as well, according to the security guards. Traditional Hawaiian netting is popular in Turtle Bay and Kuilima Cove. Spear-fishing and diving occur during the day and night at Turtle Bay, Kuilima Cove, and off of Marconi Beach. On-shore pole fishing, using bait and lures, ensues in various areas at various times along the entire Turtle Bay Resort coast line.

Other cultural activities are common in the coastal waters of the resort property. Surfing is popular west of the Turtle Bay Hotel and north, northeast, and east of Kuilima Cove. In addition, paddling, kayaking, swimming, and snorkeling are regular activities around Kuilima Cove and Kawela Bay. In regards to the proposed resort expansion, neither Josanda nor Marshall offered opinions on subject.

6.3 WITHDRAWN TESTIMONIES

While 16 interviews were performed, one of these interviews is not included in this draft report. Ms. Kylie Matsuda participated in both an interview and interview summary review, but subsequently withdrew her testimony from the public document.

6.4 CONCURRENT COMMUNITY CONSULTATIONS

The Hawaiʻi Supreme Court ruled in 2008 that Turtle Bay Resort (TBR) was required to supplement the Environmental Impact Statement (EIS) prepared by its predecessor to resume its development plans with up-to-date assessments, including a Cultural Impact Assessment (CIA), which was not a requirement under the law when the initial TBR EIS was accepted. However, the TBR Project Team recognized that a process of meaningful engagement and dialogue was necessary to re-establish trust and confidence with the broader North Shore community that TBR would *mālama* this land.

To address this issue, the TBR Project Team, under the guidance of the consultant group, Kuiwalu, has engaged in proactive community outreach, meeting with over 200 individuals and groups for the past two years to discuss concerns over potential impacts to the area's natural resources, cultural resources, and current lifestyle. Consulted Parties and Stakeholders consisted of the Kahuku Burial Committee, Kuʻilima North Shore Strategic Planning Committee, Koʻolauloa North Shore Alliance, as well as various Native Hawaiian organizations, elected officials, and government agencies. Kuiwalu used several approaches to reach out to the community, including conducting individual and small talk story interview sessions, hosted group meetings, attended traditional public meetings, created a cultural advisory council, consulted with the Kahuku Burial Committee, established the www.turtlebayseis.com website, and published notices in the Star Advertiser and the Office of Hawaiian Affairs newspaper, *Ka Wai Ola*. Appendix C provides a summary of these consultations as well as a complete table of the individuals and groups who were engaged in this outreach.

7.0 SUMMARY AND DISCUSSION

Guidelines provided by the Office of Environmental Quality Control (OEQC; Appendix A) outline acceptable methods to identify the types of cultural practices and beliefs that are subject to a Cultural Impact Assessment (CIA). To carry out the Turtle Bay Resort CIA, archival research was conducted followed by community consultations to identify cultural practices, cultural resources, and beliefs associated with SEIS Lands and surrounding areas. Cultural practices are typically customs relating to subsistence, commerce, residency, agriculture, recreation, religion, spirituality, and collection of cultural resources, which may be carried out by Hawaiian practitioners or practitioners from other ethnic groups. Further, cultural resources, such as natural features, archaeological sites, and collectable materials associated with these types of customs, as well as traditional cultural properties and historic sites were also subject to this CIA.

7.1 SUMMARY OF FINDINGS

Archival research has revealed that, in general, the SEIS Lands and surrounding areas have a long and interesting history. From the archaeological record, traditional stories and myths, and historic documents attributed to this vast area, it is evident that these lands have been the stage of many significant acts in the long drama of Oʻahu's pre- and post-Contact history. Oral traditions and historical references to the specific area are ubiquitous as found in this and previous historic investigations (Silva 1984; Wong-Smith 1989). Similarly, the Turtle Bay Resort lands have been the subject of numerous archaeological investigations between 1977 and 2006, resulting in 21 individual reports. These archaeological investigations have documented 19 archaeological sites providing data from 291 auger tests excavations, 121 controlled excavations, 78 radiocarbon dates, 50 pollen samples, and substantial midden and artifact collections. The concordant Supplemental Archaeological Inventory Survey (SAIS) is likely to add a significant amount of data to the existing archaeological record for the project area.

Ethnographical evidence obtained through community consultations upholds the archival research findings that the Turtle Bay Resort property was abundant in cultural resources and lore, though much has changed throughout time. These community consultations also verified the existence of cultural practices, such as the gathering of various traditional marine and terrestrial resources. Out of the sixteen interviews performed, information from 15 interviews is represented in this report, omitting testimonial information from one individual. From the thirteen interviews a variety of cultural resources in the Turtle Bay Resort property were identified, including a total of 40 species of flora and fauna as well as *paʻakai* (sea salt) (Figure 22; Tables 6 and 7). From the Turtle Bay Resort coastline and coastal waters, 32 marine species, including 17 species of fish, six crustacean, one mollusk, two gastropod, two sea urchin, and four sea weed species were identified. A total of six plant species and two tree species were identified as collected from inland areas of Turtle Bay Resort. These resources are currently being gathered by an array of Hawaiian cultural practitioners for a variety of traditional activities, including *lāʻau lapaʻau* (herbal healing), *kālai kiʻi* (wood carving), *lei* making, cordage making, and consumption. While none of the informants claimed that any of these cultural resources were the last of their kind or this was the only place to collect them, the majority of those interviewed shared that these resources have drastically declined in their lifetimes and are now found in diminutive numbers. Further, the locations of many resources are guarded secrets according to many informants who fear over-harvesting to the point of extinction.

Table 6. List of Cultural Resources in Turtle Bay Resort Property

	Hawaiian Name	Common Name	Scientific Name
Marine Resources	*ʻAʻawa*	Hawaiian hogfish, Table boss	*Bodianus bilunulatus*
	Āholehole	Hawaiian flagtail	*Kuhlia sandvicensis*
	ʻAmaʻama	Striped mullet	*Mugil cephalus*
	ʻAnae	Mullet	Mugilidae spp
	ʻĀweoweo	Bigeye, glasseye	Pricanthidae spp.
	Kala	Unicorn fish	Acanthuridae spp.
	Manini	Convict Tang	*Acanthurus triogus sandvicensis*
	Moi	Six-fingered threadfin	*Polydactylus sexfillis*
	Nunue	Sea chub, rudderfish	Kyphosus spp.
	ʻŌʻio	Bonefish	Albula spp.
	Palani	Eyestripe surgeonfish	*Acanthurus dussumieri*
	Weke	Goat fish	Mullidae spp.;
	Puhi	Moray eel	Gymnothorax spp.
	Toʻau	Blacktail snapper	*Lutjanus fulvus*
	Uhu	Parrotfish	Scaridae spp.
	Ulua (juv. *Pāpio*)	Jack, Trevally	*Carangidae spp.*
	ʻŪʻū	Soldierfish, menpachi	Myripristis spp.
	ʻAʻama	Natal lightfoot crab	*Grapsus grapsus tenuicrustatus*
	Kuahonu	*Haole* crab	*Portunus sanguinolentus*
	Lolo	Sand crab, Ghost crab	Ocipodidae spp.
	Pāpaʻi kualoa	Kona crab	*Ranina ranina*
	ʻUlaʻula (also *ʻula*)	Spiny lobster	*Panulirus marginatus*
	ʻUla pāpapa	Slipper lobster	*Arctides regalis*
	Heʻe	Octopus and squid	Cephalapoda spp.
	Pipipi	Nerites	*Nerita picea*
	ʻOpihi	Limpets	Patellidae spp.
	Wana	Sea urchin	Echinoidea spp.
	Hāʻukeʻuke	Shingle urchin	*Colobocentrotus atratus*
	Limu kohu	None	*Asparagopsis taxiformis*
	Limu manauea	*Ogo, ogonori (Japanese)*	Gracilaria spp.
	Limu waiwaiʻole	None	*Codium edule*
	Limu ʻopihi	None	*Grateloupia*, *Polyopes*, and *Gymnogrongus* spp

	Hawaiian Name	Common Name	Scientific Name
Terrestrial Resources	*Hala*	Pandanus, screw pine	*Pandanus tectorius, Pandanus odoratissimus*
	Hinahina	Native heliotrope, beach heliotrope	*Heliotropium anomalum*
	Koali	Morning-glory	Ipomoea spp.
	Lauwaʻe	Creeping fern, maile-scented fern	*Phymatosorus scolopendria*
	Naupaka	Scaevolas, fan-flowers, half-flowers	*Scaevola* spp.
	Pōhuehue	Beach morning glory	*Ipomoea pes-caprae subsp. brasiliensis*
	Kamani	Beach mahogany, oil nut tree	*Calophyllum inophyllum*
	Milo	Portia Tree	*Thespesia populnea*

Adding to the cultural significance of the Turtle Bay Resort property is the existence of several other cultural connections of the Hawaiian community to these lands. As evidenced by previous archaeological investigations, inadvertent discoveries, as well as community consultations there are known human burials within the property, specifically in sand dune areas. Sensitivities regarding the *iwi kūpuna* are high, given the past disturbances. Obviously, for those with ancestral ties to the land, the *iwi kūpuna* represent and reinforce spiritual ties to the land. Several interviewees objected to any disturbance of *iwi kūpuna.* Also mentioned in several interviews were manifestations of ancestor spirits and supernatural phenomenon within the property. In the testimony of Ralph Makaiau, as a child he experienced a supernatural force on this property that seemed to challenge his very being and ties to the land, yet his father contested this force, successfully warding off or placating the conflicting force. This act solidified Mr. Makaiau's spiritual connection to his ancestral lands. Another example is the existence of "Night Marchers," which are widely held by locals to traverse through the property. Mr. Makaiau suggested that the very name of the *ahupuaʻa* "ʻŌiʻō" or "ʻOiʻo", which translates as "Procession of ghosts of a departed chief and his company," refers to this path (Pukui and Elbert 1986:280). Kahu Butch Helemano maintains that these warrior spirits are the ancestors of his and others who have roots in this area. This is upheld by Aunty Dawn Wasson's account of the hotel being built in the location of an ancient *heiau* that was demolished prior to its construction. Aunty Dawn holds that harmful consequences of disturbing this site have already occurred and could transpire in the future.

In regards to cultural practices being performed in and around the Turtle Bay Resort property, other than the gathering of marine and terrestrial resources, no traditional activities were reported as occurring at the present. While surfing and paddling occur in waters around the project area, according to Kahu Helemano, Ms. Napeahi, and Mr. Pawn, none of the thirteen interviewees held this area as being a traditional or culturally significant surf spot. The lack of reference to this activity in the archival research upholds this idea as well. As Aunty Pua noted, the waters in this area are much too rough most of the year and there are better surf spots to the west. This was echoed by Kumu McKenzie during her interview.

In summary, the Turtle Bay Resort property contains an array of cultural resources that are currently being used for traditional cultural practices, including marine food sources, medicinal plants, plants used in crafts, wood for woodcarving, and salt for various uses. The presence of human burials on the property has also been established. Furthermore, supernatural and/or divine phenomenon in the project area experienced by a few informants and acknowledged by others, suggests that there is still cultural significance and spiritual connection for those who have ancestral ties to the land.

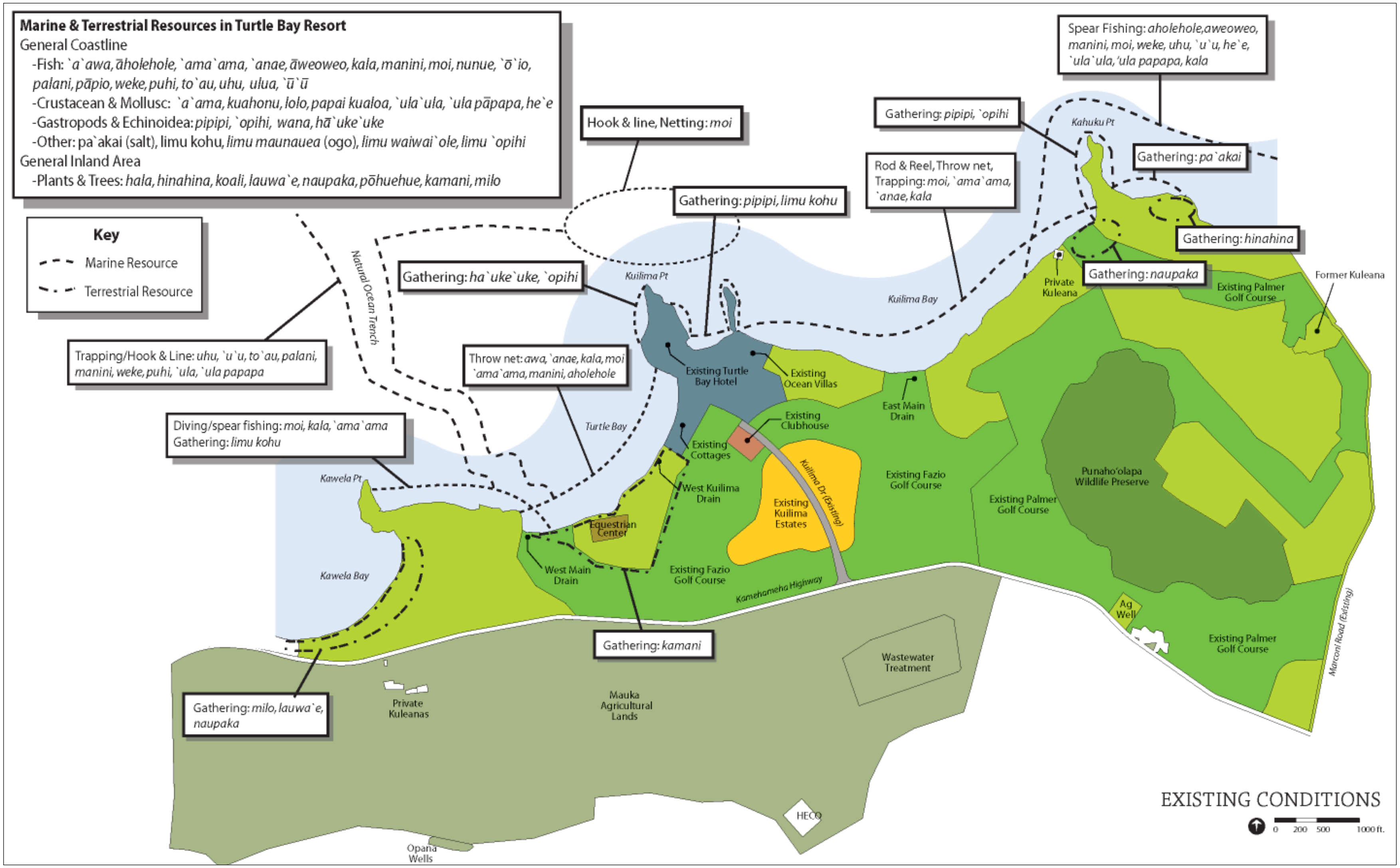

Figure 22. Existing Conditions Plan with cultural resource locations (adapted from Turtle Bay Resort SEISPN Figure 7).

Table 7. List of Informants with Cultural Resource Locations on TBR SEIS Land and Surrounding Vicinities

Cultural Informant/Title	TBR Affiliation	Past Resource Areas/Type	Present Resource/Activity Areas	Project Related Concerns
Ralph Makaiau, Senior Project Mgr. at TBR	Senior Project Manager of Turtle Bay Development; Native Hawaiian area descendent; Kahuku Burial Committee	**General coastal waters/reef:** Fishing (entire TBR coastline); recreation for *aliʻi* **Dune Areas:** burial ground **Various locations:** *lau hala* gathering for crafts like *haku leis* (Hawaiians, Samoans, Tongans);	**Coastal waters/reef:** Fishing (entire TBR coastline); recreation **Dune Areas:** ancestor burials **East of Kahuku Point:** salt pans (seasonal and tidal) **Mauka of Kam. Hwy:** pig hunting (not in TBR)	Supports TBR
Nova-Jean McKenzie, Kupuna and Kumu	Kuleana land owner in Turtle Bay property; Native Hawaiian area descendent; Kumu of Hawaiian Studies, Retired	**Kauihaiwali Kuleana (now McKenzie) pre-tidal wave:** full time traditional Hawaiian residence, *loʻi*, breadfruit trees **General coastal waters/reef around TBR:** fishing and gathering (entire TBR coastline); lobster, various fish, *pipipi, ʻopihi, limu, paʻakai* (salt) **Kawela Stream:** *ʻōpae* (shrimp) **Mauka of Kam. Hwy:** pig hunting **Dune Areas:** burial ground	**McKenzie Kuleana post tidal wave:** camping, fishing, gathering marine resources (salt, limu, shellfish) **Coastal waters/reef:** her family and others - Fishing and gathering (entire TBR coastline); lobster, various fish, *pipipi, ʻopihi, limu;* notes serious declines; preparation and harvesting of *paʻakai* (salt) **Dune areas:** ancestor burials; *hinahina* for medicine and *lei poʻo* (head *lei*)	Supports TBR; Wants to maintain access to her kuleana
John and Pua Colburn, Kūpuna	Native Hawaiian area descendent; Kuleana land owner (east of Turtle Bay property)	**Unspecified Locations**: full time traditional Hawaiian residence, *loʻi* ,Pandanus *lau hala* or *hala* seed for *lei pāpale* (hat lei) or *lei ʻāʻī* (neck lei), *ākulikuli kula* aka *wild portulaca*	**Coastal waters/reef:** Fishing and gathering, various species; does not practice; notes serious declines **General area**: *hinahina, niu, kamani, milo, kou*	Supports TBR;
Junior Primacio, N.B Chairman; Chair Parks and Rec. Committee	Fourth Generation Kahuku Village resident; Former plantation worker; Koʻolau Loa Neighborhood Board, Chair on Agriculture and Parks and Rec. Committees	**Various Locations**: Plantation families growing supplemental vegetable gardens; Not aware of traditional resource areas	**Unspecified locations:** *lāʻau lapaʻau* collections **Coastal waters/reef:** Fishing, various species; does not practice	Supports TBR
Gladys Pualoa-Ahuna, Kupuna	Seventh-generation resident of Lāʻie; Member of Koʻolau Loa Neighborhood Board	**Various locations** (home sites): small scale *loʻi kalo* and *poi* making (family consumption); family raised pigs, cows, chickens for consumption; Plantation: family supplemental vegetable gardens	**Coastal areas** (entire TBR coastline): fishing and gathering, various species; does not practice	Supports TBR; rental units and affordable housing for resort staff

Cultural Informant/Title	TBR Affiliation	Past Resource Areas/Type	Present Resource/Activity Areas	Project Related Concerns
Carol Anamizu, Cultural Practitioner	Former resident and traditional plant farmer of lands east and *mauka* of project area (Punamanō); collects traditional Hawaiian medicinal plants near the Turtle Bay property; Native Hawaiian cultural practitioner	**Mauka Areas**: *lau hala* for local use and to sell	**Coastal areas** (entire TBR coastline above the high-tide line): beach *naupaka* still can be collected for medicine; *hinahina* can still be found (rare) for medicine and *lei* making; **Throughout TBR in landscaping:** *hau, niu, kou, hala*, and *lauwa'e* for an array of traditional uses (not used by Ms. Anamizu, but may be collected by other practitioners); **Coastal waters/beaches:** *pipipi, kūpe'e, wana, 'a'ama* crab; variety of fish and *limu* for medicine; *moi, papio, manini, kala, weke, pipipi, kūpe'e, 'opihi*, slipper lobster, spiny lobster, *limu kohu, limu maunawea, huluhulu waena* for sustenance	Has concerns about inadequate sewage management system; Concerned about additional disturbances to *iwi kūpuna* ; Supports responsible development
Butch Helemano, Kahu and Kumu; Cultural Practitioner	Native Hawaiian area descendent and cultural practitioner; Master Hawaiian wood carver; collects plants and wood within the Turtle Bay property; Former resident of Turtle Bay	**Dune Areas:** burial ground **Various locations:** *mōlī* (Laysan Albatross) for tattooing implement; *pū hala* for personal adornment; <u>for wood carving</u> = *kou, milo, hau, kamani; and niu* (various uses) **Near Ranch:** *naupaka, pōhuehue, koali* **Coastal Waters:** various species (interview summary) had to get permission from konohiki or chief **Unspecified area:** *kahua pā'ani* (training ground for *lua* or hand-to-hand fighting)	**Dune Areas:** iwi **Near stables:** he and others gather *kamani* for woodcarving **Eastern sandy beaches**: knows of *naupaka* for a variety of traditional applications; *koali* (ivy-leaved morning glory); *pōhuehue* (beach morning glory) for medicine and cordage **Coastal areas** (entire TBR coastline): available species: *kala, moi, 'ō'io, 'a'awa, uhu, 'ula'ula, lobster, ahamoi, lolo* crabs, *ukiuki, wana* for sustenance	Does not advocate for or against the resort's expansion, feels that the resort should listen to the entire North Shore community – not just the rich.
Raymond "Buddy Ako", Community Liaison at TBR	Community Liaison for Turtle Bay Resort Development; Longtime employee of Turtle Bay Resort; Former resident of Kahuku; educated in Kahuku	**Coastline waters/reef**: Fishing and gathering, various species (notes serious decline of *pipipi and 'opihi*) Not aware of specifics	**Coastal waters/reef:** Fishing (entire TBR coastline), various species; does not practice	Supports TBR
Dawn Wasson, Kupuna, Educator	Cultural Practitioner; collects medicinal plants within the Turtle Bay property; Former resident of Kahuku	**Entire TBR Lands**: Plantation agriculture and housing for workers **Kuilima Point**: site of ancient *heiau* **Coastline waters/reef**: Fishing and gathering, various species	**Undisclosed locations on TBR property**: *pōhuehue, naupaka, niu, hau,* and *hala* for an array of traditional practices, including medicinal use; **Coastline waters/reef:** <u>Fishing</u> (pole, throw-net, and spear) = *'anae holo/'ama'ama, 'ō'io, lai, hou, 'āweoweo, kūmū, ula pāpapa, he'e, wana*	Against irresponsible development
Robert Nakata, Reverend; Former State Senator;	Ko'olau Loa Neighborhood Board and other civic associations	**Dune Areas:** burial ground	**Coastal waters/reefs**: *Limu ogo*; does not practice	Archaeological sites and human burials

Cultural Informant/Title	TBR Affiliation	Past Resource Areas/Type	Present Resource/Activity Areas	Project Related Concerns
Mark K. Manley, Cultural Practitioner	Commercial Fisherman; Native Hawaiian Cultural practitioner; Long-term resident of Kawela Bay; combines modern and traditional fishing methods	**General Coastal and offshore waters/reef around TBR:** fishing in general	**General Coastal and offshore waters/reef around TBR:** throw net = *manini, ʻamaʻama, ʻanae, palani, nenue, pāpio, ʻōʻio, āholehole, ʻaʻama, kona, haole* crabs; trapping = *uhu, ʻūʻū, toʻau, palani, manini, weke, puhi, ʻula, ula pāpapa, ʻaʻama, kona and haole* crabs; diving = fish, *heʻe* **Near Hotel and Kahuku Point:** *moi, āholehole, manini* and threadfish **Kawela Bay Area**: *milo* for woodworking **Kahuku Point:** *naupaka* and *lauwaʻe* for a variety of traditional applications	Expansion outside of hotel footprint; potential impacts to the ocean, water, and traffic; *iwi kūpuna* disturbances
Wayne Gemeno, Cultural Practitioner	Fisherman; fishes on Turtle Bay coast regularly for 50+ years; Plantation descendent	**Coastal waters/reef:** Fishing and diving (entire TBR coastline); lobster, squid, *āholehole*, *menpachi or ʻūʻū, ʻāweoweo, kūmū, uhu,* various *limu*	**Coastal waters/reef:** Fishing and diving (entire TBR coastline) = lobster, squid, *āholehole*, *menpachi or ʻūʻū, ʻāweoweo, kūmū, uhu,* various *limu ;* notes serious declines	Health of coastal ecosystems; enforcement of fishing regulations
Josanda Napeahi, Cultural Informant	Managing Director, Kahuku Farms; Inc. Fourth generation at Kahuku Farms; plantation descendent	Not aware of specifics	**Coastal waters/reefs**: Mostly near Kuilima Point and Turtle Bay; diving = various reef fish, shingle urchin, *ʻopihi*, *pipipi* (to access under the overhangs) **Netting:** various school fish, milk fish, mullet **General Coastal and offshore waters:** surfing	No comment
Marshall Pawn, Cultural Informant	Recreation and Security Officer at Turtle Bay Resort, eleven years; Native Hawaiian cultural informant	Not aware of specifics	**Coastal waters/reefs**: Mostly near Kahuku Point and Marconi; diving (day/night) = slipper a spiny lobster, blue crab, *mū heʻe* (octopus), *uhu* (parrot fish), other fish; pole and reel (day/night) **=** *ʻūʻū or menpachi*, *ʻāweoweo, weke, manini, kala, uhu* **General Coastal and offshore waters:** surfing	No comment

7.2 DISCUSSION

In total, 41 individual cultural resources were identified as currently being gathered from within the Turtle Bay Resort property and adjacent coastal waters, including 32 marine species of fish, shellfish, and seaweed as well as sea salt, six plant species, and two tree species. These resources are currently being gathered by an array of Hawaiian cultural practitioners for a variety of traditional activities, including *lāʻau lapaʻau* (herbal healing), *kālai kiʻi* (wood carving), *lei* making, cordage making, and consumption. None of the informants claimed that any of these cultural resources were the last of their kind or that this was the only area to collect them. However, the majority of those interviewed shared that these resources have drastically declined in their lifetimes and are now found in diminutive numbers. Further, many fear the over-harvesting of these resources to the point of extinction and keep the locations of these resources guarded secrets. Several informants fear that any expansion of the resort will impact the already resource deficient marine and terrestrial gathering areas.

There are five potential development plans as outlined in the Revised Turtle Bay SEISPN (Sichter 2012a), consisting of:

A) Reduced Density Plan (Proposed Action)
B) Full Build-Out Plan (Alternative)
C) Resort Residential Only Plan (Alternative)
D) Conservation Partner Plan (Alternative)
E) No Action (Alternative)

To address potential impacts to identified cultural resources in Turtle Bay Resort's SEIS Lands, surrounding lands, and coastal waters, the locations of identified cultural resources have been overlain on plan maps for the Reduced Density, Full Build-Out, Resort Residential Only, and Conservation Partner Plans (A-D; Figures 23 - 26). The preferred action and proposed alternatives will have unique impacts to these cultural resources. Impacts to cultural resources for each development scenario will be determined by the following three criteria:

1) Destruction of the resource
   a) Defined as the complete destruction of the area or eradication of identified cultural resource(s) caused by project related activities.

2) Limits access to the resource
   a) Defined as any project related environmental change that permanently limits the access to a cultural resource or activity area.

3) Compromises health of a cultural resource, area, and/or practitioner
   a) Defined as any threat to the physical condition of

identified cultural resources, cultural resource area, and/or cultural practitioners caused by the proposed actions

Identification of impacts was only possible for cultural resources that informants had assigned provenience to during community consultations.

7.2.1 Marine and Terrestrial Resources

As previously mentioned, at this time 32 marine species were identified through community consultations as being caught or collected from the coastline and coastal waters off of the Turtle Bay Resort. In addition, there are six plant and two tree species that are currently being gathered on the premises (Tables 6 and 7; Figure 22). Each proposed action will be examined individually to identify impacts to marine resources. Figures 23 through 26 overlay the rough locations of cultural resources onto the individual set of plans for the preferred action and alternative actions A-D (Sichter 2011: Figures 8-11; Sichter 2012a). In addition, Table 8 summarizes the impacts.

In examining Turtle Bay Resort's five proposed development options, all but the No Action (Plan E) alternative option will have some impact to cultural resources identified on the property. The identified impacts for each development scenario are as follow:

<u>Plan A – Reduced Density (Proposed Action)</u>

The Reduced Density (Proposed Action), will likely impact a variety of marine resources, including *ʻaʻawa, ʻamaʻama, ʻanae, kala, moi, manini, āholehole,* and *limu kohu,* found in the near shore waters of Turtle and Kuilima Bays, which under this option will be flanked by several hotels, resort residences, and public parks. In addition, terrestrial resources such as *lauwaʻe, naupaka, kamani*, and *milo* found within the horse stable area and Kawela Bay area will be impacted by the planned hotels and resort residences (Table 9; Figure 23).

- Construction Impacts:
    - limited to terrestrial resources, such as *lauwaʻe, naupaka, kamani*, and *milo in the path of construction* will be likely be destroyed during construction activities (Criterion 1)
- Long Term/Operational Impacts:
    - near shore marine resources, such as *ʻaʻawa, ʻamaʻama, ʻanae, kala, moi, manini, āholehole,* and *limu kohu* may be impacted by increased beach and water users invading sensitive habitats (Criterion 3)
    - terrestrial resources, such as *lauwaʻe, naupaka, kamani*, and *milo,* not destroyed during the construction phase, the health of the remaining plants and may be compromised by increase in population density (e.g. trampling) resort landscaping (Criterion 3)

Plan B - Full Build-Out (Alternative)

Plan B, which is the Full Build-Out option will impact the greatest spectrum of marine resources. The effected marine species, include *ʻaʻawa, ʻamaʻama, ʻanae, kala, moi, manini, āholehole,* as well as *pipipi, ʻopihi, hāʻukeʻuke,* and *limu kohu,* which are typically found in or on coral reefs and near-shore waters (Table 9; Figure 24). The effected terrestrial species include *lauwaʻe, naupaka, kamani*, and *milo,* which are located in the horse stable, eastern Kuilima Bay, and Kawela Bay areas where several hotels are proposed.

- Construction Impacts:
  - Limited to terrestrial resources, such as *lauwaʻe, naupaka, kamani*, and *milo* in the path of construction, will likely be destroyed during the construction of the hotels (Criterion 1)
- Long Term/ Operational Impacts:
  - Coastal resources such as *ʻaʻawa, ʻamaʻama, ʻanae, kala, manini,* and *moi*, as well as *pipipi, ʻopihi, hāʻukeʻuke* will have limited access to them due to the buildup of hotels on the coastline (Criterion 2)
  - Near shore marine resources, such as *ʻaʻawa, ʻamaʻama, ʻanae, kala, manini,* and *moi*, as well as *pipipi, ʻopihi, hāʻukeʻuke,* and *limu kohu* may be impacted by increased beach and water users (Criterion 3)
  - Terrestrial resources, such as *lauwaʻe, naupaka, kamani*, and *milo,* not destroyed during the construction phase, the health of the remaining plants and may be compromised by increase in population density (e.g. trampling) resort landscaping (Criterion 3)

Plan C - Resort Residential Only (Alternative)

Plan C, which is the Resort Residential Only option, will impact numerous marine species, including *ʻaʻawa, ʻamaʻama, ʻanae, kala, moi, manini,* and *āholehole* along most of the coastline. Terrestrial resources, including *lauwaʻe, naupaka, kamani*, and *milo* located in the horse stable, eastern Kuilima Bay, and Kawela Bay areas where will be impacted by the planned residential units and Beach Club (Table 9; Figure 25).

- Construction Impacts:
  - Limited to terrestrial resources, such as *lauwaʻe, naupaka, kamani*, and *milo* in the path of construction, will probably be destroyed during the construction of the residential and commercial areas (Criterion 1)
- Long Term/Operational Impacts:
  - Marine resources such as *ʻaʻawa, ʻamaʻama, ʻanae, kala, manini,* and *moi*, as well as *pipipi, ʻopihi, hāʻukeʻuke* will have limited access to them due to the buildup of residences and commercial areas on the coastline (Criterion 2)
  - Near shore marine species such as *ʻaʻawa, ʻamaʻama, ʻanae, kala, moi, manini,* and *āholehole* may be impacted by increased beach and water users (Criterion 3)

- o Terrestrial resources, such as *lauwa'e, naupaka, kamani*, and *milo,* not destroyed during the construction phase, the health of the remaining plants and may be compromised by increase in population density (e.g. trampling) resort landscaping (Criterion 3)

Plan D - Conservation Partner (Alternative)

Plan D, which is the Conservation Partner alternative will impact numerous marine species, such as *'a'awa, 'ama'ama, 'anae, kala, manini,* and *moi*. Yet, the impacts appear to be less extensive than the previously mentioned plans as much less of the coastal areas will be developed with fewer units (Table 9; Figure 26). Only *kamani* found in and around the horse stables appears to be potentially impacted by proposed developments on this plan.

- Construction Impacts:
  - o Limited to *kamani*, if in the path of construction, will probably be destroyed during the construction of the residential and commercial areas (Criterion 1)
- Long Term/Operational Impacts:
  - o On a much smaller scale, marine resources such as *'a'awa, 'ama'ama, 'anae, kala, manini,* and *moi* will have limited access to them due to the buildup of residences and hotels on the coastlines of Turtle Bay and west Kuilima Bay (Criterion 2)
  - o Near shore marine species such as *'a'awa, 'ama'ama, 'anae, kala, moi, manini,* and *āholehole* may be impacted by increased beach and water users, though on a smaller scale than the previously mentioned plans (Criterion 3)
  - o The *kamani* trees not destroyed during the construction phase, the health of the remaining plants and may be compromised by increase in population density (e.g. trampling) resort landscaping (Criterion 3)

Plan E - No Action (Alternative)

Plan E, referred to as the No Action alternative, has no foreseen impacts (Table 9).

In summation, the most affected marine species are those that thrive on or near reefs as well as shallow sandy waters. The foreseen impacts are trampling or crowding of habitat by an increased number of beach-going vacationers and/or residents. As the high density hotels of the Full Build-Out option are proposed to front Kuilima Bay, Turtle Bay, and Kawela Bay, these marine resources may be impacted with increased direct human contact including: trampling, dragging gear, picking up/ molesting marine life, (Kerr et al. n.d.) and increase in sunscreen introduced into water, which has a negative effect on coral reef ecosystems (European Commission 2008; Danovaro et al. 2008; Kerr et al. n.d.). Thus, the health of the cultural resource habitat will likely be compromised (Criteria 3), which will decrease the health and subsequently the population of these resources. As for the terrestrial resources, the clearing of land and construction of structures of any size will likely result in the destruction of these plants and trees.

7.2.2 Archaeological Resources

Numerous archaeological studies have been conducted in various areas within the TBR SEIS Lands and surrounding areas. From the sixteen archaeological investigations performed on SEIS Lands, a total of twenty-six traditional and historic sites have been documented including twenty-five human burials. According to Haun et al. (2011:39), "A search of the DLNR-SHPD archaeological report database and other sources identified 27 survey and excavation projects undertaken in the project area vicinity in the Koʻolauloa District from the Lands of Kaunala to the east and Mālaekahana to the west." In the concurrent SAIS (Haun 2012), adds numerous historic surface features, subsurface cultural deposits, as well as three human burials to the archaeological record. The inland portion of SEIS Lands are well documented as having been planted in sugar cane, the chance of encountering traditional archaeological sites in these lands is slight. However, coastal portions of SEIS Lands that have not been disturbed have the potential to contain archaeological deposits.

7.2.3 Iwi Kūpuna

The presence of *iwi kūpuna* in SEIS Lands and surrounding areas is already well established. Burials have been discovered in each *ahupuaʻa*, predominantly near to the coastline (Haun et al. 2011:68-71). In any ground disturbing event nearer to the coast, *iwi kūpuna* could potentially be impacted. As the inland portions of SEIS Lands are documented as former cane fields, the chance of encountering *iwi kūpuna* in these lands is less likely.

Currently, the Kahuku Burial Committee (KBC) has accepted the *kuleana* to *mālama i nā iwi kūpuna* in compliance with the burial laws.

7.2.4 Spiritual Connections to the Land

The general area has been the associated with many mythical legends and *moʻolelo,* giving it a significant place in the pre-Contact Native Hawaiian landscape and in the Native Hawaiian psyche. Thus, it is critical that Native Hawaiians and/or cultural practitioners continue to be involved in the protection and preservation of these valued cultural resources to ensure their spiritual connection to the land.

7.2.5 Contemporary Use of Land and Sea

A wide variety of contemporary and ancient versions of traditional activities as well as non-traditional activities have been identified as occurring on SEIS Lands and surrounding areas, many of which are not mutually exclusive. It is possible that marine and terrestrial activities will be impacted to varying degrees by the Proposed Action, Full Build-Out, Resort Residential Only, and Conservation Partner Plans in terms of access during and after construction (Criterion 2).

Table 8. Impact Table for Marine and Terrestrial Resources

	Species	Plan A	Plan B	Plan C	Plan D	Plan E
Marine Species	*‘A‘awa*	3	2,3	2,3	2,3	
	Āholehole	3	2,3	2,3	2,3	
	‘Ama‘ama	3	2,3	2,3	2,3	
	‘Anae	3	2,3	2,3	2,3	
	‘Āweoweo					
	Kala	3	2,3	2,3	2,3	
	Manini	3	2,3	2,3	2,3	
	Moi	3	2,3	2,3	2,3	
	Nunue					
	‘Ō‘io					
	Palani					
	Weke					
	Puhi					
	To‘au					
	Uhu					
	Ulua (juv. *Pāpio*)					
	‘Ū‘ū					
	‘A‘ama					
	Kuahonu					
	Lolo					
	Pāpa‘i kualoa					
	‘Ula‘ula (also *‘ula*)					
	‘Ula pāpapa					
	He‘e					
	Pipipi		3			
	‘Opihi		3			
	Wana					
	Hā‘uke‘uke		3			
	Limu kohu	3	2,3			
	Limu maunawea					
	Limu wāwae’iole					
	Limu ‘opihi					
Terrestrial Species	*Hala*					
	Hinahina					
	Koali					
	Lauwa‘e	1	1,3	1,3		
	Naupaka	1	1,3	1,3		
	Pōhuehue					
	Kamani	1	1,3	1,3	1,3	
	Milo	1	1,3	1,3		

Key: 1 = Destruction of the resource; 2 = Limits access to the resource; 3 = Compromises health of the resource, area, and/or practitioner

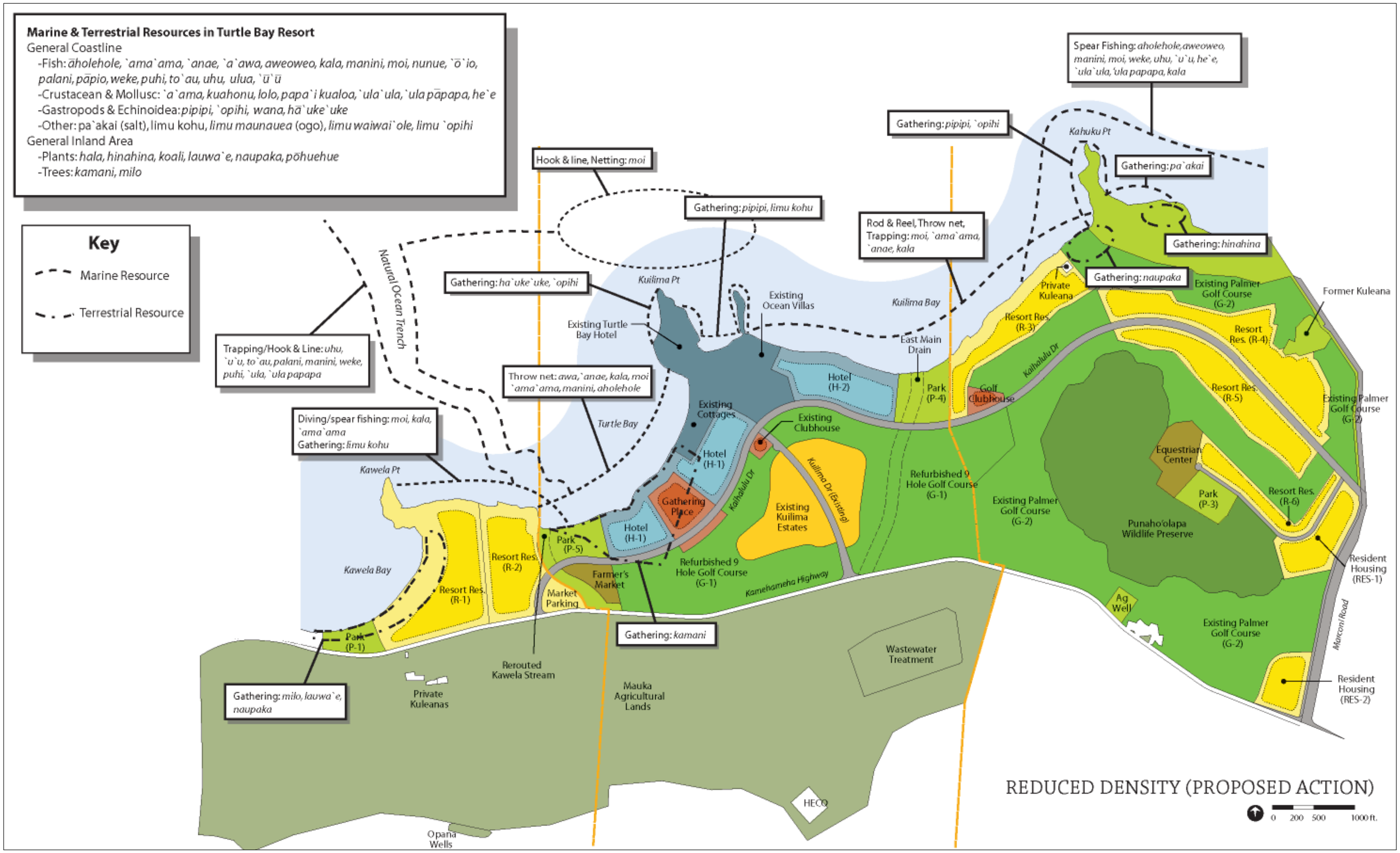

Figure 23. Plan A — Reduced Density Plan (Proposed Action) with cultural resource locations (adapted from Sichter 2011:Figure 8).

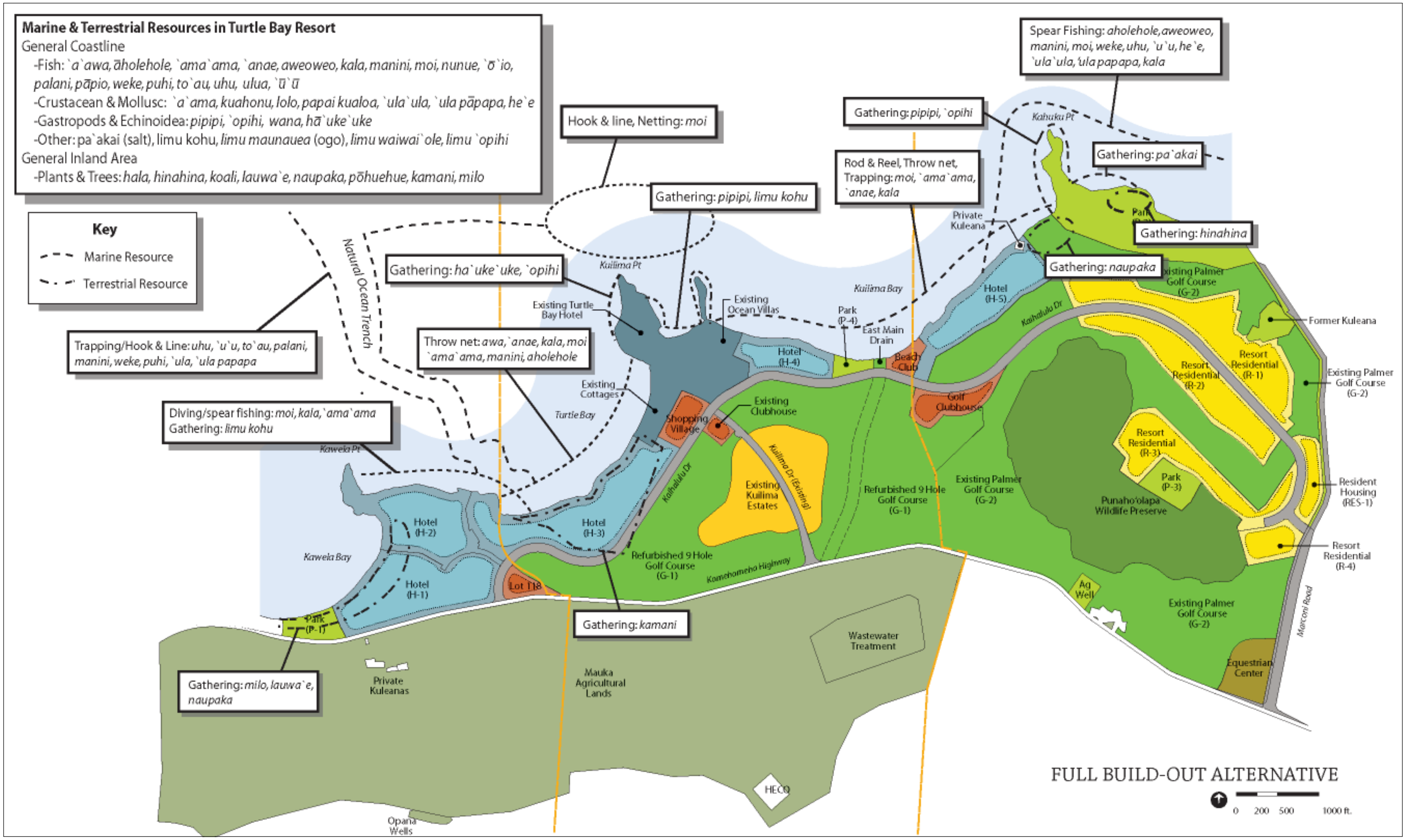

Figure 24. Plan B — Full Build-Out Plan (alternative action) with cultural resource locations (adapted from Sichter 2011:Figure 10).

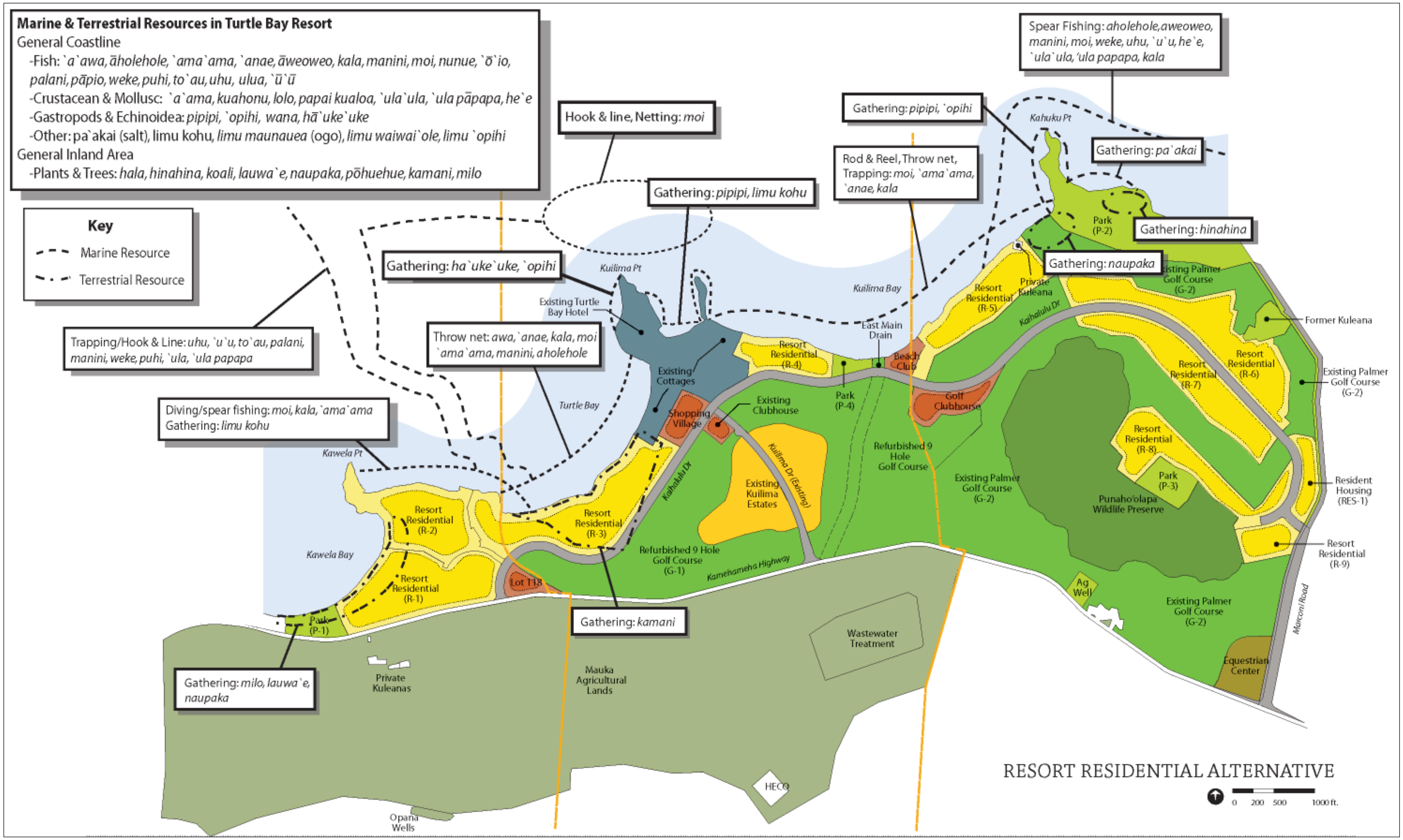

Figure 25. Plan C — Resort Residential Only Plan (alternative action) with cultural resource locations (adapted from Sichter 2011:Figure 11).

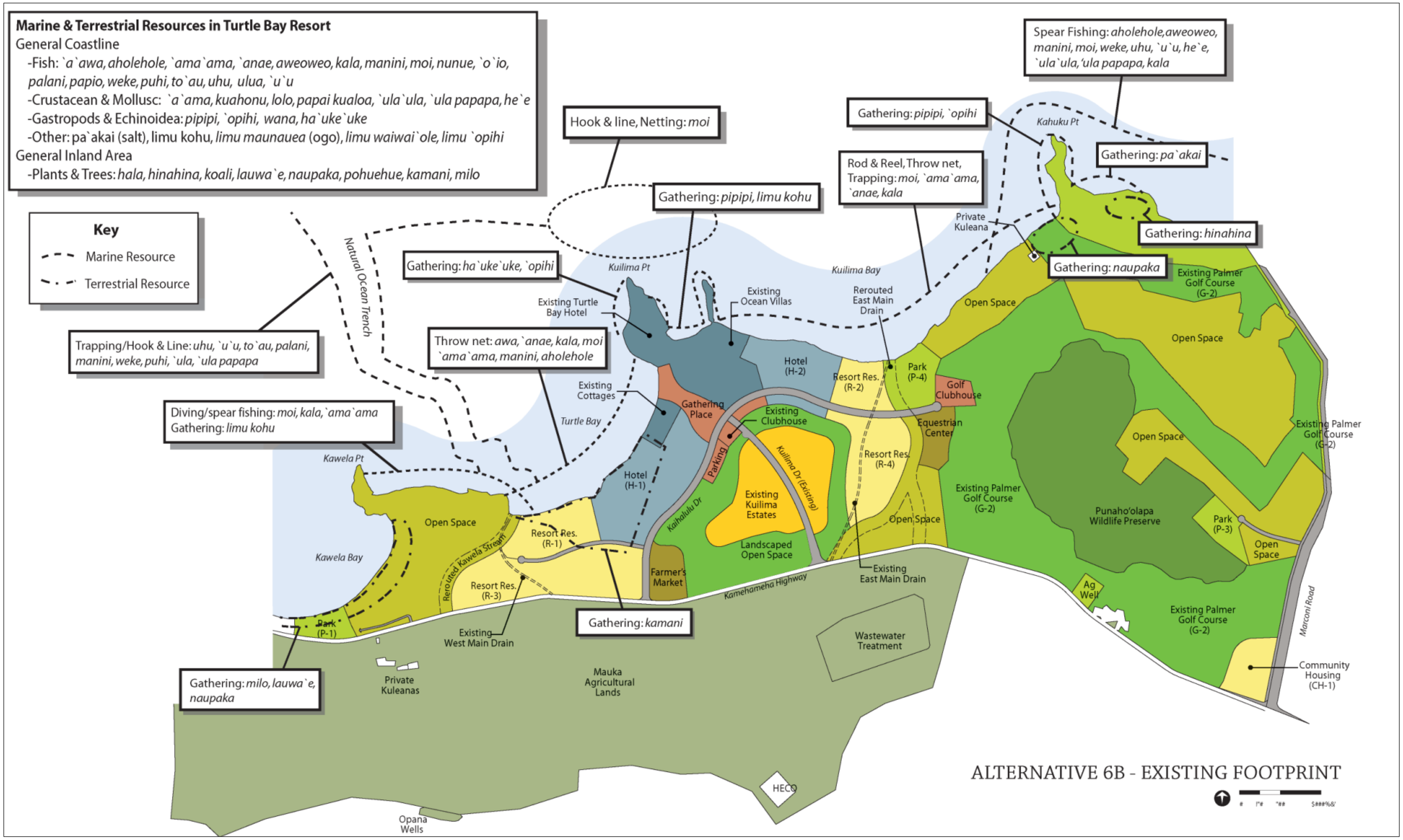

Figure 26. Plan D — Conservation Partner Plan (alternative action) with cultural resource locations (adapted from Sichter 2012).

8.0 RECOMMENDATIONS

Numerous cultural resources being utilized for cultural practices have been identified in and around TBR SEIS Lands and surrounding areas. It appears that many of these resources will be impacted should the resort choose the Proposed Action or any of the alternatives barring the No Action alternative. While none of these cultural resources are unique or restricted to TBR SEIS Lands or surrounding areas, the archival research and community consultations have suggested that this area and its resources are important to them. A number of the consulted parties do not wish to stop development or go back to a pre-Contact lifestyle, but do share a genuine concern for the land and sea, as well as a desire to ensure resources are available for present and future generations. Many want to hold on to their cultural heritage by continuing the practices of their ancestors and make sure that *iwi kūpuna* are treated with respect. Yet, there is a real need for economic stability for the younger and future generations to be able to stay in the area, which is essential to maintain familial and cultural bonds in the community.

It is acknowledged that TBR's Proposed Action intends to reduce density by approximately 60% from the density proposed in the original expansion project as formalized under the1985 Unilateral Agreement. The Proposed Action concentrates higher density development in *makai* Hanakaʻoe Ahupuaʻa, the resort's existing core, by constructing two new hotel sites and a new community Gathering Place near to the existing Turtle Bay Hotel. The originally proposed hotel sites in the *ahupua*ʻ*a* of ʻŌpana-Kawela (to the west) and Kahuku (to the east) will be developed instead with lower density resort-residential units. Density at ʻŌpana-Kawela Ahupuaʻa will be reduced by over 75% of what is allowable under the existing zoning. Similarly, Kahuku Ahupuaʻa is planned for affordable community housing and resort-residential units with 65% less density than is allowed under existing entitlements. The result is the concentration of development in the central core of the SEIS Lands and the general preservation of a rural character to the east and west. Further, the Proposed Action provides for two hotel sites, rather than the five approved in the current land use entitlements and the number of hotel units is reduced from 2,500 to a range of 625 to 1,000. By implementing generous shoreline setbacks, this development concept achieves public access to the entire shoreline intended in the Unilateral Agreement and further enhances the pedestrian experience, affording unencumbered coastal access (Sichter 2012b).

8.1 TOMORROW'S AHUPUAʻA AND THE ROLE OF KONOHIKI

TBR has elected to incorporate traditional Hawaiian values and the framework of the *ahupua*ʻ*a* system into the proposed expansion, with the concept of "Tomorrow's Ahupuaʻa". According to the Final SEISPN,

> *Tomorrow's Ahupua*ʻ*a* studies the history of the *ahupua*ʻ*a*, the successes and challenges, the elements found within each *ahupua*ʻ*a*, and the needs and resources that are available. *Tomorrow's Ahupua*ʻ*a* will honor the important aspects of the traditional *ahupua*ʻ*a*: understanding and

> maintaining lands from *mauka* to *makai*; recognizing and stewarding the unique elements and resources of each *ahupua'a* in order to strive for self-sustenance; and creating a management framework inspired by the traditional *ahupua'a* to care for the lands, resources, people, and culture (Sichter 2011:6-13).

It is recommended that TBR consult with the 'Aha Kiole Advisory Committee (AKAC), consisting solely of Native Hawaiian traditions experts and cultural practitioners, which was formed in 2007 by the Hawai'i State Legislature through Act 212 to create natural and cultural resource management system recommendations that are based on Native Hawaiian traditional land and resource management systems to be integrated into the state's existing governmental organization. The AKAC (2010) describes the *ahupua'a* as a sub-unit of land under the *moku* (regional) land management system, termed as the 'Aha Moku System. The AKAC would be instrumental in ensuring that the proposed "Tomorrow's Ahapua'a" concept is harmonious with traditional values.

The role of *konohiki* also includes maintaining the balance of resources and prosperity throughout the *ahupua'a,* keeping harmony with neighboring *ahupua'a*, and *mālama* those who depend on the resort and its leadership. In addition, maintaining respect for the land and its *mana* is crucial in developing responsibly. It is, perhaps, the best way to show respect to your host culture and to set a good example for others. It is recommended that TBR be proactive in embracing the role of *konohiki,* by consulting with local cultural practitioners and *kūpuna* to identify the needs of the *kaiāulu* (local community) and present them with possible solutions to help balance resources and prosperity within Tomorrow's Ahupua'a. It is recommended that TBR implement a *mauka-makai* (upland to ocean) and inter-*ahupua'a* resource distribution system to make TBR's Tomorrow's Ahupua'a concept a leader in cultural and natural resource management. TBR should prioritize commerce for resort operations between themselves and local agriculturists, horticulturalist, aqua-culturists, craftsmen, tradesmen and other goods or service providers over providers of goods and services from outside areas.

8.2 Marine and Terrestrial Resources

Regarding the marine and terrestrial resources that will inevitably be impacted by the proposed development, Turtle Bay Resort could embrace the role of *konohiki* by initiating an Integrated Coastal Resources Management Plan as well as a multi-media and multi-faceted Education Program.

To help formulate a balanced and integrated Coastal Resources Management Plan, it is recommended that TBR assemble a committee comprised of local *kūpuna* with expertise in marine resources as well as officials from the appropriate government agencies and environmental/wildlife organizations. This plan would provide a starting point for TBR to act as *konohiki* by facilitating meetings for the committee and between the committee and the *kaiāulu.*

The resort should also provide a venue to hold Education Program workshops to help preserve cultural practices and natural resources as well as allow non-Hawaiian peoples the opportunity to learn from their host culture. Tourists and visitors could be informed about the sensitive nature of natural resources and their importance in the traditional lifestyle. These concepts would be instrumental in enforcing a Coastal Resources Management Plan. Additionally, designing an ethnobotanical garden within the resort would be a good way to provide a space to continue traditional agricultural and horticultural practices in a way that allows local cultural practitioners to share the merits and importance of *lāʻau lapaʻau,* traditional Hawaiian diet, and traditional crafts to visitors as well as locals.

8.3 ARCHAEOLOGICAL RESOURCES

In regards to concerns about the potential disturbance of archaeological sites, an Archaeological Monitoring Plan (AMP) should be prepared prior to the commencement of construction. Further, if archaeological sites are encountered during ground disturbing activities of any alternative chosen by the TBR, a cultural interpretive display is recommended using artifacts (to the extent possible), archival photos, artistic renderings, and traditional accounts from ʻŌpana, Hanakaʻoe, and Kahuku Ahupuaʻa descendants and Native cultural practitioners to educate its patrons of colorful past.

8.4 IWI KŪPUNA

TBR is advised to treat *iwi kūpuna* with the utmost respect. To those who have roots in the area, *iwi kūpuna* are the remains of their ancestors and any disturbance to them should be avoided. A thorough AMP should address concerns of encountering inadvertent discoveries during project related construction. TBR should continue to regularly consult with the Kahuku Burial Committee (KBC), which represents individuals and families who have a lineal and cultural connection to the *iwi kūpuna* as well as the area.

8.5 SPIRITUAL CONNECTIONS TO THE LAND

A concern has been established by community consultations that unsettled or displaced spirits may plague the new development and/or surrounding localities. Further, several localities in the subject area are known as *wahi pana* (legendary places), where *nā kūpuna* (ancestors) lived and worshiped, and is the final resting place for the ancestors of many local people. Therefore, it is recommended that any major event or construction related activity be preceded with a blessing ceremony performed by a *kahuna* or *kahu pule*.

8.6 CONTEMPORARY USE OF LAND AND SEA

As there have been a plethora of activities perceived as contemporary and ancient versions of traditional activities as well as non-traditional activities have been identified as occurring on SEIS Lands and surrounding areas. To ensure that these activities are not impacted, it is advised that TBR provide alternate access routes to these activity areas should current routes be obstructed by project or resort related activities.

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APPENDIX A

GUIDELINES FOR ASSESSING CULTURAL IMPACTS
OBTAINED FROM
OFFICE OF ENVIRONMENTAL QUALITY CONTROL WEBSITE

Guidelines for Assessing Cultural Impacts

Adopted by the Environmental Council, State of Hawaii
November 19, 1997

1. INTRODUCTION

It is the policy of the State of Hawaii under Chapter 343, HRS, to alert decision makers, through the environmental assessment process, about significant environmental effects which may result from the implementation of certain actions. An environmental assessment of cultural impacts gathers information about cultural practices and cultural features that may be affected by actions subject to Chapter 343, and promotes responsible decision making.

Articles IX and XII of the State Constitution, other state laws, and the courts of the state require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Chapter 343 also requires environmental assessment of cultural resources, in determining the significance of a proposed project.

The Environmental Council encourages preparers of environmental assessments and environmental impact statements to analyze the impact of a proposed action on cultural practices and features associated with the project area. The Council provides the following methodology and content protocol as guidance for any assessment of a project that may significantly affect cultural resources.

Background

Prior to the arrival of westerners and the ideas of private land ownership, Hawaiians freely accessed and gathered resources of the land and seas to fulfill their community responsibilities. During the Mahele of 1848, large tracts of land were divided and control was given to private individuals. When King Kamehameha the III was forced to set up this new system of land ownership, he reserved the right of access to privately owned lands for Native Hawaiian ahupua'a tenants. However, with the later emergence of the western concept of land ownership, many Hawaiians were denied access to previously available traditional resources.

In 1978, the Hawaii constitution was amended to protect and preserve traditional and customary rights of Native Hawaiians. Then in 1995 the Hawaii Supreme Court confirmed that Native Hawaiians have rights to access undeveloped and under-developed private lands. Recently, state lawmakers clarified that government agencies and private developers must assess the impacts of their development on the traditional practices of Native Hawaiians as well as the cultural resources of all people of Hawaii. These Hawaii laws, and the National Historic Preservation Act, clearly mandate federal agencies in Hawaii, including the military, to evaluate the impacts of their actions on traditional practices and cultural resources.

If you own or control undeveloped or under-developed lands in Hawaii, here are some hints as to whether traditional practices are occurring or may have occurred on your lands. If there is a trail on your property, that may be an indication of traditional practices or customary usage. Other clues include streams, caves and native plants. Another important point to remember is that, although traditional practices may have been interrupted for many years, these customary practices cannot be denied in the future.

These traditional practices of Native Hawaiians were primarily for subsistence, medicinal, religious, and cultural purposes. Examples of traditional subsistence practices include fishing, picking opihi and collecting limu or seaweed. The collection of herbs to cure the sick is an example of a traditional medicinal practice. The underlying purpose for conducting these traditional practices is to fulfill one's community responsibilities, such as feeding people or healing the sick.

As it is the responsibility of Native Hawaiians to conduct these traditional practices, government agencies and private developers also have a responsibility to follow the law and assess the impacts of their actions on traditional and cultural resources.

The State Environmental Council has prepared guidelines for assessing cultural resources and has compiled a directory of cultural consultants who can conduct such studies. The State Historic Preservation Division has drafted guidelines on how to conduct ethnographic inventory surveys. And the Office of Planning has recently completed a case study on traditional gathering rights on Kaua'i.

The most important element of preparing Cultural Impact Assessments is consulting with community groups, especially with expert and responsible cultural records and review of transcripts of previous ethnographic interviews. Once all the information has been collected, and verified by the community experts, the assessment can then be used to protect and preserve these valuable traditional practices.

Native Hawaiians performed these traditional and customary practices out of a sense of responsibility: to feed their families, cure the sick, nurture the land, and honor their ancestors. As stewards of this sacred land, we too have a responsibility to preserve, protect and restore these cultural resources for future generations.

TEXT OF ACT 50, SLH 2000

A BILL FOR AN ACT RELATING TO ENVIRONMENTAL IMPACT STATEMENTS

UNOFFICIAL VERSION

HOUSE OF REPRESENTATIVES H.B. NO, 2895 H.D.1
TWENTIETH LEGISLATURE, 2000
STATE OF HAWAII

A BILL FOR AN ACT

RELATING TO ENVIRONMENTAL IMPACT STATEMENTS.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

SECTION 1. The legislature finds that there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawai'i's culture, and traditional and customary rights.

The legislature also finds that native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the "aloha spirit' in Hawaii. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.

Moreover, the past failure to require native Hawaiian cultural impact assessments has resulted in the loss and destruction of many important cultural resources and has interfered with the exercise of native Hawaiian culture. The legislature further finds that due consideration of the effects of human activities on native Hawaiian culture and the exercise thereof is necessary to ensure the continued existence, development, and exercise of native Hawaiian culture.

The purpose of this Act is to: (1) Require that environmental impact statements include the disclosure of the effects of a proposed action on the cultural practices of the community and State; and (2) Amend the definition of "significant effect" to include adverse effects on cultural practices.

SECTION 2. Section 343-2, Hawai`i Revised Statutes, is amended by amending the definitions of "environmental impact statement' or "statement" and "significant effect", to read as follows:

"'Environmental impact statement" or "statement" means an informational document prepared in compliance with the rules adopted under section 343-6 and which discloses the environmental effects of a proposed action, effects of a proposed action on the economic [and] welfare, social welfare, and cultural practices of the community and State, effects of the economic activities arising out of the proposed action, measures proposed to minimize adverse effects, and alternatives to the action and their environmental effects.

The initial statement filed for public review shall be referred to as the draft statement and shall be distinguished from the final statement which is the document that has incorporated the public's comments and the responses to those comments. The final statement is the document that shall be evaluated for acceptability by the respective accepting authority.

"Significant effect" means the sum of effects on the quality of the environment, including actions that irrevocably commit a natural resource, curtail the range of beneficial uses of the environment, are contrary to the State's environmental policies or long-term environmental goals as established by law, or adversely affect the economic [or] welfare, social welfare[.], or cultural practices of the community and State."

SECTION 3. Statutory material to be repealed is bracketed. New statutory material is underscored.

SECTION 4. This Act shall take effect upon its approval.

Approved by the Governor as Act 50 on April 26, 2000

2. CULTURAL IMPACT ASSESSMENT METHODOLOGY

Cultural impacts differ from other types of impacts assessed in environmental assessments or environmental impact statements. A cultural impact assessment includes information relating to the practices and beliefs of a particular cultural or ethnic group or groups.

Such information may be obtained through scoping, community meetings, ethnographic interviews and oral histories. Information provided by knowledgeable informants, including traditional cultural practitioners, can be applied to the analysis of cultural impacts in conjunction with information concerning cultural practices and features obtained through consultation and from documentary research.

In scoping the cultural portion of an environmental assessment, the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment. Thus, for example, a proposed action that may not physically alter gathering practices, but may affect access to gathering areas would be included in the assessment. An ahupuaʻa is usually the appropriate geographical unit to begin an assessment of cultural impacts of a proposed action, particularly if it includes all of the types of cultural practices associated with the project area. In some cases, cultural practices are likely to extend beyond the ahupua'a and the geographical extent of the study area should take into account those cultural practices.

The historical period studied in a cultural impact assessment should commence with the initial presence in the area of the particular group whose cultural practices and features are being assessed. The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs.

The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, including submerged cultural resources, which support such cultural practices and beliefs.

The Environmental Council recommends that preparers of assessments analyzing cultural impacts adopt the following protocol:

1. identify and consult with individuals and organizations with expertise concerning the types of cultural resources, practices and beliefs found within the broad geographical area, e.g., district or ahupuaʻa;
2. identify and consult with individuals and organizations with knowledge of the area potentially affected by the proposed action;
3. receive information from or conduct ethnographic interviews and oral histories with persons having knowledge of the potentially affected area;
4. conduct ethnographic, historical, anthropological, sociological, and other culturally related documentary research;
5. identify and describe the cultural resources, practices and beliefs located within the potentially affected area; and

6. assess the impact of the proposed action, alternatives to the proposed action, and mitigation measures, on the cultural resources, practices and beliefs identified.

Interviews and oral histories with knowledgeable individuals may be recorded, if consent is given, and field visits by preparers accompanied by informants are encouraged. Persons interviewed should be afforded an opportunity to review the record of the interview, and consent to publish the record should be obtained whenever possible. For example, the Primary source materials reviewed and analyzed may include, as appropriate: Mahele, land court, census and tax records, including testimonies; vital statistics records; family histories and genealogies; previously published or recorded ethnographic interviews and oral histories; community studies, old maps and photographs; and other archival documents, including correspondence, newspaper or almanac articles, and visitor journals. Secondary source materials such as historical, sociological, and anthropological texts, manuscripts, and similar materials, published and unpublished, should also be consulted. Other materials which should be examined include prior land use proposals, decisions, and rulings which pertain to the study area.

3. CULTURAL IMPACT ASSESSMENT CONTENTS

In addition to the content requirements for environmental assessments and environmental impact statements, which are set out in HAR §§ 11-200-10 and 16 through 18, the portion of the assessment concerning cultural impacts should address, but not necessarily be limited to, the following matters:

1. A discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints or limitations which might have affected the quality of the information obtained.
2. A description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken.

3. Ethnographic and oral history interview procedures, including the institutions and repositories searched, and the level of effort undertaken. This discussion should include, if appropriate, the particular perspective of the authors, any opposing views, and any other relevant constraints, limitations or biases.

6. A discussion concerning the cultural resources, practices and beliefs identified, and, for resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site.

7. A discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project.

8. An explanation of confidential information that has been withheld from public disclosure in the assessment.

9. A discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs.

10. An analysis of the potential effect of any proposed physical alteration on cultural resources, practices or beliefs; the potential of the proposed action to isolate cultural resources, practices or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place.

11. A bibliography of references, and attached records of interviews which were allowed to be disclosed.

The inclusion of this information will help make environmental assessments and environmental impact statements complete and meet the requirements of Chapter 343, HRS. If you have any questions, please call 586-4185.

APPENDIX B

HISTORICAL RESEARCH REPORTS ON KAHUKU
AND SURROUNDING AHUPUAʻA

- CAROL SILVA (1984)
- HELEN WONG-SMITH (1989)

Coprosma are from the wetter regions of the forest. Note however, that they are not as common as the cheno-am pollen. The pollen of Pritchardia, an endemic Pacific palm, is found in great abundance here, which is a bit puzzling. Selling included pollen of this genus in his sum of hygrophytic indicators but also noted that it may occur in either a wet or a dry forest (1948: 85-86). It is possible that this palm was prehistorically more common and more abundant at lower elevations; today they are confined chiefly to between 1000-3000 feet. Selling notes that their distribution is highly local; that is, they may be confined to one valley only (1947: 335-337). Also, many planted groves have now disappeared, perhaps due to insect damage. It would be difficult to interpret almost one-quarter Pritchardia pollen without invoking a localized grove or clump of trees within the drainage basin.

Sample No. 34, the clay with rich organic lenses, is presumably derived from overlying sediment at a time of higher standing water. The algal record attests to this. The most prevalent form was Pediastrum at 25% (calculated as a double-fixed sum), which prefers freshwater with some circulation (i.e., not stagnant and not swiftly running) (Table 8). Other algal (and perhaps animal) cysts and cells support this idea. Sedge pollen is much reduced from the underlying sample and is of a smaller size. The remaining allothonous pollen and spores include Pritchardia at 20%, monolete fern spores at 19%, cheno-ams at 4%, and various tree and shrub pollen with a tricolpate or tricolporate morphology. With few variations in percentages in the latter categories, Sample No. 34 presents a similar paleoclimatic picture with respect to the dry indicators present (cheno-ams, Umbelliferae), while the ecologic changes are slight--chiefly with a greater amount of standing water in the basin favoring floating algai and various cysts. Pritchardia retains a similar ecologic abundance here as in the lower sample suggesting its prevalence in the valley. There was nothing in either sample that could be likened to cultivated plant pollen.

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APPENDIX C:

PRELIMINARY HISTORICAL DOCUMENTARY RESEARCH

Lands of Opana, Kawela, Hanakaoe, Oio, Ulupehupehu,
Punalau and Kahuku Koolauloa, Island of Oahu

by

Carol L. Silva, B.A.
Historical Researcher

It is the intent of this preliminary research effort to identify and examine immediately available sources for information relative to the project site.

A sampling of specific mythological, cultural and historical information has been assembled from the writings of native historians, from missionary and travellers' accounts, land records and cartographic sources.

It is hoped that the data collected herein will prove useful in the formation of a general impression and understanding of the total land area, as well as provide specific historical information of service to professional consultants.

MYTHOLOGY

Several traditions have survived regarding the origin of this district. The striking commonality that exists among these myths is that the district is characterized by a certain physical instability.

A proverb which captures this states:

Kahuku 'Āina lewa. Kahuku, an unstable land.

An accompanying note to the above explains further:

> O'ahu, according to legend, was once two islands that grew together. Kahuku is the part that bridges the gap. (Pukui, 1983:144)

Levi Chamberlain related the following tale which he recorded on his 1828 tour of Oahu:

> The natives tell a marvellous story respecting the origin of this destrict /sic/, which they say floated in from the sea, and attached itself to the ancient shora of the island, that there was a subterranean communication between the sea & the ancient shore, by which a shark used to pass, & make depredations up on land. The basis of the tract, which is from 5 to 7 miles in length, & from 1 to 2 miles in breadth, appears to be of coral; and it was evidently redeemed from the sea, as a good deal of the land, in many places along the shore around the whole circuit of the island, evidently has been. (Chamberlain, 1957:35-6)

A third rather novel creation myth links the district with the sacred legendary princess, Laieikawai. Within this tradition are found the names of two small bodies of water that act as anchorages for the floating Kahuku land mass:

> Kahuku district, according to legend, was once a floating island blown about by the winds. As it banged against Oahu, it made noises which disturbed the old women guarding the Princess Laieikawai. The old women grappled the island with fishhooks and attached it securely to Oahu. Polou pool on the sea side of the Kahuku mill is one spot where the hook was fastened. The other end was fastened at Kukio pond, 300 feet inland at Kahuku Point. (Boswell, 1958:68)

In the final creation tradition, the floating land mass was cited as a home of the menehune. This legend bears particular import in that it acknowledges two natural attributes of the area - the district's springs and its verdant uplands.

> Ka-hu-ku section of O'ahu was once a separate island... It was an islet whose people were the Mene-hune, or Dwarfs as

> they are called today. Many stories are told about the miraculous feats performed by the Little People of ancient Hawaii. It is known, also, that they always worked from just after sunset until just before dawn.
> Legend tells us that Kahuku was a floating island situated several miles out to sea. For a long time, the people of O'ahu had planned to make the island a part of their land, for they saw it come close to O'ahu's shores. The floating island of the Menehune did not have any fresh-water springs because there were no high mountains covered with verdure and trees to capture the rains. So, the Little Folk used to paddle their islet into the bays of O'ahu at night to haul water from the springs of the large island.
> One day, a resident of Kahuku suggested that all the people gather together to make strong hooks of whalebone and attach them to a stout rope made of sacred Olona fibres. This was done.
> The Menehune came to take water as usual, then the residents of O'ahu attached the large hooks to the floating isle while the Little Folk were off at the water-springs. When the water was loaded, the Menehune started to paddle off again, but they could not move their islet or free it from the ivory hooks and Olona ropes.
> Today, many people who travel Kahuku section of O'ahu and see the many islets seeming to float off shore, and hear the sea singing its songs, they say, 'Listen to the Menehune grumbling while they try to move their island that used to float!'
> The rumbling and grumbling is heard only at night, for that is the time for the Menehune to be working at Kahuku. (Paki, 1972:53)

Aside from creation myths, a colorful assortment of legends exist for the broad Kahuku area. These will be examined first as I believe they exemplify some of the characteristics that can also be attached to the less-written-about ahupuaa just north of Kahuku which fall within project boundaries. Once the bulk of pertinent Kahuku literature is exhausted - a close perusal of the relatively few legendary references to Opana, Kawela, Ulupehupehu, Oio, Punalau and Hanakaoe will be conducted.

The entire district of Kahuku was well-remembered for its fragrant groves of hala; the following proverb and translation memorializes them for all time:

Nani i ka hala ka ʻōiwi o Kahuku.
The body of Kahuku is beautified by hala trees.
(Pukui, 1983:248)

The above appears to be extracted from a chant composed by Halemano. In an attempt to win back the attention of his wife, Halemano recalls pleasant sentiments shared:

A kukui au a Kahewahewa,
Ku au nana i laila,
Haloiloi kuu waimaka e uwe,
Nani na hala ka oiwi o Kahuku,
I ka lawe a ka makani he mikioi. (Elbert, 1965:281)

As I reported to Kahewahewa,
I stood and gazed, then
Tears filled my eyes causing me to weep.
How beautiful are the hala, native trees of Kahuku,
As they are being fanned by the Mikioi wind. (ibid.:280)

Mention is made of the famed hala groves of Kahuku in the tragic tale of the prophet Kaopulupulu. Kaopulupulu and his son are summoned by chief Kahahana to appear before him in consequence of an act that Kaopulupulu dutifully performed. Although the prophet clearly foresees his death, he and his son set out for Kahahana's court.

...In the morning, ascending a hill, they turned and looked back over the sea-spray of Waialua to the swimming halas of Kahuku beyond. Love for the place of his birth so overcame Kaopulupulu for a time that his tears flowed for that he should see it no more. (Thrum, 1912:210)

A final reference to the hala of Kahuku can be found in the classical myth of Pele and Hiiaka. In travelling to Kauai to fetch Pele's loved one, Lohiau, Hiiaka encounters two rude creatures who refuse the goddess Hiiaka the slightest acknowledgement. Their discourtesy causes Hiiaka to compose chant lines employing a word-play on "hala".

They /Hiiaka and companions/ passed through the lands of Laie, Malae-kahana and Keana and at Kahipa they saw the crouching figures of Puna-he'e-lapa and Pahi-pahi-alua, who stole

away into the shelter of the pandanus groves without deigning to give them any salutation. At this show of disrespect, Hiiaka called out:

Komo i ka nahele ulu hinalo,
Nahele hala o Po'o-kaha-lulu;
Oia nahele hala makai o Kahuku.
Heaha la ho'i ka hala
I kapu ai o ka leo, e?
I Hookuli ai oe i ka uwalo, e?
E uwalo aku ana au;
Maloko mai oe, e!

We enter the fragrant groves,
Hala groves whose heads make a calm,
Wild growths by the sea of Kahuku,
But what, indeed, are your halas?
Shall their murmur forbid you speech?
Make you dumb to my salutation?
I make this kindly entreaty
To you who sit in the grove. (Emerson, 1915:97-8)

Emerson includes the following footnote relative to the hala word-play:

There seems to lurk a play in this word hala. It stood not only for the pandanus tree; it also meant a fault, a sin. (ibid.:97)

In another well-known classic - the tradition of the pig-god Kamapuaa - residents of Kahuku are called upon by their chief, Olopana, to capture the chicken-thief, Kamapuaa. Once he is bound and readied to be carried off, his grandmother's chanting stirs Kamapuaa into action and he decimates his many captors and gains freedom. (Elbert, 1965:200-1)

Another set of traditions deal with a stream which courses under the mountain range and connects Kahuku with Waipahu. The following proverb summarizes this characteristic feature:

Pukana wai o Kahuku.
The water outlet of Kahuku.
Refers to the outlet of an underground stream that once flowed from Kahuku to Waipahu, O'ahu. (Pukui, 1983:299)

An abstract of this legend appears in a descriptive account of the Kahuku area as visited by train in the early 1900's.

> As our train sped on toward Kahuku, we were told of the various water-holes of the district with certain of them furnishing catches of fish, but only on the nights of Kane. One called Punamano is famed for a shark-man's exploits, and another as having connection with Waipahu, in the Ewa district, which is said to have been verified in the following manner:
>
> A kapa-beating log of peculiar sound, unlike any other known on the island, which was placed in its waters at the close of a kapa-making season to keep it smooth and free from cracks that would impart an impression to the cloth in its manufacture, was missed, and, believing it to have been stolen, search was made all through the Koolau, Waialua and other districts till at last it was found in use at Waipahu. Recognizing it by its resonant tone, it was claimed by the searching owner, and right thereto by those in possession as vigorously maintained. To test the truth of ownership as claimed, the Ewa people accompanied the claimant back to Kahuku to visit the scene and witness a test of the underground stream theory. A bundle of ti leaves were gathered, which was wrapped together and consigned to the waters of Punahoolapa. In the course of a few days they were lost to sight, whereupon the party set out for Ewa, and after careful watching, as predicted, the bundle of ti leaves came forth on the bosom of the waters of the Waipahu stream. The kapa log was thereupon recognized as the rightful property of the Kahuku claimant. (Thrum, 1910:130-1)

Another version of the same tale, though somewhat more embellished, is presented by Pukui and Curtis in The Water of Kane. (Pukui and Curtis, 1976:162-7)

The legend, which closes this section of mythology relating to the general Kahuku area, appears antiquated in its content; it is set during the period of migration to Hawaii from Kahiki (foreign lands).

> The story I am about to tell you came to me as a marvellous, mysterious, miraculous myth of the long ago, when strange powers dwelt in both animals and men, and when cannibalism might have been carried on to be reported later under the guise of eating the flesh of beast or fish. In the long ago there were two "fish" crossing the trackless waters of the Pacific Ocean. Their home was in one of the far-away lands, known as Tahiti. These "fish" were great canoes filled with men. They decided that they would like to visit some of the lands about which they had heard in the legends relat-

> ed by their fathers. They knew that certain stars were always in certain places in the sky during a part of every year. By sailing according to these stars at night and the sun by day they felt confident that they could find the wonderful fire-land of Hawaii about which they had been taught in the stories of returned travellers. So the two "fish" - the two boats - after weary days and nights of storm and calm, of soft breeze and strong, continuous winds, found the northeast side of the island of Oahu with its rugged front of steep, precipitous rocks. The travellers landed first on a point of land extending far out into the sea, terminating in a small volcano. Here they made examination of the unfriendly coast and decided to journey entirely around the island, one fish, or boat, going toward the north and the other toward the south. They were apparently intending to pass around the island and find an appropriate location for a settlement. Possibly they planned to make a permanent home or hoped to meet some good community into which they might be absorbed. The point of land which marked the separation of the two companies is called Makapuu. The boat which sailed toward the north found no good resting-place until it came to the fishing-village of Hauula. The stories told by the old natives of the present time do not give any details of the meeting between the strangers and the people residing in the village. Evidently there was dissension and at last a battle. The whole story is summed up by the Hawaiian legend in the saying: "The fish from Tahiti was caught by the fishermen of Hauula. They killed it and cut it up into pieces for food." Thus the visitors found death instead of friendship, and cannibalism was thereby veiled by calling the victims "fish" and the victory a "catch."...
>
> The second fish from Tahiti had gone on southward in its journey around the island of Oahu. It passed the rough and desolate craters of Koko Head on the eastern end of the island. It swam by Diamond Head and the beautiful Waikiki Beach. Either the number of the inhabitants was so large that they were afraid to make any stay or else they preferred to make the complete circuit of the island before locating, for they evidently made only a very short stay wherever they landed, and then hurried on their journey. By the time they reached Kaena, the northwestern cape of Oahu, they were evidently anxious concerning their missing companions. Not a boat on the miles of water between Kaena and Kahuku, the most northerly point on the island. The legend says that the fish changed itself into a man and went inland to search the coast for its friend, but the search was unsuccessful. It was now a weary journey from point to point, watching the sea and exploring all the spots on the beach where it seemed as if there was any prospect of finding a trace of their expected friends. Where a break in the coral reef permitted their boat to approach the land they forced their way to shore. Then when the thorough search failed again, the boat was pushed out over the line of white inrolling breakers to the great sea until at last the Tahitians came to Kahuku.

Now they appeared no longer as "fish," but went to the village at Kahuku as men. They made themselves at home among the people and were invited to a great feast. They heard the story of a battle with a great fish at Hauula and the capture of the monster. They heard how it had been cut up and its fragments widely distributed among the villages on the northwest coast. Evidently provision had been made for several great feasts. The people of Kahuku, although several miles distant from Hauula, had received their portion. The friendly strangers must share this great gift with them. But the men from Tahiti with heavy hearts recognized the fragments as a part of their companion. They could not partake of the feast, but by kindliness and strategy they managed not only to decline the invitation, but also to secure some portions of the flesh to carry down to the sea. These were thrown into the water, and immediately came to life. They had the color of blood as a reminder of the death from which they had been reclaimed. Ever after they bore the name "Hilu-ula," or "the red Hilu."

Then the "fish" from Tahiti went on around to Hauula. They went up to the tabu land back of Hauula. They pulled up the tabu flags. Then they dammed up the waters of the valley above the village until there was sufficient for a mighty flood. The storms from the heavy clouds drove the people into their homes. Then the Tahitians opened the floodgates of their mountain reservoir and let the irresistible waters down upon the village. The houses and their inhabitants were swept into the sea and destroyed. Thus vengeance came upon the cannibals.

The Tahitians were "fish," therefore they went back into the ocean to swim around the islands. Sometimes they came near enough to the haunts of fishermen to be taken for food. They bear the name "hilu." But there are two varieties. The red hilu is cooked and eaten, but never eaten without having felt the power of fire. The trace of the cannibal feast is always over its flesh. Therefore it has to be removed by purification of the flames over which it is prepared for food. The blue hilu, the natives say, is salted and eaten uncooked. Thus the legend says the two fish came from Tahiti, and thus they became the origin of some of the beautiful fish whose colors flash like the rainbow through the clear waters of Hawaii. (Westervelt, 1973:139-145)

EARLY HISTORY OF THE KAHUKU DISTRICT

The native historian S. M. Kamakau bridges the time gap between the mythological and historical eras by relating the following long-held traditions of the ancients:

There is only one famous hiding cave, ana huna, on Oahu. It is Pohukaina. The opening on Kalaeoka'o'io that faces toward Ka'a'awa is believed to be in the pali of Kanehoalani, between Kualoa and Ka'a'awa, and the second opening is at the spring Ka'ahu'ula-punawai. This is a burial cave for chiefs, and much wealth was hidden away there with the chiefs of old. On the Kona side of the island the cave had three openings, one at Hailikulamanu - near the lower side of the cave of Koleana in Moanalua - another in Kalihi, and another in Pu'iwa. There was an opening at Waipahu, in Ewa, and another at Kahuku in Ko'olauloa. The mountain peak of Konahuanui was the highest point of the ridgepole of this burial cave "house," which sloped down toward Kahuku. Many stories tell of people going into it with kukui-nut torches in Kona and coming out at Kahuku. Within this cave are pools of water, streams, creeks, and decorations by the hand of man (hana kinohinohi'ia), and in some places there is level land.

According to the traditions of some people, Oahu was said to have once been a floating land, he 'aina lewa o Oahu. The Kahuku side was a wide open gap (puka hamama) and this was called Ka puka o Kahipa a me Nawaiuolewa, "The opening of Kahipa and Nawaiuolewa." The piece of land that closed it up was called Kahuku, and the hooks that made fast the piece of land and joined it to the island were called Kilou and Polou. (Kamakau, 1974:38-9)

Included under this heading "early history" is a brief discussion of ancient sacred relics uncovered in the Kahuku district.

In his series Arts and Crafts of Hawaii - Religion, Peter H. Buck numbers three carved images as having been found in Kahuku.

The first two are classified as temple images; they are described as follows:

Two images of a similar type were found at Kahuku, Oahu. Both have the high head slab, one plain and the other with triangular and lozenge-shaped openings...Each has a pointed prop and each is more than 5 feet tall. The image with the slab openings was destroyed by fire, and the other is in a private collection. Fortunately, the Museum has field photographs, from one of which the figure was drawn. (Buck, 1964:495)

The last of the three is categorized as a worked stone god.

Regarding these, Buck notes:

Worked stone representing the human form in part or in whole was termed a ki'i pohaku (stone image), and it was only after the necessary ritual that it became an akua pohaku (stone god). After the general acceptance of Christianity, many keepers of the stone gods hid them, either from lingering sentiment or because they were afraid to destroy them by breaking them up. Thus they have been found in caves, in concealment cavities in stone piles, in taro swamps, and buried underground. Some were kept by families, particularly by fishermen, who saw no contradiction to Christianity in keeping a good luck talisman which increased the supply of fish....(ibid.:496)

...The last drawing (fig. 312,e), taken from a cast of a specimen in the Berlin Ethnographic Museum, is from Kahuku, Oahu. It differs from the Hawaii specimens in having raised elliptical eyes; a small, raised nose; a hollowed mouth with a raised upper lip; and a sharp chin. (ibid.: 498)

A SAMPLING OF HISTORICAL ACCOUNTS - Post 1778

Two of the earliest voyager descriptions of the northwestern part of Oahu mention expanses of cultivated fields and well-inhabited communities. Cook's officers who assumed command of his ships after his death jotted the following impressions:

SUNDAY 28th. Winds E[t]erly, fresh breezes with open Cloudy Weather. Run round the N[o]ern Extreme of the Isle which terminates in a low Point rather projecting;[2] off it lay a ledge of rocks extending a full Mile into the Sea, many of them above the surface of the Water; the Country in this neighbourhood is exceedingly fine & fertile; here is a large Village, in the midst of it is run up a high Pyramid doubtlessly part of a Morai.[3] I stood into a Bay just to the W[t]ward of this point[4] the Eastern Shore of which was far the most beautifull /sic/ Country we have as yet seen among these Isles, here was a fine expanse of Low Land bounteously cloath'd with Verdure, on which were situate many large Villages and extensive plantations; at the Water side it terminated in a fine sloping, sandy Beach...(Clerke in Beaglehole, 1967:I:572)

[2]Kahuku Point, low, covered with sand dunes; its position, lat. 21°43' N, long. 157°59' W, gives us a check on Clerke's noon position a few lines above.

[3]An oracle tower,' lana nu'u mamao; cf. p. 270, n.3 above.

[4]Waimea Bay, not a very deep indentation in the coast. (ibid.)

WOA'HOO.[3] We saw this Island the beginning of last year, but only just as a high lump. We this Time saild along its NE & NW sides but saw nothing of the S[o]ern part. What we did see of this Island was by far the most beautiful country of any in the Groupe; particularly the Neck that Stretches to the N[o]ward: & its NW side. Nothing could exceed the verdure of

the hills, nor the Variety which the face of the Country display'd. It /s north-eastern/ parts[4] were cliffy, & rugg'd to the Sea side, but the Valleys look'd exceedingly pleasant, near the N point we were charmd with the narrow border full of Villages, & the Moderate hills that rose behind them;... (King in Beaglehole, 1967:I:610)

An excellent discussion of the historical agrarian aspects of of the district is given in The Hawaiian Planter:

KAHUKU

This blunt northern tip of the island of Oahu, whose name means "The hillock," is now the seat of the Kahuku Plantation Company's offices, town, and mill, and for many years has been planted in sugar cane. Kahuku ahupua'a presents something of a paradox. McAllister (1933, p.153) remarked in his survey that it did not seem possible that this "rather desolate, wind-swept" plain could ever have supported much life, agricultural or human, before the era of industrial machinery and organization. Yet one of his informants "remembers the time when trees now found only in the mountains" covered it. And in Captain Cook's time it was reported that "nothing can exceed the verdure of the hills, the variety of wood and lawn, and the rich cultivated valleys which the whole face of the country /on this northern end/ displayed" (Cook, 1784, Vol. 3, p. 115). Thirteen years later Vancouver (1798, Vol. 3, p. 71) wrote of Kahuku and surrounding territory: "Our examination confirmed the remark of Capt. King excepting that in point of cultivation or fertility, the country did not appear in so flourishing a state, nor to be so numerously inhabited, as he represented it to have been at that time, occasioned most probably by the constant hostilities that had existed since that period." There is a similar discrepancy between the descriptions of other areas in the 1780's and 1950's /sic/ insofar as cultivation is concerned; but not in verdure. What catastrophe of the elements, slow or swift, has wrought the change in Kahuku?

In 1833 Hall (1839) observed at Kahuku that "much taro land now lies waste because the diminished population of the district does not require its cultivation." There seems no evidence of old terraces in the upland along either branch of Kahuku Stream, but in the seaward swampland north and south of Kukio Pond there are such remains. A 1935 informant, Kaleo, knew the names of 11 localities where terraces were formerly cultivated.

Rounding the northern tip past Kahuku onto the "sunset coast," the next sizable wet-taro area is the deep valley of Waimea. Before reaching Waimea the intervening stream beds, shown on the map as Hanako'ae, Pahipahiaula /sic/, and Kaunala, had not sufficent flatlands for taro cultivation under the old system. Two exceptions to noncultivation in this region were to be found. One was in 'Opana (The-squeezing) adjoining Hanako'ae /sic/, where there was formerly a small spring-watered terrace area named Ka-wela (The-heat), which is also the name of the bay below. The other was in Waiale'e, next before Kaunala, where there were another small group of terraces anciently named Kane-ali'i. In 'Opana the legend is told that the gods Kane and Kanaloa struck spring water from a rock known as Wai-kane, to give life to this hitherto waterless region around Kawela Bay." (Handy, Handy and Pukui, 1972:462-3)

Agricultural notes are also found within a delightful description of Pahipahialua (which adjoins the ahupuaa of Opana) and its surrounding lands. This 1815 account is provided by a visitor named John B. Whitman; the following excerpt is taken from his An Account of the Sandwich Islands:

A friend of mine having lived on Owhyhee for several months had returned to Woahoo for the purpose of taking possession of a large plantation which the high priest of the Islands had given him. He requested me to accompany him, and we commenced our journey early in the morning of September 6, 1815...

Passed through Whyamere /cs:Waimea/ and arrived at Pypy-arure /cs:Pahipahialua/ which makes the point of the Island. It is not so fertile as Whyarure /cs:Waialua/ the low lands being rock and uncultivated. It was late in the afternoon when we arrived at the estate belonging to my friend and was introduced to the superintendant. He was a good looking man whose grey hair and wrinkled visage bespoke him not far from sixty years of age. Being informed of the nature of our visit, his rapid orders produced a confusion among the under tenants somewhat resembling the bustle at a country inn on the arrival of unexpected hungry travellers. An uproar in the hog pen announced the speedy dissolution of two of the members. New mats were brought for us to set on. The tarbooed fire was lighted from the old mans match rope, another fire blazed at some distance. I perceived a farce was playing which I could not rightly comprehend, but waited with patience the conclusion of it. Fresh taro was brought by different hands and laid near the two fires. Two gourd shells filled with water were next brought and I determined to solve the mystery. Taking hold of one of them I was saluted with ayer no wye tarboo (that is tarbooed water), and the other was immediately handed to me. It appeared we were to have two suppers cooked. One tarbooed, the other nored /cs: noa-made free of restriction/ and as we did not wish to be idle, in the mean time, we sallied forth to take a cursory view of the newly acquired estate.

It consisted of a small valley well stocked with taro in fine order, several of the patches having been recently planted. A strip of low rocky land extending to the sea and a large extent of fishing ground which was said to be very

productive.

Returning to our host we found supper ready. The old superintendant, our guides and my friend seated themselves on a large mat and partook of a tarbooed supper consisting of a hog and poey /cs:poi/. My friend it seems had been regularly tarbooed by the Head Priest on Owhyhee which entitled him to the privilege of eating out of the same dish with him, and with any of his tarbooed men. Not having had that distinguished honor conferred upon me I of course was excluded from the sacred feast, but much to my satisfaction I found a hog well cooked and served up separate. Not being inclined to a supper "a le solitaire" I invited the boys to partake with me and jocularly observed to our host that I had tarbooed them as my hicarnies /cs:aikane/ or friends for the time being. Supper being finished we spent the evening with the old man who gave us an account of the estate and its resources, and the yearly rent which he had prepared to send the High Priest which consisted of about two hundred large salted fish, two hogs of the largest size, five suits of tarper /cs:tapa/, five pows /cs:pa'u/ and ten maros. Having no knowledge of the value of gold and silver and no standard circulating medium by which to establish the relative value of things, the rents are paid in the produce of the soil and the quantity is proportionate to the size of the farm.

January 9th. The transfer of the estate being settled and the old man reinstated as superintendant, we retired to rest in an old hut which served as the sleeping house of all the family, men and women, hogs, dogs and fleas.

In one corner our host had prepared some clean new mats and two suits of new tarpers for our comfort. Here we laid ourselves down to rest. The jabbering of the inmates gradually subsided and nothing was heard save the grunt of a hog, or the whining of a whelp caused by a host of fleas levying contributions on their half starved carcasses; or the ejaculatory plaint awa ker ootoo (oh, dear, the fleas) which now and then escaped from our guides.

Our new bedding for some time preserved us from this troublesome insect, but after having been asleep a short time I awoke and found myself literally covered with them. My friend storming like a madman, rushed out of this worse than hornets nest, and finding I must retreat, I soon followed him, and we took up our quarters in the open field, where we passed the remainder of the night in undisturbed repose.

In the morning we commenced our line of march homeward, and, as is the custom, after being hospitably entertained, and provided with new carpers, we paid our host the compliment to take the tarpers along with us...

After proceeding for some time over an uncultivated plain, we arrived at a small village situated on the sea shore. It consisted of about twenty huts occupied by fishermen, by the side of the pathway there was a fine bed of watermelons, and we sat down on a fallen cocoa nut tree to rest ourselves, several of the natives came to us and one of them offered us some melons. We gladly accepted his kind offer and told our servants to pull some for us, but the Indian who had offered us the melons, said something to them which deterred them from going on to the ground. He however bade us pull what we might want, which we did. Our servants would not eat or touch any. We shortly discovered the reason of their mysterious conduct, for the kindness of the Indian had like to have caused some trouble. This generous fellow in his zeal to serve the white men had overstapped the bounds of honesty, and given us what was not his. The rightful owner came and was somewhat exasperated to see us encroaching upon his property without asking his consent. We assured him of our honest intentions, telling him the circumstances without pointing out the offender, which he desired us to do, but knowing the motives which had actuated our friend, we declined giving the information, at the time offering him compensation for his melons, which after some hesitation he accepted. He was very desirous to discover who it was that had given us the liberty but was not satisfied on this point, although there were a number of the villagers who had witnessed the whole transaction, some of whom even upbraided him, his want of generosity in receiving recompence, he however, became passified and we parted friends, having supplied ourselves with a number of very fine melons. (Whitman, 1979:74, 78-82)

In 1828, missionary Levi Chamberlain completed his second circuit of the island of Oahu, examining students and in general evaluating the effectiveness of teachers and education upon the native populace. His remarks demonstrate that within Kahuku there still existed a viable and fairly progressive community - one whose scholars were numerous and whose head-man apparently valued formal education.

Tuesday Feb. 5th. After breakfast I examined two schools, belonging to Laie & Malaekahana, and was pleased with the appearance of the scholars. At a quarter before 11 A.M. we set out for Kahuku, and after travelling about two hours over a level sandy country, arrived at the school house, where we found 83 scholars assembled, waiting to be examined. A lad of about 11 years of age had the direction of the school. His father the head man of the place was present, and gave countenance to his son, who managed the school with a good deal of address. I gave books to those of the scholars who were destitute, whom I found able to read....

A good hog had been cooked for us, & when the examination closed, dinner was waiting. I had not been very well since morning, and had not much appetite to eat, but my attendants made a hearty meal; and the remainder of the food was placed in the calabashes of our natives, and carried along to furnish

food for us when we should be again in need. (Chamberlain, 1957:35-6)

The mid-1800's brought enormous transformations in land ownership patterns. At that time, Kamehameha III relinquished absolute ownership of land in the Islands and individuals were allowed to register legal verifiable claims to their houselots and agricultural plots.

Numerous awards were granted within the project boundaries; a detailed discussion of each can be found in this report under the headings of "Archival Documents" and "Original Land Ownership: Land Commission Awards."

As part of his Crown Lands, Kamehameha III chose to retain the ahupuaa of Kahuku and Kawela (Indices, 1929:27-8). The remaining ahupuaa within project boundaries were all classified as Government lands (ibid.:40-44). Rights of native tennants in these Crown and Government lands were strictly respected.

Almost immediately after this land division occurred, sales and leases of parcels within these seven ahupuaa were conveyed. Thus, over the years an intricate chain of title arose. Suffice it to say, for the purpose of this preliminary study, that large tracts of land were obtained in fee or in lease-hold by men such as C. G. Hopkins in 1850-1 (Index, 1916:53) and Robert Moffitt Stoney for the purposes of sheep and cattle and thorough-bred horse ranching.

The following news article provides a brief history of ownership and a description of Kahuku Ranch (which stretched from Kahuku Point northward) at the time it was purchased by James Campbell:

Kahuku Ranch. This fine ranch, covering the north portion of Oahu, formerly the property of the late R. Moffitt, and more recently of Juluis L. Richardson, Esq., was last week sold by the latter to James Campbell, Esq., one of the proprietors of the Pioneer Sugar Mill of Lahaina, for the sum of $63,500 cash. It includes 25,000 acres in fee simple, and large tracts of mountain land under long leases, with $34,000 worth of live stock, including 3,000 head of cattle, with the choice band of marino sheep and horses now on it. It is unquestionably the best stock ranch on these islands, and it has been brought to a high state of perfection under the management of the late proprietors, who divided the plain into ten or twelve large paddocks, walled with heavy stone walls. It stretches from Laie to Waimea, a distance of thirteen miles, and those who have ever visited it must have admired its lovely green pastures of manienie grass so fattening to stock. It is the intention of Mr. Campbell to increase his band of sheep to 30,000 of the choicest breed. The price paid is a handsome one, securing to its present proprietor the most desirable ranch on the Islands, and to Mr. Richardson a comfortable fortune, the result in part of his industry and good management, and in part of the Reciprocity Treaty, the first fruit from which he has been so fortunate as to reap.... (Hawaiian Gazette, 10/4/1876, p.3:2)

Campbell's development of his lands, his deep involvement in sugar cultivation and the post-1900 history of the project site demand much additional research time and therefore will not be addressed in this preliminary work.

CARTOGRAPHIC RECORDS

Tax maps and the maps on file at the State Survey Division revealed the general location of a sizeable number of original awards deeded during the Great Mahele of Kamehameha III (mid-1840's through early-1850's). In spite of the fact that a proportion of these early awards were neither plotted nor even surveyed and also considering that for those parcels that were delineated, the accuracy of location can not be guaranteed - one is still quite able to gain a fair understanding of residential and agricultural patterns existing over a century ago in these particular districts.

Pertinent data from several of these maps was collected and all the awarded claims which were shown have been roughly sketched on current Tax Maps of the area. These Tax Maps as well as a map depicting the placement of the seven ahupuaa comprising the total land area under study have been included at the end of the present preliminary report (Figures 16-18).

Once a comprehensive list of land claims falling within the project's bounds was drafted and Land Commission Award numbers were compiled, then archival land records were carefully examined.

ARCHIVAL DOCUMENTS

During the Mahele, it was a requirement for individuals to register claims only for those lands actively used for farming and for residence. Testimony was then submitted by witnesses who verified or contested an individual's claim.

Data gleaned from these registers proved to be particularly useful as claimants often submitted detailed inventories of their fixed properties - mentioning even the number of taro patches, cultivated plots, fisheries, varieties of trees and sometimes the general location of each.

A full tally of all holdings mentioned within the entire ahupuaa was then developed in an effort to re-create broad land use patterns for each district. They are as follows:

Opana contained

7 taro patched, some in cultivated kula lands
1 cultivated kula plot
1 cluster of hala trees

Kawela contained

28 taro patches
11 houselots
10 upland gardens planted with noni, sweet potatoes, gourds, bananas, sugar cane and wauke
17 kula plots and gardens planted with wauke, noni, ulu, sweet potatoes, sugar cane, bananas and ohia
1 fishery
2 watercourses
1 salt land
5 clusters of hala trees
1 ulu tree

Hanakaoe contained

1 fishery
1 salt bed
1 salt pool
1 hala grove
several gardens and kula plots planted with noni, onions, sweet potatoes
1 cultivated upland plot

Oio contained

15+ gardens and kula plots planted with awa, taro, banana, noni, wauke, sugar cane, sweet potato, gourd, edible friuts
36 koa canoe trees
5 houselots
4 taro patches
3 groves of hala
3 salt bed lands
1 sweet potato patch cultivated upon cliffs
4 cultivated upland plots planted with banana, awa, sugar cane, wauke, sweet potato, gourd

Ulupehupehu contained

15+ kula plots and gardens planted with wauke, sweet potato, gourd, banana, sugar cane
7 koa canoe trees
2 cultivated upland plots planted with wauke, banana, orange trees
1 banana plantation
1 cluster of hala
1 houselot

Punalau contained

10 taro patches
1 fish pond named Puekahi
10 kula plots and gardens planted with sweet potato, banana, noni, ulu
4 cultivated upland plots
8 houselots
4 coconut trees
3 shore areas/fisheries
2 koa canoe trees

Kahuku contained

162 taro patches
39 kula plots and gardens planted with awa, banana, wauke, gourd, sweet potato, sugar cane, noni, watermelon, pili grass
7 cluster of hala
6 salt lands
4 koa canoe trees
2 fishponds
10 houselots
1 sweet potato patch cultivated upon cliffs
1 watercourse bank
3 cultivated upland plots
1 brackish spring
1 wooded upland area of ulu, ohia, kukui, koa, ti leaf, noni, etc..

The above listing is by no means complete nor is it restricted only to the project area; it serves merely as a guideline. However, the next set of data compiled from the registers, testimony and survey notes relate to the specific parcels plotted within the project.

ORIGINAL LAND OWNERSHIP: LAND COMMISSION AWARDS

Opana Ahupuaa

1. Claimant Kookoo (LCA 2897:2)
"I have a claim at Opana with three lo'i and a kula, bounded on the north by the sea, on the east by the kula, on the south by the pali, on the west by Pahipahialua." (Native Register v.3:683)

2. Claimant Paukoa (LCA 2734:3)
"I have a little claim for two lo'i at Opana, bounded on the north, east and south by a kula, on the west by Kookoo's /land/...My claim is from my makuas, from the time of Kamehameha I to the present." (Native Register v.3:612)

3. Claimant Kuheleloa (LCA 2835:2)
"At Opana I have a claim for two lo'i, surrounded by kula, it is cultivated kula land." (Native Register v.3:657)

Boundaries of the above parcel, translated from the survey notes state:
"Parcel 2. One taro patch at Opana. Commence at the south angle and run N. 18 W. 100 links
then N. 74 E. 57 "
then S. 14 E. 98 "
then S. 72 W. 48 " . It is surrounded by Konohiki lands. .05 acre." (Survey Notes RP 509)

Kawela Ahupuaa

1. Claimant Kookoo (LCA 2897:2)
"I, Kookoo, have a claim for land at Kawela.
1. Three lo'i,...the boundaries are: North, Kaili's lo'is, east and south, kula, west, Peelalau's /land/...
4. I also have a claim for salt land, bounded on the north and east by the sea, on the south by the kula, on the west by Kauahi's /land/...
There is a houselot at Kawela, bounded on the north by the shore, on the east by Kekua's lot, on the south by the Road, on the west by Makaino's lot.
These are my claims which were from my makuas, from the time of Kamehameha I to this time." (Native Register v.3:383)

"Kalakoa, sworn, says he knows the land claimed by Kookoo in Kawela. It consists of 3 kalo patches and a House site. The 3 kalo patches form one piece, bounded on Hauula side by the kula land, mauka and Waialua side by Lono's land, makai by the Konohiki.
The kula land claimed has not been cultivated for some time. The House site is near the kalo patches. It is enclosed with a wooden fence. Claimant has held the land for over ten years.
The Konohiki had no objections to this claim." (Foreign

Testimony v.10:159)

Translated survey notes give the boundaries of LCA 2897:2 as:
"Parcel 2. Houselot. Commence at the south angle and run
N. 15¼ W. 158 links
then N. 74¼ E. 158 "
then S. 15¼ E. 158 "
then S. 74¼ W. 158 " . It is surrounded by the Konohiki lands. ¼ acre." (Survey Notes RP 506)

2. Claimant Kamakai (LCA 2837:2)
"My house claim is at Kawela, bounded on the north by the sea, on the east by a pond, on the south by a sandy gulch, on the west by the lot of Peelalau." (Native Register v.3:658)

"His /Kamakai's/ House site is in Kawela. It is not enclosed. He got the land from Kaeo some 10 years ago. The Konohiki consented to this claim." (Foreign Testimony v.10:158)

Translated boundaries for LCA 2837:2 are:
"Parcel 2. Houselot. Commence at the south angle and run
N. 14 W. 116 links along Pailalau's /Peelalau's/ lot,
then N. 80 E. 100 "
then S. 9 W. 110 "
then S. 81 E. 72 " along the stone wall to the point of commencement. .09 acre." (Survey Notes RP 507)

3. Claimant Pailalau (or Peelalau) (LCA 3815:1)
"My houselot is at Kawela. My occupancy of these claims was since the time of Kamehameha II." (Native Register v.4:176)

"His /Pailalau's/ House site is near the sea side and is not enclosed. Claimant died about 2 years ago leaving the land to his widow. He got the land from Kaeo some ten years ago.
The Konohiki consented to this claim." (Foreign Testimony v.10:170)

Translated survey boundaries:
"Houselot. Commence at the south angle and run
N. 21 W. 114 links
then N. 80 E. 100 " along the stone wall
then S. 14 E. 116 " " Kamakai's lot
then S. 81 W. 74 " " the stone wall to the point of commencement. .1 acre." (Survey Notes RP 511)

4. Claimant Moo (LCA 2784)
"I, Moo, am a claimant for land at Kawela. There are four lo'i and also two kula. The boundaries are north, Kekua's land, east, Kaumahi, south, Kuheleloa, west, kula...
A houselot is another claim of mine, bounded on the north by the trail and a kula, on the east, a kula, on the west by the lot of Kawi. This is my claim which I had from the makuas, from the time of the Ali'i Kamehameha I, until the present." (Native Register v.3:634)

"Kalakoa, sworn, says he knows the land claimed by Moo in Kawela. It consists of 2 kalo patches and a House site. The 2 kalo patches are bounded on Hauula side by Kauaula's land, - mauka by Paku's land, - Waialua side by Kelemana's land, - makai by Paukoa's land. Claimant has no kula land in Kawela. His House site is near the kalo land and is not enclosed. He has held the land for about ten years....
The Konohiki consented to this claim." (Foreign Testimony v.10:156)

Translated survey boundaries for LCA 2784 are:
"Parcel 1. 2 taro patches. Commence at the south angle
and run N. 14 W. 100 links along Kauaula's lot
then N. 82 E. 122 " " the Konohiki's land
then S. 70 E. 41 " " Paukoa's lot
then S. 20 E. 59 " " Kalemana's lot
then S. 70 W. 165 " " Paku's lot to the point of commencement. .13 acre..
"Parcel 2. Houselot. Commence at the south-west angle
and run N. 2 W. 158 links
then N. 88 E. 158 "
then S. 2 E. 158 "
then S. 88 W. 158 " . It is surrounded by Konohiki lands. ¼ acre." (Survey Notes RP 512)

5. Claimant Kawi (LCA 2850)
"My houselot is at Kawela, bounded on the north by a fresh water pond, on the east by Moo's house, on the south by a land fence, on the west by the sea.
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:663)

"Kalakoa, sworn, says he knows the kalo patch claimed by Kawi in Kawela. It is a Koele of the Konohiki. Witnefs /sic/ knows the House site of claimant in Kawela. It is near the sea side and not enclosed. Claimant has lived there some ten years.
The Konohiki consented to the claim for a House Lot, but claimed the kalo patch." (Foreign Testimony v.10:155)

Translated survey boundaries are:
"Houselot. Commence at the south angle and run
N. 3¼ W. 133 links
then N. 79 E. 173 "
then S. 30 E. 90 "
then S. 60 W. 228 " along the stone wall. It is surrounded by Konohiki land. .23 acre." (Survey Notes RP 515)

6. Claimant Makaino (LCA 2770:2)
"I, Makaino, am a claimant for land at Keokea /a land division in Kawela just mauka of Kamehameha Hwy./. There is one taro lo'i and a kai /fishery/ and a kula...
My house claim is at Kawela. My right of occupancy was from the time of Kamehameha II." (Native Register v.3:628)

"Claimant's House site is near the sea side, and not enclosed. Claimant has had this land about ten years. He got it from Kaeo.

The Konohiki consented to this claim." (Foreign Testimony v.10:155)

Translated survey boundaries for LCA 2770:2 are:
"Parcel 2. Houselot. Commence at the south-western angle and
run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . It is surrounded by Konohiki land. ¼ acre."
(Survey Notes RP 513)

7. Claimant Kekua (LCA 2878:2)
"I, Kekua am a claimant of land at Kamooiki,...My house is at Kawela...." (Native Register v.3:676)

"Claimant's House site is in Kawela. It is near the sea side and is not enclosed. Claimant got his land from Kaeo, some 8 or 10 years ago.
The Konohiki had no objections to this claim." (Foreign Testimony v.10:155)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and
run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . It is surrounded by Konohiki land. ¼ acre."
(Survey Notes RP 516)

8. Claimant Paukoa (LCA 2734:3)
"I, Paukoa, have a claim for land at Kawela...The houselot is for my kaikua'ana, I dwell in the house. My claim is from my makuas, from the time of Kamehameha I to the present." (Native Register v.3:612)

"He /Paukoa/ has a House site makai of the land. It is not enclosed. He has held the land about ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:158)

9. Claimant Kauwahi (LCA 2838:2)
"My /Kauwahi's/ house claim is at Kawela, bounded on the north by the sea, on the east and south by kula, on the west by Kekua's /land/. My right of occupancy is from the time of Kamehameha I." (Native Register v.3:658)

"He /Kauwahi/ has a House site which is not enclosed...Claimant has held the land in Kawela for about ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:159)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle and run
N. 15¼ W. 225 links along Paukoa's houselot
then N. 74¼ E. 120 "
then S. 15 E. 225 "
then S. 74¼ W. 120 " " the Konohiki's land. ¼ acre."
(Survey Notes RP 510)

10. Claimant Paku (LCA 2724:3)
"My /Paku's/ house is at Kawela. My right of occupancy was from Kinau." (Native Register v.3:608)

"Kalakoa, sworn, says he knows the land claimed by Paku in Kawela...
His House Site is near the sea side and is enclosed with a wooden fence. Claimant has held the land for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:156)

Translated survey boundaries are:
"Parcel 3. Houselot. Commence at the south-western angle
and run N. 250 links along Kuheleloa's parcel
then E. 100 " " the Konohiki's land
then S. 250 " " " " "
then W. 100 " " " " " to the point
of commencement. ¼ acre." (Survey Notes RP 514)

11. Claimant Kuheleloa (LCA 2835:3)
"Claimant's House Lot is in Kawela. It is not enclosed. He has held the land since the time of Kaeo (10 years). The land belongs properly to Lono the wife of Kuheleloa, who divorced her husband for adultery.
The Konohiki consented to this claim." (Foreign Testimony v.10:157)

Translated survey boundaries are:
"Parcel 3. Houselot at Kawela. Commence at the south angle
and run N. 250 links
then E. 100 "
then S. 250 "
then W. 100 . It is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 509)

12. Claimant I (deceased) (LCA 2682)
According to the Native Register (v.3:588), I claimed 2 lo'i and a houselot in Kawela. However I passed away before the claim could be awarded or surveyed, thus we have no record of the exact location of either the lo'i or the houselot.

"Kalakoa, sworn, says he knows the kalo patch claimed by I, in Kawela. It reverted to the Konohiki recently, on the death of I." (Foreign Testimony v.10:157)

Hanakaoe Ahupuaa

1. Claimant Kamakai (LCA 2837)
"I, Kamakai, hereby state my claim for land at...Hanakaoe is a kaheka pa'akai /salt pool/." (Native Register v.3:658)

2. Claimant Pailalau (LCA 3815)
"...My occupancy of these claims was since the time of Kamehameha II...At Hanakaee /sic/ is a fishery and a salt bed..." (Native Register v.4:176)

3. Claimant Kaili (LCA 235 H)
"Revd James Kekela, sworn, says at the time he was drawing up claims for the people of Kawela, the son of Kaili came to him and got Kaili's claim drawn up by witnefs /sic/. It was put in a parcel with other claims and given to Revd Mr. Emerson to bring to Honolulu.
Kane, sworn says, he knows the land of Kaili in Kawela. It consists of 5 kalo patches in two pieces.
The first piece, of 3 patches, is bounded on Hauula side by the Konohiki, Mauka by Kookoo's land, Waialua side by the Konohiki, Makai, by Kauaula's land.
The second piece, of 2 patches, is bounded on Hauula side by the Konohiki, Mauka by Kookoo's land, Waialua side by the Konohiki, Makai by Kelemana's land.
Claimant's House site is makai of the land. It is enclosed with a wooden fence - there is one house in it. Claimant held the land for about 12 years. He died in March 1849, leaving his property to his daughter Nahuli." (Foreign Testimony v.11:239)

Translated survey boundaries are:
"Parcel 1. 5 taro patches. Commence at the south angle and
run N. 16 W. 110 links along Paku's lot
then N. 73 E. 325 " " Kaunahi's lot
then N. 43 E. 56 " " the Konohiki's land
then S. 20 E. 155 " " " " "
then S. 73 W. 383 " " Kookoo's lot to the point of
commencement. .41 acre.

"Parcel 2. Houselot at Hanakaoe. Commence at the south angle
and run N. 14 E. 158 links
then S. 76 E. 158 "
then S. 14 W. 158 "
then N. 76 W. 158 " . It is surrounded by Konohiki
lands. ¼ acre." (Survey Notes RP 508)

Oio Ahupuaa

1. Claimant Pakanaka (LCA 2744:2)
"I, Pakanaka, the konohiki of Oio, hereby state my claim for land at Oio. It is...and salt bed land...
My houselot is at Oio, bounded on the north by that of Kauhikai, on the east by kula, on the south by I's /land/, on the west by the sea. My right of occupation is from the time of Kamehameha I." (Native Register v.3:617-8)

"The land claimed in Oio has not been cultivated for some time.
Claimant's House Lot is in Oio. It is not enclosed...
The Konohiki consented to the claim for one patch and House Lot." (Foreign Testimony v.10:177)

2. Claimant Kauaihikai (LCA 2936:2)
"I, Kauaihikai, hereby state my claim for land at Oio, some malas of 'awa, banana, wauke, sugar cane, two koa canoe trees, and some malas of sweet potato and gourd from the upland to

the sea...My house claim is at Oio, bounded on the north by a pig pen, on the east by a hala grove, on the south by Pakanaka's /land/, on the west by the sea.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:701)

"The other patches claimed, have been abandoned. The cultivation of the kula land has been abandoned.
Claimant's House site is in Oio, and is not enclosed... He died in 1848, leaving his land to Upai his widow, who now claims it.
The Konohiki consented to this Claim." (Foreign Testimony v.10:186)

3. Claimant Hoolae (LCA 2716:2)
"I, Hoolae, hereby state my claim for land at Oio...My houselot is at Oio and is bounded on the north by Kekohai's houselot, on the east by a kula, on the south by Kekuauli's lot, on the west by the sea. My right of occupancy is from the time of Kamehameha II." (Native Register v.3:601-2)

"Claimant's House site is in Oio, near the sea side, not enclosed. He has held the land for a long time. He says he has no kula land in Oio.
The Konohiki consented to this claim." (Foreign Testimony v.10:161)

4. Claimant Kekuauli (LCA 2935)
"My houselot is at Oio, bounded on the north and east by kula, on the south by a land fence, on the west by the sea.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:700)

Ulupehupehu Ahupuaa

1. Claimant Waanui (LCA 2698:2)
"I, Waanui, hereby state my claim for land at...Ulupehupehu are some gardens of sweet potato and gourd. My houselot is at Ulupehupehu. On the north is the sea, on the east and the south is kula, on the west is the houselot of Kane.
My right of occupancy is from Kamehameha III." (Native Register v.3:595-6)

"Claimant's House site is in Ulupehupehu. It is not enclosed. He has also a patch of noni in that land, which is bounded on all sides by the Konohiki.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " to the point of commencement; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 340)

Punalau Ahupuaa

1. Claimant Manukeokeo (LCA 2781:1)
"I, Manukeokeo, hereby state my claim for land...My house claim is also at Punalau and is bounded on the north by Kaohele's lot, on the east by a kula, on the south by the land fence, on the west by a kula. I have had the right of occupancy on these places from the year of our Lord 1842." (Native Register v.3:632-3)

"Claimant's House site is in Punalau. It is not properly enclosed. He has held the land for about ten years.
The Konohiki consented to the claim for kalo land and a House Lot." (Foreign Testimony v.10:177)

Translated survey boundaries are:
"Parcel 1. Houselot at Punalau. Commence at the south angle and run N. 15 W. 158 links
then N. 75 E. 158 "
then S. 15 E. 158 "
then S. 75 W. 158 " along the stone wall; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 533)

2. Claimant Kekua (LCA 2913:2)
"I, Kekua, hereby state my claim for land at Punalau. There is one lo'i bounded on the north and east by kula land, on the south by Kaopupahi's /land/, on the west by Kanehekili. There is cultivated kula and shore land....
My right of occupancy is from the time of Kamehameha I." (Native Register v.3:690-1)

"Claimant's House site is in Kahuku /in Punalau/, and is not enclosed...Kekua died about 2 years ago, leaving his land to Luiki who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:180)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 337)

3. Claimant Kaohele (LCA 2861:2)
"I, Kaohele, hereby state my claim for land at...Punalau is a cultivated kula...My house claim is at Punalau, bounded on the north by a kalawaone /curved beach, bigger than a cove, smaller then a bay/, on the east by Kainalu's lot, south by a land fence, on the west by a kula.
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:667-8)

"Kailiuku, re-examined, says claimant's House site is near his kalo patches. It is not properly enclosed.
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-eastern angle and
run N. 4 E. 158 links along the taro patch
then N. 86 W. 158 "
then S. 4 W. 158 "
then S. 86 E. 158 " along the Konohiki's land to the point
of commencement. ¼ acre."(Survey Notes RP 524)

4. Claimant Kaopupahi (LCA 2869)
"I, Kaopupahi, hereby state my claim for land at Punalau. There is one lo'i, bounded on the north by Kekua's /land/, on the east by Iosua's /land/, on the south by the kula, on the west by Maulua's /land/. There is also a kula land, from the mountain to the sea...My house claim is at Punalau, bounded on the north by the sea, on the east by a sedge kula, on the south by a land fence, on the west by a kula. My right of occupancy is from the time of Kamehameha I." (Native Register v.3:671)

"Kiha, sworn, says he knows the kalo patch claimed by Kaopupahi in Punalau. Its cultivation has been abandoned. Lo has the cultivation of the kula land mentioned in this claim. Claimant resides lately in Honolulu. He has a House site in Punalau. It is not enclosed. He has held this House site for about ten years.
The Konohiki consented to the claim for a House Lot, but claimed the land." (Foreign Testimony v.10:181-181a)

Translated survey boundaries are:
"Parcel 1. Houselot. Commence at the south angle and run to
the N. 45 W. 158 links along the Konohiki's land then
N. 45 E. 158 " " " stone wall then
S. 45 E. 158 " " " Konohiki's land then
S. 45 W. 158 " to the point of commencement. ¼ acre."
(Survey Notes RP 6324)

5. Claimant Iosua Kiha (LCA 2864:2)
"I, I. Kiha, the konohiki of Punalau, hereby state my claim for land at Punalau. There is one lo'i, bounded on the north by a kula land, on the east and south by kula, on the west by Kaopupahi's /land/. There is also kula land, mountain land and shore land...My house claim is at Punalau, bounded on the north by the sea, on the east by the kula, on the south by the land fence, on the west by Kainalu's /land/.
My right of occupancy is from the time of Kamehameha I." (Native Register v.3:669)

"Kailiuku, sworn, says he knows the 2 kalo patches claimed by Kiha, one in Kahuku and one in Punalau. Neither of them are planted...
The kula land claimed is nahelehele /overgrown with weeds -cs/. It has not been cultivated for some time. Claimant's House Lot is in Punalau, and is not enclosed...
The Konohiki consented to this claim." (Foreign Testimony v.10:179)

Translated survey boundaries are:
"Houselot. Fenced in - Commence at S. angle and
run N. 73 E. 140 links along the Konohiki's land
then N. 17 W. 177 " " " " "
then S. 73 W. 140 " " " " "
then S. 17 E. 177 " " " " " . Area ¼
acre." (Survey Notes RP 520)

6. Claimant Kamalama (LCA 2909)
"I, Kamalama, hereby state my claim for land at Punalau. There are three lo'i, surrounded by kula, a kula cultivated in sweet potato and gourd...My house claim is at Punalau, bounded on the north by the sea, on the east by Kainalu's fence, on the south by a land fence, on the west by Kaohele's fence.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:688-9)

"Kiha, sworn, says he knows the kalo land of Claimant in Punalau. It consists of one patch. Its cultivation has been abandoned, as also that of the kula land mentioned in this claim.
Claimant's House Lot is in Punalau and is not enclosed.
..Kamalama died a few months ago, leaving a widow, Kaloena.
The Konohiki consented to the claim for a House Lot only." (Foreign Testimony v.10:182)

7. Claimant Kainalu (LCA 2892:2)
"I, Kainalu, hereby state my claim for land...My houselot is at Punalau, bounded on the north by the sea, on the east by Kika's /sic-Kiha's-cs/ houselot, on the south by a land fence, on the west by Kaohele's houselot. My right of occupancy is from the time of Kamehameha II." (Native Register v.3:681)

"Claimant's House Lot is in Punalau and is not enclosed.
The Konohiki consented to the claim for kalo land and a House Lot." (Foreign Testimony v.10:183)

Translated survey boundaries are:
"Parcel 2. Houselot at Punalau. Commence at the south-western
angle and run to the N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by the
Konohiki's land. ¼ acre." (Survey Notes RP 252)

8. Claimant Kupihea (LCA 2885)
"I, Kupihea, hereby state my claim for land at Punalau, consisting of one lo'i bounded on the north and west by a kula, on the east by Kaopupahi's /land/, on the south by Maulua's /land/. There is also a kula land, mountain land, and a kai /shore area or fishery/...My house claim is at Punalau. My right of occupancy is from the time of Kamehameha I."

"Kailiuku, sworn, says he knows the land claimed by Kupihea. There is one patch in Kahuku and one in Punalau...The patch in Punalau has not been cultivated for a long time. Claimant has no kula land, - he had no House Lot, but lived with some

friend. He held the kalo patch in Kahuku several years. He left Kahuku some months ago and gave his land to Kiha.
The Konohiki consented to this claim." (Foreign Testimony v.10:181)

9. Claimant Maulua (LCA 2771 - unawarded)
"I, Maulua, hereby state my claim for land at Punalau. There are two lo'i, bounded on the north by Kupihea's /land/, on the east by Kaopupahi's /land/, on the south by kula land, on the west by a kula. There are a fish pond /named/ Puekahi, a kula land, and a mountain /land/ and a shore land...My house claim is at Punalau, bounded on the north by the sea, on the east by a pond, on the south by the kula, on the west by a row of hala. My right of occupancy is from the time of Kamehameha III." (Native Register v.3:629)

"Kiha, sworn, says he knows the 2 kalo patches claimed by Maulua in Punalau. One of them is a Koele and belongs to the Konohiki, and the cultivation of the other has been abandoned. The cultivation of the kula land mentioned has been abandoned.
Claimant has no House Lot - he lives with some one else.
The Konohiki claims all the land mentioned in this claim." (Foreign Testimony v.10:182)

Kahuku Ahupuaa

1. Claimant Kauihawale (LCA 2928:2)
"I, Kauihaiwale, hereby state my claim for land at Kahuku... a salt land, and one koa canoe tree. My houselot is at Kahuku, bounded on the north by a mala of wauke, on the east by a taro lo'i, on the south and west by a kula.
My right of occupancy is from the reign of Kamehameha III." (Native Register v.3:697)

"...Claimant's House site is distinct from his land, and is not enclosed....
The Konohiki consented to the claim for...a House Lot." (Foreign Testimony v.10:168)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south-western angle
and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " . This parcel is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 251)

2. Claimant Umeume (LCA 2679:2)
"I, Umeume, hereby state my claim for land at Kahuku...Here at Kahuku is a puna pa'akai /brackish spring?/ and my two hala trees. My houselot is here in Kahuku. Its boundaries are surrounded by kula." (Native Register v.3:2679)

"...Claimant's House Lot is distinct from his land, and is enclosed with a wooden fence...He has held his land in Kahu-

ku for over 15 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:174)

Translated survey boundaries are:
"Houselot. Commence at North West angle and
run East 230 links along a Road
then South 110 " " Konohiki
then West 230 " " same
then North 110 " " same to the point of Commencement.
Area ¼ acre." (Survey Notes RP 259)

3. Claimant Malailua (LCA 2775:2)
"I, Malailua, hereby state my claim for land at Kahuku...A row /or cluster/ of hala trees is at Amo, at Luahine...A salt land is at Luahine. My house claim is here in Kahuku, bounded on the north by a land fence, on the east, south and west by a hala grove. My right of occupancy was from the time of Kamehameha II." (Native Register v.3:630)

"...Claimant's House site is distinct from his land and is not enclosed.
He has held the land for over twenty years...
The Konohiki of Kahuku consented to this claim." (Foreign Testimony v.10:166)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the north angle
and run S. 68 E. 158 links along the stone wall
then S. 22 W. 158 "
then N. 68 W. 158 "
then N. 22 E. 158 " " " Konohiki's land to the
point of commencement. ¼ acre." (Survey Notes RP 534)

4. Claimant Waanui (LCA 2698:1,3)
"I, Waanui, hereby state my claim for land at Kahuku. The name of the mo'o is Puaakea, and I have two lo'i. On the north is Lokea's, on the east is Kailiuku's, on the south is Kaukaha's land, on the west is Napoe's land.
My right of occupancy is from Kamehameha III." (Native Register v.3:595-6)

"Kailiuku, Sworn, says he knows the two kalo patches claimed by Waanui in Kahuku.
They are bounded on Hauula side by Pahanui's land, - Mauka by Kaukaha's land, - Waialua side by Hea's land, - Makai by Puu's land.
...He has held the land in Kahuku for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"Parcel 1. 2 Taro Patches at Kahuku. Commence at the south angle and run N. 13 W. 71 links along the Konohiki land
then N. 81 E. 250 " " " " "
then S. 8 E. 74 "
then S. 81 W. 241 " " " " " .

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.18 acre...

"Parcel 3. Open flat lands. Commence at the south angle
and run N. 10 W. 160 links
then N. 77 E. 205 "
then S. 15 E. 170 "
then S. 80 W. 215 " ; it is surrounded by Konohiki
land. .32 acre." (Survey Notes RP 340)

5. Claimant Lokea (LCA 3809)
Waanui also assumes this claim as Lokea had passed away before it was completely processed and awarded.

"I, Lokea, am a claimant for land and kula at Puaakea, consisting of seven taro lo'i and the kula...My house is at Puaakea. My right of occupancy is from the time of Kamehameha I." (Native Register v.4:174)

"Kailiuku, sworn, says he knows the kalo land claimed by Lokea in Kahuku. There are 3 patches planted. They are bounded on Hauula side by Pahanui's land, - Mauka by Kaukaha's land, - Waialua side by Heea's land, - Makai by Puu's land. The kula land claimed by Lokea is nahelehele /overgrown with weeds - cs/. Claimant's House Lot has been abandoned. He held the land for about 12 years. He died the present year leaving his land to Waanui who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:165)

Translated survey boundaries are:
"3 Taro Patches. Commence at the south-western angle
and run N. 103 links along the Konohiki's land
then N. 81 E. 241 links along Waanui's land
then S. 8 E. 122 " " Kanahuna's land
then S. 85½ W. 256 " " Puu's land to the point of
commencement. .27 acre." (Survey Notes RP 334)

6. Claimant Holoaia (LCA 2706:2)
"Kailiuku, sworn, says he knows the kalo land of Holoaia in Kahuku...
Claimant's House site is near the sea side and is not enclosed.
Holoaia held the land for over ten years. He died recently, and his daughter Kaleikini is his Heir.
The Konohiki consented to this Claim." (Foreign Testimony v.10:186)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle
and run N. 10 W. 158 links
then N. 80 E. 158 "
then S. 10 E. 158 "
then S. 80 W. 158 " ; it is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 244)

7. Claimant Kaukaha (LCA 4341:2)
"I, Kaukaha, hereby state my claim for land in Kahuku...My house claim is at Kahuku. It is bounded on the north by the pasture and on the east, south and west by kula. My right of occupancy is from the time of Kamehameha I." (Native Re-

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gister v.4:266)

"Pahanui, Sworn says, he knows the kalo land of Clt. in Kahuku...
Claimant's House lot is makai of his land - not enclosed. He has held the land for over ten years.
The Konohiki consented to this claim." (Foreign Testimony v.11:320)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the south angle
and run N. 42 E. 165 links
then S. 54 E. 150 "
then S. 38 W. 143 "
then N. 61 W. 164 " along the stone wall; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 526)

8. Claimant Makilo (LCA 2779:2)
"I, Makilo, hereby state my claim for land at Kahuku...The kula land is Kuhiwa, also Hoahale. My right of occupancy is from the time of Kamehameha III." (Native Register v.3:632)

"...Claimant has also a piece of kula land fenced in. It is bounded on all sides by the Konohiki's land. It is planted with wauke, banana' &c. Claimant has held the land over 3 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:167)

Translated survey boundaries are:
"Open flat land. Commence at the south angle
and run N. 70 E. 190 links
then N. 5 W. 367 "
then S. 54 W. 310 "
then S. 23 E. 280 " ; it is surrounded by Konohiki land.
3/4 acre." (Survey Notes RP 530)

9. Claimant Nauluhao (LCA 3958:2)
"I, Nauluhao, hereby state my claim for land...My right of occupancy, to this day, is from the time of Kamehameha I. My house is at Kalimaloa..." (Native Register v.4:200)

"Kahikapu, sworn, says he knows the land claimed by Nauluhao in Kahuku...
Claimant's House site is in Kahuku, but it is distinct from the land. It is not enclosed. Claimant derived the land from his parents and has held it about 30 years.
The Konohiki consented to this claim." (Foreign Testimony v.10:151)

Translated survey boundaries are:
"Parcel 2. Houselot. Commence at the north-western angle
and run N. 84 E. 158 links along the stone wall
then S. 6 E. 158 "
then S. 84 W. 158 "
then N. 6 W. 158 " ; it is surrounded by Konohiki land.
¼ acre." (Survey Notes RP 254)

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10. Claimant Palu (LCA 2738:3)
"I, Palu, hereby state my claim for land in Kahuku...There is a salt land at Ahamau, a wauke garden and a row of hala trees. My houselot is at Kahuku, and is surrounded by kula.
My right of occupation is from the time of Kamehameha I." (Native Register v.3:614)

"...Claimant's House site is distinct from the land and is not enclosed. He held the land since the time of Kam. II.
Palu died about 2 years ago, leaving his land to his widow, Iheihei.
The Konohiki consented to the...House site." (Foreign Testimony v.10:183)

Translated survey boundaries are:
"Parcel 3. Houselot. Commence at the south-western angle
and run N. 158 links
then E. 158 "
then S. 158 "
then W. 158 " ; it is surrounded by Konohiki land. ¼ acre." (Survey Notes RP 518)

11. Claimant Luiki (LCA 2690:2)
"I, Luiki, hereby state my claim for land at Kahuku...My house claim is at Kahuku and is bounded on the north by the land fence, on the east by the weed grown kula, and likewise on the south, on the west, a kula.
The occupation of my claim has been from the time of Kamehameha I." (Native Register v.3:591-2)

"...Claimant's House site is distinct from the kalo land and is not enclosed. He derived the land from his ancestors who held from the time of Kam. I...
The Konohiki consented to this claim." (Foreign Testimony v.10:164)

Translated survey boundaries are:
"Houselot. Commence at south angle and run
N. 28 W. 200 links along the Konohiki's land
then S. 62 W. 125 " " " same
then S. 28 E. 200 " " " same
then N. 62 E. 125 " " " same to point of commencement. Area ¼ acre." (Survey Notes RP 339)

12. Claimant Kupau (LCA 2880:2)
Luiki /Luike/ also assumes this claim as Kupau had passed away before it was completely processed and awarded.

"I, Kupau, hereby state my claim for land at Kahuku...A kula land is planted in sweet potato, noni, sugar cane and banana. ..My right of occupancy is from the time of Kahahana." (Native Register v.3:675)

"...Claimant has a piece of cultivated kula land also. It is planted with wauke, bananas &c. It is bounded on Hauula side by a path, - on all the other sides by the Konohiki...
...Kupau has held the land in Kahuku since the time of

Kam. I. He died the present year, leaving his land to Luiki who now claims it.
The Konohiki consented to this claim." (Foreign Testimony v.10:164)

Translated survey boundaries are:
"Parcel 2. Open flatland. Commence at the south angle
and run N. 76 W. 115 links
then N. 20 E. 140 "
then S. 71 E. 100 "
then S. 12 W. 120 " ; it is surrounded by Konohiki land. .14 acre." (Survey Notes RP 338)

13. Claimant Kaohele (LCA 2861:1)
"I, Kaohele, hereby state my claim for land at Kahuku. The name of the mo'o is Lanahu. There are five lo'i bounded on the north by Kaihu's holua /a sliding place for sport/, on the other three sides by kula....
My right of occupancy is from the time of Kamehameha II." (Native Register v.3:667-8)

"Kailiuku, sworn, says he knows the land claimed by Kaohele in Kahuku. It consists of 5 kalo patches, in one piece, bounded on Hauula side by the Konohiki, - Mauka and Waialua side by kula land, - Makai by Makoli's land...Claimant has held the kalo land for over 20 years...
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

"Parcel 1. 5 taro patches. Commence at the north-south angle
and run S.25 E. 74 links along the Konohiki's land
then S.61 W. 132 " " Pakanaka's land
then S.27 E. 81 "
then N.76 E. 216 " " " "
then S.8½ E. 196 " " the Konohiki's land
then W.64 links
then N.57 W. 103 links
then S.12½ W. 90 "
then N.87 W. 84 "
then N. 2 E. 170 "
then S.70 W. 272 "
then N.35 W. 117 " along the Konohiki's land
then N. 5 E. 188 "
then N.42 E. 73 "
then S.57 E. 122 "
then S.74 E. 85 "
then N.15 E. 70 " along the Konohiki's land
then S.88 W. 122 " " Makole's land to the point of commencement. 1.36 acres." (Survey Notes RP 524)

NOTE: Kaohele's houselot (LCA 2861:1) adjoins the above-described taro patches. This houselot is listed under Punalau ahupuaa; see description for claimant #3.

14. Claimant Pakanaka (LCA 2744:1)
"I, Pakanaka, the konohiki of Oio, hereby state my claim for land...At Kahuku is one lo'i adjoining those of Kaihiholua

and Lonoopuakauila...
My right of occupation is from the time of Kamehameha I."
(Native Register v.3:617-8)

"Kailiuku, Sworn, says he knows the kalo patch claimed by Pakanaka in Kahuku.
It is bounded on Hauula side by the Konohiki, - Mauka and Waialua side by Kainalu's land, - Makai by Makole's land....
...He has held the patch in Kahuku ten years.
The Konohiki consented to the claim for one patch..."
(Foreign Testimony v.10:177)

15. Claimant Kapaiaala (LCA 2868:2)
"I, Kapaiaala, hereby state my claim for land at Kahuku...
My house claim also is surrounded by kula." (Native Register v.3:670)

"Kailiuku, sworn, says he knows the land claimed by Kapaiaala in Kahuku...The House site of claimant is distinct from his land. It is not enclosed. Claimant has held the land for 20 years or more.
The Konohiki consented to this claim." (Foreign Testimony v.10:153)

Translated survey boundaries are:
"Houselot. ¼ acre.
N. 20 E. 158 links along the Konohiki's land
S. 70 E. 158 links " " " "
S. 20 W. 158 links " " " "
N. 70 W. 158 links " " " "." (Survey Notes RP 531)

RECOMMENDATIONS

Additional research hours should be expended in locating more references, specific in nature, that will serve to expand what has been presented both mythologically and historically.

Land records relating to individual awards need to be analyzed and a sketch mapping land use should be drafted from the raw data presented herein.

Early government correspondence and court records relative to land-owners and lands within project boundaries should be examined for new historical and cultural material.

Finally, a cohesive narrative utilizing available data should be developed; this final report should be fairly comprehensive and well-documented.

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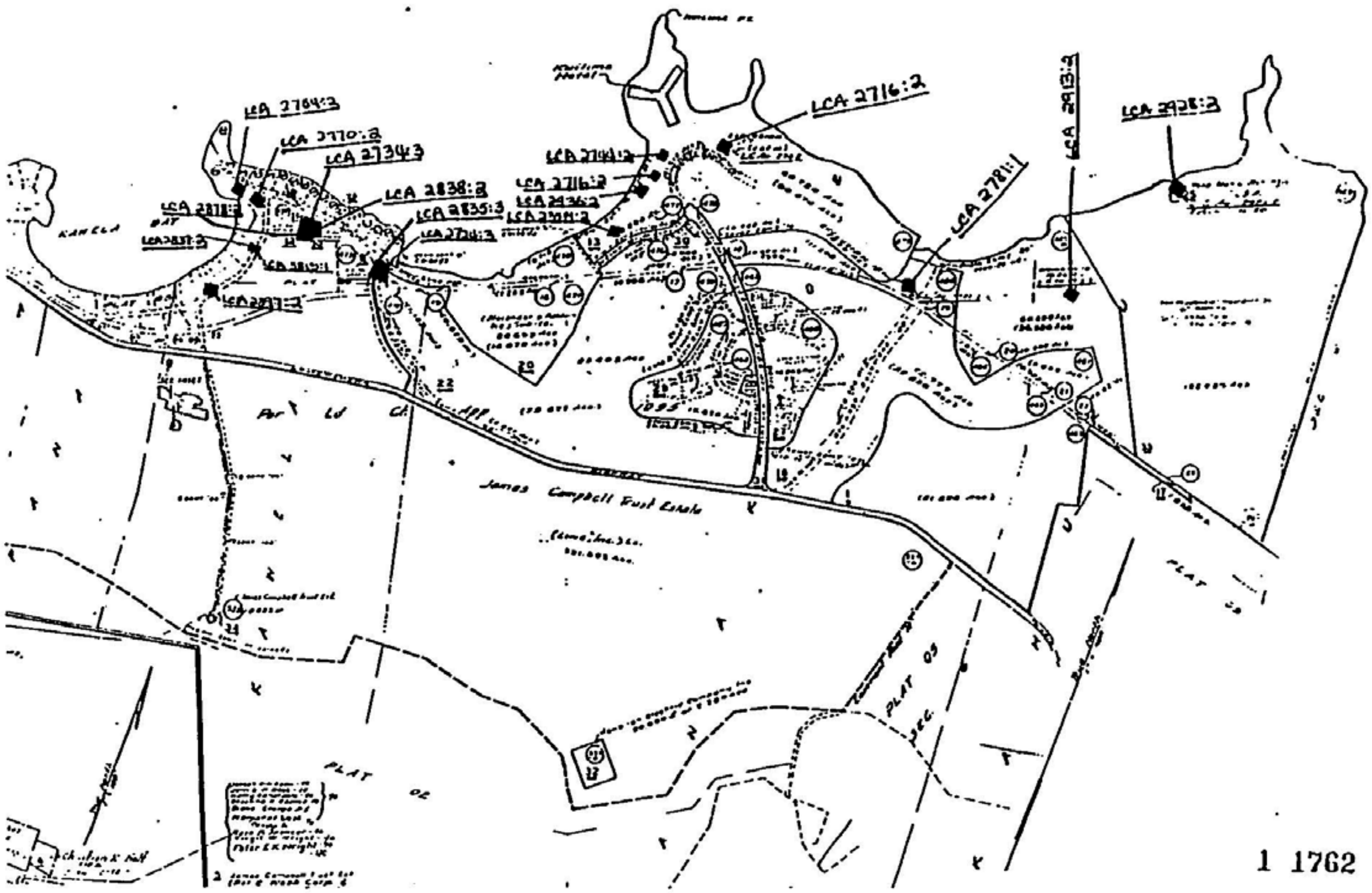
Figure 16.

TAX MAP AND LAND COMMISSION AWARDS (LCA):
KAWELA BAY TO KAHUKU POINT

137-100784



C-42

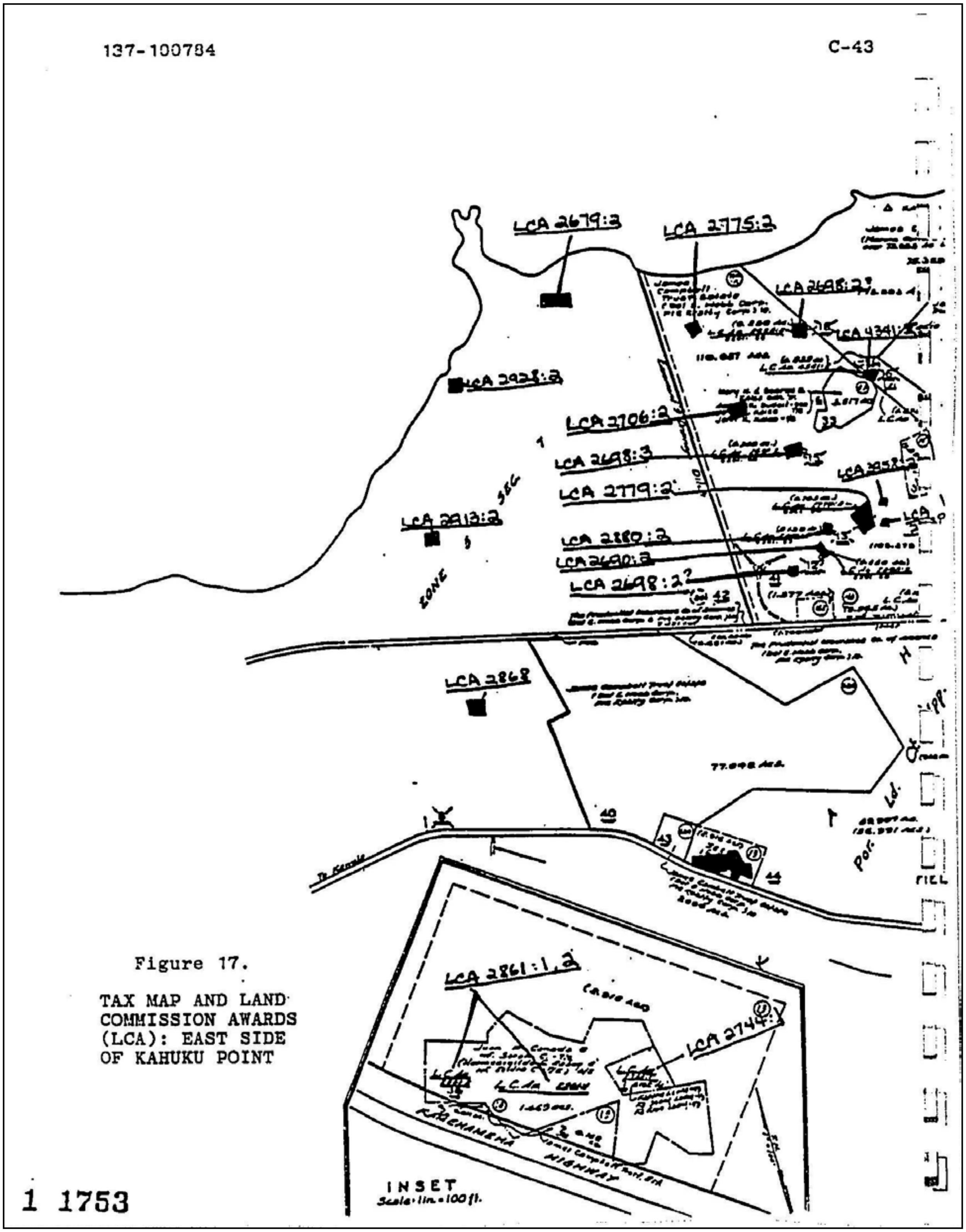
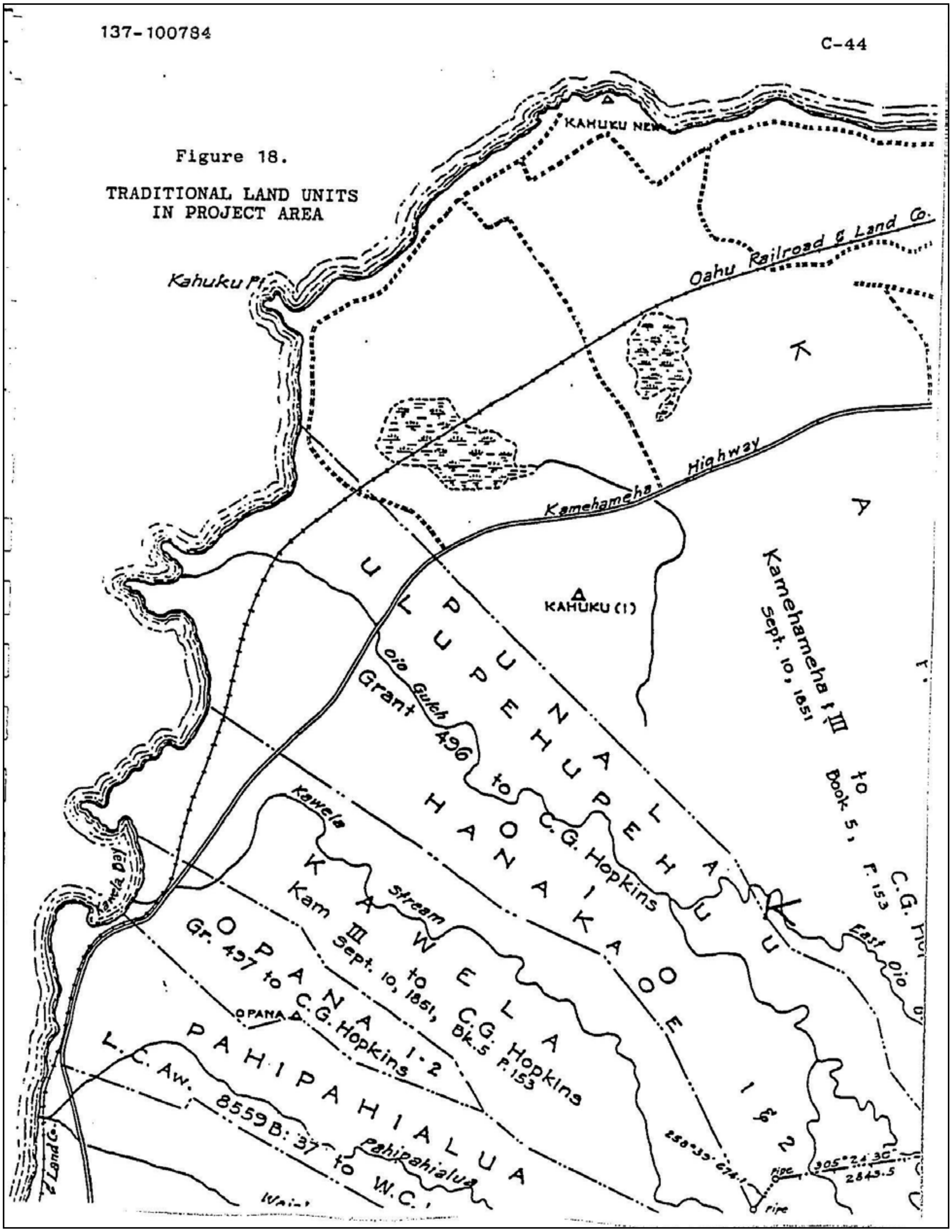
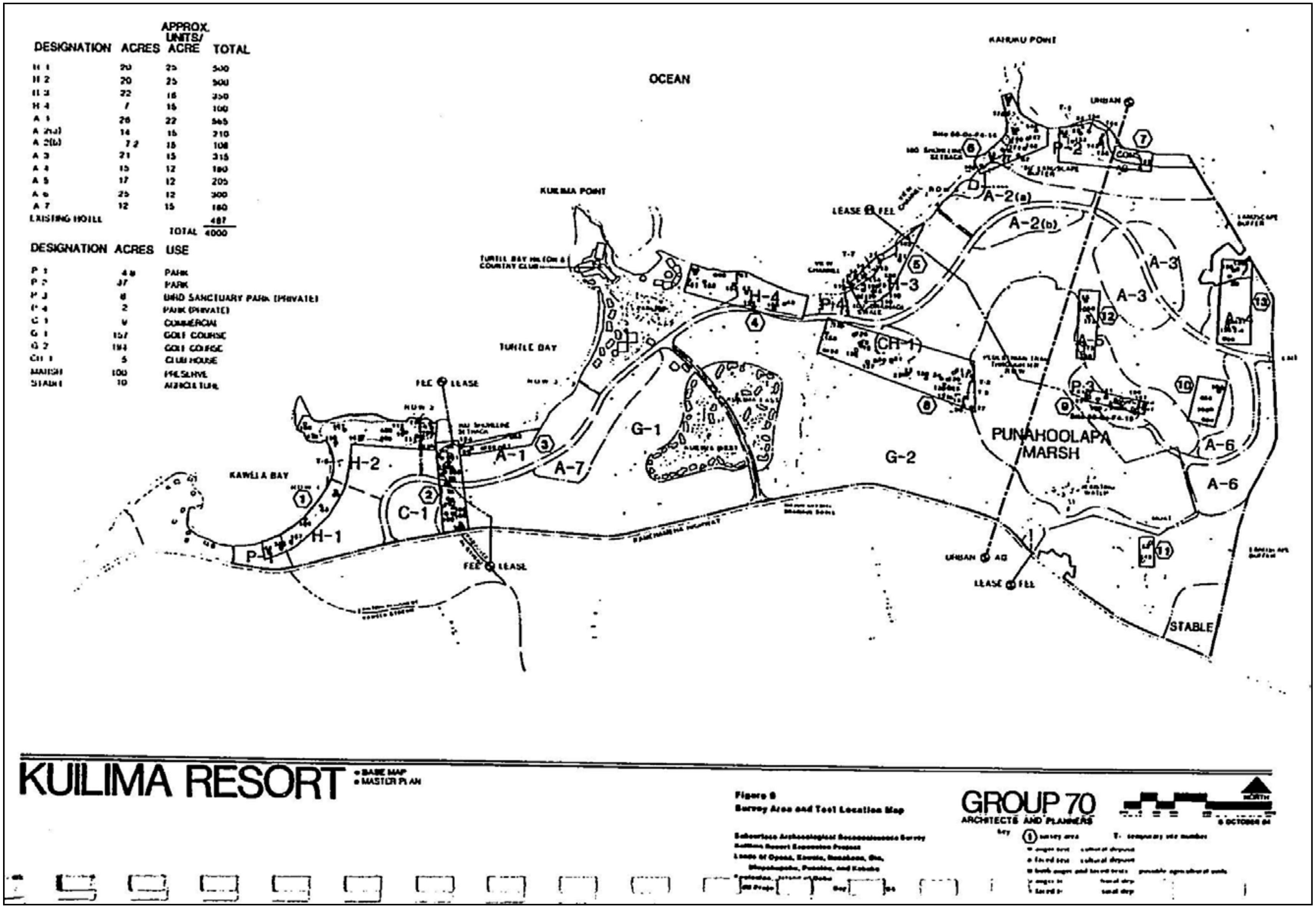


Figure 17.

TAX MAP AND LAND COMMISSION AWARDS (LCA): EAST SIDE OF KAHUKU POINT


137-100784
C-44
Figure 18.
TRADITIONAL LAND UNITS
IN PROJECT AREA
Kahuku Pt.
KAHUKU NEW
Oahu Railroad & Land Co.
K
A
Kamehameha Highway
KAHUKU (1)
Kamehameha III
Sept. 10, 1851
to
Book 5, P. 153
C.G. Hopkins
ULUPEHUPEHAU
PUNALAU
Oio Gulch
Grant 496 to C.G. Hopkins
HANAKAOE
Kawela Stream
KAWELA
Kam III to C.G. Hopkins
Sept. 10, 1851, Bk.5 P.153
Kawela Bay
OPANA
Gr. 497 to C.G. Hopkins
OPANA 1·2
PAHIPAHIALUA
L.C. Aw. 8559B: 37 to W.C.
Pahipahialua
East Oio
Pipe
305°24'30"
2843.5


DESIGNATION ACRES APPROX. UNITS/ ACRE TOTAL
H 1 20 25 500
H 2 20 25 500
H 3 22 16 350
H 4 7 15 100
A 1 26 22 565
A 2(a) 14 15 210
A 2(b) 7.2 15 108
A 3 21 15 315
A 4 15 12 180
A 5 17 12 205
A 6 25 12 300
A 7 12 15 180
EXISTING HOTEL 487
TOTAL 4000
DESIGNATION ACRES USE
P 1 4.8 PARK
P 2 37 PARK
P 3 8 BIRD SANCTUARY PARK (PRIVATE)
P 4 2 PARK (PRIVATE)
C 1 9 COMMERCIAL
G 1 157 GOLF COURSE
G 2 194 GOLF COURSE
CH 1 5 CLUB HOUSE
MARSH 100 PRESERVE
STABLE 10 AGRICULTURE
OCEAN
KAHUKU POINT
KUILIMA POINT
TURTLE BAY
KAWELA BAY
PUNAHOOLAPA MARSH
STABLE
URBAN
AG
LEASE
FEE
H-1
H-2
H-3
H-4
A-1
A-2(a)
A-2(b)
A-3
A-5
A-6
A-7
C-1
CH-1
G-1
G-2
P-1
P-2
P-3
P-4
KUILIMA RESORT
• BASE MAP
• MASTER PLAN
Figure 6
Survey Area and Test Location Map
GROUP 70
ARCHITECTS AND PLANNERS

483-040489

APPENDIX A:

PRELIMINARY HISTORICAL DOCUMENTARY RESEARCH
PUNAMANO AND MALAEKAHANA GOLF COURSES
LAND OF KAHUKU, ISLAND OF O'AHU

by Helen Wong Smith, B.A.

The following presents the findings of a preliminary historical literature search in connection with the five ahupua'a in which the project area is situated. The ahupua'a are Ulupehupehu, Punalau, Kahuku, Malaekahana, and Laie. There is some disagreement as to whether the South project area extends into Laie ahupua'a; however, according to the USGS map, it does, and for this reason a few references to Laie are included within this study. Preliminary historical documentary research on the lands of Opana, Kawela, Hanakaoe, Oio, Ulupehupehu, Punalau and Kahuku, Koolauloa, Island of Oahu was conducted by Carol L. Silva in 1984. Much of Silva's findings on the ahupua'a of Kahuku are presented in this report; in regard to Kahuku, the author has merely attempted to expand on Silva's work.

MYTHOLOGY

Kahuku is an ahupua'a rich with legends, ranging from legends of its one-time separation from the island of Oahu, to legends concerning its hala groves. The following legends are presented here in order to give an indication of how Kahuku was perceived by the ancient Hawaiians.

The natives of the windward side of Oahu, where Kahuku is located, relate a legend that tells of how Kahuku, the northeast point of Oahu, drifted in from the sea and was caught by the people of the Koolauloa district by its two loko (landlocked body of water), and was drawn in to shore and made fast. In evidence thereof, the hollow sound of a section of Kahuku as one rides over the ground is mentioned, and the coastal character of an alleged ancient shore now far inland is referred to as conclusive proof (Thrum 1902:178).

An important legend about Kahuku, similar to the one above, tells how its shore area to the middle of Waialee once formed a small island that floated separate from Oahu at the mercy of strong north to northeast winds. The island had been struck apart from Oahu by Lonokaeho, leaving an open gap at Kalaiokahipa Ridge, now located a mile inland, and leaving the Kahuku plain under water so that ocean waves lapped about Kalaiokahipa.

In reference to these legends concerning Kahuku as an island and Kahuku Plain as submerged, geologists verify that ancient coral reefs are found inland and that a white lime soil covers the flats near the sea (Wilcox 1975). In addition, while touring Oahu in 1928, Levi Chamberlain recorded this tale which gives us more insight into the nature of the land:

> The natives tell a marvellous story respecting the origin of this destrict [sic], which they say floated in from the sea, and attached itself to the ancient shore of the island, that there was a subterranean communication between the sea and the ancient shore, by which a shark used to pass, and make depredations up on land. The basis of the tract, which is from five to seven miles in length, and from one to two miles in breadth, appears to be of coral; and it was evidently redeemed from the sea, as a good deal of land, in many places along the shore around the whole circuit of the island, evidently has been (Chamberlain 1957:35-6).

McAllister (1933) tells another tale of the time when Kahuku was submerged:

> Kane and Kanaloa lived in the vicinity of the ridge (Kalaiokahipa ridge); but that was at the time when the Kahuku plain was still under water, and waves lapped about Kalaiokahipa. The brothers are said to have obtained fish by dipping into two holes on opposite sides of a large rock which now lies in the cane field (Sterling and Summers 1978).

There are many stories which explain the linking of Kahuku to Oahu. Here are two:

> Legend tells us that Kahuku was a floating island situated several miles out to sea. For a long time, the people of O'ahu had planned to make the island a part of their land, for they saw it come close to O'ahu's shores. The floating island of the Menehune did not have any fresh-water springs because there were no high mountains covered with verdure and trees to capture the rains. So, the Little Folk used to paddle their islet into the bays of O'ahu at night to haul water from the springs of the large island.
>
> One day, a resident of Kahuku suggested that all the people gather together to make strong hooks of whalebone and attach then to a stout rope made of sacred Olona fibres. This was done.
>
> The Menehune came to take water as usual, then the residents of O'ahu attached the large hooks to the floating isle while the Little Folk were off at the water-springs. When the water was loaded, the Menehune started to paddle off again, but they could not move their islet or free it from the ivory hooks and Olona ropes.
>
> Today, many people who travel Kahuku section on O'ahu and see the many islets seeming to float off shore, and hear the sea singing its songs, they say, 'Listen to the Menehune grumbling while they try to move their island that used to float!'

> The rumbling and grumbling is heard only at night, for that is the time for the Menehune to be working at Kahuku (Paki 1972:53).

Kamakau's version of the story gives a totally different perspective to the joining of the two land masses. According to him, it was Oahu that did the floating:

> According to traditions of some people, Oahu was said to have once been a floating land, <u>he 'aina lewa o Oahu</u>. The Kahuku side was a wide open gap (puka hamama) and this was called <u>Ka puka o Kahipa a me Nawaiuolewa</u>, "The opening of Kahipa and Nawaiuolewa." The piece of land that closed it up was called Kahuku, and the hooks that made fast the piece of land and joined it to the island were called Kilou and Polou (Kamakau 1974:38-9).

Kalaiokahipa Ridge, within the project area in the <u>ahupua'a</u> of Kahuku, is rich with its own legends. You will notice in the following legends concerning Kalaiokahipa that there is non-concurrence as to the gender of the characters in the legends. The following references concerning Kalaiokahipa Ridge are found in Sterling and Summers (1978):

> Nawai-o-lewa is on the northwest side of the rocky brow of Kalaeokihipa and now only one breast is left to move in the gusty winds of Kahuku-lewa. The other was broken off by that supernatural son of Ku and Hina...Between Kalaeokahipa and Nawaiuolewa, just above is a small round opening to a secret cave...The small secret cave belonged to Ka-alae-huapi (Red head mud hen) and others in the first Kahuku that was covered by a hala grove (J.K. Apuakehau, Kuokoa, June 29, 1922).

> The many caves in the porous formation were used as places of burial by the old Hawaiians. On the Waimea side is an overhanging ledge where formerly hung two stalactites from which water continually dripped. They very closely resembled the breasts of a woman, and this was said to be Nawaiolewa, a goddess of the region. Some years ago, a white man removed one of the stalactites, or breasts, according to the story, and the water immediately stopped dripping down from the other (McAllister 1933).

> It is here that the breasts of Lewa were set asway at the brow of the cliff Kahipa (J.A. Kahiona, <u>Oahu Places</u>, Kuakoa, Nov. 28, 1919).

> The Hole of Kahipa and Nawaiuolewa is pointed out today but the story is lost. Kanui, a woman 105 years old, told Mary Pukui that the two were brother and sister. In order to make it one, the two sat down and hooked their fingers together and drew the islands together. The hole marks the place where they sat (Kamakau Part II, Moolelo o Hawaii, Note 4, Chap 12; IN Sterling and Summers 1978).

Kahipa, said to be the name of a mythological character, now applied to a place in Kahuku where the mountains present the form of two female breasts.

Kahipa, na waiu olewa	Kahipa with pendulous breasts
Lele ana, ku ka mahiki akea	How they swing to and fro

(Emerson, Unwritten Literature, p.205).

On Nov. 28, 1919, the newspaper Kuokoa published this item (concerning the hooks [loko]) by J.A. Kahiona:

> It was a land that moved to and fro and it was Maui who pinned it down again. Polou and Kalou are deep water holes...All of the islands know the tale that Kahuku was an unstable land (Sterling and Summers 1978).

These water holes are mentioned in the creation myth of the sacred princess, Laiekawai:

> Kahuku district, according to legend, was once a floating island blown about by the winds. As it banged against Oahu, it made noises which disturbed the old women guarding the Princess Laiekawai. The old women grappled the island with fishhooks and attached it securely to Oahu. Polou pool on the sea side of the Kahuku mill is one spot where the hook was fastened. The other end was fastened at Kukio pond, 300 feet inland at Kahuku Point (Boswell 1958:68).

It is through Kamakau and others that we learn of Kahuku's various underground structures and their connections:

> There is only one famous hiding cave, ana huna, on Oahu. It is Pokukaina. The opening on Kalaeoka'o'io that faces toward Ka'a'awa is believed to be in the pali of Kanehoalani, between Kualoa and Ka'a'awa, and the second opening is at the spring Ka'ahu'ula-punawai. This is a burial cave for chiefs, and much wealth was hidden away there with the chiefs of old. On the Kona side of the island the cave had three openings, one at Hailikulamanu--near the lower side of the cave of Koleana in Moanalua--another in Kalihi, and another in Pu'iwa. There was an opening at Waipahu, in Ewa, and another at Kahuku in Ko'olauloa. The mountain peak of Konahuanui was the highest point of the ridgepole of this burial cave "house," which sloped down toward Kahuku. Many stories tell of people going into it with kukui-nut torches in Kona and coming out at Kahuku. Within this cave are pools of water, streams, creeks, and decorations by the hand of man (hana kinohinoh'ia), and in some places there is level land (Kamakau 1974:38).

Two stones known as Kahoa in the water about 250 ft. from the

> beach just opposite from Kalaehila heiau, Kahuku Point. Many years ago a woman who lived on this beach was frequently seen to swim to these stones and disappear. At times she would be gone for as much as a week. Sometimes she was seen to put her clothes in a watertight calabash and swim away. When she returned she usually wore a kou lei. It was finally discovered that this was the entrance to another land, known as Ulukaa or Kahuna Moku (McAllister 1933).

Streams are said to connect Kahuku with Waipahu. In Olelo Noeau (1983), Pukui writes:

> Pukana wai o Kahuku. The water outlet of Kahuku.
>
> Refers to the outlet of an underground stream that once flowed from Kahuku to Waipahu, O'ahu (Pukui 1983:299)

T.G. Thrum, while touring the Kahuku area by train in the early 1900s, gives us the possible background to the proverb in Pukui.

> A kapa-beating log of peculiar sound, unlike any other known on the island, which was placed in its waters at the close of a kapa-making season to keep it smooth and free from cracks that would impart an impression to the cloth in its manufacture, was missed, and believing it to have been stolen, search was made all through the Koolau, Waialua and other districts till at last it was found in use at Waipahu. Recognizing it by its resonant tone, it was claimed by the searching owner, and right thereto by those in possession was vigorously maintained. To test the truth of ownership as claimed, the Ewa people accompanied the claimant back to Kahuku to visit the scene and witness a test of the underground stream theory. A bundle of ti leaves were gathered, which was wrapped together and consigned to the waters of Punahoolapa (makai of the present project area). In the course of a few days they were lost to sight, whereupon the party set out for Ewa, and after careful watching, as predicted, the bundle of ti leaves came forth on the bosom of the waters of the Waipahu stream. The kapa log was thereupon recognized as the rightful property of the Kahuku claimant (Thrum 1911:130).

Although one thinks of sugar and pineapple when one thinks of Kahuku, this was not always so. Both legendary and early historic references cite the hala groves of Kahuku.

> ...he flew to Kahuku and adorned his neck with wreaths of the pandanus fruit and his head with the flowers of sugar cane." [This showed that he had come from Kahuku] (Thrum 1912:100).
>
> This is the land of the hala tree..."I sent out word...among the people that there should be no one leaving here (Kahuku) for Waimea or Waialua who had not a wreath of hala-fruit..." (Cummins 1913:241-2).

...men from Kahuku were identified by leis of the orange hala fruit which they wore by order of their chief when they left their ahupua'a... (Wilcox 1975).

Halemano*, while attempting to win back the attention of his wife, composes a chant (Elbert 1965:280-281):

A kukui au a Kahewahewa
Ku au nana i laila,
Haloiloi kuu waimaka e uwe,
Nani na hala ka oiwi o Kahuku,
I ka lawe a ka makani he mikioi.

As I reported to Kahewahewa
I stood and gazed, then
Tears filled my eyes causing me to weep.
How beautiful are the hala, native trees of Kahuku,
As they are being fanned by the Mikoioi wind

Kahuku hala is also mentioned in Emerson (1915:97-98), who relates a story of Hiiaka's trek to Kauai to bring back Lohiau for her sister Pele. Hiiaka encounters two rude creatures who refuse the goddess the slightest acknowledgment. Their discourtesy causes Hiiaka to compose a chant using a word play on "hala" which according to Emerson may be translated to mean "a fault, a sin".

Komo i ka nahele ulu hinalo
Nahele hala o Po'o-kaha-lulu;
Oia nahele hala maki o Kahuku
Heaha la ho'ika hala
I kapu ai o ka leo, e?
I Hookuli ai oe i ka uwalo, e?
E uwalo aku ana au;
Maloko mai oe, e!

We enter the fragrant groves,
Hala groves whose heads make a calm
Wild growths by the sea of Kahuku.
But what, indeed, are your halas?

---

*Halemano was a mortal who is credited with the evolution of hula. Born in Waianae, Oahu, he becomes "faultless in beauty" (Beckwith 1970:524). He marries the beauty of Puna, Kamalalawalu, who is sought by the chiefs of Puna and Hilo. While seeking refuge at the court of Kukuipahu, ruling chief of Kohala, Kamalalawalu leaves Halemano several times for a new lover. His sister, the sorceress Laenihi, suggests that he win her back by learning the hula. It is during this wooing that the above chant is relayed. Kamalalawalu returns to him only to find that now he is weary of her love.

Shall their murmur forbid you speech?
Make you dumb to my salutation?
I make this kindly entreaty
To you who sit in the grove.

Punamano is the name of a spring and swamp (makai of the project area) (Pukui 1974). McAllister (1933) provides some information on this spring and swamp:

> Small water hole, called Punamano, pointed out by Kahione, Kaleo, and Luika Kaio in the flat limestone plain of Kahuku Point. It is about 15 ft. in diameter and brackish in taste. My informants told this story:
>
> One time when the people of Kahuku were fishing they caught a small shark. Putting him in a calabash of water they carried him to their houses near the beach. Here he was cared for and put in larger and larger calabashes as he grew bigger. Finally having outgrown even the largest calabash that could be found, it was decided to place him in one of the pools of brackish water which came to be known as Punamano. A man and woman living near the pool became guardians. They had lived in their grass huts with a breadfruit tree near the pool and taro and potato patches near the mountains for several years when the brother of the woman came to live with them. Sometime after, the man and his wife went to the mountains to gather taro and potatoes. The brother, who was staying at home, thought that he would like to have some food prepared when his sister and her husband returned. He climbed the breadfruit tree and gathered several, throwing the fruit into the water instead of on the ground, where it would have been bruised in the fall. After picking enough for a few days he descended the tree and gathered most of the fruit from the bank. Two had floated to the middle of the pond and he could not reach them. Now this man knew of the shark that lived in the water, but he had frequently bathed in the pool and no thought of fear crossed his mind as he swam to the breadfruit. He did not know, however, that his sister had warned the shark not to allow anyone to steal breadfruit when they were gone. When the sister and her husband returned they could not find the brother. Neither was the shark to be found, but they saw the breadfruit floating in the pool and a reddish color to the water. They guessed what had occurred. For nearly a mile they followed the bloody trail until they came to the spring known as Punahoolapa. Not only was the brother never seen, but the shark has never been seen to this day. A plantation pump now marks the site of the spring, near the sea side of the road.

Another version by S. Kaupuu, recounted in the newspaper, Ka Hae Hawaii in 1861, portrays the brother as a thief, taking the breadfruit for his own needs. At the site of his own home, about 10 fathoms away, the spring had newly appeared, also reddened with his blood.

Thrum (1911:128) also mentions Punamano:

> ...water-holes of the district with certain of them furnishing catches of fish, but only on the nights of Kane. One called Punamano is famed for a shark-man's exploits, and another as having underground stream Ku's rock spring, a lone rock out upon the plain, distant from hill connections, which gives forth its trickling stream of pure spring water.

J.A. Kahiona gives us a version of the same story, placing the focus of the tale at Punahoolapa. He also portrays the shark as a sinister being who can change form at will.

> Nanahu-ka-mano was a pool in which a shark lived and Puna-hoolapa was the pit where he watched for men to eat to fill his stomach. He asked, "Where are you going?" "To the beach for sea weeds, sand crabs, papi crabs and shell fish." "The shark has not yet had his breakfast." When these passed on, he questioned others and told them the same thing that the shark has not yet breakfasted. He, himself was the shark he was talking about that had not eaten breakfast. The mouth of the rascal was on his back, a little below..." (Kuokoa 1919) (eligible for NRHP)

Two other sites in Kahuku ahupua'a, Kukio Pond, a natural basin filled with brackish water located about 300 ft from the sea, and Kaauhelemoa Fishpond, once located on the Waimea side of Kahuku, are mentioned by McAllister (1933).

> The pond (Kukio) was formerly much larger and contained many kinds of fish. It is said to have been surrounded by a large Hawaiian settlement. Mrs. John Kaleo is probably the only survivor and her former friends and relatives have been buried in shallow graves in the sand between the pond and the sea.
>
> Old fishpond known by the name of its guardian (mo'o), Kaauhelemoa, who was half man and half chicken, a being of supernatural power who could change himself at will into a man or chicken. The pond is said to have been fed by a spring. The area has now been turned into cane.

Another site, Waiapuka, situated just outside the South project area, is mentioned by Beck (1970:526) in relation to Laie-i-ka-wai (Laie in the water), mentioned earlier in this study, and her twin sister. The twin sisters were born at Laie on Oahu of Kahauokapaka the father, chief of the northern lands of the island, and Malaekahana. Kahauokapaka had made it known that he should bear a son before a daughter. So when Malaekahana gave birth to the twin daughters, she gave them to close relatives who hid the babies. Laieikawai was given to Waka, who first hid her in a cavern in Laie. Waiapuka pool has a small crevice which is said to open into the cavern where Laieikawai was hidden. The pool was described by McAllister (1933:156-157) as being oval in shape and measuring 30 feet by 60 feet. On Jackson's 1884 map of Laie (IN Bath 1985), a small pond labeled "Laieikawai" is shown on the grassy plain.

A final legend for the Laie-Malaekahana area, which ties mythology with occurrences during the post-contact years, is found in Yent and Estioko-Griffin's report on Malaekahana (1980:12):

> Manuwahi, the keeper of the gods at Laie, lived in a house at Malaekahana with his son and grandson, all three men possessing supernatural powers (Rice 1923:113). At this time, Malaekahana was the only part of Oahu not conquered by Kamehameha I. Kamehameha I had sent his bodyguard Ka-hala-iu with his bravest soldiers to conquer Malaekahana but during the first attempt, Manuwahi had deceived them. On the second attempt, Manuwahi summoned the help of the akua from the North, South, East and West and killed all the soldiers except Ka-hala-iu. Manuwahi sent him back to Kamehameha I who in turn, sent Ka-hala-iu back with more soldiers. This third attempt was again unsuccessful and Malaekahan was never subdued by Kamehameha I. Manuwahi spared Ka-hala-iu's life and Ka-hala-iu decided to stay and help Manuwahi clear the land and plant 'awa.

EARLY HISTORICAL ACCOUNTS

Two of the earliest voyager descriptions of the northwestern part of Oahu mention expanses of cultivated fields and well-inhabited communities. Cook's officers, who assumed command of his ships after his death, provide the following impressions:

> SUNDAY 28th. ...Run round the Northern Extreme of the Isle which terminates in a low Point rather projecting; off it lay a ledge of rocks extending a full Mile into the Sea, many of them above the surface of the Water; the Country in this neighbourhood is exceedingly fine and fertile; here is a large Village, in the midst of it is run up a high Pyramid doubtlessly part of a Morai. I stood into a Bay just to the Westward of this point the Eastern Shore of which was far the most beautifull [sic] Country we have as yet seen among these Isles, here was a fine expanse of Low Land bounteously cloath'd with Verdure, on which were situate many large Villages and extensive plantations; at the Water side it terminated in a fine sloping, sandy Beach...(Clerk IN Beaglehole 1967:I:572).

> WOA'HOO We saw this Island the beginning of last year, but only just as a high lump, We this Time sailed along its NE & NW sides but say nothing of the Southern part. What we did see of this Island was by far the most beautiful country of any in the Groupe; particularly the Neck that Stretches to the Northward and its NW side. Nothing could exceed the verdure of the hills, nor the Variety which the face of the Country dispaly'd. It /s north-eastern/ parts were cliffy, & rugg'd to

the Sea side, but the Valley look'd exceedingly pleasant, near the N point we were charmed with the narrow border full of Villages, & the Moderate hills that rose behind them...(King IN Beaglehole 1967:I:610).

In 1794, British captain, George Vancouver, says of Kahuku and the surrounding territory:

> Our examination confirmed the remark of Capt. King excepting that in point of cultivation or fertility, the country did not appear in so flourishing a state, nor to have been at that time, occasioned most probably by the constant hostilities that had existed since that period (Vancouver 1798(3):71).

Besides constant hostilities, a probable reason for a decline in the population of Kahuku and thus decline in cultivation was what one author has called the "devastating scourge of Western diseases" (Lind 1938:40). Venereal disease was introduced at the island of Niihau by the Cook expedition in January 1778 (Kuykendall 1938:14-15). Captain King, on Cook's third voyage, was shocked by its rapid spread in Hawaii between this first contact and the second contact later that same year (Beaglehole 1967:498). Depopulation was general by the time Vancouver returned to the islands in 1792, 1793, and 1794. Kahuku, being at the north point of the Oahu, may have been seriously affected by the disease. Between 1778 and 1823, when the first missionaries compiled estimates of the Hawaiian population, the population had declined from an estimated 300,000 persons to 134,925 (Schmitt 1968:10).

This population decline had severe repercussions. A missionary census (Schmitt 1973) shows a Laie population of 452 in 1831, out of a total Koolau population of 2,891. It is noted that a population loss of 210 for the entire district occurred between 1831 and 1835. In 1838, Hall makes the general statement in regard to Koolauloa: "Much taro land now lies waste, because the diminished population of the district does not require its cultivation" (McAllister 1933:153).

E.S. Craighill Handy (1940:156) notes that, although taro was cultivated at Kahuku, "sweet potato was the primary food in most of the districts of this section...". Handy (1972:287) mentions clusters of houses encircling the small bays along the windward coast at Laie, Kahana, Kaneohe, and Kailua. It is probable that Malaekahana conformed to this coastal pattern but with a smaller population than Laie (Yent and Estioko-Griffin 1980:16). Handy (1940:88) also mentions agriculture in lands <u>mauka</u> of the project site:

> Inland from Kahuku ranch house in Kaainapele Spring. Terrace symbols are shown south of the ranch house, but Judge Rathburn says that there flats were built by Chinese before 1890 for rice paddies. They were irrigated with artesian water, but the water turned brackish and the paddies were abandoned. They were never used for taro. The 1917 map show extensive terrace

> areas in the swampland seaward of Oahu Railway, stretching 1.5 miles south of Kukio Pond. These were originally terraces, were later planted to rice, and are now under sugar cane. According to John Kaleo, there is a small group of terraces up Kahuku Stream or Kaohiaae, its upland branch. Kaleo knew the names of 11 localities where terraces were formerly cultivated.

In Malaekahana ahupua'a, Handy states that there were terraces that were irrigated by Kaukanalaau Stream (1940:89).

In 1828, missionary Levi Chamberlain completed his second circuit of the island of Oahu, during which he had examined students and had generally evaluated the effectiveness of teachers and education upon the native populace. His remarks demonstrate that within Kahuku at that time there still existed a viable and fairly progressive community (Chamberlain 1957:35-6).

> Tuesday Feb. 5th. After breakfast I examined two schools, belonging to *Laie & Malaekahana*, and was pleased with the appearance of the scholars. At a quarter before 11 A.M. we set out for Kahuku, and after travelling about two hours over a level sandy country, arrived at the school house, where we found 83 scholars assembled, waiting to be examined...A good hog had been cooked for us & when the examination closed, dinner was waiting...my attendants made a heartly meal; and the remainder of the food was placed in the calabashes of our natives, and carried along to furnish food for us when we should be again in need.

LAND USE CHANGES

In 1848, the Mahele, in which Kamehameha III relinquished absolute ownership of all lands, drastically changed the land tenure system in Hawaii. Individuals were given a chance to register legal verifiable claims to their house and agricultural plots. The land that the king received as a result of the Mahele, after the division with the 245 konohiki (high-ranking chiefs) was concluded, was divided into two parts. One part was reserved for the kings and came to be called "Crown lands," while the other part was given over to the Hawaiian government and came to be called "Government lands" (Kuykendall 1938:288-289). As part of Crown Lands, the king (under the name of Victoria Kamamalu) retained the entire ahupua'a of Kahuku, excepting the rights of the native tenants. This amounted to 4,752 acres (Indices 1929:27-8).

The ahupua'a of Malaekahana was awarded to A. Keohokalole, the mother of King Kalakaua, Queen Liliuokalani, Miriam Likelike Cleghorn, and William Pitt Leleiohoku. The 3,280 acres that constituted Malaekahana were parceled out in the following manner during the Mahele (names are tenants who retained the right to cultivate the alii's land):

483-040489

LCA	Acreage	Awardee	Book	Page
8452	3280	Keohokalole	10	414
8355	.55	Kakau	4	680
8537	.38	Kahawaii	6	14
3870	.22	Puu	6	15
7727	.13	Paukoa	6	15

Three testimonies are given here to give an indication of the agricultural practices in Malaekahana:

> LCA 8537 AWARDEE Kahawaii (Deceased) - Kuhapa, sworn, says he knows the land claimed by Kahawaii in Malaekahana. Part of it is planted in wauke. This part is bounded on all sides by the Konohiki's lands. The house site of claimant is not enclosed. Claimant held land from his youth. He died last April (1840). His wife is his heir. Paakahi, sworn, says he knows of 3 kalo patches claimed by Kahawaii in Laie. The Konohiki took this land away because claimant did not got he poalima. The konohiki of Malaekahana consented to this claim.

> LCA 7727 AWARDEE Paukoa (Deceased) - Kuhapa, sworn,...in Malaekahana. Part of it has been given up to the Konohiki by claimant's widow. The portion retained by her is planted with wauke. It is bounded on the Hauula sideby Kahoowaha's land, Mauka by Kuhapa's land, Waialua side by Kananui''sland, makai by Nawai's land. Paukoa died in the present year.

> LCA 8355 AWARDEE Kakau - ...is not presently cultivated. Part of it was planted last year with bananas, wauke (about half an acre). Claimant occupied these lands since the time of Kamehameha I...

Ulupehupehu and Punalau, which the North project area barely overlaps, were considered part of the <u>ahupua'a</u> of Hanakaoe and were classified as Government lands during the Mahele (Indices 1929:41-43). A tally by Silva (1984) helps in assessing early land use in the following <u>ahupua'a</u>:

Ulupehupehu contained:

15+	kula plots and gardens planted with wauke, sweet potato, gourd, banana, sugar cane
7	koa canoe trees
2	cultivated upland plots planted with wauke, banana, orange trees
1	banana plantation
1	cluster of hala
1	houselot

Punalau contained:

10	taro patches
1	fish pond named Puekahi
10	kula plots and gardens planted w/sweet potato, banana, noni, ulu
4	cultivated upland plots
8	houselots
4	coconut trees
3	shore areas/fisheries
2	koa canoe trees

Kahuku contained

162	taro patches
39	kula plots & gardens planted w/awa, banana, wauke, gourd, sweet potato, sugar cane, noni, watermelon, pili grass
7	cluster of hala
6	salt lands
4	koa canoe trees
2	fishponds
10	houselots
1	sweet potato parch cultivated upon cliffs
1	watercourse bank
3	cultivated upland plots
1	brackish spring
1	wooded upland area of ulu, ohia, kukui, koa, ti,noni, etc...

Testimonies given for the above three ahupua'a can be found in Silva's report (1984:26-36). Bertell Davis (1981) notes that "...the only Land Commission Awards recorded in 1848 for this [general] region are located on the coastal plains (Indices 1929). With the exception of Crown Lands at Kawela and Kahuku, Government Lands at Hanakaoe...there are no Land Commission Awards in the uplands (Davis 1981:9).

The ahupua'a of Laie (6,194 acres) was awarded to King William C. Lunalilo. The Hawaiian historian John I'i (1959) recorded the succession of chiefly control in Laie after the battle of Nu'uanu in the last decade of the 1700s. Kamehameha I gave Laie ahupua'a to his half-brother Kalaimamahu. From Kalaimamahu, control passed to his daughter, Kekauluohi o Mano, and finally to his grandson, Lunalilo (Bath 1985:7). Laie ahupua'a too was subject to the rights of the tenants, and several kuleana were awarded to those who improved small areas for their own purposes. A look at the list of awards indicate that most of the claimants in Laie grew sweet potato and bananas and cultivated taro patches.

As a result of the Mahele, western entrepeneurs eventually acquired large tracts of Hawaiian lands; this later was to have a profound effect on the course of Hawaii's development (Walker 1986). R. Moffitt, an Irish cattleman, gained control of the konohiki land in Kahuku from the chief in 1846. (Nakamura [1981] dates Moffitt's purchases as late 1850s and early 1860s, which is probably more accurate.) His pastures extended along the shore for 12 miles and inland to the mountain range. His blooded herds and flocks ran over small homesteads scattered here and there through his land, stripping them of verdure. The Hawaiians asked in vain for protection of their (hala) trees and vegetable patches. They wrote to the missionary, Emerson, who urged them to build fences and appealed to authorities in their behalf asking that government pounds be set up to enforce newly established trespass laws. With the disappearance of their hala forests, the people also began to disappear. Once well populated, Kahuku became a lonely sheep and cattle ranch famous for its prize English breeds and its imported water fowl (Wilcox 1975).

In 1850-51, only three years after the Mahele, Englishman Charles Gordon Hopkins, agent for the rental and sale of the Crown lands (Korn 1958:208), purchased over 8,000 acres of Hawaiian lands, some from Moffitt and some in Malaekahana from A. Keohokalole, and founded Kahuku Ranch, a cattle and sheep ranch. In 1861, Laie was conveyed to Henry H. Howland. Other Englishmen who acquired large tracts of Kahuku lands at this time include R.C. Wyllie and H.A. Widemann. By 1873, Kahuku Ranch was owned solely by H.A. Widemann and included the ahupua'a of Kaunala, Pahipahialua, Opana 1 and 2, Kawela, Hanakaoe, Oio 1 and 2, Ulupehupehu, Punaluau, Kahuku, Malaekahana, Keana, and a part of Laie—a total of c. 15,000 ac. Previous archaeological surveys and Loebenstein's 1890 map of Kahuku Ranch indicate that scattered remains of the ranch have also been identified in the vicinity of Punahoolapa Marsh (Bath 1984:33,50; Davis 1986:7-8). In 1874, Kahuku Ranch, was renamed Kahuku and Malekahana Ranch, and was sold to Julius L. Richardson for $45,000 (Thayer 1934:138), and in 1876 Richardson sold the ranch for $63,000 to James Campbell (Wilcox 1975).

The following portion of a news article provides a brief overview of the particulars of Campbell's purchase:

> ...It includes 25,000 acres in fee simple, and large tracts of mountain land under long leases, with $34,000 worth of live stock, including 3,000 head of cattle, with the choice band of merino sheep and horses now on it. It is unquestionably the best stock ranch on these islands, and it has been brought to a high state of perfection under the management of the late proprietors, who divided the plain into ten or twelve large paddocks, walled with heavy stone walls. It stretches from Laie to Waimea, a distance of thirteen miles, and those who have ever visited it must have admired its lovely green pastures of manienie grass so fattening to stock. It is the intention to Mr. Campbell to increase his band of sheep to 30,000 of the choicest breed. The price paid is a handsome one, securing to its present proprietor the most desirable ranch on the Islands, and to Mr. Richardson a comfortable fortune, the result in part of his industry and good management, and in part of the Reciprocity Treaty, the first fruit from which he has been so fortunate as to reap... (Hawaiian Gazette 10/4/1876:3:2).

During the mid-19th century, the isolation of the Kahuku area from the city of Honolulu was being alleviated with the construction of roads. A description is provided by Kuykendall (1835:25):

> On Oahu, what came to be called the "round-the-island road"--ancestor of Kamehameha Highway--extended from Honolulu to Ewa, thence across the central plateau to Waialua; from that place it ran along the coast past Kahuku and Kualoa to Kaneohe, where it joined the road which came over the Nuuanu pali from Honolulu. In 1856, for the first time, a four-wheeled carriage drawn by a pair of horses was driven over the portion of this road between Honolulu and Kahuku. Three years later, a Captain Coffin is reported to have driven with a carriage and span of horses from Honolulu to Kahuku one day in ten hours and to have returned the following day in eight hours.

Campbell had a land colonization scheme to develop and acquired Ewa ranch lands. Meanwhile, Benjamin F. Dillingham spearheaded construction of a railway circling the island. Dillingham and Campbell found that they could best implement their goals by working together. Campbell leased his Kahuku lands to Dillingham for 50 years, the lease commencing Jan. 1, 1890 and concluding Dec. 31, 1939, at an annual rate of $50,000 (Kuykendall 1967:69). Dillingham sub-leased land and water rights to Castle (Liber 128:143), and Castle assigned the sublease to Kahuku Plantation Co., which was incorporated Jan. 30, 1890, to grow cane and produce sugar. Castle was the first president of the Kahuku Plantation Co. (Wilcox 1975).

At first, the plantation relied on pumped spring water, stream water, and rain to irrigate the sugarcane, but these sources were found to be insufficient. Thereafter, the company resorted to artesian wells, which came to be the main source of water (Kuykendall 1967:69).

For its first nine years Kahuku Plantation Co. relied on little coastal vessels which anchored offshore from Kahuku Landing to bring supplies and return raw sugar to Honolulu. Five miles of 36-inch gauge railway, some of it portable, had been laid in 1890 to haul the cane through the plantation fields to the Kahuku mill and thence to the landing. The plantation track extended south opposite Laie and the Mormon settlement, which sent its cane to be ground at Kahuku (Wilcox 1975).

The plantation's Manager's Report of Aug. 31, 1898 (in abbreviated form) is presented here:

> Planted last year...a total of 872 acres of cane--5200 tons of sugar could be expected. Besides these 5200 tons I expect 500 tons more of sugar from short ratoons, on 150 acres from the mauka portion of Malekahana, making crop total of 5700 tons; but then the 500 tons do not come in now, owing to change in rotation of crops caused by the flood, but will be made up in the two following crops as is shown hereafter. I had concluded to crop again, this year, the mauka portion of Malaekahana,

> about 150 acres, to come off next crop, together with field 4/10, by running this mauka portion of Malaekahana into short ratoons and after that raise it for long ratoons so as to bring this part of Malaekahana and field 4/10 into one cane field of about 500 acres. All to come of as long ratoons in 1900. Due to flood, prevented, and the mauka portion of Malaekahana a plant cane crop in 1900 and short ratoons in 1901. (Flood was March 27, Sunday) and for a while it looked as if there would be nothing left of the plantation but a few buildings...There was not a Government Road Bridge left in the district and our two Rail Road Bridges were carried away. Approximate Costs and Repairs of Damage done by Flood:
> Labor - $5,954.52; Railroad and Repair of Bridges: labor - $607.50, material - $392.61, manager - $1,000. Treasurer's Report: sold 4,140 tons at $71.24; Receipts $315,551.59; Expenses $311,370.86

In 1899, the Oahu Railway finally laid track to a terminal at Kahuku. It hauled sugar and the agricultural freight products back and forth across the windward part of Oahu. The Koolau Railway Co. laid tracks from Kahana to Kahuku and served as a common carrier until 1931. From then until the 1950s, its sole function was to carry cane from the northeastern field of the island (Hungerford 1963:77).

In 1900, Alexander & Baldwin, Ltd. (with Castle as its treasurer) became agent for Kahuku Plantation Co., which Castle still headed as president. In 1906, Castle sold his interest to A&B, which then became the largest stockholder, and Henry P. Baldwin, president of A&B, became president of Kahuku Plantation Co. (Wilcox 1975).

The Kahuku community flourished during its plantation day. The plantation's hospital was the only medical facility from Waialua to Kaneohe. The plantation pioneered concrete stoves for laborer's cottages and sanitation drains that were used as models for other plantations. The first plantation day nursery and high school were established by Kahuku Plantation Co. The town of Kahuku boasted the biggest baseball diamond and the first golf course. The company laboratories pioneered the carbonation of white raw sugar, using the native limestone around Kahuku for filter. The company devised the money-saving use of molasses as mill fuel. The company also discovered that night lighting of the fields prevented tasseling and increased sugar yield of cane (Wilcox 1975).

In 1916, the Kahuku Plantation Co. leased 171.5 acres of land to C. Okayama at a rate of ten dollars per acre, per year, for pineapple cultivation (Liber 443:364). Subsequently, the Oahu Railway & Land Co. leased land to several small individual pineapple growers; these growers, through signing "chattel mortgages," were obligated to sell their crops to Hawaiian Pineapple Co., Ltd; Libby, McNeill & Libby of Honolulu, Ltd; and California Packing Corporation. Eventually, large tracts of Kahuku land were leased to California Packing Corporation (later Del Monte Corp.); the Del Monte Corp in 1956 subleased nearly 200 acres in Kahuku to the United

States government, which wanted to use the land for a military training facility. In late 1956, Campbell Estate leased to the U.S. government over 3,000 acres of Kahuku land for military training activities which continue today. In the post-World War II period, sugar experienced fluctuations in value of sales (Schmitt 1977:165). The Kahuku Plantation Co. lasted for about 80 years, officially closing in 1971. A detailed history of the company can be found in the Honolulu Star Bulletin (October 19, 1935) (Nakamura 1981:11).

POST PLANTATION

What does one do with abandoned cane fields? An evaluation, "Kahuku Whole Plant Sugarcane Greenchop as a Ruminant Feedstuff," was conducted in 1973. The conclusion was that "although chopped sugarcane may have a slightly lower digestibility than pineapple greenchop, sugarcane contains considerably more dry matter on a fresh-chopped basis. Based on the results of this study, it can be concluded that chopped whole sugarcane plant from Kahuku is a fairly high quality fodder and should be at least equal to pineapple green chop on a fresh-chopped basis" (Olbrich, Koshi, and Wayman 1973).

Population densities in the Kahuku vicinity changed dramatically after the close of the plantation and is expected to continue changing. The Neighborhood Data Book filed these population trends during the 1970s:

> The population percentage increase between 1970-79 is more than double that for total Oahu for the same period. Predominately young; Filipino and Caucasian...Kamaainan in character...a majority of the residents have resided in Hawaii over 20 years...Over half of the households are below the Oahu median income and 3 out of 5 have incomes in the moderate-lower range. Housing units increased at a greater rate than Oahu's percentage housing units. Three-fourths of land is classified as agricultural and [is] predominately planned as agricultural and open space. Agricultural zoned lands are those with the capacity for intensive cultivation and a minimum lot size of one acre. It is regulated by the State Land Commission, but administered by the counties.

In 1975, the State of Hawaii began purchasing the ma kai acreage of Malaekahana from Campbell Estate for the development of Malaekahan a State Park. The areas that concern the project area are still used as ranch and pasture land. The South project area, which borders Malaekahana and Laie ahupua'a, contains small parcels that are leased to Cackle Fresh Egg Farms, Amorient Aquafarm Inc., and two businesses that run cattle on the lands.

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APPENDIX C

- PACIFIC LEGACY COMMUNICATION LOG - ORGANIZATIONS AND INDIVIDUALS CONTACTED
- KUIWALU CONSULTATION SUMMARY
- KUIWALU APPLICANT'S CONTACT LIST

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Ah Quin, Norland	Referred by Dawn Wasson	No contact info obtained
Ah Quin, Samuel	Grew up in Kahuku, brother of Deedee Aki, referred by Ralph Makaiau and Dawn Wasson	Requested contact info from KOOLAULOA NEIGHBORHOOD BOARD NO. 28 members 5/10/11; the Colburn s are neighbors of Sam and elected to talk with him about an interview 6/14/11; called phone number provided by Pua Colburn and the number has been disconnected;
Ah-Quin, William	Referred by Dawn Wasson	No contact info obtained
Ahuna, Gladys Pualoa "Auntie Gladys"	La'ie Community Association; Ko'olauloa Neighborhood Board; Hawaiian Civic Clubs; Lanihuli Hawaiian Civic Club, co-founder; family has lived in La'ie for seven generations	Sent letter to Lanihuli Hawaiian Civic Club address 5/10/11; sent another request letter 6/15/11; 6/10/11Aunty Gladys called the office, but her number was not recorded; letter resent to her to make contact 6/13/11; on 6/17/11 Aunty Gladys called my cell to make contact and left a message for me to call ; 6/17/11 called Aunty Gladys back and we set a date for 12 pm Wed. 6/22/11 to meet in La'ie for interview; Interviewed Aunty Gladys with Junior Primacio at Tita's Café in Kahuku 6/22/11 at 12pm;
Aki, Dee Dee	Grew up in Kahuku, sister of Sam Ahquin; referred by Ralph Makaiau	Requested contact info from KOOLAULOA NEIGHBORHOOD BOARD NO. 28 members 5/10/11
Ako, Buddy	Former. Resident of Kahuku and current TBR employee, familiar with sites	Requested contact info from KOOLAULOA NEIGHBORHOOD BOARD NO. 28 members 5/10/11; 8/22/11Got Uncle Buddy's phone numbers from Uncle Ralph Makaiau; Called Uncle Buddy and asked if he was interested in participating in an interview and he said yes – he thinks that other fishermen who are actually from the area should be interviewed as well, says he's going to coordinate a meeting with the other fishermen to do a joint interview

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Anamizu, Carol	Cultural practitioner who lived and farmed *ti* in adjacent lands to east (Anamizu Farms); also knowledgeable on Japanese Cemetery; referred by Dawn Chang and Ralph Makaiau	Sent letter to home address 5/10/11; found out from Ralph Makaiau that Carol was living on Molokai for some time, but came back to Oahu to care for an elderly relative who lives in Honolulu (staying at their residence in Honolulu); Pua Colburn did not have contact info for Carol; Called Ms. Anamizu 6/27/11 10 am and she was upset that I had been given the phone number reserved for family and patients – asked me to delete that phone number and call her on a different line later this evening; Called Aunty Carol again at 5:50pm and spoke with her about an interview, she said she would like to participate and that she is booked until the week of July 16th – asked me to call her again Monday of that week; 7/27/11 called Aunty Carol to set a date for an interview and she said she would not return to Oahu until the 10th of August and I said I would call her on the 12th or 15th to set a date; 8/22/11 spoke with Aunty Carol on the phone and she said that my persistence got me into her schedule and she would like to take me for a walk on the TBR premises to introduce me to the *la*ʻ*au* plants and salt collected by her and several others – she says that she would like to bring Aunty Pua along - will call me back when she gets a hold of Aunty Pua.; Talked to Aunty Carol and she says that she's sick and can't make it on Saturday, but would like me to come out to the project area for the *la*ʻ*au* plant collection and to attend the TBR development meeting with her; Interview with Aunty Carol at her house on 9/6/11; called Aunty Carol 9/20/11 to see if she was able to make it out to TBR on the weekend; 10/05/11 called – no answer, left message on machine; 10/27/11 called and talked to her daughter (not Joy) and she said she would be in Japan until the end of December, I asked if she could pass on my email address and to have her contact me to let me know if she had a chance to make it out to Kahuku for the *la*ʻ*au* plant pictures or if she thinks it will be possible to do so after she returns; the daughter said she would pass on info; called 1/10/12 and left a message on answering machine; called 1/30/12 and left another message on answering machine; 2/1/12 left another message on answering machine telling her that I could not add her info into report; 3/8/12 met with Aunty Carol at Turtle Bay so she could show me the locations of the *la*ʻ*au* and share their medicinal and traditional uses. Took pictures of some plants, but became too dark and rainy to continue taking pictures (was unable to record the uses as I was driving the golf cart and it was sprinkling the whole time). Aunty Carol said we could go over the details over the phone or at her house. As she was sick, she had to conclude the field trip early; 3/15/12 called Aunty Carol to see if she'd like to go over the *la*ʻ*au* uses, no answer – left message; 3/19/12 called Aunty Carol to see if she'd like to go over the *la*ʻ*au* uses, no answer – left message; 3/21/12 called Aunty Carol to see if she'd like to go over the *la*ʻ*au* uses, no answer – left message; 3/23/12 called Aunty Carol again, no answer – left message; called Aunty Carol's cell phone and spoke with her (bad connection – call kept getting dropped), she said she'd call back to set a time before the end of the day Monday 3/26/12; 4/11/12 an interview was conducted to summarize and conclude previous meetings with Aunty Carol; 4/13/12 meet with Aunty Carol to go over interview summary, she had some edit requests, ORF was signed with the agreement that I would make the edits to the interview summary prior to releasing the document for review
Au, Kawika	Aunty Betty Referred him to Corlyn Orr for North Shore 5yr Plan CIA	No contact info obtained
Deceased Awai, James	Lifelong Kahuku resident; family goes back for many generations in the Waialua District	called 11:30 am 5/2/11, wrong number; Requested contact info from KOOLAULOA NEIGHBORHOOD BOARD NO. 28 members 5/10/11; 5/11/11 were informed that Mr. Awai is <u>deceased</u> by Mike Lyons and Tomas Shirai Jr. of the KOOLAULOA NEIGHBORHOOD BOARD NO. 28
Awai-Lennox, Gladys "Honey"	Lifelong Kahuku resident; family goes back many generations in Waialua District; Wai\`alua Hawaiian Civic Club .	Sent letter to Wai\`alua Hawaiian Civic Club address 5/10/11; sent another request letter 6/15/11
Beirne-Keawe, Danielle Ululani	Ko\`olauloa Hawaiian Civic Club, President	Sent letter to Ko\`olauloa Hawaiian Civic Club address 5/10/11

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Bloomfield, Tinker	North Shore Kama`aina, worked in Waimea Valley (25+ yrs) 1978-2003	called 11:35 am 5/2/11, spoke with Ms. Bloomfield was given names and phone numbers of three potential informants: Bob Nakata, Margaret Primacio, and Mark Manley; advised me to attend; Ms. Bloomfield emailed me 6/2/11 the following: "My part-Hawaiian family living at Kawela is the 5th generation who has lived there, and fished there, to supplement our diet." On 6/3/11 I replied to ask if any of these family members would be interested in interviewing with me and she said she would ask and gave me more contact info for Mark Manley, Margaret Primacio, and the Mattoon's
Bridges, Cy	Cultural practitioner of North Shore; Kumu hula; Cultural Director at the Polynesian Cultural Center; resident of Hau`ula	During the phone conversation with Ms. Kela Miller, she asked C. Bridges if he knew of any cultural practitioners gathering materials in the TBR area (as they work in the same office) and he said he did not know of any currently practicing in the area
Chock, Al Keali'i	Adjunct UH Professor of Botany, Ethnobotany of Hawaii	emailed 5/2 2:35pm; Dr. Chock responded via email 5/5/11 3:08pm - Stated that he had no experience in Ko`olauloa District; Dr. Chock sent another email w/ reference to Ms. Katie Kamelamela Master's Defense: Contemporary Native Hawaiian Gathering Practices in Culturally Vibrant Communities; I replied w/ a thank you email 5/7/11
Colburn, John and Pua	Has kuleana land adjacent to project area; Kahuku Burial Committee; referred by Ralph Makaiau and Dawn Wasson	Requested contact info from KOOLAULOA NEIGHBORHOOD BOARD NO. 28 members 5/10/11; D. Wasson gave me the Colburn's phone number during interview 5/18/11; called the Colburn residence phone and reached Ms. Colburn 5/24/11; she said she had done several interviews and that she would like a letter outlining what the interview goals are and then she will call me; sent letter to PO Box address 5/24/11; Ms. Colburn called me at the office 1:15 pm 5/31/11 agreeing to participate in interview, set date for 6/10/11 at 10 am at the Colburn Residence; Called Aunty Pua to ask for contact information for Sam Ah Quin or any other Ah Quin family member, she gave me her latest phone #; called to touch base with the and make sure they know that I haven't forgotten about them and that I'd get resume the Turtle Bay project in a couple weeks; 10/05/11 called to check status, she says she has made some corrections and has to have Uncle John okay them, but he's in the hospital; 10/27/11 called to see what the status is on the summary and she said she's going to send the marked up copy asap; 11/15/12 called and spoke with Aunty Pua, she said she had made some edits to the summary and will send it soon; called 11/30/12 left a message on machine; called 1/6/12 and left a message on machine; called 1/6/12 and left a message on machine
Gemeno, Wayne	Born and Raised in North Shore (Waimea), has been fishing at TBR over 50 years; Member of North Shore Pole Benders & Waialua Casting Club (won many tournaments in area); family fishing here for generations	Approached Mr. Gemeno in the Public Beach Parking at TBR as he was loading his fishing gear into his truck; after a short discussion about his experiences fishing in the area, he agreed to be interviewed; called Wayne and spoke with him about sending him a summary of interview for his review and he agreed 7/27/11.
Cole, Doug	North Shore Community Land Trust, referred by Tim Tybuszewski	Emailed Doug Cole 6/2/11 requesting participation
Hee, Maka`io	Kahuku North Shore Health Center, healer	Called health center 5/2 2:45pm, not in, but will be in tomorrow; spoke with Mr. Hee 5/3 at 9:30am and he expressed his concerns about his practice and the lands of Ku'ilima; sent request letter 5/10/11 to the health center; called Mr. Hee to follow up on request letter and he was not available, receptionist said he may be on leave and gave me the Admin ph #; called Admin # no answer, no machine
Helemano, Butch	Na Hoa o Pu'u o Mahuka, member/volunteer; Hui Malama O Pupukea, member; Pupukea Marine Life Conservation Cultural Practitioner: Kahu, caretaker of ancient sites	Called home or cell number 5/10/11 11:00 am and left a message on machine; called number again 6/1/11 2:15 pm and left another message on machine; Mr. Helemano called office phone and spoke to me 6/1/11 @ 4:45pm, says he will be in Los Angeles until the 22 June, but would like to participate after his return; he requested that I send him an email outlining the goal of the interview and I agreed; 6/2/11 sent email outlining the goals of the CIA and my contact info; called 6/27/11 at 10:55 am and left a message; 7/28/11 received an email reply from B. Helemano apologizing for not getting back to me sooner, says he's been extremely busy – suggests that the best time to reach him for interviews is when he is teaching my Hawaiian class in Waimea Valley on Sundays; emailed Butch 8/22/11 to tell him I'd like to interview him this Sunday before or after his Hawaiian class at Waimea Valley – awaiting response; 8/22/11 later in the day got a response to my email saying that this Sunday would be perfect.

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Heron, Deedee	Regularly picked limu and fished around Turtle Bay; Referred to me by Tinker Bloomfield	No contact info obtained
Jenkins, Betty "Auntie"	Kumu/Kupuna: Hālau o Hale'iwa, co-founder; OHA, HIDOE, Hawaiian Studies Program, NHEC, Oahu Audubon Stewardship Board ; Active in North Shore, more in Waialea side	Called NHEC office and left message for Ms. Jenkins; Sent letter to home address 5/10/11; 5/14/11 letter returned "no mail receptacle"; called the home phone number and left a message on answering machine 5/18/11 10:50am; 6/1/11 11:24am called Aunty Betty and got through to her, she said that he is interested in participating, but would like to first attend a meeting regarding this issue later this week, she asked me to email her and send a letter to her mailing address; sent letter and email 6/1/11; sent another email 6/15/11
Jonathan Napela Center for Hawaiian and Pacific Studies	Possible knowledge of cultural practices and practitioners in TBR	Sent email 5/10/11; sent another email 6/2/11
Judd, Nanette PhD.	Fmr. director/instructor in, Imi Ho'ola post-BA program at UH, School of Medicine; Center of Excellence (NHCOE) Native Hawaiian dissertation was on la'au lapa'au	Called 5/2/11 2:05 pm - Dr. Judd is retired, so I was transferred to Mele Look (Waimanalo Health Center, Board of Directors).
Kahalewai, Sam	Born and raised in Haleiwa, has worked for and against TBR	6/14/11 Was given Mr. Kahalewai's contact info by Ku'iwalu (Shirlyn Hookano), who said he replied to the TBR notice posted in the newspaper by Ku'iwalu; 6/20/11 called Mr. Kahalewai to request an interview, but he declined due to health reasons – said he would be interested in sending info at a later date when he is feeling better
Kalua'u, Moana	Ko`olauloa Neighborhood Board, Treasurer	called 5/2/11 4:12 pm; Spoke with Moana - she referred me to the Kahuku Neighborhood Board and told me to ask for Didi (no last name provided); also to look into "Keep the Country Country"
Kaluhiokalani, Naomi	Referred by Dawn Wasson	No contact info obtained
Kaluhiokalani, Norman A.	Ko`olauloa Neighborhood Board, member	called 5/2/11 4:12 pm, left message on machine; Sent letter to home address 5/10/11; called home number 6/1/11 and left a message on machine; called business phone and it's no longer in service
Kaluhiokalani, Walter	Referred by Dawn Wasson	No contact info obtained
Kamelamela, Katie	MS Defense: Contemporary Native Hawaiian Gathering Practices in Culturally Vibrant Communities UHM Botany Department; referred by A. Chock	Emailed K. Kamelamela 6/2/11 to ask for participation in assessment; Ms. Kamelamela replied 6/2/11 at 5:21pm and stated that she did know of practitioners in the area, but said that she is busy and doesn't know if her contacts will be interested or have the time. I wrote back 6/3/11 requesting that she pass on my contact information to anyone who might be interested in participating
Kamauoha, Burke and Wanda	Referred by Dawn Wasson	Called phone number provided by Ms. Wasson and reached Burke Kamauoha; he said he was at work but agreed to have me send a request letter to his PO Box; sent letter to PO Box 5/24/11; called 6/1/11 @ 3pm, says he didn't get letter yet, but hasn't checked PO Box in a while, says he will look again for letter and call me when he gets it
Kapua, Charles	`Aha Moku, `Aha Ki'ole Advisory Committee (O`ahu); Cultural Practitioner: Mahi'ai and lawai'a, lei maker, weaver; fishing, gathering, agriculture	Sent email 5/2/11; sent another email 6/1/11
Kasuga, John	Referred by Dawn Wasson	No contact info obtained
Kealoha, Jonathan	Referred by Dawn Wasson	No contact info obtained
Keliiluli, Eugene	Referred by Dawn Wasson	No contact info obtained
Keliikuli, Odetta	Referred by Dawn Wasson	No contact info obtained
Kenui, Edna	Referred by Dawn Wasson	No contact info obtained
Kruse, Tyler	Referred by Aimee Vogelsang; Polynesian Cultural Center Public Relations	6/3/11 3:15 pm T. Kruse emailed me, possibly Aimee Vogelsang had given him my info ; wanted to know more about the CIA process and what types of people I was interested in interviewing; I replied 6/5/11 with an outline of the CIA process and my contact info

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Leota-Pascual, Dannette Kaliko "Sista"	Ko`olauloa Hawaiian Civic Club, Vice President & Historian	Sent letter to Ko`olauloa Hawaiian Civic Club address 5/10/11
Logan, Roland Maiola "Ahi "	Lifelong Ko`olauloa resident; Fisherman	Sent letter to home address 5/10/11; called home phone and left a message on machine 6/1/11 @ 11am; Aunty Gladys and Junior Primacio said they would try to talk to Uncle Ahi to see if he is interested 6/22/11; called home phone and left a message 6/27/11
Logan, Bula	Cultural Practitioner: Malama Na Pua Healing Center, Kahuna; Raised in La'ie; Ho'oponopono, E Lua Ho'olomilomi, La'au Lapa'au,Pule & Spiritual Counseling	called 5/2/11 4:10 pm, left message on machine; Mr. B. Logan returned my call 5/9/11 at 10 am; He expressed that he was not supportive of the expansion and that he is not practicing on Oahu currently; he suggested that I talk to the homeowners on kuleana lands on the SE end of project area, Pua Colburn, & the Ah Quins; Explained the traditional story of Kahuku being originally an island and how it's still not fully rooted onto Oahu; He expressed his concerns about the fragile reef and coastline ecosystem being contaminated by runoff & ground contaminates from the expansion
Look, Mele	Center for Native and Pacific Health Disparities Research; Waimanalo Health Center, Board of Directors	Ms. Look advised me to contact the Ko`olauloa Community Health Center and Ke`ola Mamo (Nat. Hwn. Health Care Systems); gave me Ms. Jenkins email address, advised me that she communicates via email regularly
Maghanoy, Sonny	Referred by Dawn Wasson	No contact info obtained
Makaiau, Ralph	Turtle Bay Resort, Sr. Proj. Manager; Lifelong Kahuku resident; Kahuku Community Association	called 5/2/11 11:15am; would like to be interviewed, set interview date for Friday 5/6/11 at 11 am; interviewed Ralph Makaiau on 5/6/11 at 11 am; Mr. Makaiau toured me through the resort grounds 5/11/11 for nearly 2 hours; 6/1/11called Mr. Makaiau again to see if I could get contact information for Sam Ah Quin and Carol Anamizu, he said he did not have either, but would look into it for me; 8/22/11 called Uncle Ralph to give an update on TBR CIA and that i would get an interview summary to him by the end of the week and asked for Buddy Ako's contact info; called 10/05/11 and 10/27/11 leaving messages to ask what the status is on the summary
Manley, Mark	Kahuku Resident, Defend Oahu Coalition	Called 5/10/11 and number was disconnected or no longer in service; New contact given to me by T. Bloomfield 6/3/11; called Mark 6/6/11 at 4pm and we spoke about CIA and he agreed to participate, but his schedule is tight this week – wants me to call this Friday to make a date after the 13^{th}; called Mark on Monday 6/13/11 and we agreed to meet on Friday 6/17/11 at 4pm; called Mark 7/27/11 to let him know that I hadn't forgotten about him and that I would get his summary to him sometime around mid-August, he says it works out better for him with his hectic schedule; 10/05/11 called, left message; 10/27/11 called, left message; 11/8/11 called, left message and sent an email containing letter and oral release form
Martin, Beverly	Referred by Dawn Wasson	No contact info obtained
Matsuda, Melvin	Kahuku Farms, Co-owner; 3rd generation farmer in Kahuku; Referred by Dawn Chang	Sent letter to home address 5/10/11; 5/14/11 letter returned "no mail receptacle"; faxed letter to Kahuku Farms 5/17/11 4:45 pm; called 6/1/11 and spoke to Clyde – said to call Kylie
Matsuda, Kylie	Kahuku Farms, entrepreneur; 4th generation farmer in Kahuku; Referred by Dawn Chang	Sent letter to home address 5/10/11; 5/14/11 letter returned "no mail receptacle"; faxed letter to Kahuku Farms 5/17/11 4:45 pm; called 6/1/11 and left message on answering service; Kylie called me back 6/3/11 at 11 am to ask about how long an interview would take and that she had already interviewed with Dawn Chang, and I explained that the interview would not take too long and that my interview would differ from D. Chang's in terms of the type of questions asked; Agreed to interview Friday 6/10/11 sometime around noon, but to call at around 9:30am first to make sure.
Mattoon, Creighton Ualani	Ko`olauloa Neighborhood Board, Chair; Fmr. Punalu'u Community Association	called 5/2/11 3:30 pm, left message on machine; Sent letter to home address 5/10/11; called residence phone 6/1/11 and left a message on machine; T. Bloomfield emails me new contact email address 6/3/11
Mattoon, Cathleen Pi'ilani	Ko`olauloa Hawaiian Civic Club, Recorder & Former President	Sent letter to home address 5/10/11; Ms. Mattoon sent a letter outlining concerns about burials 6/13/11

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
McKenzie, Nova-Jean	Former resident of the Kuleana property located on the coast within the TBR property – moved from the area in the 1940's	Was given contact info via email from Ku'iwalu (S. Hookano) 6/23/11; 6/27/11 called Ms. McKenzie and left a message on machine; emailed Ms. McKenzie 6/27/11; Ms. McKenzie returned my call and left a message (with Lisa) saying she was interested in speaking with me, but I was in field for two weeks (KMA project); called Ms. McKenzie 7/27/11 and spoke with her regarding project and we set an interview for August 25, 2011; 8/26/11 sent a thank you email to Aunty Nova-Jean; sent an email 10/30/11 to get in touch w/Kumu McKenzie
McQuivey, Jace L.	Ko`olauloa Burial Council, member; Hawaii Reserves, Inc., Vice President & General Legal Counsel; active in Native Hawaiian cultural and economic affairs	called bus. ph. 5/2/11 3:37 pm, left message on machine; Sent letter to home address 5/10/11; 5/14/11 letter returned "no such number"; resent to Hawaii Reserves address 5/17/11; sent email to Hawaii reserves email address 6/2/11
Merlin, Mark PhD.	UH Professor of Botany, Ethnobotany of Hawaii	Called and left message on machine 5/10/11
Miller, Antya	North Shore Chamber of Commerce, executive director; Neighborhood Board Member, Sunset Beach; lives in Pupukea	called NS Chamber of Comm. 5/2/11 4:05 pm, left message on machine; was called back 5/5/11, told me to call Bob Nakata and Betty Jenkins
Miller, Kela	Ku'ilima North Shore Alliance; Kumu hula; La'ie Kupuna Council; Kahuku resident; resident of La'ie	Spoke with Ms. Miller on 5/9/11 and she said that she does not know of anyone using the property to gather plants or other materials for medicinal or traditional craft purposes for quite some time; Ms. Miller suggested I talk to the Ah Quins, Hanalei Fong, and Pua Colburn. She said she would ask around to see if others knew of cultural practitioners relying on the area.
Nakata, Reverend Bob	referred to me by T. Bloomfield, Dawn Chang, & Kathleen Pahinui as a knowledgeable individual	called 5/2/11 3:58 pm, left message on machine; Sent letter to home address 5/9/11; spoke with B. Nakata 6/1/11 on phone and he agreed to an interview 6/7/11, gave me directions etc.; Interviewed Rev. Bob Nakata 6/7/11 at 9:30 am to 11:00 am, which went well, although not many specifics about the project area; gave me some interesting insights about the history of TBR Development; Called 7/27/11 to let him know that I had not forgotten him and that I would send him a summary along with his copy of the CSH 2006 report that I promised soon (left message on machine); called 11/15/11 spoke with Rev. Nakata and he said he would get to the interview summary and send it to me; called 12/9/12 called Rev. Nakata and he said he would send me an email copy of his amended statement; 1/12/12 called Rev. Nakata and left a message; 1/30/12 called and asked what the status was on the interview summary and statement, he said he thought he'd already emailed it to me and I said I never received it and gave him my email addresses again; 2/2/12
Napeahi, Josanda	Recreation and Security Officer at TBR; 11 years at TBR; Lives in Kahuku (ca. 11 years)	Approached Ms. Napeahi who was attending the information booth with M. Pawn at swimming beach on east side of TBR Hotel; after a few initial questions about fishing etc. in the area, I realized she had a wealth of knowledge about the area's marine resources and cultural practices taking place within and decided to conduct an onsite interview (joint interview with M. Pawn); emailed Ms. Napeahi to let her know that I would be sending the summary in mid-August and apologized for the delay 7/27/11;
Paglinawan, Richard	Cultural Advisor to the Kahuku Burial Committee	Sent letter to home address 5/10/11; no response
Pahinui, Kathleen	North Shore Chamber of Commerce, member/fmr. Chair; The Waialua Community Association, trustee	called 5/2/11 3:56 pm, left message on machine; Ms. Pahinui returned my call @ 4pm and she said she'd like to help; K. Pahinui called 5/10/11 9:45 am and said she would like to email me a few names and she'd like to meet at the Talk Story 3 forum; called Kathleen again and left message on machine 6/1/11; 6/2/11 8:50 am K. Pahinui called back and left message; 6/2/11 I called K. Pahinui back and she told me that she was going to introduce me to the Mattoons, but we did not connect, says those are the people I want to talk to

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Pawn, Marshall	Recreation and Security Officer at TBR; 7 years at TBR; born in area, lives in Hau'ula; family has been fishing at TBR/Marconi for generations	Approached Mr. Pawn who was attending the information booth with Ms. Napeahi at swimming beach on east side of TBR Hotel; asked him a few questions about fishing etc. in the area, when I realized he had a wealth of knowledge about the area's marine resources and is himself a cultural practitioner who regularly fishes in the area (family doing so for generations) I decided to interview him on the spot (joint interview with Ms. Napeahi); emailed Marshall to let him know that I would be sending the summary in mid-August and apologized for the delay 7/27/11.; emailed him 9/15/11, 10/5/11, 10/27/11
Primacio, John Junior	5th Generation Kahuku Resident	Sent letter to home address 5/10/11; 5/14/11 letter returned "no such number"; resent letter 5/17/11 to PO box ; sent a follow up email 6/2/11; Jointly interviewed with Aunty Gladys Pualoa Ahuna 6/22/11 12pm at Tita's Café in Kahuku; 7/27/11 called Junior and let him know that I had not forgotten him and that I would be sending him a summary of our interview in a couple of weeks, he said that it would be fine ; 09/15/11 sent the interview summary letter; called him 10/5/11 and he said he did not get the letter, so I resent the letter 10/5/11
Primacio, Margaret	Kahuku Villages Association (no longer working here), fmr. Vice President; Kahuku High & Int Account Clerk; 7 generations in Kahuku	called 5/2/11 3:40 pm, left message on machine; Sent letter to Kahuku Villages Association address 5/10/11; 6/1/11spoke to KVA member and they said she no longer works there and that I should try to contact her via Kahuku High; sent letter to Kahuku high 6/1/11; T. Bloomfield passes on new contact info in email 6/3/11; Called M. Primacio 6/6/11 4:15 pm and spoke with her briefly – said she was in a meeting, but got my letter and would call me back
Saunders, Davina Iese	Referred by Dawn Wasson	No contact info obtained
Saunders, Jane Kenui	Referred by Dawn Wasson	No contact info obtained
Saunders, Lonnie	Referred by Dawn Wasson	No contact info obtained
Tybuszewski, Tim	Surfrider Foundation :Possible contacts - Kahuku area surfers	Sent email to Oahu Chapter general email address, was contacted by Tim Tybuszewski [surfrideroahu@gmail.com], who referred me to Doug Cole of the North Shore Community Land Trust: dougcole@hawaii.rr.com or Tim Vanderveer of the Defend Oahu Coalition: tvandeveer76@hotmail.com
Vandevere, Tim	Defend Oahu Coalition	Sent email 6/2/11 requesting participation or info on potential participation
Vogelgesang, Aimee Polynesian Cultural Center Public Relations	Cultural informants for other Polynesian groups	Sent email 5/10/11 2:07 pm; sent a follow-up email to Aimee 6/2/11

PACIFIC LEGACY - TURTLE BAY EXPANSION CULTURAL IMPACT ASSESSMENT - CULTURAL INFORMANTS		
Name	**Affiliation/Association**	**Contact Log**
Wasson, Dawn Kahala Taotafa	Hau'ula Elementary - Kupuna; Ko'olauloa Hawaiian Civic Club, Member; Ko'olauloa Health and Wellness Center, Kupuna Council; Ko'olauloa Neighborhood Board No. 28, Culture Committee, chair	called 5/2/11 3:40 pm, left message on machine; Sent letter to Ko`olauloa Community Health & Wellness Center address 5/10/11; Received call from Ms. Wasson 5/18/11 at 11am who received the letter and would like to interview today because she leaves tomorrow for Alaska until the end of June; Interviewed Ms. Wasson 5/18/11 2-5pm at Denny's Restaurant in Kaneohe; interview not audio recorded by Ms. Wasson request; see CONF D. Wasson int. summary and report section 4.1.2 for details; Sent an email touching base with Aunty Dawn 7/27/11, told her that I would not be able to work on TBR until after mid-may; 7/28/11 received an email from Aunty Dawn stating that she has comments and for me to call her ; 8/22/11 called two times, but message service would not accept new messages – so I emailed Ms. Wasson to respond; 10/5/11 called and talked to her, she said she did not get the next email, resent email; 10/30/11 called her on the phone and said she'd like for me to come meet with her; went to North Shore 11/13/11 to pick up oral release form and she was not available, told me to snail mail it to her; 11/18/11 sent her another copy of interview summary and oral release form to her PO Box; 11/30/11 called and left a message on her phone; 1/30/12 called 852-8778 and her phone was not accepting messages; 1/30/12 called 692-6901 and spoke with Aunty Dawn, she said her computer was down and was unable to view the emailed version of the interview summary, asked me to mail her another hard copy asap and she would get back to me before the 3rd of February (sent letter with printed letter emailed to her in Sept. 2011); called both phone numbers 2/2/12 to see if she received the mail and if she would give me her verbal agreement to use her testimony in the report – left messages; 3/1/12 called both numbers and left message on home phone, reached her on her cell phone and she said she had information to share, but was at a restaurant and would call me back at the office – NEVER CALLED BACK; 3/6/12 sent email letting her know that I would be in Kahuku on 3/8/12 and offered to meet her and that this might be the last chance to add her statement to the CIA, NO REPLY; called 3/15/12 reached Aunty Dawn, she said she has experienced some misfortunes as of late and was unable to receive my messages, letters, and emails; would like to meet with me on Thursday 3/22/12 to go back over the interview summary; 3/22/12 meet with Aunty Dawn in Punaluu to go over interview summary, she advises me to edit some statements and signs the ORF under the agreement that those changes would be made prior to the submittal of the document for review

KUIWALU COMMUNITY CONSULTATIONS

1.0 COMMUNITY ENGAGEMENT PROCESS

1.1 Basis for Consultation

In 2008, the Hawaii Supreme Court determined that the Environmental Impact Statement prepared by Turtle Bay Resort's predecessor was inadequate and required that the EIS be supplemented if TBR was to proceed with its development plans. In the face of this decision, TBR recognized the necessity to "step back" and re-evaluate the existing Master Plan but more importantly to genuinely engage the community in the development process.

It became very evident to the TBR Project Team that the legal challenge to the adequacy of the EIS was merely the "tip of the iceberg" of the community's frustration in unclear engagement from the land owners regarding this stretch of land in Kahuku known fondly to so many as Kuilima or Turtle Bay. For many, places like Kawela Bay represented a pristine ocean resource once full of vibrant marine life, places like Kahuku Point were known as a native Hawaiian burial site, and Kuilima Hotel was a favorite get away for many local families.

The TBR Project Team acknowledged these frustrations and emotions, and recognized that a process of meaningful engagement and dialogue was necessary to re-establish trust and confidence that the TBR would honor and respect this land. Thus over the past two years, TBR and its project team has engaged in proactive community outreach, meeting with over 200 individuals and groups even before the Draft SEIS was announced. Appendix A is a table of the individuals and groups who were engaged in the outreach. Need to check with Lee for the list that was attached to the SEISP prep notice or Debbie may have an updated list of all contacts.

There was a concerted outreach to the Hawaiian community who for many called this land home for many generations before western contact, who continue to exercise traditional and customary practices, and who expressed concerns about potential discovery of iwi kūpuna or human burial remains. The TBR Project Team appreciated that the protection and preservation of cultural resources is not only based upon past practices but the Hawaiian culture is a living culture. Thus, this Cultural Impact Assessment provided the opportunity to incorporate the extensive community outreach that involved not only native Hawaiian cultural practices but emerging cultural practices (i.e. surfing, waterman sports, agricultural uses) into a comprehensive CIA.

1.2 Consulted Parties and Stakeholders

There are a number of families and organizations who have an active and in some cases geneaological relationship to the TBR lands. Key stakeholders with documented cultural, legal, or community affiliation with TBR have been consulted and their views and perspectives given careful consideration. They include the following:

Kahuku Burial Committee who represent families or individuals who have a cultural or lineal connection to these lands and have accepted the kuleana to malama i na iwi kūpuna.

Kuʻilima North Shore Strategic Planning Committee who was established when Kuilima Hotel was initially built and was active in the development of the Unilateral Agreement.

Koʻolauloa North Shore Alliance who is composed of various environmental and public interest organizations whose mission is to preserve "Keep Country Country."

Native Hawaiian Organizations, including Office of Hawaiian Affairs, Oʻahu Island Burial Council, Koʻolauloa and Koʻolaupoko Hawaiian Civic Clubs, Malama ʻOhana, Kahuku Community Association, Koʻolauloa Neighborhood Board, etc.

Elected Officials who serve the Kahuku community at the county and state levels.

Government agencies that have regulatory oversight of the resources on the lands to be developed at TBR, including State Historic Preservation Division, Army Corp of Engineers, U.S. Fish & Wildlife Services, Department of Transportation.

1.3 Consultation Process and Methods

TBR sought to re-establish a meaningful community relationship with the general public and particularly with the range of stakeholders involved with the lands at TBR. To achieve this goal, a multi-faced consultation process was undertaken. A deliberate attempt was made by the TBR Project Team to initiate the request with various stakeholders to "listen" them in settings or forums of their choosing. The following is a brief description of the approaches that were engaged in to reach out to the community and some of the results of that engagement.

Individual and small talk story sessions. For many Hawaiians who previously dissociated themselves from community dialogues, requests were made to meet them in informal, one-on-one small talk story sessions. Similarly, elected officials and government agencies were given individualized briefings. For various Hawaiian families, cultural practitioners and resource gatherers, requests were made for small talk story sessions where the discussions could be confidential and respectful.

Group meetings. TBR project team attended regular public meetings of the Koʻolauloa Neighborhood Board and Kahuku Community Association. Presentations were made to various organizations including the Koʻolauloa and Koʻolaupoko Hawaiian Civic Clubs to provide them a briefing of the Revised Master Plan and to get their mana'o on cultural practices or issues and concerns they may have about the project. The Association of Hawaiian Civic Club held their annual convention at Turtle Bay on October 26, 2011 and hosted a panel discussion including Pi'ilani Smith, Creighton Mattoon, Dawn Chang, and Senator Clayton Hee that was moderated by Naʻu Kamalii.

Traditional Public Meetings. In an effort to reach out to the broader community, TBR held a large public forum hosted at Turtle Bay Resort on September 15, 2011. The TBR project team convened a public open house and informational meeting. The event was well attended with over 100 people.

Cultural Advisory Council. The TBR Project Team convened a Cultural Advisory Council composed of Hawaiian cultural practitioners, educators, cultural experts, and individuals who could provide cultural guidance to TBR as it revised its Master Plan and SEIS.

Kahuku Burial Committee. Several years ago, TBR convened a group of individuals who have lineal and cultural connections to these lands who accepted the kuleana to malama (care for) any iwi kupuna that may be discovered on the project site as well as within the Ahupua'a of Kahuku. The KBC has met regularly and several may seek formal recognition as lineal or cultural descendants by the Oʻahu Island Burial Council for any iwi kupuna discovered on the project site. The KBC's Kahu has been Richard and Lynette Paglinawan, well respected cultural practitioners.

Established a website. The TBR project team established website *www.turtlebayseis.com* to keep the public informed of the progress of the Revised Master Plan and the SEIS. The website also provided opportunity for the community to provide specific input or mana'o on cultural practices and resources in the area.

Publication. The TBR Project team voluntarily published a notice in the StarAdvertiser on, and in the Office of Hawaiian Affairs *Ka Wai Ola* informing the public of its intent to develop specific lands identified by tax map keys, also listing the names of the land commission awardees on the property, requesting any information about cultural resources including potential burials. The publication is attached as Appendix B. We received several responses from the publication and followed up with the respondees.

Ethnographic Interviews. Pacific Legacy conducted 16 ethnographic interviews of individuals who had a personal association with Turtle Bay Resort. Their methodology and results are forthwith.

Table 1. Kuiwalu's Consulted Parties and Stakeholders

Groups	Agencies	Individuals
Adopt-A-Beach Hawaiʻi	Board of Water Supply	Bill Paty
Association of Hawaiian Civic Clubs	Councilmember Ernie Martin	Bob Leinau
Beach Access Hawaiʻi	Department of Land and Natural Resources	Bob Nakata
Brigham Young University of Hawaiʻi	Department Of Transportation	Brett Lee
Building Industry Association	Department of Planning and Permitting	Buddy Ako
Campbell Estates	Governor Neil Abercrombie	Carol Anamizu
Carpenters Union	KHPR - Townsquare	Charlie Toguchi
Continental Pacific/Marconi Point	Land Use Research Foundation	Chhorvy Oung
Defend Oʻahu Coalition	Office of Environmental Quality Control	Christino Bumanglag
Electricial Workers Union	Oʻahu Island Burial Council	Chue Vang Outtaphone
Friends of Kewalo Basin	Office of Hawaiian Affairs	David Arakawa
Friends for Waialua Town	Representative Jessica Wooley	David Baker
Haleʻiwa Community Association	Representive Gil Riviere	Doug Cole
Hauʻula Community Association	Senator Clayton Hee	Fong Sourivong
Hawaiʻi Reserves Inc.	State Historic Preservation Division	Fred Hemmings
Hawaiʻi State Body Surfing Association	State Water Commission	Fred Trotter
Hiʻipaka LLC	U.S. Army Corp of Engineers	Hans Hedeman
Hui Mālama O Pūpūkea Waimea	U.S. Army Garrison Hawaiʻi	Inhta Saysiri
Ilioulaokalani Coalition		Jim Anthony
ILWU		John Morgan
Jeanies Fine Jewelry		Junior AhYou
Kaʻaʻawa Community Association		Kathleen Pahinui
Kahana Community Association		Kela Miller
Kahuku Burial Committee		Kent Fonoimoana
Kahuku Community Association		Keona Marks
Kahuku Farmers Association		Kylie Matsuda
Kahuku Healthcare Family Medical Center		Lonnie Sanders
Kahuku Intermediate and High Schools		Manichanh Phongphila
Kahuku Village Association		Mitch Coztino
Kawailoa Ranch		Nainoa Thompson
Kawela Community Association		Nova Jean McKenzie
Keep Kahuku Country		Paul Cleghorn
Keep the North Shore Country		Pete Delacruz
Kohala Collections		Peter Cole
Ko'olau Loa City Neighborhood Board, District #28		Pua Colburn
Ko'olau Loa City Sustainable Community Plan		Ran Sok
Ko'olau Loa City Watershed Plan		Randy Rarrick
Ko'olau Loa Hawaiian Civic Club		Ricardo Rabago
Ko'olau Loa North Shore Alliance		Richard Paglinawan

Groups	Agencies	Individuals
Koʻolaupoko Hawaiian Civic Club		Roger Corpuz
Kualoa Ranch		Ron Valencia
Groups (continued)		**Individuals (continued)**
Kuilima Estates East Community Association		Samay Sourivong
Kuilima Estates West Community Association		Steve Hoag
Kuilima North Shore Strategic Planning Committee		Sunny Greer
Labors Union		Teo Soukhaseum
Lāʻie Community Association		Tim Law
Lāʻie Kūpuna Council		Tom Kiely
Lamont's Sundries		Virgilio Tomas
Lei Lei's/Ian and Mike		Warren Soh
Les Enderton/ Oahu Visitors Bureau		Will Schoettle
Local 5		You Soukaseum
Mālaekahana West Mauka		
Mālama ʻOhana		
Mason/Bricklayers Union		
North Shore Chamber of Commerce		
North Shore City Neighborhood Board, District #27		
North Shore Community Land Trust		
North Shore Health & Wellness Center		
North Shore Moto Cross Track		
North Shore Outdoor Circle		
NORTH SHORE WEDDINGS & FLOWERS		
Ocean Villas		
Operating Engineers Local 3		
Operating Engineers Local 3 Training School		
Pacific Resourses INC.		
Painters Union		
Paradise Helicopters		
Park Dedications, City Parks and Recreation		
Plumbers Union		
Polynesian Cultural Center		
Punalu'u Community Association		
Pūpūkea Community Association		
Queen Liliʻuokalani Childrens Center, Punalu'u		
Save the Monk Seals		
Save the Sea Turtles		
Shaka Kayaks		
Sierra Club, Hawaiʻi Chapter		
Sunset Community Association		
Surfrider Foundation, Oʻahu Chapter		

Groups	Agencies	Individuals
Teamsters Union		
Trust for Public Lands		
Turtle Bay Golf Employees		
Groups (continued)		
Turtle Bay Resort Cultural Advisory Council		
Turtle Bay Resort Hotel Employees		
UH School of Law/Alliance		
U. S. Fish & Wildlife Service		
VAN's Triple Crown		
Waialua Community Association		
Waialua Hawaiian Civic Club		
Waialua Intermediate and High Schools		
Waimea Valley		

APPENDIX D

ETHNOGRAPHIC INTERVIEW QUESTIONNAIRE

Pacific Legacy, Inc.
Cultural Impact Assessment (CIA)
Ethnographic Interview Form

Job Name/#:______________________________________ Interviewer Name:______________________________

Location:____ Date/Time:____________________

Permission to Record Audio (Y/N):____

Interviewee Full Name:	Birth Name:
Birth Date:	Occupation/Title:
Current Residence:	Birth Place & Place of formative years:
Years spent in or near subject area:	Affiliation with subject area:
Parents:	Informants/Mentors:

1) How familiar are you with the subject area?

2) What is this area traditionally called? Can you recall any other names of the area?

3) What stories or mythologies have you heard of this area?

4) How would you describe the physical characteristics of the area from your earliest memory?

5) Are there any significant or special features (i.e. landmarks or unique topography) in this area as it relates to land use and/or its history?

6) How was the area used by people in the past?

Land Use Details:

Activity	Types (specific names)	When	Intensity and Frequency	By Who
7) Hunting/ Fishing				
8) Gathering				
9) Agriculture/ Aquaculture				
10) Habitation				
11) Ceremonial				
12) Burial				
13) Other				

14) Have you observed changes to the land or its resources? Please Explain.

15) What are your thoughts about the project proposal?

16) Additional Comments by the Interviewee:

17) Additional Comments:

Would you like to view the synopsis of the interview prior to CIA report submittal(Y/N)?________________

Time Interview Concludes :___________________________

Interviewee Signature: ____ Date: _____________________

APPENDIX E

SIGNED ORAL HISTORY RELEASE FORMS

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: TURTLE BAY CIA

Date of Interview: 6 MAY 2011

I, RALPH MAKAIAU, have been previously interviewed by KIMBERLY MOONEY of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Interviewee Signature

11/29/11
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay CIA

Date of Interview: 25 August 2011

I, Nova-Jean McKenzie, have been previously interviewed by

Kimberly Mooney of Pacific Legacy, Inc. for the above referenced project.

I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Nova-Jean Leialoha McKenzie
Interviewee Signature

12-8-11
Date

Pacific Legacy Historic Preservation

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay Resort CIA

Date of Interview: 6/14/11

I, Rea + John Colburn have been interviewed by Kim Mooney of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

Rea Colburn
Interviewee Signature

2/2/12
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: TURTLE BAY CIA

Date of Interview: 22 JUNE 2011

I, JUNIOR PRIMACIO, have been previously interviewed by

KIMBERLY MOONEY of Pacific Legacy, Inc. for the above referenced project.

I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Junior Primacio

Interviewee Signature

12/10/11

Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: CIA of the Turtle Bay Resort Expansion

Date of Interview: 22 June 2011

I, Gladys K. Pualoa-Ahuna have been previously interviewed by

Kimberly M. Mooney of Pacific Legacy, Inc. for the above referenced project.

I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

Name correction: Gladys Kuuleipuakokahua Pualoa - Ahuna

Father: Peter McRae Enos

Mother: Sophie Nainoa Keia

SPECIFIC OBJECTIONS AND RESTRICTIONS:

GPAhuna
Interviewee Signature

30 Sept 2011
Date

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: TURTLE BAY RESORT CIA

Date of Interview: 11 APRIL 2012

I, [signature], have been interviewed by K. MOONEY of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

[signature]
Interviewee Signature

11 April 12
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay "Kui Ama"

Date of Interview: 28 August 2011

I, Butch Helemano, have been previously interviewed by

Kimberly Mooney of Pacific Legacy, Inc. for the above referenced project.

I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS: None

SPECIFIC OBJECTIONS AND RESTRICTIONS: None

Kahu Butch Helemano
Interviewee Signature

11/23/2011
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay Cultural Impact Assesment

Date of Interview: 2 February 2012

I, Raymond AKo, have been interviewed by Kimberly Mooney of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

Raymond G. H. Ako
Interviewee Signature

2/6/12
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay Resort CIA

Date of Interview: May 18, 2011

I, Dawn K. Wasson, have been previously interviewed by Kim Mooney of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

See corrections and/or changes as dictated.

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Dawn K Wasson
Interviewee Signature

03/22/12
Date

p.1

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Turtle Bay Resort Expansion Archaeological Mitigation Plan

Date of Interview: ____________________

I, Robert S. Nakata, have been interviewed by Kimberley Mooney of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

Robert S. Nakata
Interviewee Signature

Feb. 2, 2012
Date

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: TBR

Date of Interview: TURTLE BAY CULTURAL IMPACT ASSESS. 11/5/11

I, MARK K. MANLEY, have been previously interviewed by KIMBERLY M. MOOKE of Pacific Legacy, Inc. for the above referenced project. I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

SPECIFIC OBJECTIONS AND RESTRICTIONS:

Mark K. Manley
Interviewee Signature

12/1/11
Date

Pacific Legacy Historic Preservation

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Cultural Impact Assessment (CIA) of turtle Bay Resort Expansion

Date of Interview: August 2011

I, Josanda Napeahi, have been interviewed by Kimberly of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

Josanda Napeahi
Interviewee Signature

11/08/11
Date

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Cultural Impact Assessment

Date of Interview: 9/22/11

I, Marshall K Pauon, have been interviewed by Kimberly M. McOhey of Pacific Legacy, Inc. for the above referenced project. I agree that the interview information may be used in a report that may be made public.

Interviewee Signature

11/10/11
Date

2/2 11-10-2011 02:41:45 p.m. 2932531

11/21/2011 14:46 8085550226 KAHUKU FARMS PAGE 01/01

PACIFIC LEGACY, INC.

ORAL HISTORY STUDY
PERSONAL RELEASE OF INTERVIEW RECORDS

Project: Proposed Turtle Bay Resort expansion

Date of Interview: June 10, 2011

I, Kylie Matsuda, have been previously interviewed by Kimberly Mooney of Pacific Legacy, Inc. for the above referenced project.

I have reviewed the typed summary of the interview and agree that this documentation is complete and accurate, except for the clarifications and corrections noted below. I further agree that the interview information may be used in a report that may be made public, subject to my specific objections and restrictions set forth below.

CLARIFICATIONS AND CORRECTIONS:

1st paragraph: I started Kahuku Farms in 2005 specifically for our agtourism project, not to be confused with our farming operation, Matsuda-Fukuyama Farms in which our generations of farming is built on. (Just want to clarify so people don't think I have taken over farming operation of 300 acres) all else looks ok.

SPECIFIC OBJECTIONS AND RESTRICTIONS:

My interview can be used for Turtle Bay Expansion Research, but I do not wish to make it public information.

Kylie Matsuda
Interviewee Signature

11/30/11
Date

APPENDIX F

ADDITIONAL STATEMENTS SUBMITTED

REVEREND ROBERT NAKATA
CATHLEEN PIʻILANI MATTOON

From: [redacted]
To: [redacted]
Sent: 11/12/2011 8:21:07 A.M. Hawaiian Standard Time
Subj: Turtle Bay Archaeological Mitigation Plan

11/12/11

Turtle Bay Archaeological Mitigation Plan of August 2006
Must Be Formally Submitted

The owners of Turtle Bay Resort submitted an archaeological mitigation plan in August 2006 to replace the one officially accepted and approved by the State Historic Preservation Division (SHPD) in March 2005. This 2006 plan was done and submitted, in all likelihood, because Turtle Bay was caught grubbing along the Alpha Road without required SHPD permit in late 2005 or early 2006, as a close reading of correspondence between Turtle Bay and SHPD reveals.

After being caught doing this illegal grubbing, Turtle Bay goes to SHPD, offering to do a new mitigation plan, in spite of having the approved March 2005 Plan. SHPD agrees to this, chastising Turtle Bay for not getting a permit for the Alpha Road grubbing but not fining or punishing Turtle Bay in any way for it. The impression is left that the new plan is agreed to by Turtle Bay in lieu of a fine or other sanctions. Turtle Bay agrees to strict guidelines for preconstruction survey work to identify archaeological sites, especially burials. These guidelines call for much trenching work at all proposed construction sites, with strong probability ratings for possible sites.

When the August 2006 Plan was submitted, SHPD Administrator Melanie Chinen's response is to ask Turtle Bay to completely redo its resort master plan because of the high probability of burial sites at all construction sites, a 200 meter shoreline setback, which is extraordinarily large again because of the high probability of running into burial sites. So the August 2006 Plan paid for by Turtle Bay must have been damning for Turtle Bay.

After Chinen's response was publicized by the Advertiser (but not the Plan itself), Turtle Bay withdrew the 2006 Plan from SHPD, saying Chinen's response was unwarranted and would jeopardize its 400 million dollar financing package. The State Attorney General agreed to allow Turtle Bay to withdraw the August 2006 Mitigation Plan (remember, done and paid for by Turtle Bay), so it has not been officially seen by the Oahu Island Burial Council). Neither has SHPD itself processed it for approval, so the March 2005 approved mitigation is still the officially approved plan. Turtle Bay has therefore not been punished for its illegal grubbing in 2005-2006 because SHPD has not ruled on the acceptability of the August 2006 Mitigation Plan. Turtle Bay should be required to resubmit it for approval before the Supreme Court ordered SEIS is approved. It has been several years since Turtle Bay changed hands and the 400 million dollar financing plan was abandoned, more reason the new owners should be required to have a new, approved mitigation plan before the SEIS is done and approved.

The Defend Oahu Coalition (DOC) acquired the August 2006 Mitigation Plan through the Freedom of Information Act and has widely disseminated it and the correspondence between SHPD and Turtle Bay that led to its creation, Melanie Chinen's response, Turtle Bay's response to her response, the Attorney General's response. These documents have been given to you, Mr. Aila, DLNR Director, for your action.

It should also be pointed out that the section of the August 2006 Plan dealing with the Alpha Road grubbing in 2005-2006, if carefully read, indicates the three previously (1980's) identified sites could not be found, leaving the strong suspicion that the sites were destroyed by the grubbing. This should be addressed in the SEIS.

Ko'olauloa Hawaiian Civic Club

P.O. BOX 532
HAU'ULA, HI 96717

June 13, 2011

Kimberly M. Mooney, Archaeologist
Pacific Legacy
Aulike Street, Suite 301
Kailua, Hawaii, 96717

Dear Ms. Mooney,

Attached is a letter dated May 10, 2006 which summarizes my affiliation with The Ko`olauloa Hawaiian Civic Club. Included here also is a copy of the KHCC resolution of April 20, 2006 opposing the planned development at Kuilima. The action taken by the organization is necessary to meeting the objectives of KHCC.

At the meeting of the Oahu Island Burial Council, June 14, 2006 I requested recognition of KHCC as claimant to the iwi kupuna at Kuilima and requested to be considered cultural advisors. We also supported the need to reassess the mitigation measures Kuilima was following at that time. We supported the Kuilima Archaeological Mitigation Plan summited by Hallet Hammatt of Cultural Surveys Hawaii, August 2006. We are familiar with CSH work and have high regard for their staff.

Of major concern to KHCC is the impact development has had on the burial sites of our ancestors. We have had to malama too many iwi desecrated by developers in Ko`olauloa. We will object to the removal of any kupuna for the purpose of construction of structures including roads. To thrive the Hawaiian needs both land and sea, therefore the impact on cultural practices by development must be recognized and mitigated.

Presently, KHCC is participating in meetings with Turtle Bay Representative Drew Stotesbury of Replay Resorts. We look forward to review of your findings and recommendations.

Sincerely,

Cathleen Mattoon

Cathleen Pi`ilani Mattoon
Ko`olauloa Hawaiian Civic Club
Past President and Board Member
mattoonc001@hawaii.rr.com

enclosures: reso 5/11/06 and letr. OIBC 6/10/06

To: Ko`olauloa Neighborhood Board No., 28
From: Ko`olauloa Hawaiian Civic Club
Subject: Opposition to the Turtle Bay Resort expansion
Date: May 11, 2006

Ko`olauloa Hawaiian Civic Club was founded in 1924 by William Isaac Kanakanui a highly respected leader in the Hawaiian community. We are dedicated to the preservation and practice of our culture and we support the well being of our people through participation in government, health, education and economic development.

On April 20, 2006 the following resolution was passed by the Association:

The Ko`olauloa Hawaiian Civic Club opposes the planned Turtle Bay expansion for the following reasons:

1. *The 20 year old plan did not take into account any cultural impact of the project. There is concern that na iwi kupuna and other burial items will be disturbed and that native Hawaiian traditional and customary practices will be restricted.*
2. *The plan did not address the social impact of the development*
3. *The Lead Oahu Archeologist for the State Historic Preservation Division of the Department of Land & Natural Resources has informed us that after ten years a new archeological study would be conducted for the area to be developed.*
4. *A development of this size (4,000 hotel and condominium units) would severely impact the two lane Kamehameha Highway from Kahalu`u to the North Shore.*
5. *The plan does not take into account the cumulative impact this development along with planned hotel and housing developments in La`ie will have on the infrastructure, highway, water supply, emergency services, schools, etc. in Ko`olauloa and the North Shore.*

This planned development would affect not only the life style of the North Shore but all of O`ahu since it will have removed the last bit of country that island residents as well as visitors have come to enjoy. Changes have occurred in the past 20 years and common sense would seem to indicate that, at the very least, a thorough reevaluation of this plan is in order.

In closing we wish to emphasize the fact that we will not accept the removal of na `Iwi kupuna for reburial elsewhere. Our burial grounds are as sacred as any cemetery and we will not accept their desecration for the sake of tourism.

Cathleen Mattoon, President

Ko'olauloa Hawaiian Civic Club

P.O. BOX 532
HAUULA, HI 96717

June 10, 2006

Chairman
Oahu Island Burial Council
601 Kamokila Boulevard, Rm 555
Kapolei, Hawaii 96707

COPY

Re: Kuilima Resort Expansion Plans

Aloha,

This is a request for recognition of the Ko'olauloa Hawaiian Civic Club as a cultural claimant to Na Iwi Kupuna in the Ko'olauloa moku and more specifically to Na Iwi Kupuna threatened by the expansion plans of Oak Tree at Kuilima, Oahu. KHCC is an acknowledged claimant for Na Iwi Kupuna of Kualoa Regional Park and Mokapu on the Marine Corps Base in Kaneohe. KHCC is included in the repatriation and reinterment processes at both sites. Additionally, KHCC is a consulting party to the Department of Transportation and the Board of Water Supply for all projects in Ko`olauloa.

Ko'olauloa Hawaiian Civic Club was established in June 1924 with these objectives: (1) Preserve Hawaiian historic sites, mele and language. (2) Assist in the education of those of Hawaiian ancestry. (3) Participate in civic, economic and social welfare of the Hawaiian community.

The position adopted by the membership of KHCC on May 11, 2006 declares our opposition to the planned expansion at Turtle Bay. This 20-year-old plan did not include cultural or social impacts. Please be informed that KHCC takes the position that we will not accept the removal of Na Iwi Kupuna for reburial elsewhere. Our burial grounds are as sacred as any cemetery and we will not accept their desecration for the sake of tourism.

Mahalo nui,

Cathleen Pi'ilani Mattoon

Cathleen Pi`ilani Mattoon, President

APPENDIX G

PICTURES OF TURTLE BAY RESORT
LĀʻAU

Beach *naupaka(Scaevola taccada)*, east side of Kuilima Bay shoreline, facing northeast.

Beach *naupaka (Scaevola taccada)*, east side of Kuilima Bay shoreline, close up.

***Hau* (*Hibiscus tiliaceus*) tree, mauka of Lele's Restaurant, facing northeast.**

***Hau* (*Hibiscus tiliaceus*) flower, mauka of Lele's Restaurant, close up.**

***Hinahina* (*Heliotropium anomalum*), near Kahuku Point, facing north.**

***Hinahina* (*Heliotropium anomalum*), near Kahuku Point, close up.**

***Hala* tree (*Pandanus tectorius*), northeast of hotel, facing southwest.**

***Hala* tree (*Pandanus tectorius*), southwest of hotel, close up.**

Lauwa'e **(*Phymatosorus scolopendria*), parking lot west of Ocean Villas, facing east.**

Pōhuehue **(*Ipomoea pes-caprae subsp. Brasiliensis*), near Kahuku Point, close up.**

C

APPENDIX C:

DRAFT SUPPLEMENTAL ARCHAEOLOGICAL INVENTORY SURVEY

DRAFT

SUPPLEMENTAL ARCHAEOLOGICAL INVENTORY SURVEY

TURTLE BAY RESORT

LANDS OF KAHUKU, PUNALAU, ULUPEHUPEHU, ʻŌIʻO, HANAKAʻOE, KAWELA AND ʻŌPANA

KOʻOLAULOA DISTRICT, ISLAND OF OʻAHU
(TMK: [1] 5-6-003: 033, 040, 041, 042, 043, 044, 048; 5-7-001: 001, 016, 017, 020, 022, 030, 031, 033, 037; and 5-7-006: 001, 002, 022, 023)

Haun & Associates
Archaeological, Cultural and Historical Resource Management Services
73-1168 Kahuna Aʻo Road, Kailua-Kona HI 96740 Phone: 325-2402 Fax: 325-1520

DRAFT

SUPPLEMENTAL ARCHAEOLOGICAL INVENTORY SURVEY

TURTLE BAY RESORT

LANDS OF KAHUKU, PUNALAU, ULUPEHUPEHU, ʻŌIʻO, HANAKAʻOE, KAWELA AND ʻŌPANA

KOʻOLAULOA DISTRICT, ISLAND OF OʻAHU

(TMK: [1] 5-6-003: 033, 040, 041, 042, 043, 044, 048; 5-7-001:001, 016, 017, 020, 022, 030, 031, 033, 037; and 5-7-006: 001, 002, 022, 023)

By:

Alan E. Haun, Ph.D.
Dave Henry, B.S.
and
Dianne Berrigan, M.A.

Prepared for:

Turtle Bay Resort Development
57-091 Kamehameha Highway
Kahuku, Hawaiʻi 96731

August 2012

Haun & Associates
Archaeological, Cultural and Historical Resource Management Services
73-1168 Kahuna Aʻo Road, Kailua-Kona HI 96740 Phone: 325-2402 Fax: 325-1520

Management Summary

At the request of Turtle Bay Resort Development (TBR), Haun & Associates completed a Supplemental Archaeological Inventory Survey (SAIS) for the c. 840-acre resort property situated in Kahuku, Koʻolauloa District, Island of Oʻahu in conjunction with a Supplemental Environmental Impact Statement. The resort area spans seven traditional land divisions (Kahuku, Punalau, Ulupehupehu, ʻŌiʻo, Hanakaʻoe, Kawela, and ʻŌpana) and numerous (20) tax map parcels (TMK: [1] 5-6-003: 033, 040, 041, 042, 043, 044, 048; 5-7-001:001, 016, 017, 020, 022, 030, 031, 033, 037; 5-7-006:001, 002, 022, 023). The fieldwork was guided by a Supplemental Archaeological Inventory Survey Plan (SAIS) that was approved by the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD).

Fieldwork consisted of a systematic pedestrian survey of undeveloped portions of the resort including the Kahuku Point Archaeological Preserve and seven subsurface testing areas (Test Areas A-G) where development is planned. Twenty-nine surface sites with 35 features were documented as a result of the pedestrian survey. Seven future development areas also were subjected to systematic, mechanical excavation of 345 trenches.

The SAIS Plan made predictions regarding expected site types based on previous archaeological research and historical documentary evidence. As expected, prehistoric to early historic remains documented in the project area include subsurface cultural deposits and subsurface features including a house floor, fire pit, post mold, and burials. Also as expected, historic remains dating to the 1800s to 1900s were documented including the OR&L railroad, and at least one probable Kahuku Ranch-related wall. Other expected sites are the extensive WW II military-related remains of Kahuku Army Airfield including the main runway, revetments, defensive fortifications and a variety of support facilities.

The 39 sites identified during the project consist of 29 surface sites with 35 features and ten subsurface sites with 11 features. The surface features consist of concrete structures, concrete blocks, concrete slabs, asphalt pavements, artifact scatters and one each of the following: transit bus, concrete cylinder, a pair of metal gateposts, metal tank, railroad grade, revetment, stone mound and wall. Subsurface trenching and test excavations documented ten subsurface sites. Human remains were identified in three locations; two *in situ* burials and a secondarily deposited human metatarsal. Feature function includes antenna support, foundation, habitation, gun position, transportation, burial, trash disposal, storage, and several miscellaneous functions.

The 39 sites are all assessed as significant under Criterion "d". The sites have yielded information important for understanding prehistoric and historic land use in project area. One site is assessed as significant under Criterion "c" as good site type example of a defensive feature associated with Kahuku Army Airfield. Three sites are additionally assessed as significant under Criterion "e" because human burials of probable Hawaiian ancestry are present.

Mapping, written description and photography at 16 sites provide adequate documentation and no further work or preservation is recommended. Treatment of the human remains at two sites, and a third site where data recovery is also proposed for the non-burial portion, will be determined by the Oʻahu Island Burial Council in consultation with the Kahuku Burial Committee, other SHPD-recognized lineal or cultural descendants, and TBR. The determination process will require preparation of a Burial Treatment Plan.

Thirteen sites are recommended for preservation. Measures to protect the non-burial sites recommended for preservation would be described in an Archaeological Site Preservation Plan prepared for DLNR-SHPD review and approval. The eight remaining sites and the non-burial portion of another site retain the potential to yield information important for understanding prehistoric and early historic land use. These sites are recommended for data recovery. The plans for data recovery would be detailed in a Data Recovery Plan prepared for DLNR-SHPD review and approval.

It is also recommended that all ground disturbing activities within the project area be monitored by an archaeologist. The extent and nature of this monitoring activity would be described in an Archaeological Monitoring Plan prepared for DLNR-SHPD review and approval.

Table of Contents

List of Figures

List of Figures (con't.)

List of Figures (con't.)

List of Figures (con't.)

List of Tables

INTRODUCTION

At the request of Turtle Bay Resort Development, Haun & Associates completed a Supplemental Archaeological Inventory Survey (SAIS) for the c. 840-acre resort property situated in Kahuku, Koʻolauloa District, Island of Oʻahu (*Figure 1*). The resort area spans seven traditional land divisions (Kahuku, Punalau, Ulupehupehu, ʻŌiʻo, Hanakaʻoe, Kawela, and ʻŌpana) and numerous (20) tax map parcels (TMK: [1] 5-6-003: 033, 040, 041, 042, 043, 044, 048; 5-7-001:001, 016, 017, 020, 022, 030, 031, 033, 037; 5-7-006:001, 002, 022, 023 – *Figure 2* and *Figure 3*).

The SAIS fieldwork was guided by a Plan for Supplemental Archaeological Inventory Survey (Haun *et al.* 2011). The plan was reviewed and approved by the DLNR-SHPD on December 12, 2012 (Letter from Pua Aiu to Alan Haun, Log No. 2011.3197, Doc. No. 1112PA02 – ***Appendix A***).

The SAIS fieldwork was conducted between December 5, 2011 and February 3, 2012 under the direction of Principal Archaeologist Alan Haun, Ph.D. Approximately 165 days of labor were required to complete the fieldwork portion of the project. This SAIS report was prepared in accordance with the requirements for an archaeological inventory survey report detailed in Hawaiʻi Administrative Rules (HAR) §13-13-276-5. This report contains a description of the project area, a summary of previous archaeological work within the Turtle Bay Resort, the SAIS Plan research design that guided the fieldwork, the surface and subsurface findings from the project and a conclusion section containing significance assessments of the sites with recommended treatments. Historical documentary research and archaeological background sections from the SAIS Plan are omitted from this report in conformance with HAR §13-276-5(b)(3).

Turtle Bay Resort

Turtle Bay Resort (TBR) is currently owned and operated by Turtle Bay Resort LLC. The resort was constructed in the early 1970s by casino developer Del Webb and opened its doors in May 1972 as the Kuilima Resort and Country Club. Hyatt Hotels operated the resort in the mid-1970s. Hilton Hotels and Resorts purchased it in August 1983 and renamed it The Turtle Bay Golf and Tennis Resort.

Today the resort encompasses the Turtle Bay Hotel located at Kuilima Point, the adjacent Ocean Villas and Beach Cottages, the Kuilima Estates development, restaurants, beachside amenities, two 18-hole golf courses, a clubhouse, ten tennis courts, several swimming pools, a horseback riding facility and parking lots (*Figure 4*). Access to the resort is from Kamehameha Highway via Kuilima Drive. The proposed resort expansion plans includes two hotels, 590 resort residential units, 160 affordable housing units and additional parks, shoreline setback areas and public shoreline access.

Summary of TBR Archaeological Studies

The Bernice Pauahi Bishop Museum (BPBM) conducted the first systematic archaeological survey of all undeveloped TBR property (649 acres) in 1977 for Prudential Insurance Company (Dye 1977). This pedestrian survey was followed by a series of subsurface testing projects conducted by Paul H. Rosendahl, Ph.D. Inc. (PHRI) in the mid-1980s. Beginning in 1984, PHRI (Bath *et al*. 1984) conducted a subsurface reconnaissance survey of thirteen areas throughout the resort property including further investigation of subsurface deposits initially identified by Dye. The initial reconnaissance testing project was followed by three intensive subsurface testing projects conducted in 1986 that focused on cultural deposits identified by Bath *et al*. at Kawela Bay (Walker *et al*. 1988a), Kahuku Point (Walker *et al*. 1988b), and Punahoʻolapa Marsh (Davis *et al.* 1986).

In 1987, PHRI prepared an archaeological Data Recovery Plan (DRP; Walker *et al*. 1987) to mitigate the effect of resort expansion on archaeological sites at Kawela Bay, Kahuku Point, and Punahoʻolapa Marsh. The Plan was incorporated into a Memorandum of Agreement (MOA) executed in 1988 by the U.S. Army Corp of Engineers – Honolulu District (COE), the Hawaiʻi State Historic Preservation Department (SHPD) Officer, the Office of Hawaiian

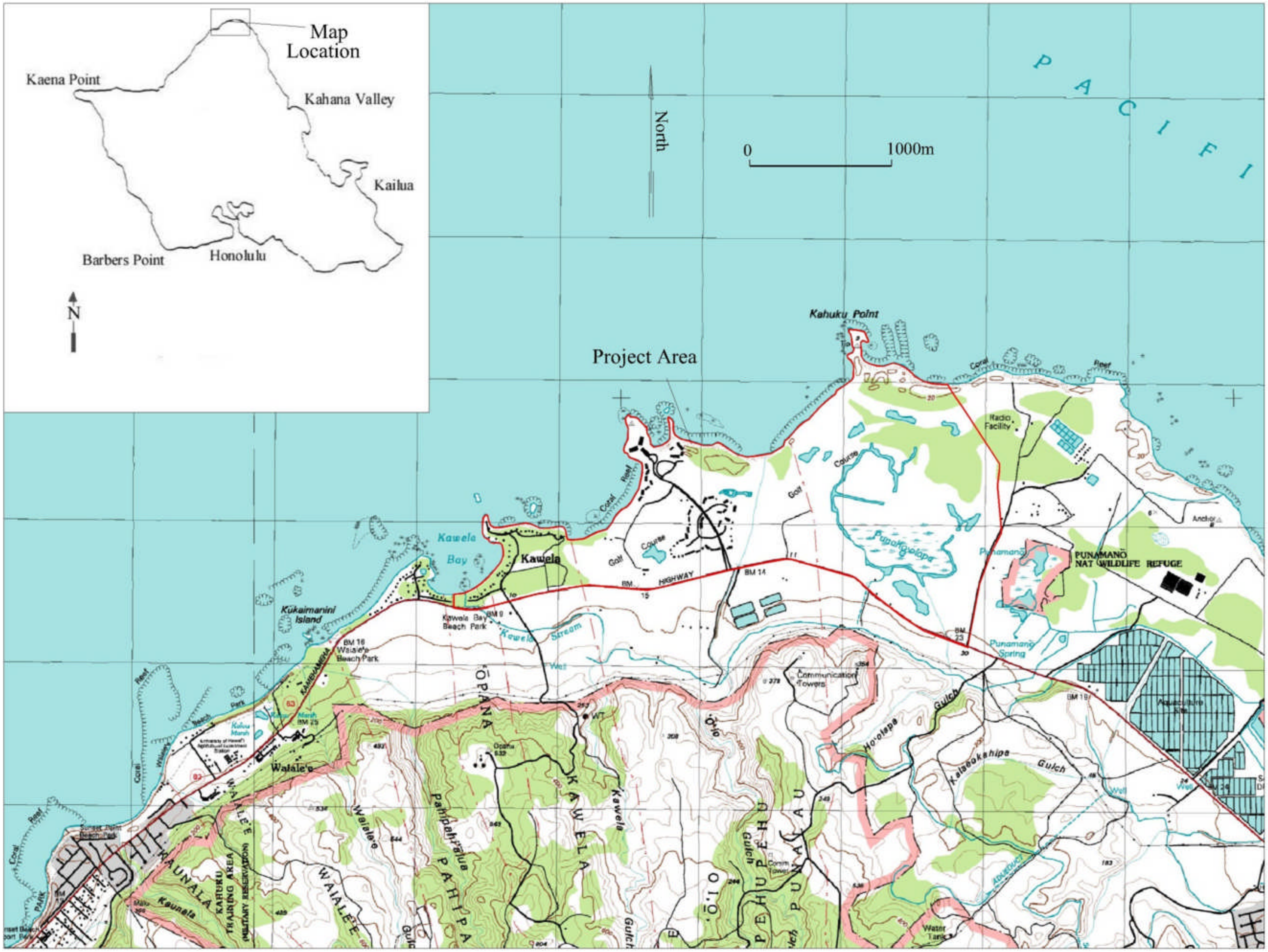


Figure 1. Portion of 1998 USGS Kahuku Quadrangle showing project area

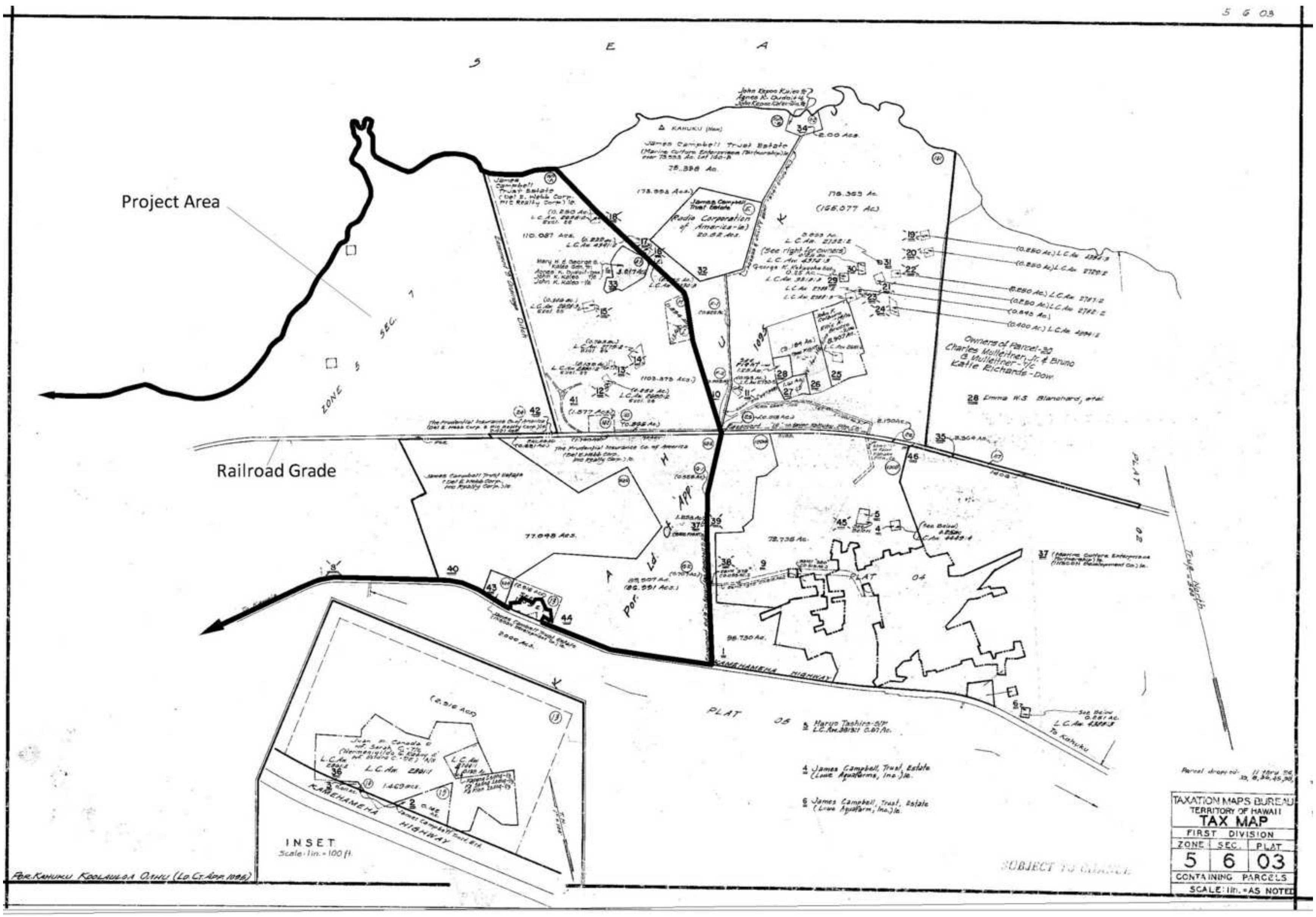


Figure 2. Tax Map Key 5-6-03 showing portion of project area

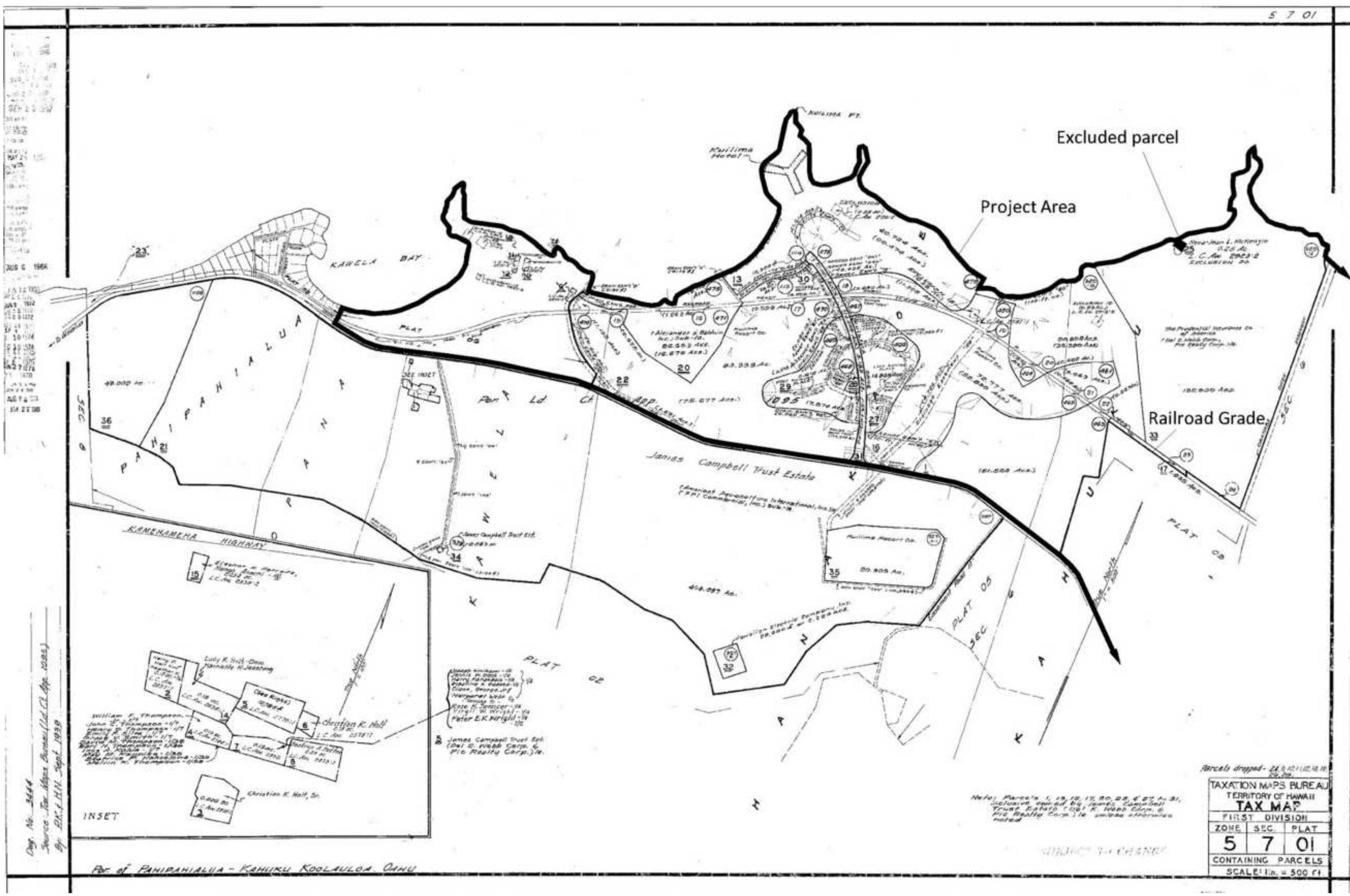
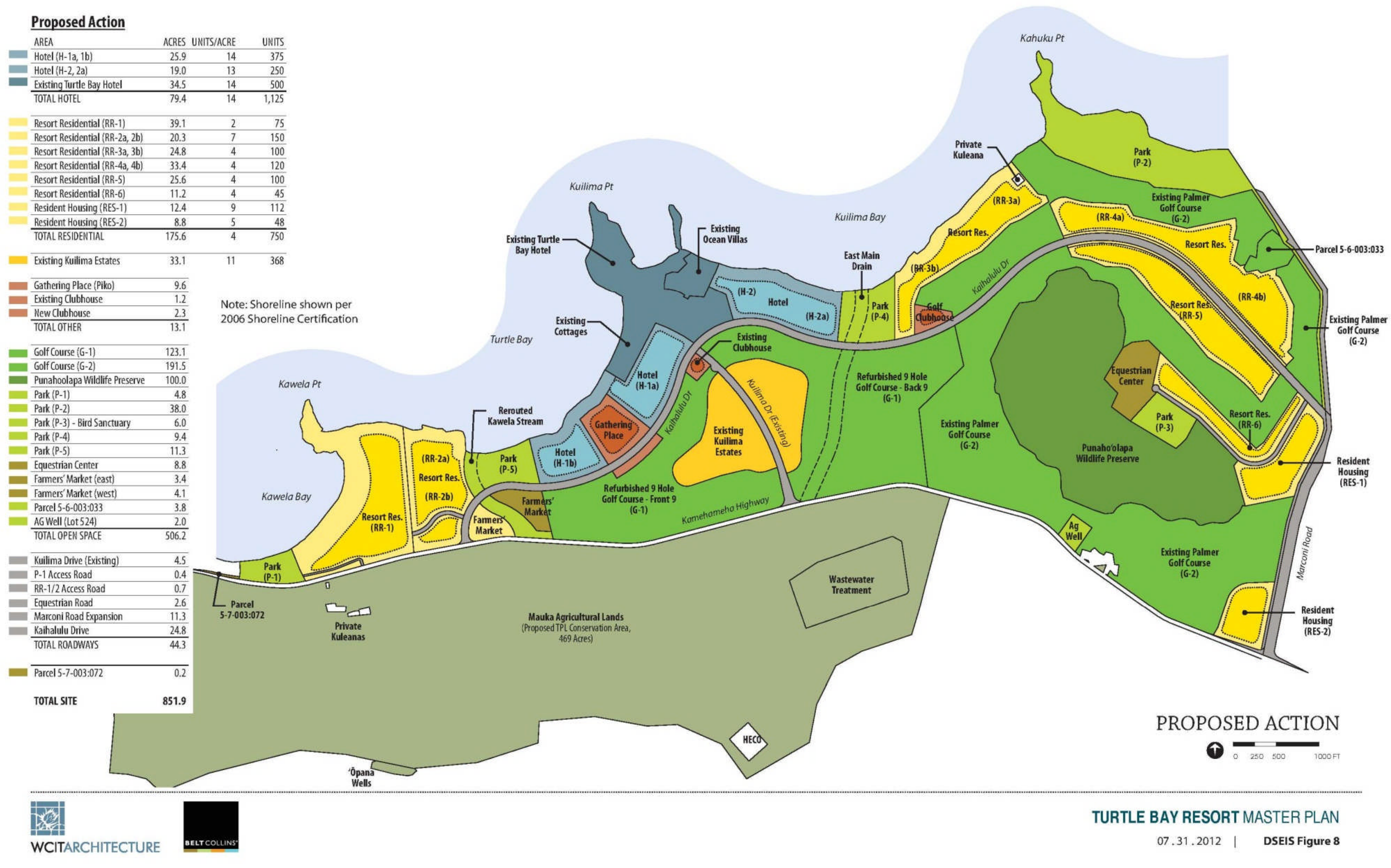


Figure 3. Tax Map Key 5-7-1 showing portion of project area



AREA	ACRES	UNITS/ACRE	UNITS
Hotel (H-1a, 1b)	25.9	14	375
Hotel (H-2, 2a)	19.0	13	250
Existing Turtle Bay Hotel	34.5	14	500
TOTAL HOTEL	79.4	14	1,125
Resort Residential (RR-1)	39.1	2	75
Resort Residential (RR-2a, 2b)	20.3	7	150
Resort Residential (RR-3a, 3b)	24.8	4	100
Resort Residential (RR-4a, 4b)	33.4	4	120
Resort Residential (RR-5)	25.6	4	100
Resort Residential (RR-6)	11.2	4	45
Resident Housing (RES-1)	12.4	9	112
Resident Housing (RES-2)	8.8	5	48
TOTAL RESIDENTIAL	175.6	4	750
Existing Kuilima Estates	33.1	11	368
Gathering Place (Piko)	9.6		
Existing Clubhouse	1.2		
New Clubhouse	2.3		
TOTAL OTHER	13.1		
Golf Course (G-1)	123.1		
Golf Course (G-2)	191.5		
Punahoolapa Wildlife Preserve	100.0		
Park (P-1)	4.8		
Park (P-2)	38.0		
Park (P-3) - Bird Sanctuary	6.0		
Park (P-4)	9.4		
Park (P-5)	11.3		
Equestrian Center	8.8		
Farmers' Market (east)	3.4		
Farmers' Market (west)	4.1		
Parcel 5-6-003:033	3.8		
AG Well (Lot 524)	2.0		
TOTAL OPEN SPACE	506.2		
Kuilima Drive (Existing)	4.5		
P-1 Access Road	0.4		
RR-1/2 Access Road	0.7		
Equestrian Road	2.6		
Marconi Road Expansion	11.3		
Kaihalulu Drive	24.8		
TOTAL ROADWAYS	44.3		
Parcel 5-7-003:072	0.2		
TOTAL SITE	851.9		

Figure 4. Turtle Bay Master Plan

Affairs (OHA), the Advisory Council on Historic Preservation (ACHP), and the City and County of Honolulu (CCHONO). In addition to implementation of the DRP, the MOA required development and implementation of plans for archaeological monitoring and for burial disinterment and reburial. PHRI prepared the plans for monitoring and burial treatment (Jensen 1989) that were approved by the Department of Land and Natural Resources (DLNR) State Historic Preservation Program Director in 1990 (January 9, 1990 letter from Don Hibbard to Paul Rosendahl).

The archaeological data recovery work and monitoring were conducted by PHRI from late 1990 to 1991. After initial data recovery excavations at the Kahuku Point Site were initiated, the landowner decided to halt further work and preserve the site. Monitoring fieldwork results were reported in a series of monthly status reports prepared by PHRI (Sullivan 1990, 1991; Dunn 1991; Donahue 1991). Corbin (2003) reported the findings of the PHRI data recovery and monitoring fieldwork and subsequent analyses. DLNR-SPHD approved the Corbin (2003) report in 2005 (letter from Melanie Chinen to Paul Rosendahl March 11, 2005 Log No: 2005.0110; Doc No: 0501SC05).

In 1992, PHRI prepared a Burial Treatment Plan (Maly and Rosendahl 1992) for the reburial and preservation of remains recovered during previous data recovery and monitoring. The plan was prepared to comply with legislation enacted in 1990 pertaining to the treatment of traditional Hawaiian burials under Hawaiʻi Revised Statutes (HRS) Chapter 6E:43, Act 306. The plan also included reburial of remains inadvertently discovered in 1992 near the resort hotel (Kennedy 1992) and in the mid-1980s at Kahuku Point (Neller 1984, 1989). MOA mandated osteological analysis of human remains by PHRI is reported by Kalima (1993).

In 1996 and 1999, a report on the inadvertent discovery of additional burials was prepared by Archaeological Consultants of the Pacific (ACP) for human remains in 1996 (Carson *et al*. 1996, 1999). Cultural Surveys Hawaiʻi (CSH) conducted archaeological monitoring for golf course refurbishment in 2001 but encountered no cultural deposits (Borthwick *et al*. 2001).

Environment

The Turtle Bay Resort project area is a c. 840-acre ocean-front parcel located on a broad, low-lying coastal plain at the north end of the Island of Oʻahu. Kamehameha Highway borders the property on the south (inland) side. The west side terminates at the center of Kawela Bay, while Marconi Road and undeveloped land border the east side. The land is generally level, with the terrain sloping gently to the north towards the shoreline. Elevation rises from sea level at the coast to a maximum of c. 40 ft at the southeast corner of the property, extends from one-quarter mile to just over a mile inland. Some dunes at the coast rise 20 ft above mean sea level (amsl), but much of the property is significantly less than 20 ft amsl, and Punaho'olapa Marsh is only c. 3 ft amsl. An aerial view of the project area is depicted in *Figure 5*.

The property spans seven traditional land divisions within the Koʻolauloa District (*Figure 6*). From east to west these consist of Kahuku, Punalau, Ulupehupehu, ʻŌiʻo, Hanakaʻoe, Kawela and ʻŌpana. Only the boundaries of Kahuku, ʻŌpana and Kawela are individually defined on current USGS quadrangle and tax maps of the area. The Land of Kahuku occupies the largest portion of the project area, encompassing 480-acres or 57% of the total area; Kawela encompasses 68-acres (8%) and ʻŌpana 9-acres (1%). The four remaining *ahupuaʻa* are depicted on the maps with no boundary divisions between them. These *ahupuaʻa* (Punalau, Ulupehupehu, ʻŌiʻo, Hanakaʻoe) encompass 283-acres (34%).

Kawela Stream originates at the base of the coastal bluff in the Land of Kawela at c. 800 ft elevation and enters the property beneath the Kawela Bridge at the Kamehameha Highway and empties into the central portion of Kawela Bay; its original channel has long been covered by sediments and the stream course has been artificially channeled for quite some time. ʻŌiʻo Stream originates in Waialua District ʻŌiʻo Gulch at c. 1,400 ft elevation; it empties into the ocean at Kaihalulu Bay, between Kuilima and Kahuku Points. The 120-acre freshwater Punahoʻolapa Marsh is located in the east half of the property. The James Campbell National Wildlife Refuge, administered by the US Fish

Figure 5. Aerial view of project area showing Test Areas (from Google Earth)

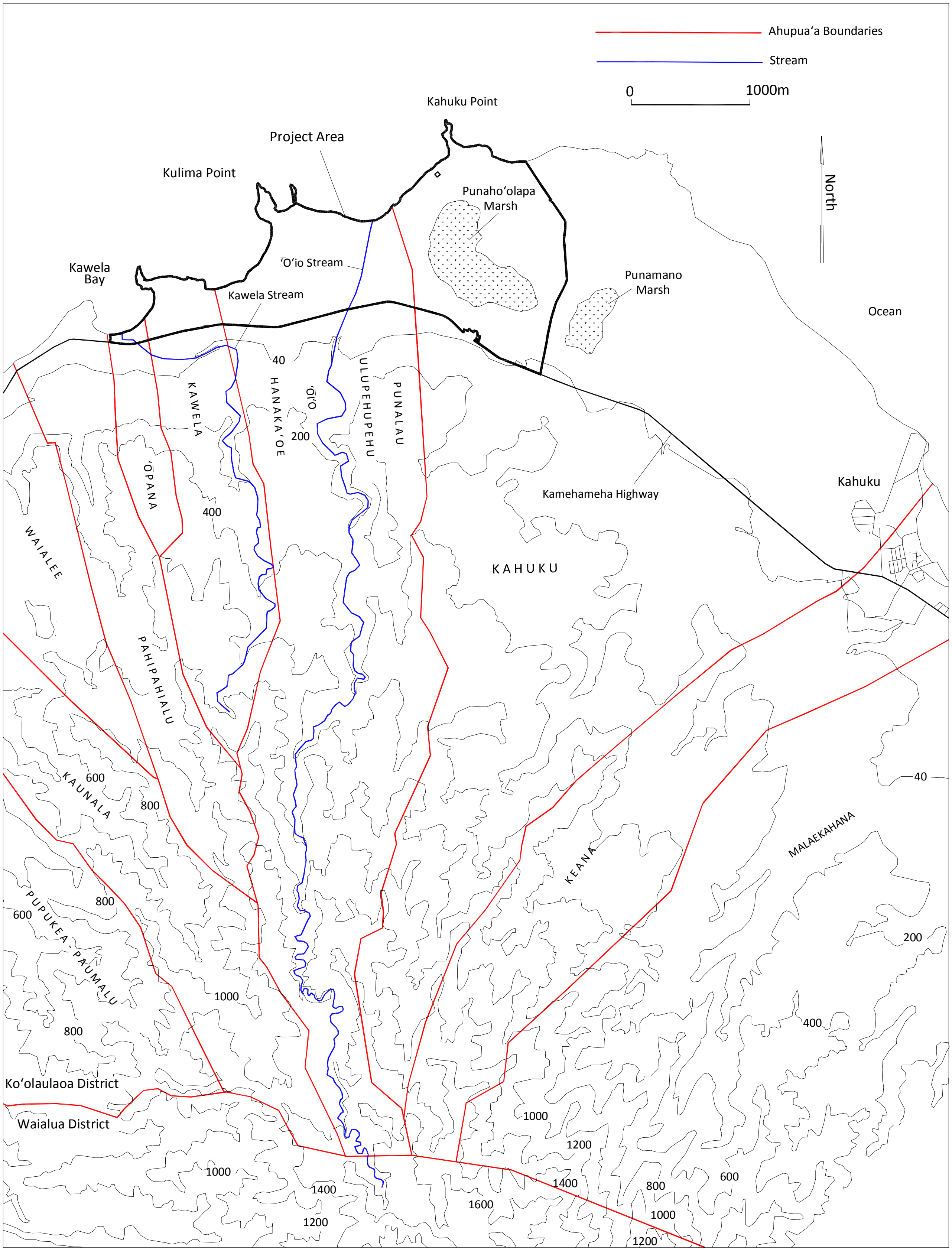


Figure 6. Ahupuaʻa boundaries

and Wildlife Service (FWS), was established in 1976 and encompasses 1,100 acres, including Punamanō Marsh and Kiʻi Pond, adjacent to the resort's east boundary.

Climate in the vicinity of the project area is typically mild with average year-round temperatures ranging from 71 to 79 degrees (city-data.com). Rainfall in the area varies from 30 to 40 inches along the coast and 40 to 60 inches per year in the inland areas (Juvik and Juvik 1998:56). The adjacent National Wildlife Refuge (FWS 2011) protects habitat for over 120 species, including four of six endangered native Hawaiian birds. It preserves coastal habitat for the endangered Hawaiian monk seal (*ʻilio holo i ka uaua*) and nesting habitat for threatened green sea turtles (*honu*) and important seabirds. The Refuge provides a strategic landfall for migratory birds coming from the northern Pacific Rim and wetlands birds including Northern pintail (*koloa mapu*), Northern shoveler (*koloa moha*), lesser scaup, Pacific golden plover (*kolea*) and ruddy turnstone (*ʻakekeke*). The migratory populations represent some of the largest concentrations of these species in Hawaiʻi and the Pacific. Other native species that benefit from the protected refuge habitat include the Hawaiian owl (*pueo*) and a species of rare damselfly.

Undeveloped portions of the TBR property support a variety of introduced plant species. The most prevalent are *koa haole* (*Leucaena glauca*), ironwood (*Casuarina equisetifolia*), Christmas berry (*Schinus terebinthifolius*) and banyan (*Ficus* sp.). Native plants include *hau* (*Hibiscus tiliaceus*), *naupaka* (*Scaevola sericea*), coconut palms (*Cocos nucifera*) and *milo* (*Thespesia populnea*). Sedges (*Scrious lacustris*), saw grass (*Cladium leptostachyum*) and ferns (*Cyclosoro interruptus*) dominate the Punahoʻolapa Marsh vegetation; Christmas berry and *hau* surround the perimeter. The adjacent National Wildlife Refuge marsh supports stands of bulrush and cattail. Invasive alien species targeted for removal on the adjacent refuge include California grass (*Urochloa mutica*), marsh fleabane (*Pluchea x fosbergii*), bullfrogs and feral mallards.

Geology, Hydrology and Soils

Oʻahu is just less than six million years old and encompasses two extinct shield volcanoes: Waiʻanae in the west and Koʻolau in the east (Juvik and Juvik 1998:41). The underlying bedrock on the TBR property was formed by lava deposited 1.7 to 2.5 million years ago from Koʻolau Volcano (*ibid*.:42). The Kahuku Plain is composed of an uplifted fossilized limestone reef formed underwater on the volcanic substratum. The reef formed during inter-glacial periods of higher sea level in the Pleistocene, 12,000 to 2,500,000 years ago (Macdonald *et al*. 1983). Sea level in the northern main Hawaiian Islands reached its Holocene maximum height (c. 2.00 m greater than present) 3,500 years before present (B.P.); subsequent sea level reduction, coupled with island uplifting, exposed the reef bench to high-intensity waves that eroded the reef surface and created the fossilized, stabilized and active sand dunes that formed along the shore (Grossman 1998, Grossman and Fletcher 1998).

The emerged limestone reef surface was eroded by waves and freshwater flows that created karstic features consisting of sinkholes, subterranean streams, fissures and caverns. The karst topography resulted in pools, ponds and marshes inland of the coastal dune fields on the nearly level Kahuku Plain. The water table is close to the surface. Small areas of limestone outcrop are still visible inland of Kawela Bay and Kuilima Point, where they are erroneously called "coral" outcrops (*Figure 7*).

Ground surface weathering also subsequently modified the uplifted limestone reef surface after the sea level receded. Accelerated weathering combined with alluvial deposition of sediments and rock derived from the volcanic uplands to essentially cover the Kahuku Plain's limestone surface with a mantel of silt and clay sediments. Talus and alluvial deposits are interbedded, bordered along the coast by wind and wave deposited sands, especially at Kahuku Point where extensive relict and modern dunes are present (Takasaki and Valenciano 1969; SOEST 2011). At Kahuku Point, lithified dunes are "shaped by chemical weathering, intertidal bioerosion, and the northeast trade winds to which they are fully exposed" (Takasaki and Valenciano 1969). Lithified clay (laterite) covers the marine bench inland of the shore at Kahuku Point (Chapman 1946).

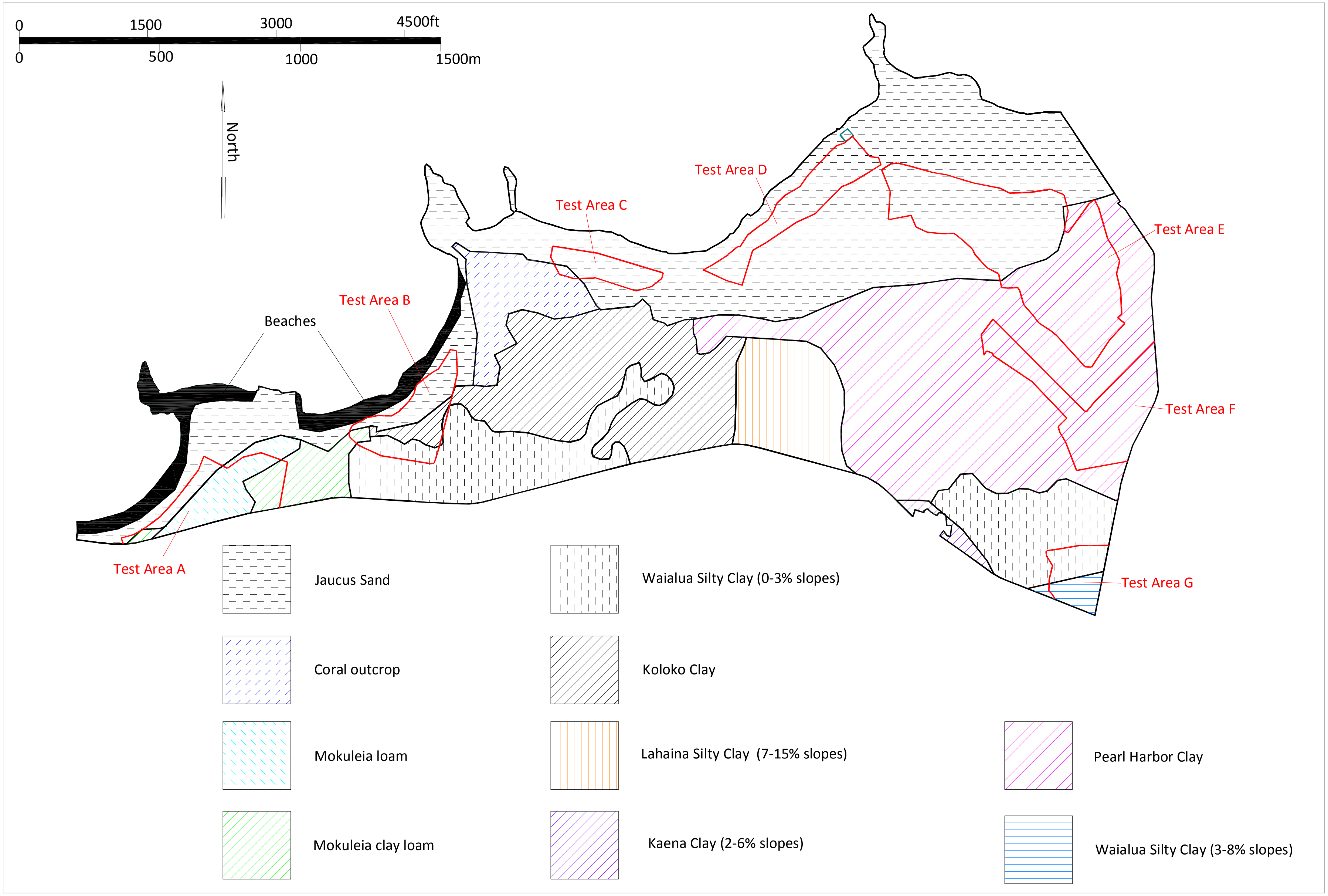


Figure 7. Distribution of soils within the project area

The north shore of Oʻahu receives the full brunt of massive waves from the North Pacific Swell in the winter, which move large quantities of sand to the shore. Beach sands are calcareous (calcium-rich) and coarse-grained, typical of high-energy waves that move detritus from the submerged reefs to shore. Active dunes at Kahuku Point "exist seaward of vegetated Holocene dunes" and "sand dunes and perched beaches along Kahuku Point are continuously reshaped by the persistent trade winds" (USGS 2011a). Catastrophic tidal waves and stream flooding from winter storm runoff are known hazards around the Kahuku Point coastline (*ibid*.):

> During the 1946 and 1957 tsunamis, flood inundation heights of 27 and 23 ft were recorded at Kahuku Point. The hazard associated with high waves is ranked high around the entire Kahuku Point, but…[t]he storm threat is ranked moderately low along the Kahuku coast because it is partly sheltered from the impact of the majority of tropical storms that historically track to the west and south of Oahu. Erosion is ranked moderately low for the small embayments lining the western portion of Kahuku Point, except along the rocky point immediately northeast of Kawela Bay beach where it is low.

On the Kahuku Plain freshwater constitutes a major natural resource. Perennial and intermittent streams once provided ample water across the plain. Coastal brackish marshes on the Kahuku Plain formed in the elevated limestone reef, fed by the numerous streams originating in the uplands to the south, by rainfall, springs and seeps (Hunt and De Carlo 2000; Takasaki and Valenciano 1969:48). Subterranean seawater extends inland from Kahuku west to Kawela and beyond, naturally contaminating the basal freshwater body (Takasaki and Valenciano 1969). Basal water channeled from volcanic dikes in the Koʻolau Range recharges the shallow water table underlying the Kahuku Plain and is perched above the infiltrating seawater (*ibid.*). This provides sufficient pressure for springs, seeps and artesian wells. Flooding is most prevalent in March, but can occur throughout the year (*ibid*.:16).

Eleven soil types have been described and mapped in the property (Foote *et al*. 1972). These consist of beach sands, coral outcrops, Jaucus sand (0-15% slopes), Pearl Harbor clay, Waialua silty clay (0-3% and 3-8% slopes), Kaloko clay, Lahaina silty clay (7-15% slopes), Mokuleia loam and clay loam, and Kaena clay (2-6% slopes). The distribution of these soils is shown in Figure 7 and their characteristics are summarized in *Table 1*.

Jaucus Sand is the most widespread sediment, which encompasses 278 acres, or 33% of the property. It is exposed along the coastal margins and is characterized by well-drained single-grained sand to depths exceeding more than 60 inches. It is considered suitable for pasture, sugarcane, truck-crops, and urban development.

Pearl Harbor Clay is the next most extensive sediment, encompassing 227 acres, or 27% of the property. It largely coincides with the former extent of Punahoʻolapa Marsh and consists of poorly drained, mottled clay overlying mottled clay subsoil, formed on layers of muck or peat. Pearl Harbor clay is classified as suitable for pasture, sugarcane, taro and bananas.

Waialua Silty Clay (0-3 and 3-8% slopes) covers 110 acres, or 14% of the total on gentle slopes in the southeastern corner of the property. It is moderately well drained and characterized by a silty clay surface layer overlying a subsoil of blocky silty clay formed on a mottled silty clay substratum. It is suitable for pasture, sugarcane and truck crops.

Kaloko Clay covers 96 acres, or 11% in the central portion of the property. It is developed in alluvium derived from igneous rock and is poorly drained. It consists of clay overlying multiple layers of clay and silt clay. It is classified as suitable for pasture and sugarcane.

Lahaina Silty Clay covers 39 acres (5%) in the east-central portion of the property. It is derived from weathered igneous rock and is well drained, and is typically exposed on slopes above the coastal plain. The surface layer is severely eroded and overlies a blocky silty clay and silty clay loam subsoil, formed on weathered igneous parent material. It is classified as suitable for sugarcane and pineapple.

Table 1. Summary of Soils within Project Area

Soil Type	Acres	% of Project Area	Description	Permeability	Runoff	Erozion Hazard	Suitability
Jaucus Sand (0-15% slope)	278	33	Single grained sands	Rapid	Very slow to ponded	Slight	Pasture, sugarcane, truck crops, urban development
Pearl Harbor Clay	227	27	Mottled clay surface layer over mottled clay subsoil, over muck or peat	Very slow	Very slow to ponded	Slight	Pasture, sugarcane, taro, bananas
Waialua Silty Clay (0-3% slope)	105	13	Silty clay surface layer over subsoil of blocky silty clay over mottled silty clay substratum	Moderate	Slow	Slight	Pasture, sugarcane and , truck crops
Kaloko Clay	96	11	Clay surface layer over clay and silt clay subsoils	Moderately slow to slow	Slow to very slow	Slight	Pasture and sugarcane
Lahaina Silty Clay (7-15% slope)	39	5	Severely eroded silty clay surface layer over blocky silty clay and silty clay loam subsoil over weathered igneous rock substratum	Moderate	Medium	Moderate	Sugarcane and pineapple
Limestone outcrop	27	3	Cemented coral or calcareous sand	n/a	n/a	n/a	Military installations, quarries, urban developemtn
Mokulei Clay Loam	20	2	Clay loam surface layer over sand and loamy sand subsoils	Moderate	Very slow	Slight	Pasture, sugarcane and truck crops
Beaches	19	2	Sandy, gravelly or cobbly areas	n/a	n/a	n/a	Recreation
Mokulei Loam	18	2	Clay loam surface layer over sand and loamy sand subsoils	Moderate	Very slow	Slight	Pasture, sugarcane and , truck crops
Kaena Clay (2-6% slope)	6	1	Clay surface layer over clay subsoil over highly weathered gravel	Slow	Slow	Slight	Pasture, sugarcane, homesites
Waialua Silty Clay (3-8% slope)	5	1	Silty clay surface layer over subsoil of blocky silty clay over mottled silty clay substratum	Moderate	Slow	Slight	Pasture, sugarcane and truck crops
Total	840	100					

Limestone Outcrops cover 27 acres, or 3% of the area, inland of Kuilima Point. The outcrops are composed of crushed and cemented coral or calcareous sand that formed in shallow ocean waters when the sea levels were higher and is classified as suitable for military installations, quarries and urban development.

Mokuleia Loam and Clay Loam encompasses 38 acres or 4% of the project area (18-acres, 2%) and is located in the southwest portion of the parcel. This soil is characterized as well-drained clay loam surface layers, over sand and loamy sand subsoils (1972:96). These soils are classified as suitable for pasture, sugarcane and truck crops.

Beaches cover 19 acres or 2% of the total property area and are restricted to Turtle Bay and Kawela Bay. The coastal strands in these bays are characterized as sandy, gravelly or cobbly and are classified as suitable solely for recreation.

Kaena Clay encompasses 6 acres, or 1% of the property, and is found only along the southeast edge of the resort. The clay is very deep, poorly drained, and is exposed on alluvial fans and talus slopes. It is characterized by a clay surface layer overlying clay subsoil, formed on a highly weathered gravel substratum. It is classified as suitable for pasture and sugarcane.

Research Design

The research design presented in the SAIS Plan (Haun *et al.* 2011) identified seven areas for proposed test excavations that were designated Test Areas A-G. Most of the remaining resort lands were excluded from the proposed testing because these are already developed with golf courses and other resort facilities. Most test areas are densely vegetated with *koa haole*, ironwood, Christmas berry and *hau*. Two forested areas, a proposed hotel site at Kawela Bay and a proposed golf clubhouse site in the central coastal portion of the property overlooking Kaihalulu Beach were graded to bedrock and filled during construction activity in 1990-1991. These areas are considered to lack any potential for significant intact subsurface cultural remains. Testing also excluded areas fronting the shoreline ranging from 200 to 300 ft wide where no development is planned.

Figure 8 is an overlay of the original proposed test excavation areas that were presented in the SAIS Plan (*ibid*.) plan, on the updated TBR master plan preferred alternative map. The combined test area extent was 173.2 acres. The pre-fieldwork boundaries of the test areas were defined using available aerial photographs and maps provided by TBR; however, on-site inspection of the areas required slight modifications of the test area boundaries. The revised test area extent is 167.9-acres. These modifications result in a 5.3-acre reduction in the total area. *Figure 9* presents the revised test excavation areas, overlain onto the TBR map.

The test areas are located where future development is planned. No additional testing was proposed for parks and other open spaces where development impacts are anticipated to be minimal, primarily consisting of landscaping that would have very shallow, less than 1 ft (30 cm) deep impact. All ground disturbing activity in the open space areas would be subject to archaeological monitoring done in accordance with a monitoring plan prepared for SHPD review and approval.

Moderate to dense vegetation covers all of the test areas, except Areas B and C. To facilitate access by excavating equipment, most transects were mechanically cleared prior to trenching. The initial clearing effort for all test areas, except Area B, involved clearing a baseline that paralleled the long axis of each test area. Next, transects were laid out perpendicular to the baseline. Transects were sequentially numbered as were the trenches within each transect. For example, BT-A-1-1, indicates backhoe trench (BT), Area A, Transect 1, Trench 1.

Baselines and transects were cleared using a mechanical flail attached to a Komatsu PC130 excavator. A total of 14,293 linear meters or nearly 9 miles of transect were cleared. Transects varied in width from 5.0 to 10.0 m. The extent of vegetation clearing is presented in *Figure 10.* No clearing was necessary for Test Area B because it is open

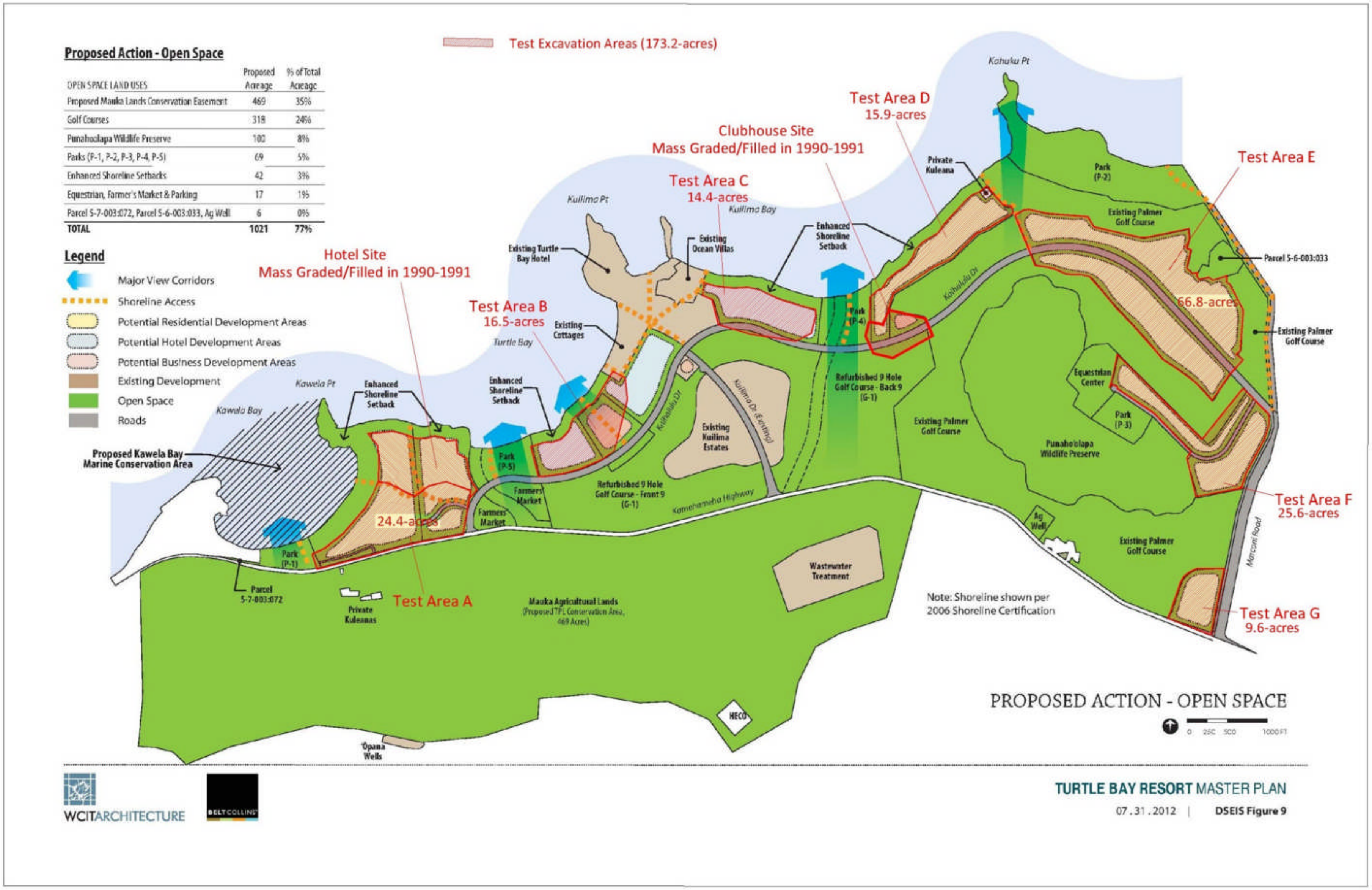


Figure 8. Proposed Test Excavation Areas and Turtle Bay Lands - Open Space Lands

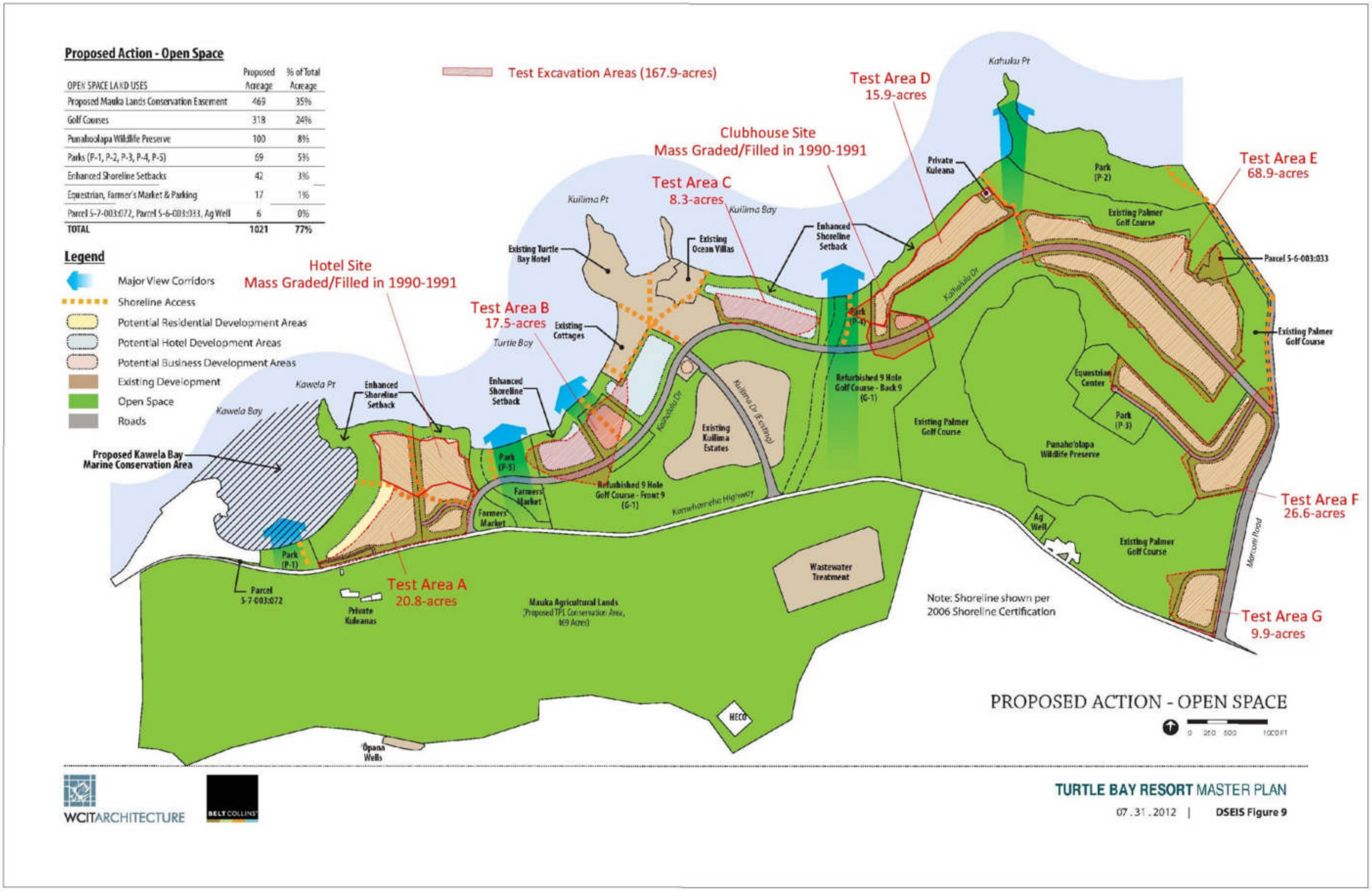


Figure 9. Revised Test Excavation Areas and Turtle Bay Lands - Open Space Lands

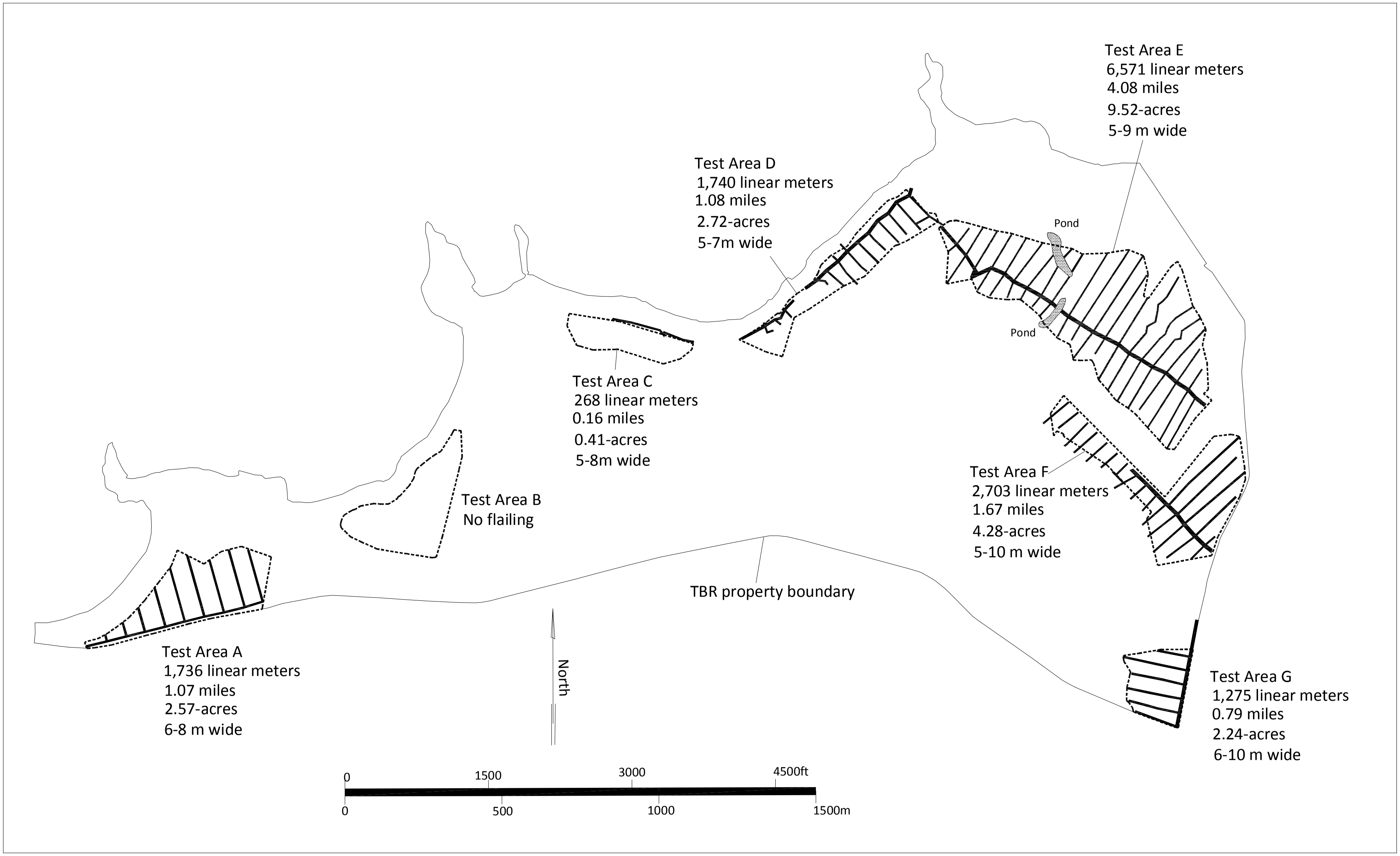


Figure 10. Extent of mechanical flailing

lawn and occupied by an equestrian facility. Test Area C is relatively open beneath a canopy of ironwood trees and mechanical clearing was limited to the baseline.

Previous archaeological studies for the TBR property established a higher potential for encountering subsurface cultural remains including burials in mapped Jaucus Sand and Pearl Harbor Clay deposits. These two soil types were subjected to higher intensity testing. Lower intensity testing sampled the various clay and loam soil types elsewhere on the TBR property.

Low density testing of 1 trench per acre sampled the Waialua/Mokuleia Clay soils at Kawela Bay (Test Area A) and the planned residential housing development (Test Area G). The remaining test areas are characterized by Jaucus Sand and Pearl Harbor Clay sediments, where high-intensity testing density of 2 trenches per acre were sampled. This sampling strategy resulted in excavation of 314 systematically placed trenches.

The SAIS Plan proposed additional discretionary trenches as needed for:

- specific areas that might be missed by the systematic transect trenching such as Land Commission Awards (LCAs);
- the location of a former plantation worker housing (Camp 3) in Area B;
- areas where subsurface cultural remains were documented by previous archaeological studies (Areas D and E);
- segments of the proposed Kaihalulu Drive outside the potential test excavation areas that are undeveloped; and
- defining the extent of subsurface cultural deposits identified in systematically placed trenches.

Field conditions required some adjustments to test area extent and trench placement. No segments of the proposed Kaihalulu Drive were tested because undeveloped sections were either in tested areas or developed portions of the resort. These modifications are discussed below.

Test Area A was reduced in size from 24.4 to 20.8-acres, to accommodate a wider (300 ft) coastal setback than the 150 ft-wide setback used in the SAIS Plan. Prior archaeological excavations in and adjacent to Test Area A reached a maximum depth of 1.15 m below surface without identifying any cultural layers (Walker *et al.* 1988b, Bath *et al.* 1984). Prior testing identified two to three non-cultural sand layers in the seaward portion of Area A and three non-cultural sandy clay and clay loam layers in the inland portion. Evidence of plowing was observed in the eastern portion of the area where the test excavations reached the water table. The plow zone is a 0.35 m thick clay loam underlain by two layers of sand.

The SAIS Plan proposed excavation of 25 systematically placed trenches and five discretionary trenches for Area A. Two discretionary trenches were proposed to test areas within adjacent LCA parcels, and three were proposed to test sand areas along the seaward side of Area A. These discretionary trenches were excluded during the fieldwork because the shoreline setback was expanded to 300 ft. Twenty-four trenches were excavated during the SAIS fieldwork in Test Area A and no intact cultural deposits were identified.

Test Area B was increased from 16.5 to 17.5-acres by the inclusion of additional areas along the south and west sides. No cultural layers were observed in prior excavations conducted adjacent to the west side of Test Area B (Bath *et al.* 1984). Previous excavations extended to a maximum depth of 2.1 m below the surface, exposing 3-4 layers of sand.

The SAIS plan proposed excavation of 33 systematically placed trenches in Test Area B and two discretionary trenches: one in the eastern portion of the area where an LCA parcel (LCA 235M) is located and one where Kahuku Plantation Camp 3 was formerly located. Thirty-seven systematically-placed trenches were excavated in Test Area B. Slight deviations in trench orientation and placement were necessitated by the equestrian stables, corrals and associated facilities. No discretionary trenches were necessary because the systematically placed trenches adequately sampled the LCA parcel and the plantation camp.

Test Area C was reduced from 14.4 to 8.3-acres as a result of an increase in the shoreline set back from 150 ft to 200 ft and other adjustments along the southern boundary, where a golf course fairway and other facilities are located. Previous excavations by Bath *et al.* (1984) in Test Area C documented three sand layers extending to a depth of 2.1 m below the surface in Test Area C. These sand deposits were highly disturbed, containing mixed prehistoric and modern debris. Site 4488 is located in the western portion of this test area, where past sand mining led to the inadvertent discovery of several burials that were documented by Kennedy (1992) and Carson *et al.* (1996). The SAIS Plan proposed excavation of eight or more manual test units in the vicinity of Site 4488. These test units were to be excavated manually until the stratigraphy in this area was well documented and the potential for encountering additional burials was evaluated. Twenty-nine systematically placed trenches were also proposed for Test Area C, with one discretionary trench to be excavated at the west end of Area C.

Several large deep depressions were identified in Test Area C, where sand mining occurred in the past. It was apparent from these deep depressions, and from a TBR-provided topographic map, that the sand deposit in some areas exceeded 6 m in depth. The depth and unconsolidated nature of the sand deposit rendered unfeasible the SAIS Plan proposal to manually excavate test pits. The alternative test excavation strategy employed was manual excavation of sand pit sides to expose vertical faces for profile documentation. Accompanying mechanical excavations adjacent to the manual profiles were used to expose the deepest portions of the deposit and the underlying bedrock. As a result of the reduced area and modified testing strategy, a total of ten manual profiles and 18 systematically placed and mechanically excavated trenches documented the subsurface deposits in Test Area C.

Test Area D retained its original size (15.9 acres) and its configuration was not changed during fieldwork. Previous excavations within and adjacent to this area documented multiple (2-6) sand layers extending to a maximum depth of 1.6 m below the surface (Walker *et al.* 1988b, Bath *et al.* 1984, Corbin 2003). An intact cultural deposit was identified at the northeast end of Area D (Site 6411, Feature C), consisting of black loamy sand that varied in depth from 1.16 to 1.41 m. The central portion of Area D contains highly disturbed sand deposits with at least some cultural material, although Corbin (2003) does not indicate which layer(s) contained cultural material. Two non-cultural sand layers are present in the southwest portion of Test Area D (Corbin 2003).

The SAIS Plan proposed 33 systematically placed trenches for Test Area D and additional discretionary trenches in the eastern and central portions to further examine previously identified cultural deposits. During the SAIS fieldwork, 36 systematically placed trenches and 3 discretionary trenches were excavated. The systematic trenches identified inland extent of the previously identified cultural deposits along the shoreline. The discretionary trenches were excavated in the western portion of the area to define the extent of a subsurface cultural deposit.

Test Area E increased from 66.8 to 68.9-acres by the inclusion of additional areas along the east and west sides during the SAIS fieldwork. Previous excavation in and adjacent to the area reached a maximum depth of 3.6 m below surface (*ibid*.). Most of the test excavations reached bedrock. An intact cultural layer was identified in the southeast portion of the area (Site 6414). This deposit was described by Corbin (2003) as dark brown silty clay loam that varied in depth from 0.59 to 0.89 m. Remnant wetland deposits were present at the northwest and west ends of the area. Sediments were impacted by airfield construction at the north end. Relatively shallow Pearl Harbor Clay deposits border Area D to the east, west and south.

The SAIS Plan proposed excavation of 133 systematically placed trenches for Test Area E and least three discretionary trenches in former LCA parcels (LCA 2698:3, 2880:2, and 3958:2). During fieldwork, 137 systematic and 20 discretionary trenches were excavated. The systematically placed trenches identified the remnants of five cultural deposits, but none of these can be correlated with previously identified Site 6414 cultural deposit. The discretionary trenches were excavated at three of the five cultural deposits to define cultural deposit extent.

Test Area F increased from 25.6 to 26.6 acres as a result of the additional areas along the northwestern side. Prior excavations adjacent to Area F extended to a maximum depth of 4.93 m below the surface. Most of these excavations extended to bedrock or the water table (Bath *et al.* 1984, Davis *et al.* 1986, Corbin 2003). Stratified cultural deposits were identified in excavations adjacent to the northeast end of the area (Site 6422). The upper cultural deposit consisted of a very dark grayish brown silty clay loam that is 0.12 to 0.31 m in depth over a brown silty clay loam cultural layer that is 0.31 to 0.42 m in depth. The SAIS Plan proposed excavation of at least two discretionary trenches next to the reported location of the stratified deposits. Remnant wetland deposits associated with Punahoʻolapa Marsh are located west of Area F and non-cultural Pearl Harbor Clay is present to the north and northwest.

The SAIS Plan proposed excavation of 52 systematically placed trenches and the two previously mentioned discretionary trenches. Fifty-eight systematically placed trenches were excavated during fieldwork. No intact prehistoric cultural deposits were identified in Test Area F.

Test Area G was increased slightly from 9.6 to 9.9-acres by the inclusion of additional areas along the west side during the SAIS fieldwork. No previous excavations were conducted in or near Test Area G. The closest prior test excavations consist of two cores located more than 100 m to the northwest by Bath *et al.* (1984). These cores extended to a depth of 3.6 m and identified multiple layers of loam, clay and silt with an intervening peat layer. No cultural deposits were present. The SAIS plan proposed 10 systematically placed trenches in Area G. Twelve trenches were excavated. No intact cultural deposits were identified in Test Area G.

Methods

An archaeologist monitored all mechanical trench excavations. The trenches were excavated using Komatsu PC 130 and Hitachi ZX200 excavators. Most trenches were excavated either to a basal limestone deposit or the water table. Two were terminated when human remains were identified (BT B-6-2 and BT D-2-1b) and two trenches were terminated when conditions made further excavation unfeasible (BT E-15-6 and F-3-4). Trenches that measured greater than 1.0 m in depth were widened and stepped for safety. Trench location was determined with a Magellan Mobile Mapper using Global Positioning System (GPS) data.

Following excavation, the trench walls were manually scraped to examine and document the stratigraphy. A profile drawing was prepared using the Munsell soil color notation system and U.S. Soil Conservation Service descriptive terminology. The depth, time and date when the water table was encountered was recorded, if present. If no intact cultural deposits were present, an average 1 meter-wide profile drawing was prepared depicting the representative stratigraphy. When cultural deposits or unique, atypical features or complex stratigraphy were encountered, larger sections, and in some cases, the entire trench wall was documented.

When cultural deposits were observed, these layers were carefully examined for portable remains. Collected remains were placed in paper bags labeled with the appropriate provenience information. When charcoal was encountered it was deposited in an aluminum foil pouch and placed in a layer bag. Following their documentation, the trenches were backfilled as expeditiously as possible.

Following completion of fieldwork, analysis of all recovered remains and data followed standard archaeological methods. All recovered artifacts were analyzed to determine morphological type, condition/degree of completion and material. Metric measurements included weight, length, width, and thickness. Standard typological classifications were used for all artifacts. Food remains were identified to the Family level, or to the Genus/species level, when possible. Quantitative analysis included a determination of total weight and total number of fragments (TNF) per taxon. All cultural material and samples collected during fieldwork are presented in the project Accession Record in Appendix D.

Human remains were identified in three locations during the project. These consist of *in situ* burials noted in trenches in Areas B and D, and a secondarily deposited human metatarsal identified on the surface of a sand pit in

Area C. Trench excavations were immediately terminated when human remains were identified and the find was immediately reported to SHPD. Profiles of the trenches were prepared and the remains carefully and respectfully documented. No photographs were taken of any burial or isolated human bone. The *in situ* burials were carefully backfilled following consultation with SHPD. After consultation with SHPD, the isolated and displaced human metatarsal was collected for temporary storage at the adjacent TBR office trailer to protect it because it was lying on the ground surface in an area frequented by hotel guests and the general public. The Kahuku Burial Committee was also consulted concerning identification of all human remains. Committee members provided appropriate cultural protocols.

Another SAIS fieldwork task was relocation and documentation of previously identified sites. This task sought to evaluate the current status of seven sites. These consist of sites that were previously assigned State Inventory of Historic Places (SIHP) site designations and ones that retain the original field temporary designations. The four SIHP sites are the Site 5791 OR&L railroad grade, a walled pool (Site 6421), and two stone walls (Sites 6424 and 6426). Sites with no prior SIHP site designation consist of Kahuku Army Airfield remnants, including a concrete structure (Site T-4), the Site T-2 wall and the Site T-3 cattle enclosure. The relocation effort confirmed the presence of the OR&L railroad grade (Site 5791), the Site T-4 military structure and portions of the Kahuku Army Airfield. Site T-4 and the airfield remnants were assigned SIHP site designations during this project. The remaining previously identified sites were destroyed, presumably by golf course related construction activity.

During the mechanical clearing of transects for subsurface testing, it became apparent that there were a number of concrete structures and structural remains that were not documented during earlier surveys. The lack of documentation was likely because these remains are mostly World War II era military-related features that had not attained sufficient age (50 years) to be considered historic resources when the earlier surveys were conducted in late 1970s to mid-1980s. To rectify this situation, the seven test areas and adjacent undeveloped lands, Kahuku Point Archaeological Preserve and the Kawela Bay shoreline were subjected to 100% pedestrian archaeological survey prior to commencing subsurface testing.

The pedestrian surface survey methodology involved walking survey transects spaced approximately 10 m apart. Identified site locations were plotted with the aid of a hand-held Magellan Mobile Mapper GPS device using the NAD 83 datum. The accuracy of this GPS device for a single point is less than one meter. Intact or predominately intact structures were subjected to detailed recording consisting of mapping, preparing standardized site and feature forms and photographic documentation. Displaced structural remnants were described and photographed, but no plan maps were made. Sites were flagged with pink and blue flagging tape and a metal site tag was placed at each site datum and the tag location was plotted on the site plan map.

FINDINGS

Fieldwork consisted of a systematic pedestrian survey of undeveloped portions of the resort including the Kahuku Point Archaeological Preserve and seven areas (Test Areas A-G) where development is planned. Twenty-nine surface sites with 35 features were documented as a result of the pedestrian survey. Seven future development areas also were subjected to systematic, mechanical excavation of 345 trenches totaling 2,045 linear meters (1.27 miles). Subsurface trenching and test excavations documented an additional ten subsurface sites with 11 features. Human remains were identified in three locations; two *in situ* burials in Areas B and D, and a secondarily deposited human metatarsal (toe bone) on the surface of a previously mined sand pit in Area C. The following describes the work conducted for the SAIS.

Surface Survey

The survey identified 29 surface sites with 35 features. These sites are summarized in *Table 2.* The features consist of 9 concrete structures, 8 concrete blocks, 5 concrete slabs, 3 asphalt pavements, 2 artifact scatters and one each of the following: transit bus, concrete cylinder, a pair of metal gateposts, metal tank, railroad grade, revetment, stone mound and wall. Feature function includes antenna support (8), foundation (4), gun position (4), transportation (3), trash disposal (2), storage (2), gate (1), livestock control (1), possible agriculture (1), possible light fixture base (1), pavement (1), runway remnant (1), water storage (1) and indeterminate (5). The majority of the sites are associated with the World War II era use of the area as an Army Airfield.

Surface sites were identified in Test Areas A, E and F, the Kahuku Point Archaeological Preserve and the northern portion of Kawela Bay. No surface sites were present in Test Areas B, C, D or G. The absence of sites in these areas is due primarily to extensive ground altering activities associated with historic agriculture, ranching and golf course-related construction.

The SAIS Plan called for relocation and evaluation of seven previously identified sites. These consist of the OR&L railroad grade, remnants of the Kahuku Army Airfield, the Site 6421 walled pool, the Site 6424 and 6426 rock walls, the Site T-2 wall, the Site T-3 cattle enclosure and the Site T-4 military structure (*Figure 11*). The OR&L railroad grade and the Kahuku Army Airfield runway were depicted on maps of the area by various researchers, but were never formally documented. Sites 6421, 6424 and 6426 were reported by Corbin (2003) and Sites T-2, T-3 and T-4 were identified by Bath *et al*. (1984).

The surface survey relocated portions of the OR&L railroad grade (Site 5791) and portions of the Kahuku Army Airfield (Sites 7275-7278, 7280-7281). An additional previously identified site (Site T-5), consisting of a stone wall (Bath *et al*. 1984) was also relocated. This wall was recorded and assigned a SIHP Site designation (Site 7299). The remaining previously identified sites have been destroyed, presumably by golf course-related construction. Descriptions of the sites identified during the project area presented below.

OR&L Railroad

Site 5791 is the portion of the OR&L Railroad grade that formerly crossed the TBR property (see *Figure 11*). The original alignment of the grade is depicted on current tax maps that show the project area (see *Figures 2* and *3*). The railroad bed was under construction from 1890 to 1900 and was operational from 1900 to 1946, when significant sections of the bed were destroyed by the April 1, 1946 tsunami. None of the previous archaeological projects documented this historic transportation route or assigned the railroad grade an SIHP site designation. The railroad was formally abandoned in 1954 (Haun and Henry 2001).

A portion of the railroad grade west of the project area in the Land of Kaunala and was assigned SIHP Site 5791 by Haun and Henry (2001:15), where a 525-meter long section of the railroad grade and several bridge foundations

Table 2. Summary of Identified Sites

SIHP Site No.	Formal type	Function	Area	TMK	Age	No. of Features	Formal Type															Function																H&A Temp Field No.
							Concrete structure	Cultural deposit	Concrete block	Concrete slab	Human remains	Asphalt area	Artifact scatter	Transit bus	Concrete cylinder	Metal posts	Metal tank	Railroad grade	Revetment	Stone mound	Wall	Habitation	Antenna support	Foundation	Gun position	Burial	Transportation	Trash disposal	Storage	Gate	Livestock control	Possible agriculture	Possible light fixture base	Pavement	Runway remnant	Water storage	Indeterminate	
4488	Human remains	Burial	C	5-7-01:013	Prehistoric/ early historic	1					1															1												
5791	OR&L Railroad grade	Transportation	A, B, F, Punaho'olapa Marsh	5-7-01:033	1899-1946	1												1									1											-
7261	Concrete structure	Gun position	Kawela Bay	5-7-06:23	1942-1946	1	1																		1													69
7262	Concrete slab	Indeterminate	Kahuku Point	5-7-01:033	1942-1946	1				1																											1	58
7263	Concrete pier block	Antenna support?	Kahuku Point	5-7-01:033	1942-1946	1			1														1															60
7264	Revetment	Storage	Kahuku Point	5-7-01:033	1942-1946	1													1										1									70
7265	Concrete slab	Foundation	F	5-7-01:033	1942-1946	1				1														1														71
7266	Concrete pier blocks	Antenna support?	Kahuku Point	5-7-01:033	1942-1946	3			3														3															63
7267	Transit bus	Transportation	A	5-7-01:033	1950s-1973	1								1													1											68
7268	Concrete structure	Indeterminate	Kahuku Point	5-7-01:033	1942-1946	1	1																														1	61
7269	Concrete structure remnant	Indeterminate	Kahuku Point	5-7-01:033	1942-1946	1	1																														1	56
7270	Metal tank	Storage	Kahuku Point	5-7-01:033	1942-1946	1											1												1									57
7271	Asphalt area	Transportation	Kahuku Point	5-7-01:033	1942-1946	1						1															1											51
7272	Concrete structure	Gun position?	Kahuku Point	5-7-01:033	1942-1946	1	1																		1													52, 55
7273	Concrete block	Indeterminate	Kahuku Point	5-7-01:033	1942-1946	1			1																												1	64
7274	Concrete cylinder	Possible light fixture	Kahuku Point	5-6-03:41	1942-1946	1									1																		1					53
7275	Asphalt area	Runway remnant	E	5-7-01:033	1942-1946	1						1																							1			6
7276	Concrete block	Anchor base	E	5-6-03:41	1942-1946	1			1														1															10
7277	Concrete slab	Foundation	E	5-6-03:41	1942-1946	1				1														1														67
7278	Concrete structure	Gun position?	E	5-6-03:41	1942-1946	1	1																														1	18
7279	Concrete block	Antenna support?	E	5-6-03:41	1933	1			1														1															19
7280	Concrete structure	Antenna support?	E	5-6-03:41	1930s	1	1																1															65
7281	Concrete structure	Gun position?	E	5-6-03:41	1942-1946	1	1																		1													49
7282	Concrete block	Antenna support?	E	5-6-03:41	1930s	1			1														1															46
7283	Stone mound	Possible agricultural	F	5-6-03:44	Prehistoric	1														1												1						37
7284	Complex	Barracks complex	F	5-6-03:44	1942-1946	5	1			2			2											2				2								1		32, 34, 35,
7285	Metal posts	Gate	F	5-6-03:44	1942-1946	1										1														1								21
7286	Asphalt area	Pavement	F	5-6-03:44	1942-1946	1						1																						1				20
7287	Concrete structures	Gun position?	F	5-6-03:44	1942-1946	1	1																		1													25
7288	Human remains	Burial	B	5-7-01:020	Prehistoric	1					1															1												BT-B-6-2
7289	Cultural deposit with human remains	Habitation/Burial	D	5-7-01:01	Prehistoric	2		1			1											1				1												BTs D-2-1, 2-1b, 2-1d
7290	Cultural deposit	Habitation	D	5-7-01:01	Prehistoric	1		1														1																BTs D-5-, 6-1, 7-1
7291	Cultural deposit	Habitation	D	5-7-01:033	Prehistoric	1		1														1																BTs D-12-2, 13-3, 14-2, 14-3, 15-3
7292	Cultural deposit	Habitation	E	5-7-1:033	Prehistoric	1		1														1																BT-E-2-3, 3-2, 3-3, 4-1, 4-2, 4-2b, 4-3
7293	Cultural deposit	Habitation	E	5-7-1:033	Prehistoric	1		1														1																BT-E-10-2
7294	Cultural deposit	Habitation	E	5-7-1:033	Prehistoric	1		1														1																BT-E-13-6, 13-6b, 13-6c, 13-6d, 136e
7295	Cultural deposit	Habitation	E	5-6-03:041	Prehistoric	1		1														1																BT-E-15-3, 15-3a, 15-3b, 15-3d
7296	Cultural deposit	Habitation	E	5-6-03:044	Prehistoric	1		1														1																BT-E-22-4
7299	Wall	Livestock control	Punaho'olapa Marsh	5-6-03:044	pre-1900	1															1										1							5
						46	9	8	8	5	3	3	2	1	1	1	1	1	1	1	1	8	8	4	4	3	3	2	2	1	1	1	1	1	1	1	5	

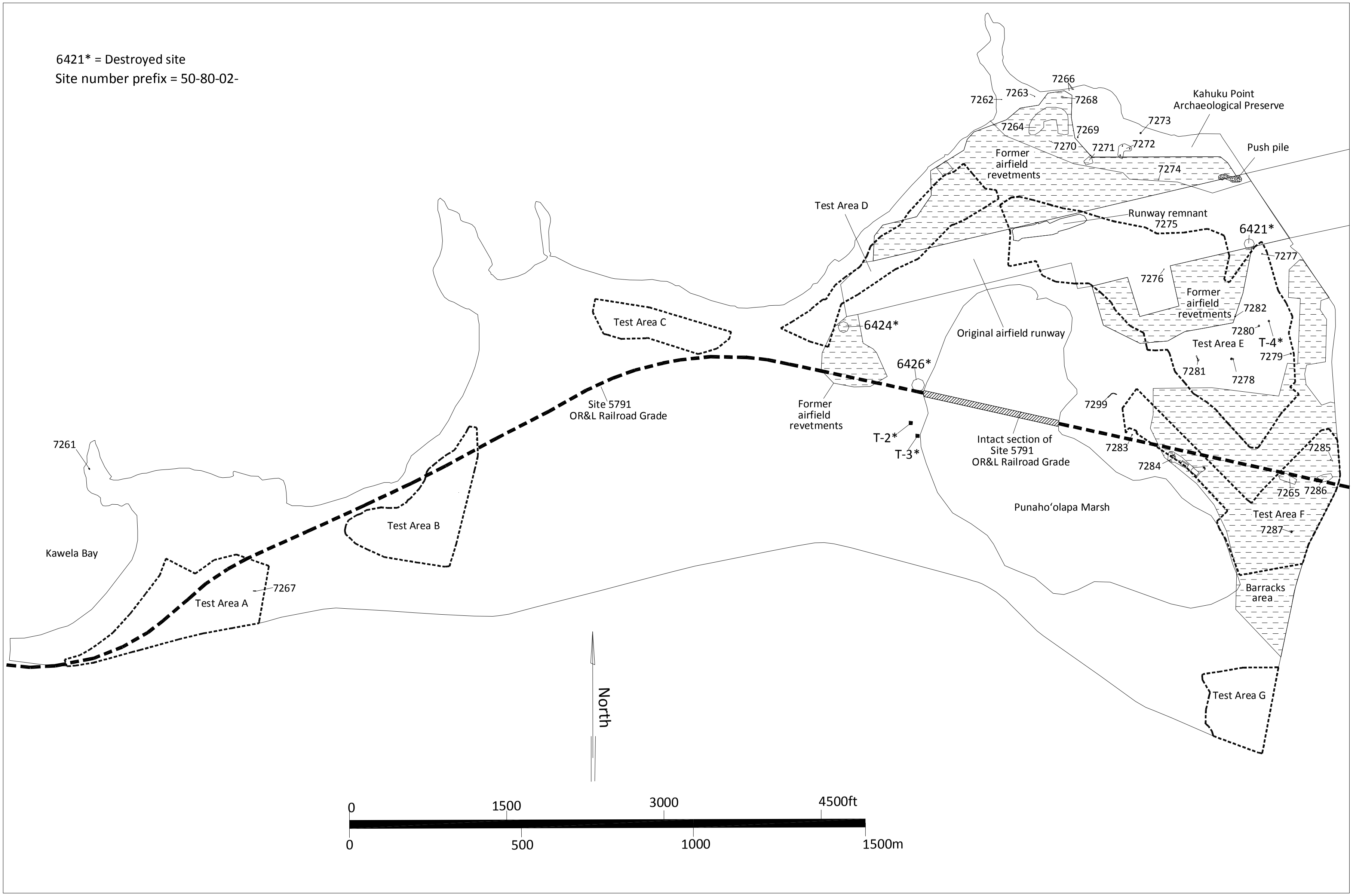


Figure 11. Surface sites and Test Areas showing extent of Kahuku Army Airfield complex (hatched areas)

were recorded. Another section of the railroad grade in the vicinity of ʻEwa Beach was documented as SIHP Site 9714 and that segment of the OR&L railroad grade was listed on the National Register of Historic Places on December 1, 1975 (NRHP n.d.).

Formerly, a c. 3,950 m segment of the railroad grade spanned the TBR property, extending from inland of Kawela Bay across Kahuku Plain in a northeasterly direction for c. 2,120 m and then to the east-southeast for an additional 1,830 m where it exited the property. The railroad continued east to Kahuku Mill. The railway was completed in 1899 and terminated at the Kahuku Mill.

Only one intact section of the railroad grade was encountered during the SAIS fieldwork. This consists of a 475 m long section that extends through Punahoʻolapa Marsh in a west-northwest by east-southeast direction (see *Figure 11*). This section consists of a raised causeway across the marsh that is 7.5 to 9.0 m wide and averages 1.5 m in height. The causeway surface is level soil, basalt and limestone gravel. No rails or ties remain. The railroad grade formerly extended through Areas A and B; however, no surface evidence of the site was encountered in these areas. Site 5791 is a historic transportation route. It is largely destroyed but a single intact section in Punahoʻolapa Marsh is in fair condition and retains substantial physical integrity.

Kawela Bay

Site 7261 is the only site identified in the Kawela Bay area. It consists of an intact concrete structure located on a sand beach at the northern side of Kawela Bay (see *Figure 11*). The structure is square, measuring 10’2” long (north-northwest by south-southeast) and 10’ wide (*Figure 12*). The concrete sides were constructed with 6” form boards, indicating it was likely constructed in place. The roof is a flat 6” thick concrete slab (*Figure 13*) and there is an entrance 2’4” wide by 3’3” high on the south side. The interior ceiling height is 6’1”. An alignment of concrete cinder blocks extends south from the east side of the entrance, and is likely a modern addition.

There are three embrasures (openings) in the seaward-facing walls. These openings are 1’ in height and taper, narrowing toward the interior. The embrasure on the north side is the largest, measuring 8’2” wide on the exterior and 5’11” on the inside. The east opening is 4’7” wide on the exterior and 2’10” on the interior. The exterior of the embrasure is 3’11” wide and the interior is 1’11” wide. There are triangular-shaped recessed areas inside the east and west openings with metal rods extending vertically from the centers (*Figure 14).* These rods probably functioned as gun mounts. The interior and exterior walls of the structure are covered in graffiti and modern trash is scattered throughout the area.

Site 7261 is a World War II era military defensive position that Bennett (2011:59) identifies as “one of the last remaining vestiges of the Kahuku AAB defenses…a machine gun pillbox”. The site is in fair condition and retains substantial physical integrity.

Kahuku Point Archaeological Preserve

The Kahuku Point Archaeological Preserve is a 32-acre undeveloped parcel located inland of Kahuku Point. In addition to the prehistoric sites, the Kahuku Army Airfield runway formerly spanned the area and airplane storage revetments were situated here (see Figure 11). Portions of the Preserve, primarily the south side, were impacted by the construction of the adjacent golf course. A large push pile of soil, stones, and concrete and asphalt rubble is present in the eastern portion of the Preserve. This 32-acre parcel was preserved as a park following identification of human remains (Walker *et al*. 1988).

The surface survey identified 11 sites in the Preserve. These consist of a concrete slab (Site 7262), three concrete block sites (Sites 7263, 7266 and 7273), an earthen revetment (Site 7264), the remnants of three disturbed concrete structures (Sites 7268, 7269 and 7272), a metal tank (Site 7270), a section of intact asphalt (Site 7271) and a concrete cylinder (Site 7274). The sites are described below.

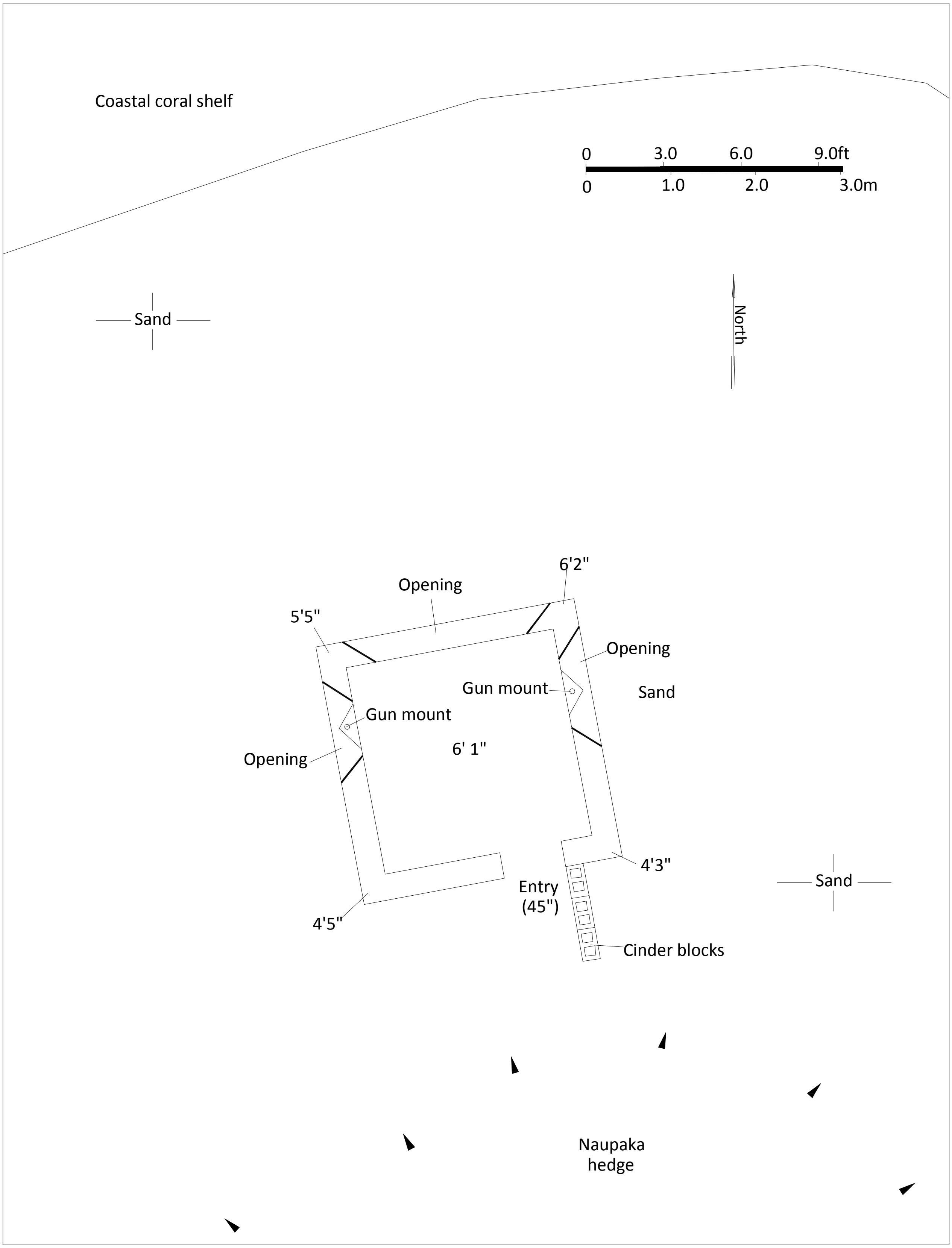


Figure 12. Site 7261 plan map

Figure 13. Site 7261 pillbox, view to west-northwest

Figure 14. Site 7261 gun mount, view to north

Figure 15. Site 7262 disturbed concrete slab, view to west

Site 7262 is a displaced concrete slab remnant that is partially buried in a sand dune on the western side of Kahuku Point. The exposed portion of the slab is 1' thick and protrudes from the sand at an angle (*Figure 15*). The exposed portion is 7' 9" long (north-northeast by south-southwest) and 3'4" wide. Metal rebar is visible in the broken edges of the slab, which was made using basalt aggregate. The exposed surface is smooth with no form board impressions visible. No other cultural material was observed. The slab is interpreted as a tsunami-displaced remnant of a World War II era structure based on its appearance and condition; however, the specific function of the slab is undetermined. The site is in poor condition and no longer retains physical integrity.

Site 7263 is a concrete block located on the sand beach just inland from the coast along the seaward portion of the Kahuku Point Preserve. The block appears to be in place and intact. It is 36 ½" square and 15" in height above the sand surface (*Figure 16*). There is a metal plate 17" square by 2" high on the top. Two 6" metal bands extend around the upper edge of the plate, with a second band 7" below it. No associated artifacts were observed. The block is probably an anchor for a guy wire support for a tower of some type, potentially an antenna. It was likely used in conjunction with the WW II use of Kahuku Army Airfield. The block is in an upright position and probably in its original location. The site is in fair condition and retains limited physical integrity.

Site 7264 is a revetment located in the west part of the Kahuku Point Preserve and is one of twenty revetments formerly situated north of the Airfield runway (*Figure 17*). This revetment is also depicted as a crescent-shaped mound on the coast immediately east of the Kahuku Point on the USGS Kahuku Quadrangle (see *Figure 1*). The revetment is a U-shaped earthen mound, open to the south. It is 375' long (east-west) and 260' wide. The walls of the revetment vary from 49' to 75' wide with a maximum height of 6'6"above the surrounding ground surface (*Figure 18*). The interior floor is level, reddish brown silty clay loam that was probably imported to the site. The revetment berm is covered with sand. There is a depression located in the interior northeast corner that is 8.35 m long by 4.9 m wide and 1.3 m deep, containing broken concrete slab fragments. No other cultural material was observed. Site 7264 is a WW II-era defensive storage area for aircraft. The site is in fair condition and retains substantial physical integrity.

Figure 16. Site 7263 concrete block, view to south

Site 7266 consists of three concrete blocks located on the sand beach 100 m east-northeast of Site 7263 in the Kahuku Point Preserve (*Figure 19*). The apparently displaced blocks are exposed over an area 45’ long (east-west) by 6’ wide. The blocks are identical in size to the Site 7263 concrete block, measuring 36-½” square. The Feature A block (located at the eastern end) is buried in the sand at an angle with the upper surface exposed and extends 30” above the surface of the sand (*Figure 20*). The rusted remnants of metal plates are visible on the weathered upper surface of Feature A and a 6” wide metal ban extends around the upper sides. The Feature B and C blocks are upside-down, possibly displaced by the 1946 or 1957 tsunami, with an irregular bottom surface exposed. This uneven surface indicates that the blocks were likely formed and poured in place on the ground surface. These blocks vary in height from 12” to 15” above the sand surface. No other cultural material was observed in association with the blocks. The Site 7266 blocks are displaced and likely served the same function as the Site 7263 block, interpreted as a guy wire anchor. The site is in poor to fair condition and retains limited physical integrity.

Site 7268 is the displaced remnant of a concrete structure located in a dense thicket of *naupaka* in the coastal portion of the Kahuku Point Preserve. The concrete material is located in a pile that is 5.0 m long (northwest by southeast) and 3.6 m wide (*Figure 21*). The remnants include what appear to be a domed roof and wall with an opening in it. The walls and roof are 1’ in width. Rebar reinforcing is visible in the broken edges. No artifacts were observed in association with the structural remnant. *Figure 22* is a sketch depicting the estimated original shape and dimensions of the structure based on the fragmentary remnants. The structure was approximately 10’ 4” long, 7’ wide and 6’8” in height. There is a low opening on one side that is 48” in height and 43” wide. There are two 4” diameter ceramic inserts in the ceiling. Site 7268 is located on the coastal side of a military revetment (see *Figure 11*). The site is the probable remnant of a World War II era structure. The specific function of the structure is undetermined; however, the thick, reinforced concrete walls and roof indicate it was likely part of a defensive position, probably a bunker. The site is in poor condition and no longer retains physical integrity.

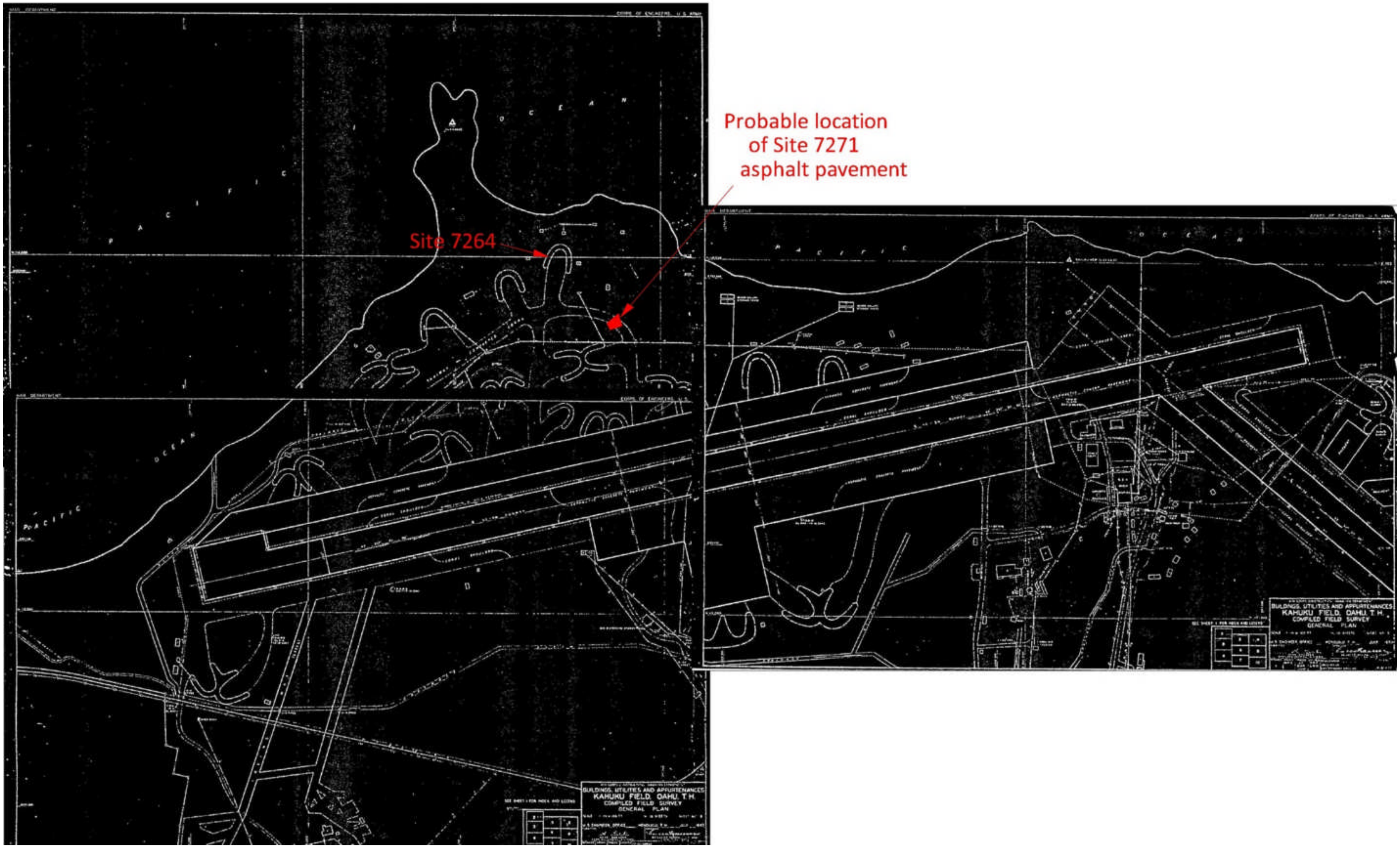


Figure 17. Composite plan map of Kahuku Army Airfield

Figure 18. Site 7264 revetment, view to north

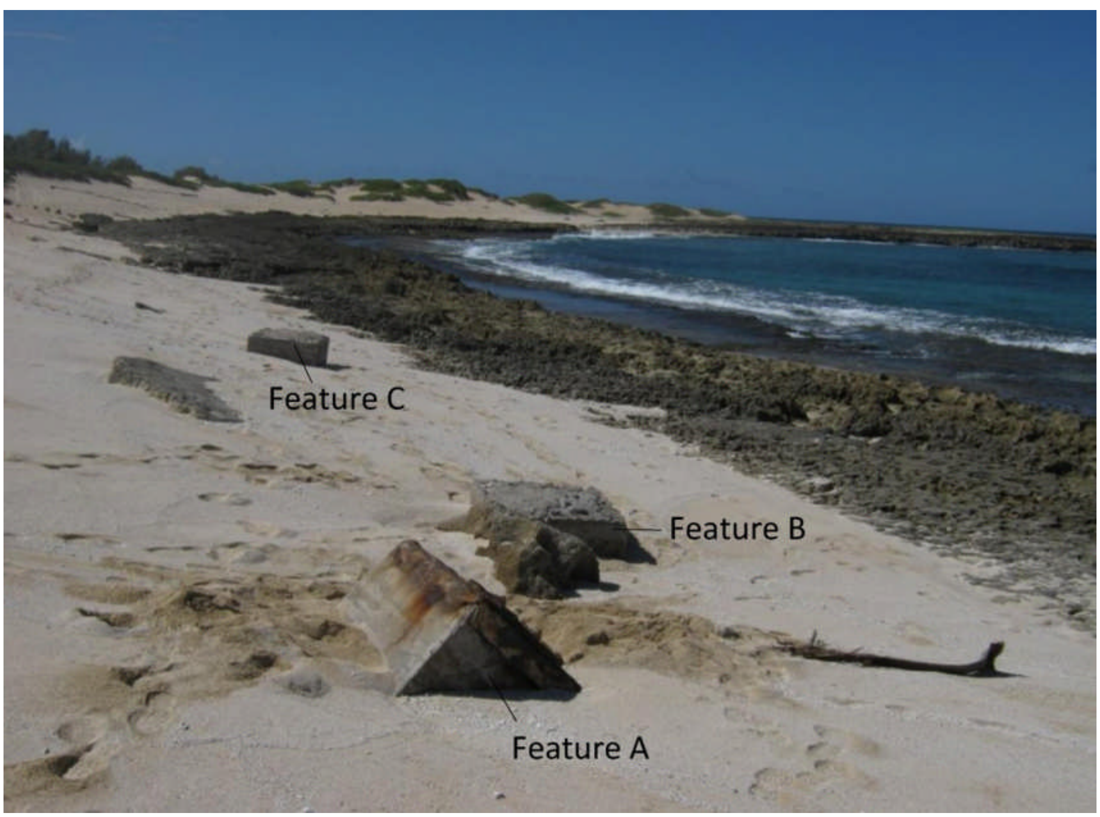


Figure 19. Site 7266 concrete blocks, view to west-northwest

Figure 20. Site 7266, Feature A concrete block, view to south

Figure 21. Site 7268 concrete structural remnant, view to south

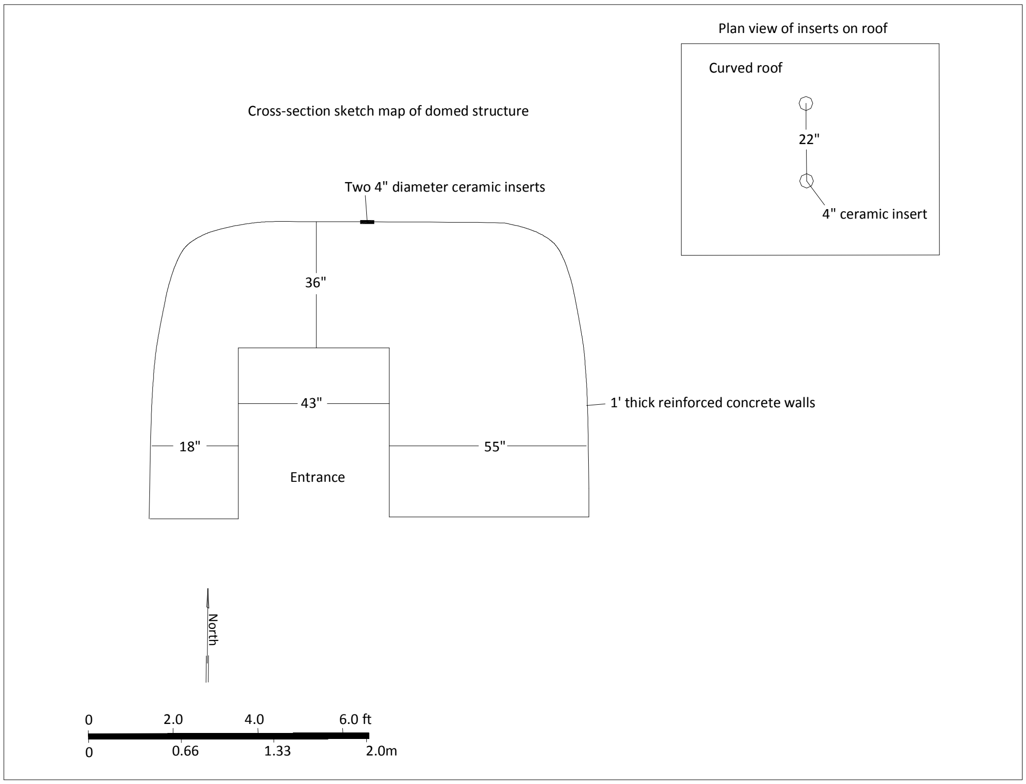


Figure 22. Sketch map showing estimated original cross-section of Site 7268

Figure 23. Site 7269 concrete structural remnant, view to east

7269 is the tsunami-displaced remnant of a concrete structure located on the crest of a sand dune, in the central portion of the Kahuku Point Preserve. The remnant is partially buried by sand. The exposed portion is 10’ long (east-west) and 4’2” wide (*Figure 23*). The impressions of 5” wide form boards are visible on the side of the structure. No artifacts were observed in association with the structure. The appearance and condition of the concrete indicates the structure likely dates to the World War II use of the area; however, its original size, shape and function are undetermined. The site is in poor condition and lacks physical integrity.

Site 7270 is a rusted rectangular metal container, or tank, located on a level soil deposit on the inland side of the Kahuku Point Preserve. The tank is 47” long, 39¼” wide and 34½” in height (*Figure 24*). It is constructed of ¼”-thick sheets of steel that are welded together. The tank interior is divided into compartments by metal sheets perforated with 6” diameter holes (*Figure 25*)*.* There is a 1 ½” diameter hole present near the top of the tank and a 3” diameter metal drainpipe at the base. No artifacts were observed in association with the container. The tank is a probably a fuel storage tank based on the compartmentalized interior, which served to reduce fluid movement during transportation. Its condition and appearance suggests it was utilized during World War II. The site is in poor condition and lacks physical integrity.

Site 7271 is a level segment of asphalt pavement located in an ironwood grove along the south side of the Kahuku Point Preserve. The exposed pavement is 76’ 6” in length (north-northwest by south-southeast) and 72’10” wide. The sides of the asphalt pavement are disturbed, with jagged edges. A section is buried beneath mechanically piled berms of soil and stone. The pavement surface is level and covered with scattered leaves and ironwood needles (*Figure 26*)*.* Recent aluminum cans and golf balls are scattered on the surface. The Site 7271 pavement is located in an area of aircraft revetments on the north of the main Kahuku Army Airfield runway. The location of the site on Figure 17 indicates that the pavement probably is a remnant of a road that connected the revetments to the airfield. The site is in poor condition and retains limited physical integrity.

Site 7272 consists of three displaced sections of a concrete structure located in an area 15 m long by 6 m wide on the dunes in the central portion of the Kahuku Point Preserve. The sections are rectangular formed-concrete pieces that range from 10’6” to 11’4” in length and 5’10” to 6’1” in width (*Figure 27*)*.* There is a 2’10” wide L-shaped projection on one end of the sections and a 2’ wide “T” shaped projection on the other. Linear grooves 1” wide are present on the exterior side of the L-shaped projections. The sections where constructed using 6” wide form boards. Rebar is visible in the broken edges. No artifacts were observed in association with the structural remnant. The concrete sections are similar to the walls of an intact structure at Site 7278 located in Area E, discussed below. The intact structure is U-shaped and is 15’10” long by 14’2” wide. The concrete walls are also 1’ wide and exhibit impressions from 6” wide form boards. The grooves noted on the Site 7272 L-shaped projections also are present at Site 7278. Site 7278 is a World War II era military structure that may have functioned as a gun position, or ordnance storage area. By analogy, Site 7272 represents a military gun position, or potentially an ordnance storage area based on the similarities in construction to Site 7278. Site 7272 is located just north of the area of revetments that border the north side of the Airfield runway. The site is extensively disturbed and in poor condition, and no longer retains physical integrity.

Site 7273 is a tsunami-displaced concrete block located on the seaward slope of a coastal sand dune, in the eastern portion of the Kahuku Point Preserve. The block is trapezoidal and measures 28” wide at the base, 16” wide at the top with sides that vary in length from 25” to 26” (Figure 28). The block is lying on its side. There is an 8” diameter pipe embedded in the block with a 1’ diameter flange at one end. The concrete has basalt aggregate inclusions. No artifacts were observed in association with the block. Site 7273 likely dates to the World War II use of the area based on the appearance of the concrete. The flanged pipe indicates it potentially had a plumbing-related function. The site is in poor condition and no longer retains physical integrity.

Site 7274 is a tsunami-displaced concrete cylinder exposed on level terrain on the south side of the Kahuku Point Preserve. The cylinder is 55” long by 27” in diameter (*Figure 29*). The concrete is rough and contains limestone gravel aggregate. A copper cable extends out of one end of the cylinder. A plastic milk crate is located adjacent to the cylinder. The shape of cylinder suggests it was originally set in a vertical position and the copper wire indicates

Figure 24. Site 7270 metal box, view to west

Figure 25. Site 7270 interior of metal box, view to northeast

Figure 26. Site 7271 asphalt area, view to east

Figure 27. Site 7272 concrete structure remnant, view to south

Figure 28. Site 7273 concrete block, view to south

Figure 29. Site 7274 concrete cylinder, view to north

an electrical function, perhaps a support for a light fixture. The site is located within an area of former revetments adjacent to the north side of the Kahuku Army Airfield runway (see *Figure 11*), potentially lending support to a light fixture support function. Site 7274 is poor condition and no longer retains physical integrity.

Test Area A

Test Area A encompasses 20.8-acres in the west portion of the TBR property, seaward of the Kamehameha Highway and inland of the east side of Kawela Bay (*Figure 30*). Test Area A was extensively disturbed by agricultural use for sugarcane cultivation (Haun *et al*. 2011). A section of the OR&L railroad grade (Site 5791) formerly extended through the area but no evidence of it was identified during the pedestrian surface survey of Test Area A. A 1950s era bus was identified during the surface survey. *Figure 31* depicts the bus location and the former extent of the railroad grade.

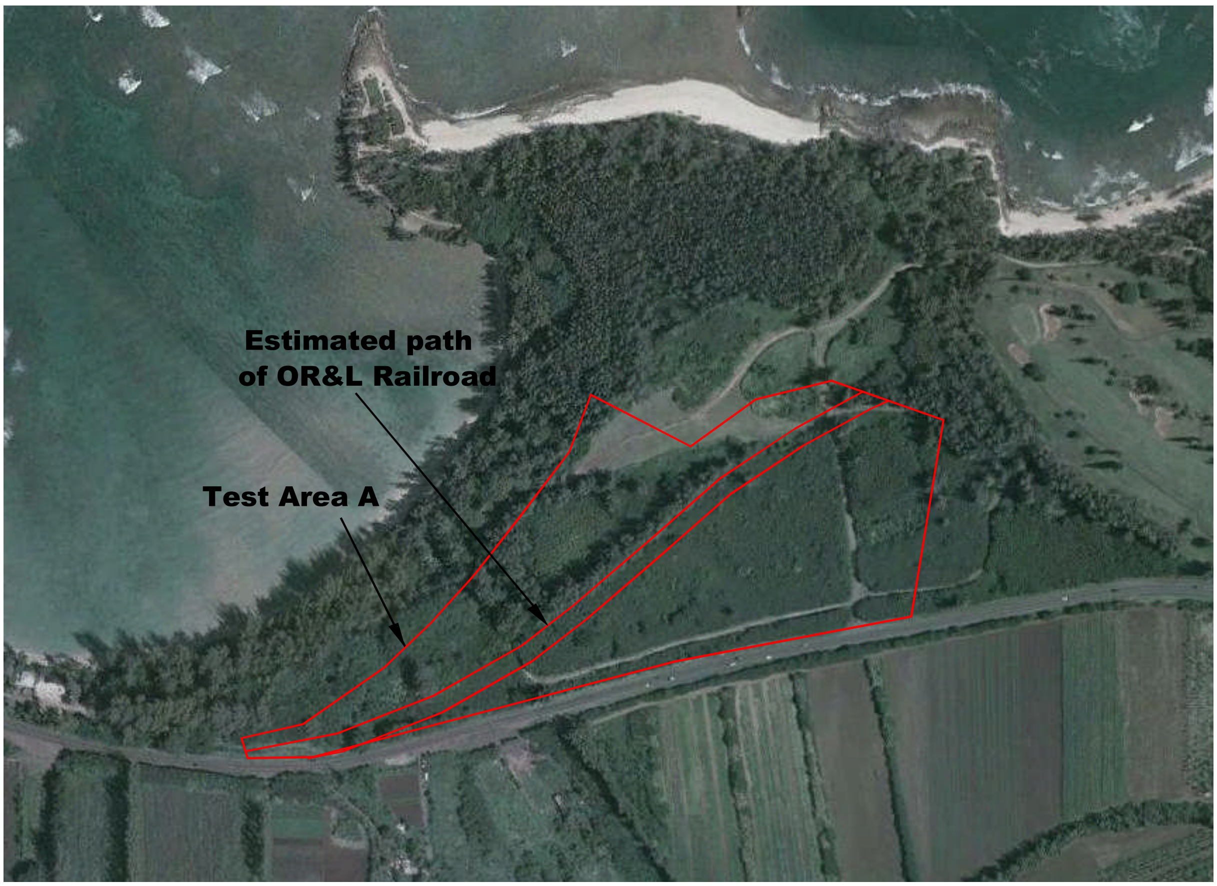


Figure 30. Aerial view of Test Area A (from Google Earth)

Site 7267 is an abandoned bus located in the eastern portion of Test Area A. The bus is a public transit vehicle made by the "White" company with nine side windows, a driver's side window and front and rear windows (*Figure 32*). A bus with a similar design is depicted on a 1950s era brochure for the Honolulu Rapid Transit Company (*Figure 33*). The bus is 32'6" ft long, 8' in wide and 8'10" high. A folding entry door provided access on the right side of the vehicle opposite the driver seat. There are blue vinyl-covered benches inside the bus. A "stop" cord extends along the interior sides above the windows. A sign reading "44 seating capacity and 30 standing" is present at the front of the bus interior. The bus license plate indicates it was in use until at least 1973, operated

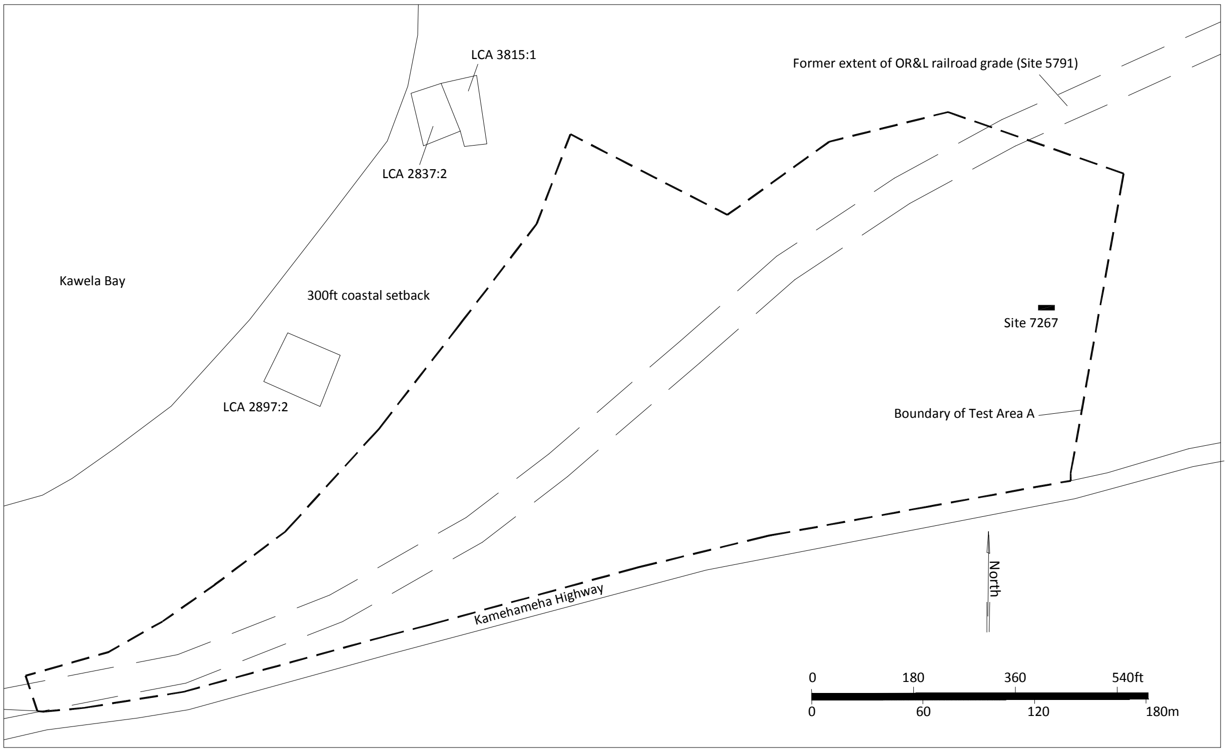


Figure 31. Surface of Test Area A

Figure 32. Site 7267 transit bus, view to south

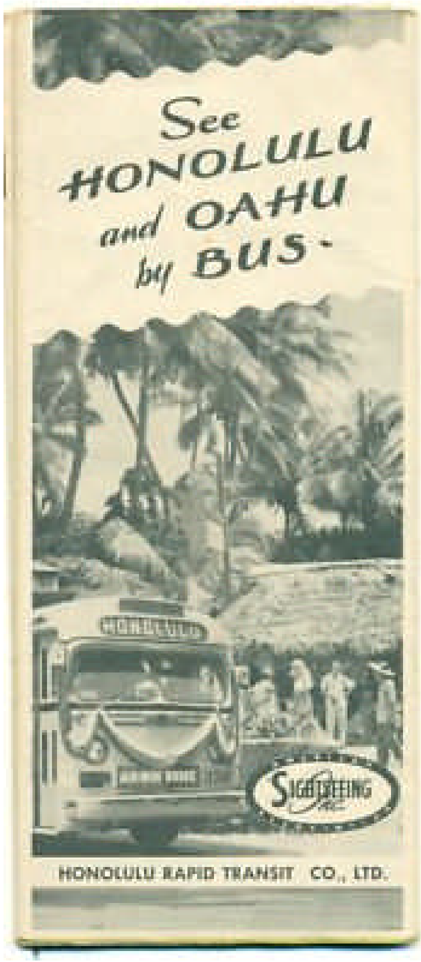


Figure 33. Honolulu Rapid Transit Company brochure

Figure 34. Site 7267 license plate

by the City and County of Honolulu (*Figure 34*). The bus was probably sold by the CCHONO, repurposed as a temporary dwelling or farm crew vehicle and abandoned in place. The vehicle is completely deteriorated and lacks physical integrity.

Test Area B

Test Area B encompasses 17.5-acres just inland of the coastal dunes and is bordered by the Fazio golf course fairways on all but the seaward side (*Figure 35*). No surface sites were identified in this area. Test Area B was extensively disturbed by sugarcane cultivation and subsequently by its current use as a horse stable and corral facility. A Land Commission Award (LCA 235M) parcel for Kaili was formerly located at the north end of the area. The OR&L railroad grade once extended through the north end of the area and a plantation workers camp (Camp 3) was located adjacent to the inland side of the railroad grade. No surface evidence of these historic features was identified. The locations of the stables and former historic features are depicted in *Figure 36.*

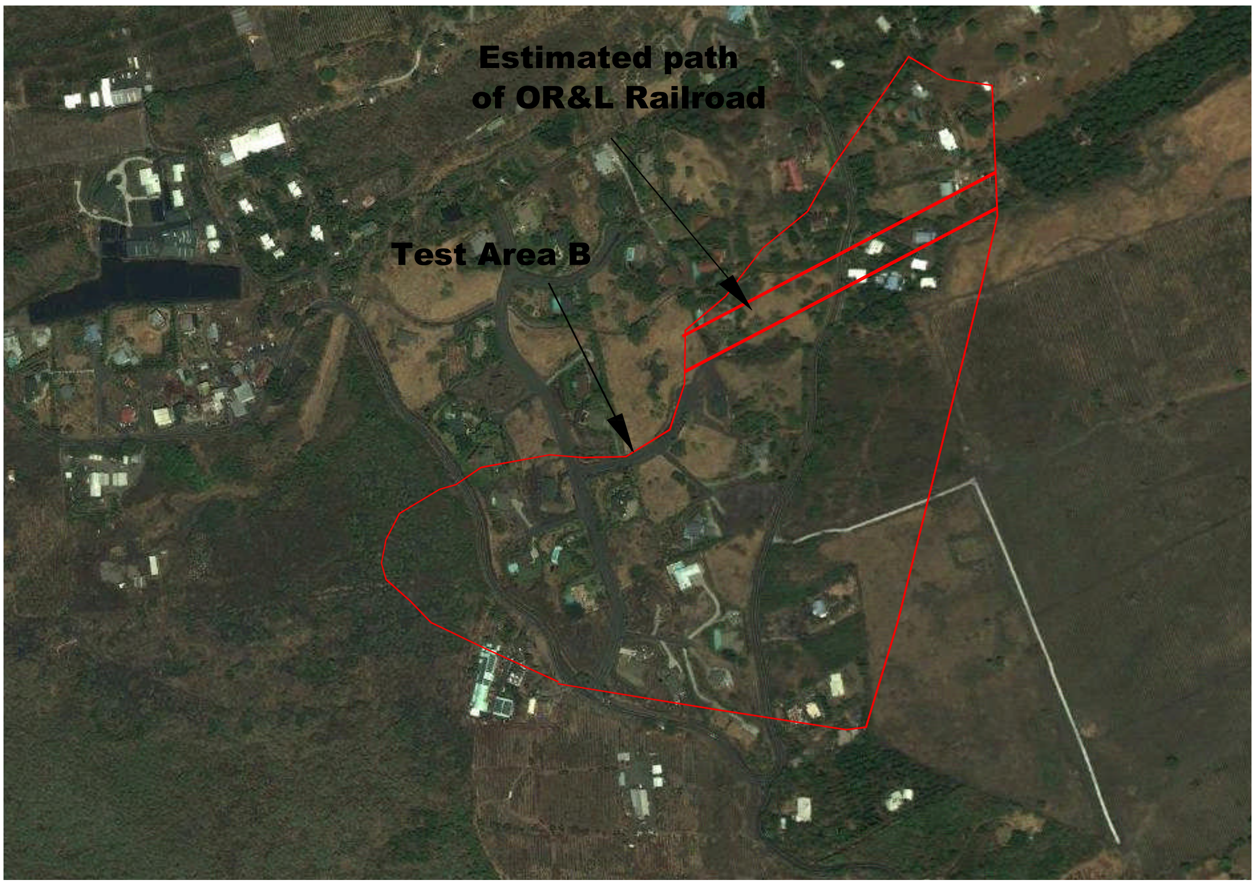


Figure 35. Aerial view of Test Area B (from Google Earth)

Test Area C

Test Area C encompasses 8.3-acres located on east side of the TBR hotel and is inland of the beach front and bordered by the Palmer golf course fairways on all other sides (*Figure 37*). No surface sites were identified in Area C. A series of twelve pits were previously excavated to obtain sand from the dune that covers Area C. These pits, labeled SP-1 through SP-12 range in length from 2.8 to 47.1 m, in width from 1.8 to 15.7 m and in depth from

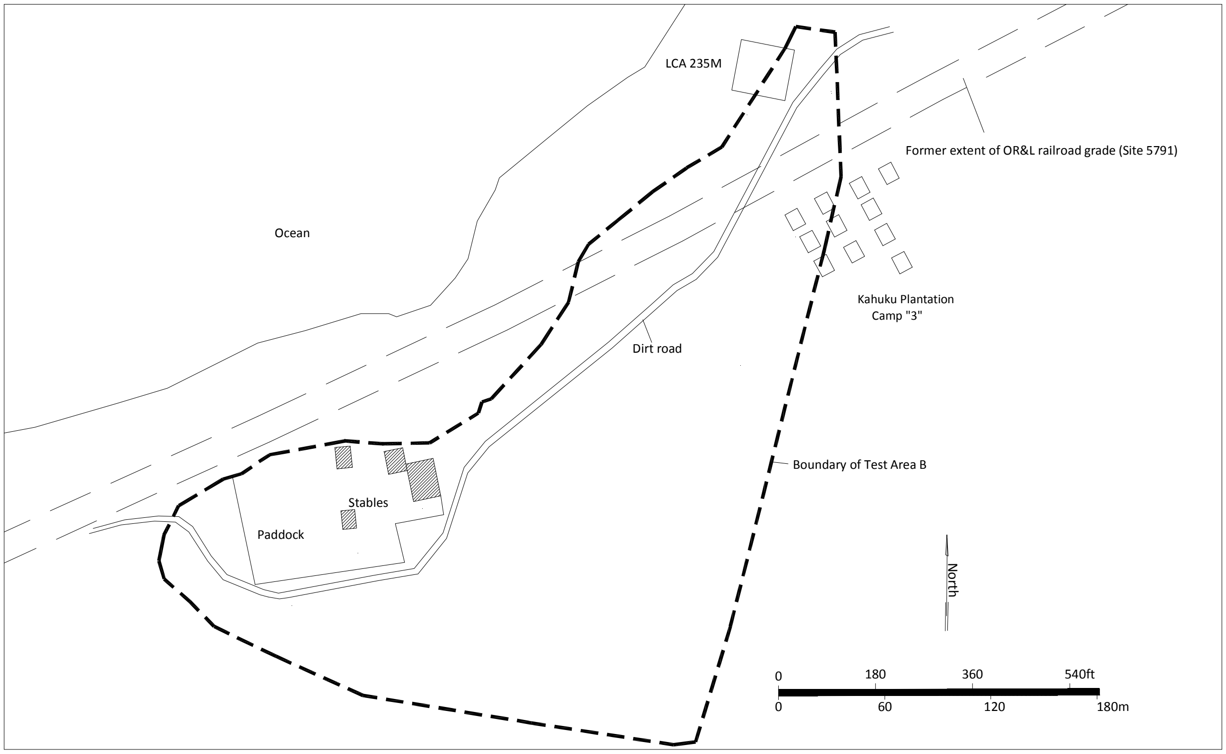


Figure 36. Surface of Test Area B

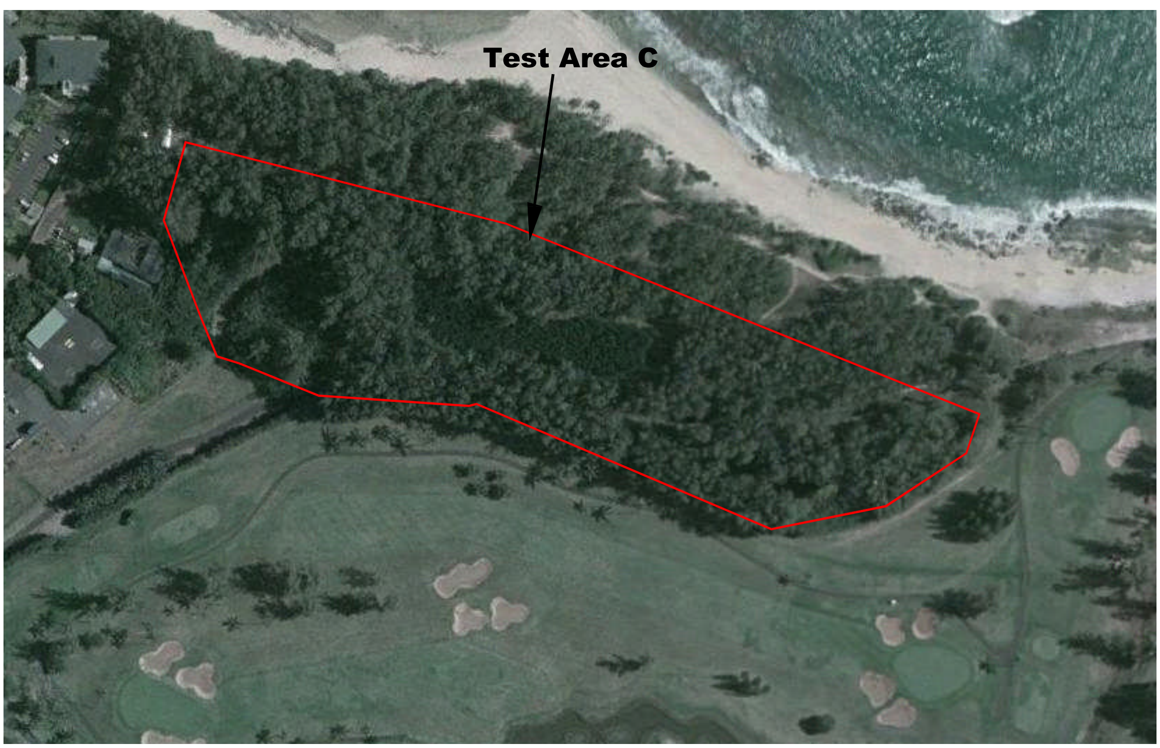


Figure 37. Aerial view of Test Area C

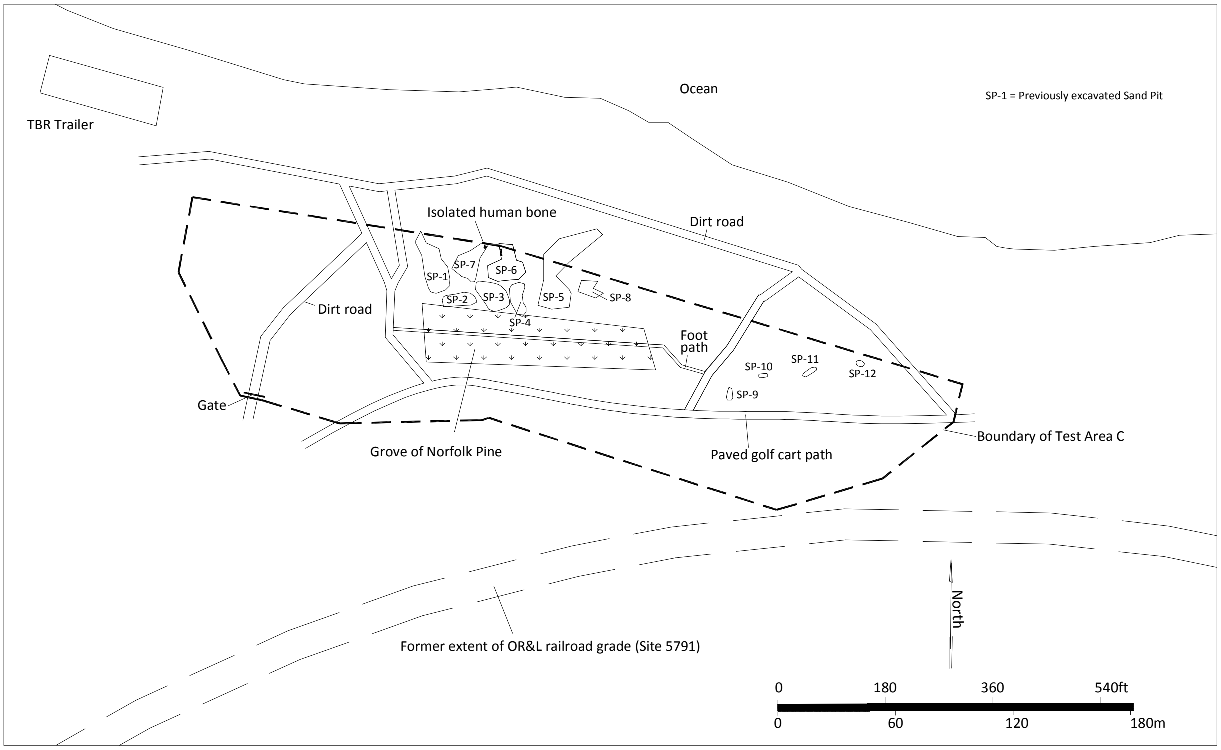


Figure 38. Surface of Test Area C

Figure 39. Area C, Sand Pit 1 showing mechanical excavation, view to south

Figure 40. Area C, Sand Pit 6 showing manual profiling, view to southeast

approximately 0.5 to 6.0 m (*Figure 38*). A secondarily deposited human metatarsal (toe bone) was identified on the surface of Sand Pit 7, displaced during previous sand mining activity from a subsurface burial. Two sand pits are illustrated in *Figures 39* and *40*. A grove of Norfolk pines trees is planted in a rectangular 0.71-acre area in the central portion of Area C, and was formerly part of a nursery. A series of dirt roads, paths and a paved golf cart road cross the area.

Test Area D

Test Area D encompasses 15.9-acres and is parallel to the shoreline, bordered on the other sides by the Palmer golf course fairways (*Figure 41*). No surface sites were identified in Test Area D. The Kahuku Point Army Airfield runway, taxiways, and airplane storage revetments formerly occupied the northeastern portion of the area and a second revetment area was located adjacent to southern end of Test Area D (*Figure 42*). No surface manifestations of these facilities were encountered. An area of scattered asphalt in the central portion of Area D, is located in an area 205 m long northeast by southwest, and 30 to 70 m wide. A series of dirt roads cross Area D and a golf course cart path borders the east side. A privately owned LCA parcel (TMK: 5-7-01:028) is located at the north end of Area D.

Test Area E

Test Area E encompasses 68-.9-acres and is surrounded by the Palmer Golf Course (*Figures 43* and *44*). The surface of Test Area E was extensively modified from 1942 to 1946 for the Kahuku Army Airfield (see *Figure 43).* The main runway formerly extended across the northern portion of Area E. An intact portion of the runway was recorded as Site 7275. Scattered pieces of asphalt are still present in the central portion of Area E. Revetments were once located just south of the runway and barracks were once located in the southern part of Area E.

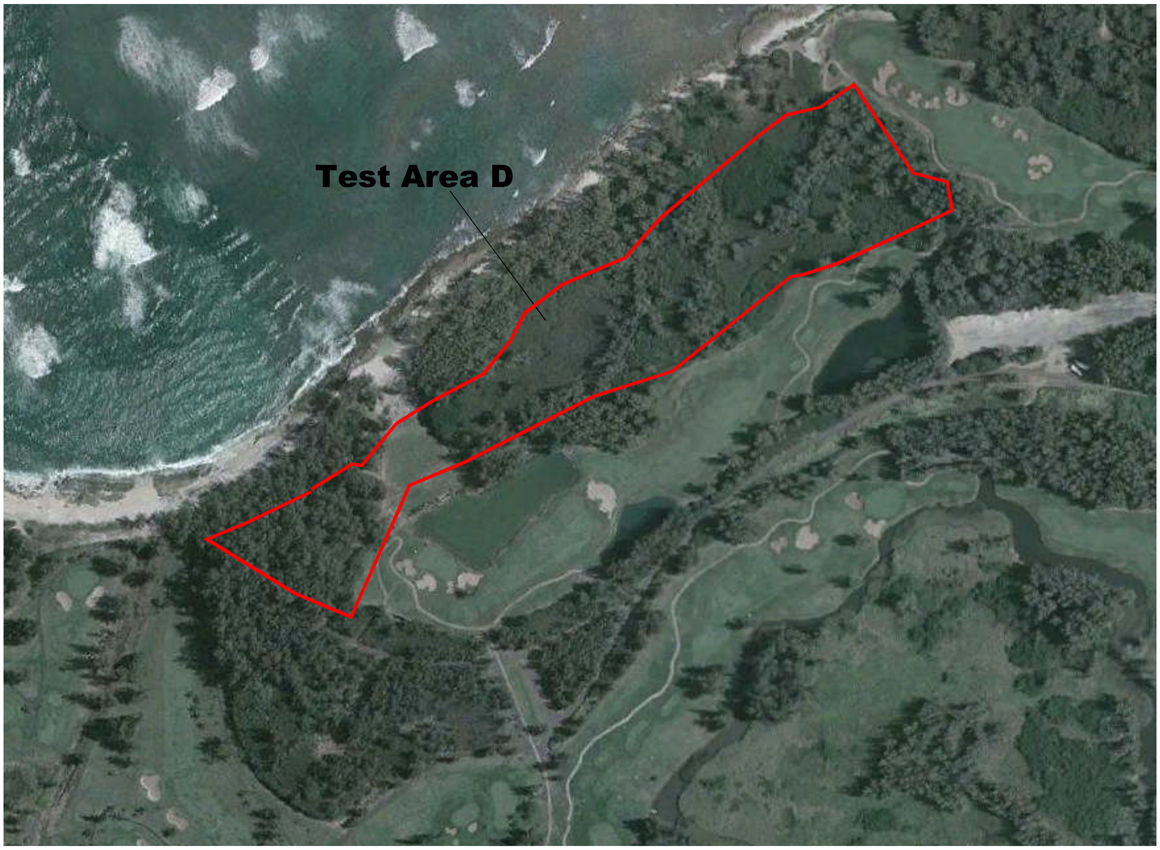


Figure 41. Aerial view of Test Area D (from Google Earth)

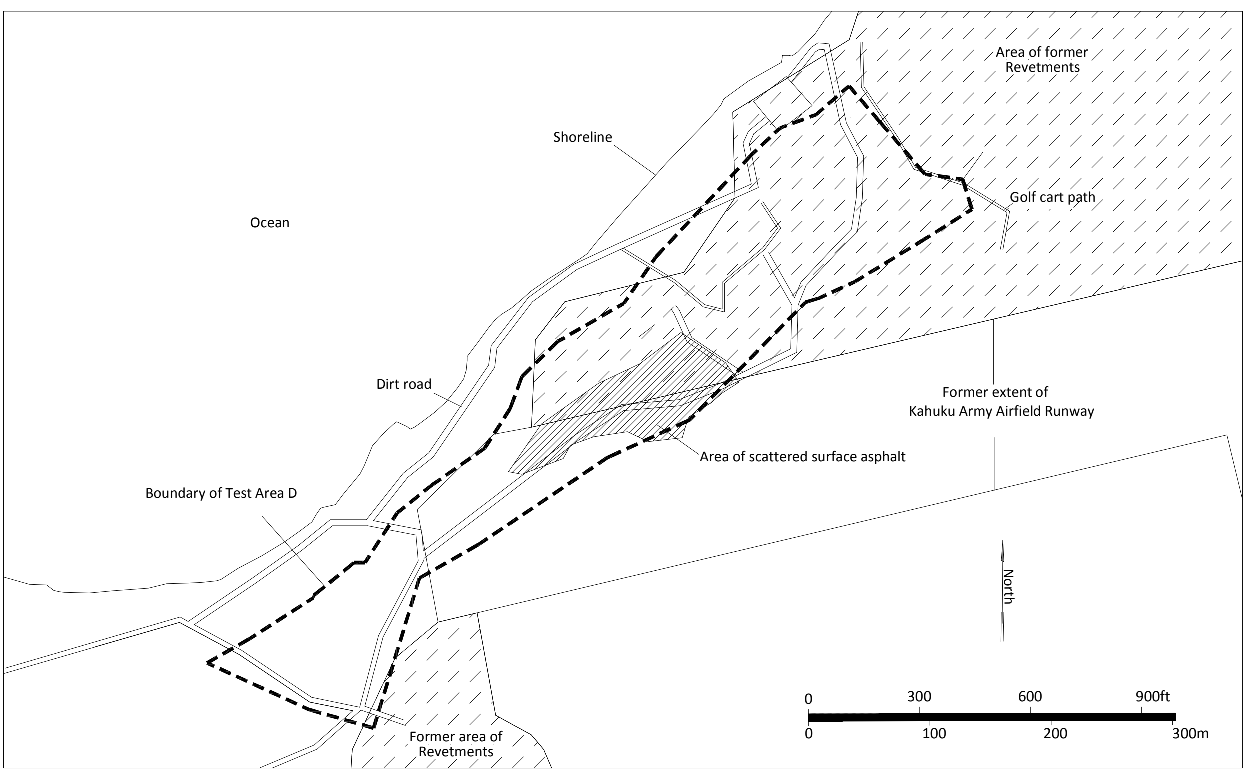


Figure 42. Surface of Test Area D

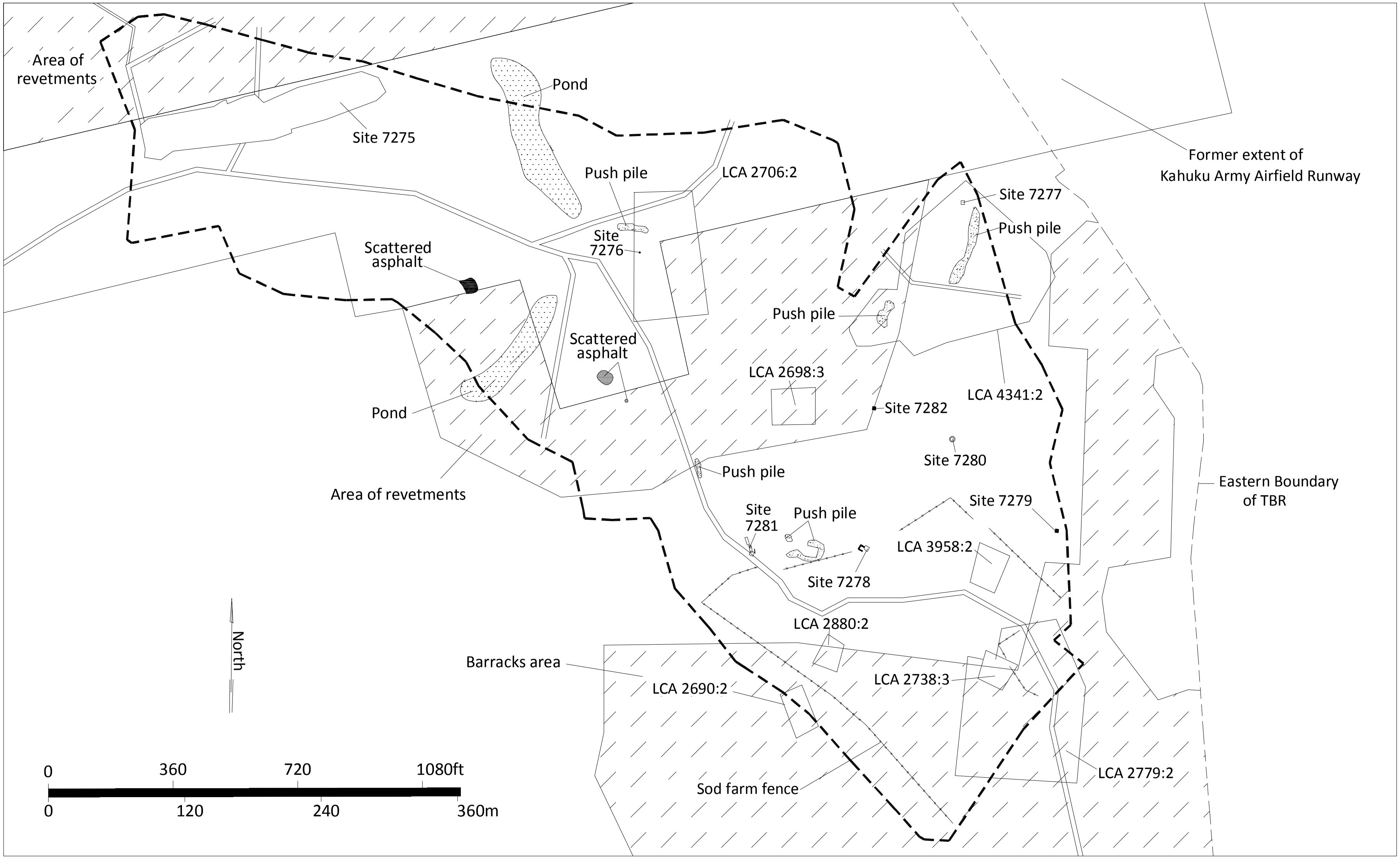


Figure 43. Surface of Test Area E

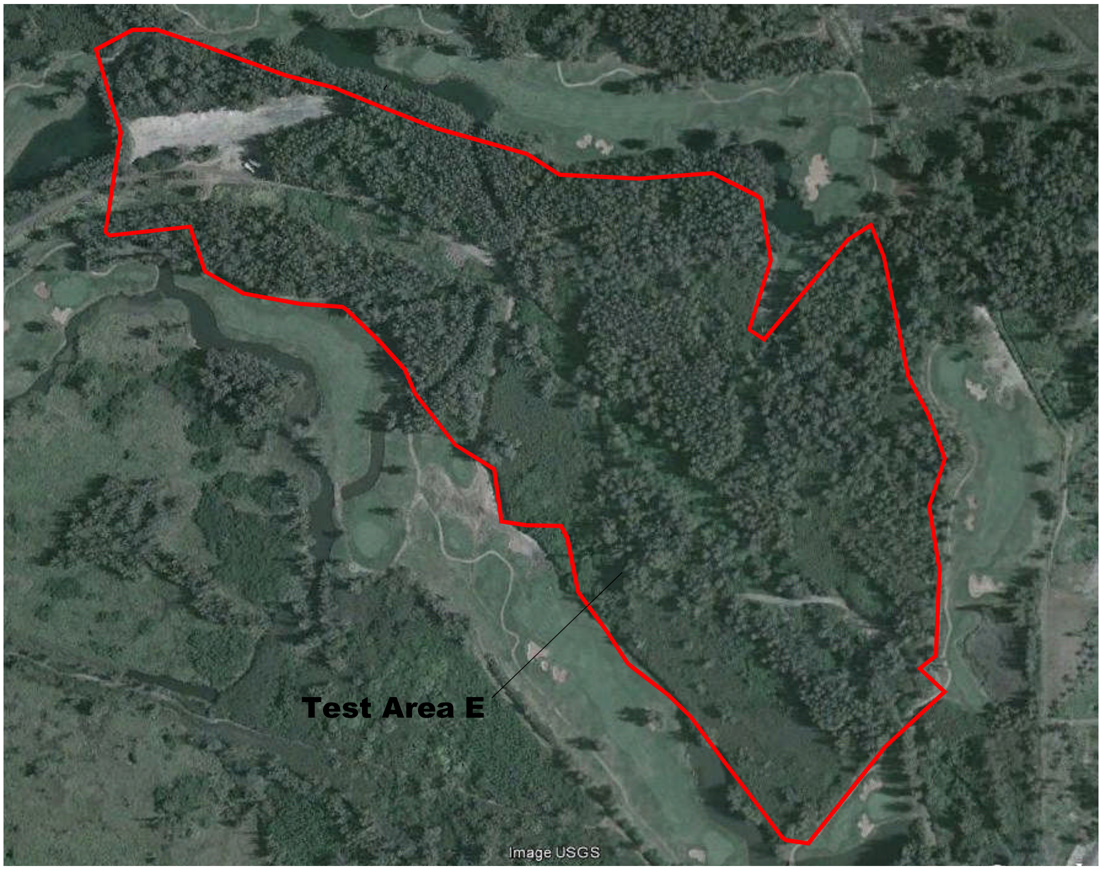


Figure 44. Aerial view of Test Area E (from Google Earth)

Eight LCAs are located within Area E: LCA 2690:2 to Luiki (Luihi), 2698:3 to Waanui, 2706:2 to Holoaia, 2738:3 to Paiu, 2779:2 to Makilo, 2880:2 to Kupau, 3958:2 to Nakuhao (Nakuhae), and 4341:2 to Kaukaha. No extant cultural features were identified within the LCA parcels.

Two artificial ponds in Area E were built in conjunction with the Palmer Golf Course constructed in 1990-1991. One pond occupies an area of approximately 0.58 acre and the other is just under an acre in size. There are six large bulldozed push-piles of soil, stones, concrete and asphalt rubble that occupy approximately 0.29 acres in Area E. These features also appear to be related to golf course construction. Several dirt roads cross Area E and a 10.7-acre roughly rectangular parcel bordered a wire fence in the south portion of Area E represents the former extent of a sod farm and nursery.

Eight sites associated with the Kahuku Army Airfield were identified during the surface survey of Area E. These consist of the runway remnant (Site 7275), three concrete blocks (Sites 7276, 7279 and 7282), a concrete slab (Site 7277) and three concrete structures (Sites 7278, 7280 and 7281). The sites are described below.

Site 7275 consists of an exposed asphalt pavement located at the northwestern end of Area E. The pavement is a portion of the main Kahuku Army Airfield runway (see *Figure 43*). The extant pavement is 717’ long (east-northeast by west-southwest) and from 104’ to 138’ wide. Originally, the runway was 6,500’ in length; however, large portions were destroyed during golf course construction (Trojan n.d.). The pavement is currently used as storage for sand and soil stockpiles and five metal shipping containers (*Figure 45*). No artifacts associated with the World War II era use of the runway were identified. The site retains limited physical integrity, representing only a portion of the former extent of the runway, and is in fair condition.


Figure 45. Site 7275 runway with shipping containers, view to east

Figure 46. Site 7276 concrete block, view to west

Site 7276 is a concrete block located in the approximate center of Area E. The block is 4' square at the base and 3' square at the top, with 1.2' high tapering sides (*Figure 46*). Form board impressions are visible on the sides and a projection on the base indicates it was poured in place. Braided wire loops are embedded on each side of the block and a rusted metal remnant of a possible hook or eye protrudes from the top. Fragments of asphalt are scattered around the block. Site 7276 is a probable anchor, potentially used to secure guy wires. It is unclear if the block is in its original location and is in fair condition.

Site 7277 is a rectangular concrete slab located on the northwest side of Area E. The slab is 10' 9 ¼" long (north-south) and 9' 8¼" wide (*Figure 47*). The sides are mostly broken although linear, intact edges are present along each of the four sides. The slab is formed concrete and the surface is level and smooth. Modern debris is scattered throughout the area although no remains were in direct association with the slab. The slab presumably served as a foundation likely associated with the Kahuku Army Airfield. It is altered and in fair condition.

Figure 47. Site 7277 concrete slab, view to southwest

Site 7278 is an intact U-shaped concrete structure located in the southeast portion of Area E, north of the barracks and south of the revetment bordering the main runway (see *Figure 43*). The structure is 15'10" long (northeast-southwest) by 14'2" wide and open to the southeast (Figure 48). The walls are 4'2" to 4'7" high and 1' thick, with impressions from 6" form boards. The walls were constructed with reinforcing steel bars visible in broken edges. The top of the structure is open with eave-like overhanging sections 2'10" wide on the interior (Figure 49). Two linear, parallel grooves 1" wide and ¾" deep are located on the underside of the overhanging sections; remnants of wood are still visible in the grooves. The floor of the structure is covered with soil and displaced concrete slab fragments. The structure is extensively damaged. Damage to the north and west corners resulted in the complete destruction of the exterior corners and in holes through the concrete to the interior of the structure (*Figure 50*), a pattern that might be the result of an explosive charge detonated in an attempt to destroy the structure. A water

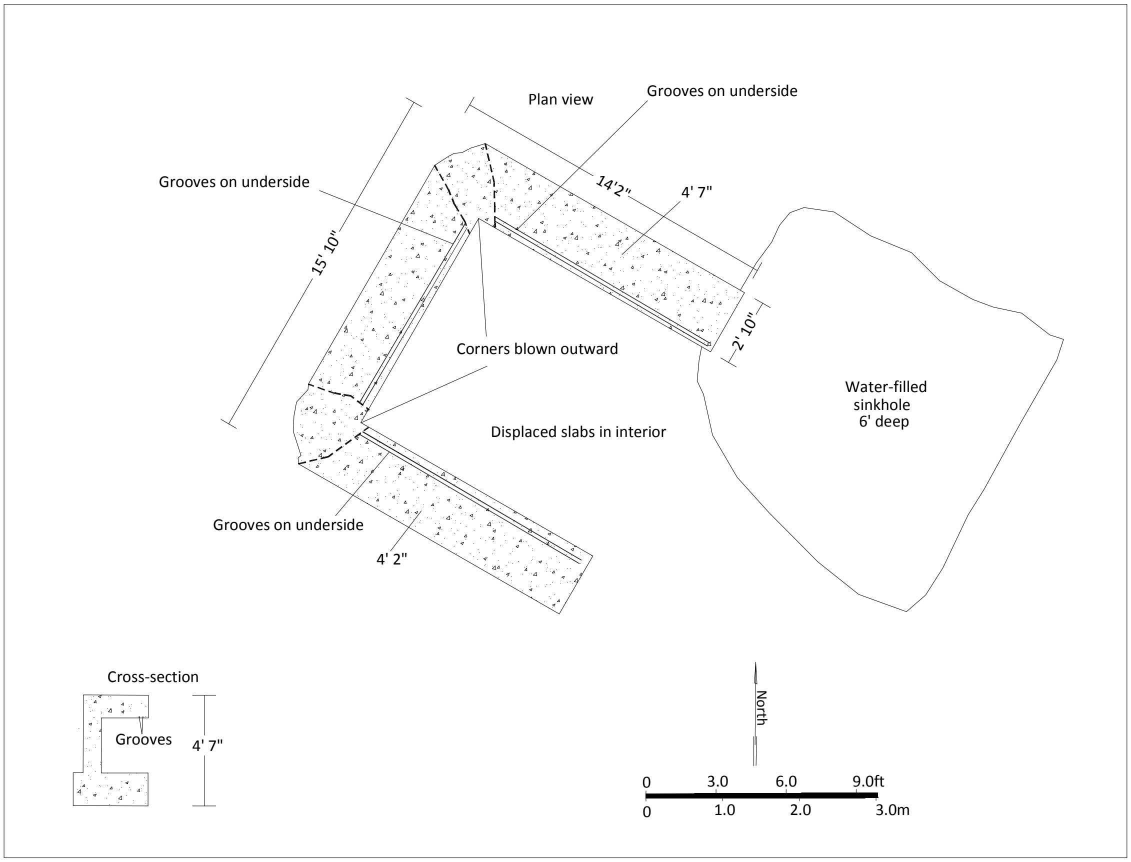


Figure 48. Site 7278 plan map

Figure 49. Site 7278 concrete structure, view to northwest

Figure 50. Site 7278 blown out corner of concrete structure, view to southwest

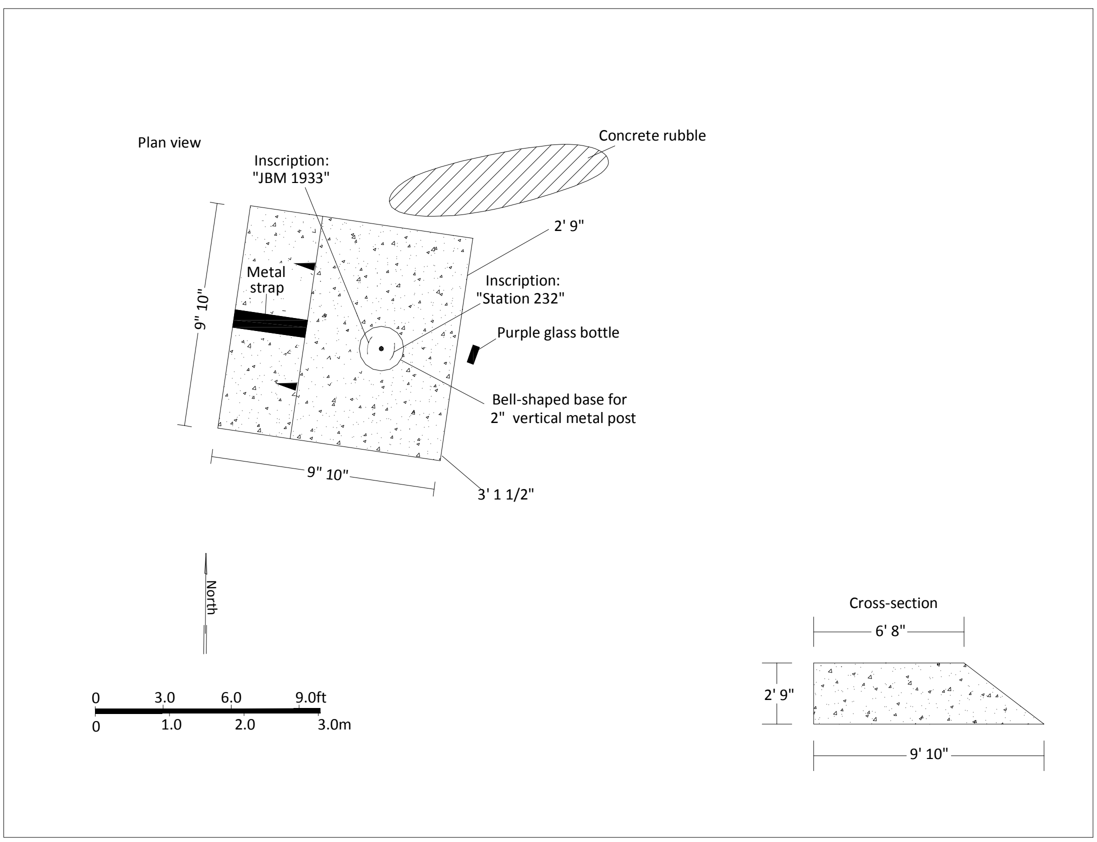


Figure 51. Site 7279 plan map

filled sinkhole roughly 13’ square and 6’ deep is located adjacent to the southeast side of the structure. No artifacts were observed in association with the structure. Site 7278 is interpreted as a World War II era facility based on formal type and condition. Its specific function is undetermined, but its peripheral location and thick reinforced concrete walls might indicate use as a defensive structure, perhaps a gun position, or an ordnance storage facility. Site 7278 is in poor condition and lacks substantial physical integrity.

Site 7279 is a square concrete block located on level ground on the east side of Area E. The block is intact and measures 9’10” on each side (*Figure 51*). The east two-thirds of the block has a level upper surface 2’9” high. The west side slopes to the ground surface (*Figure 52*). An 8” wide metal strap is imbedded in the sloping surface (*Figure 53*). A conical concrete mound on the upper surface of the block is 1’7” in diameter and 1’ high. A 2” rusted metal pipe extends vertically from the center of the mound. Two inscriptions are present on the sides of the mound: “Station 232” is inscribed on the east side (*Figure 54*) and “JBM 1933” is inscribed on the west side (*Figure 55*). A purple glass bottle is present on the ground surface east of the block and a pile of concrete rubble is located adjacent to the north side of the block.

Figure 56 is a 1932 U.S. Coast and Geodetic Survey Map of the Kahuku Point Area that depicts 5 poles that appear to be related to the Marconi Wireless Station. Marconi Station is located east of the TBR property, but the poles depicted on the 1932 map were located within it. When Sites 7279 and 7282 (another concrete block) are plotted on the 1932 map, they rough align with the poles and are positioned between the easternmost pair of poles and the Marconi “Power house”. *Figure 57* is a plan map depicting the transmitting aerials on the north side of Marconi Station. The power plant provided electricity to the Marconi Wireless Station, which was one of a series of stations that provided world-wide wireless telegraph communication. Similar facilities were located in Canada, Ireland, Newfoundland, the United States and the United Kingdom. Construction of the Marconi Station began shortly after World War I began in Europe in 1914. According to the Honolulu newspaper, the *Pacific Commercial Advertiser* (terrastories.com):

> We celebrate today opening Marconi radio plant of O‘ahu. The radius of action is upwards of 5,000 miles, and insures communication in time of war, regardless of any cutting of the cable.

Site 7279 is interpreted as a support for an antenna that was installed in 1933 as part of the Marconi Wireless Station communication facility. The site is in fair condition retains substantial physical integrity.

Site 7280 is a low, octagonal concrete structure 6’ 3” wide and open on the top, located on a level ground surface in the east portion of Area E (*Figure 58*). The walls are formed concrete, 1’ thick and 2’2” to 2’8” high. A tapered opening in the southwest side is 1’9” wide on the exterior and 1’1” wide on the interior (*Figure 59)*. The corners and upper edges of structure are broken, exposing the interior wall surfaces, where steel rebar is exposed. The floor is level soil. No artifacts were observed in association with the feature. Site 7280 appears to be in its original location, but is severely damaged. The site is in fair condition and retains limited physical integrity.

Site 7280 is identical in construction and shape to Site T-4 reported by Bath *et al.* (1984:37), which was not mapped or assigned a SIHP site designation. Bath *et al*. describe T-4 as “a roofless, poured concrete octagonal structure, 2.25 m in diameter and 1.22 m high. About 45 cm below the top of the structure is a small rectangular aperture, 45 cm wide by 77 cm high. Wall thickness is 50 cm.” The dimensions reported by *Bath et al*. are larger than the ones for recorded for Site 7280 and the reported location is approximately 90 m east of the plotted location for 7280. These differences suggest that T-4 is not the same feature as Site 7280, but one that had similar morphological characteristics and function. The morphology and construction size and shape of both features suggest they may have functioned as an antenna supports. Further support for this interpretation comes from their location in an area that was in between the seaward runway and revetments and the inland barracks in an area where two other sites (7279 and 7282) that were part of the Marconi communication facility are situated.

Figure 52. Site 7279 concrete block, view to south

Figure 53. Site 7279 showing metal strap, view to west

Figure 54. Site 7279 concrete mound with inscription, view to east

Figure 55. Site 7279 concrete mound with inscription, view to west

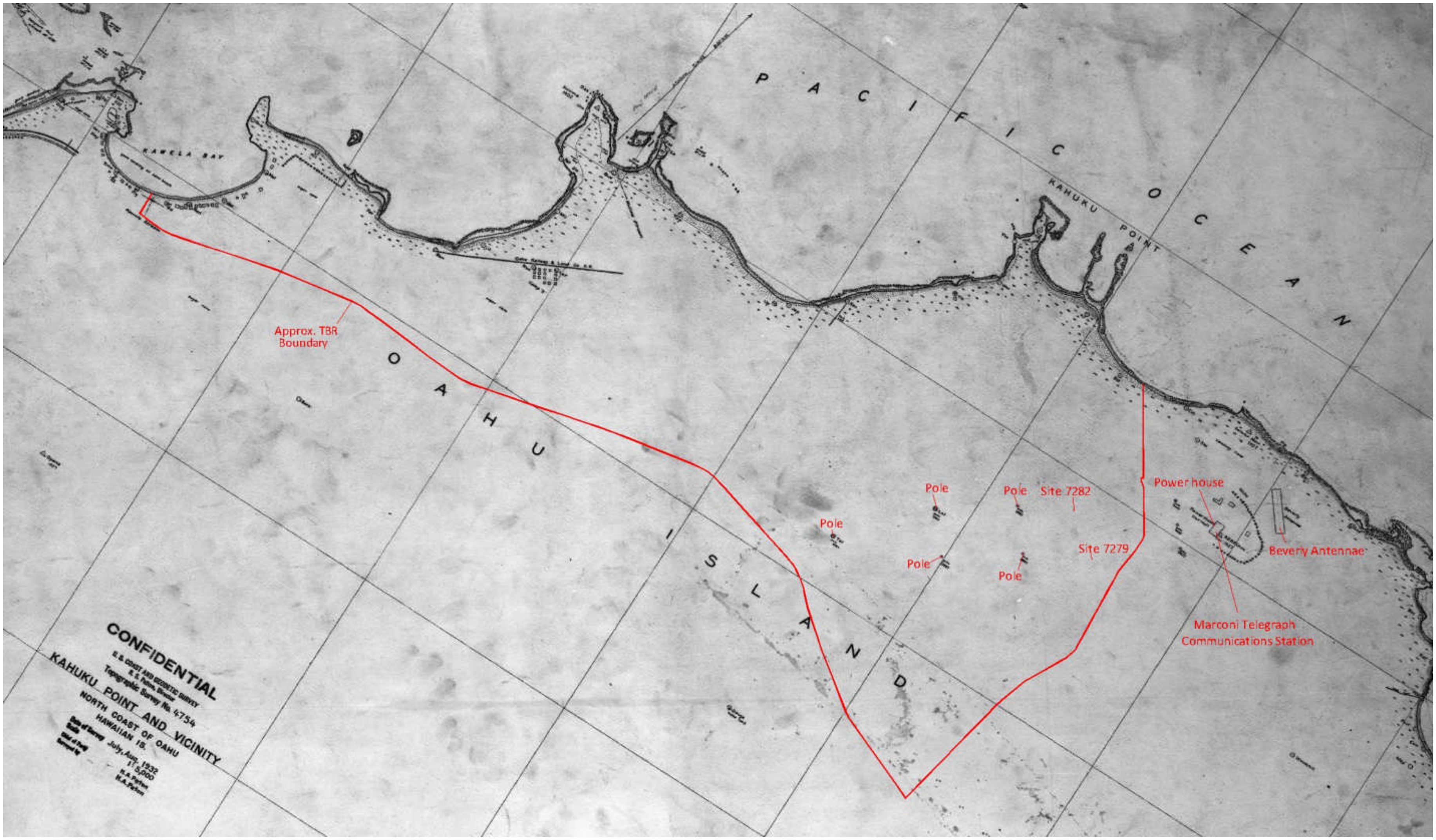


Figure 56. 1932 U.S. Coast and Geodetic Survey Map

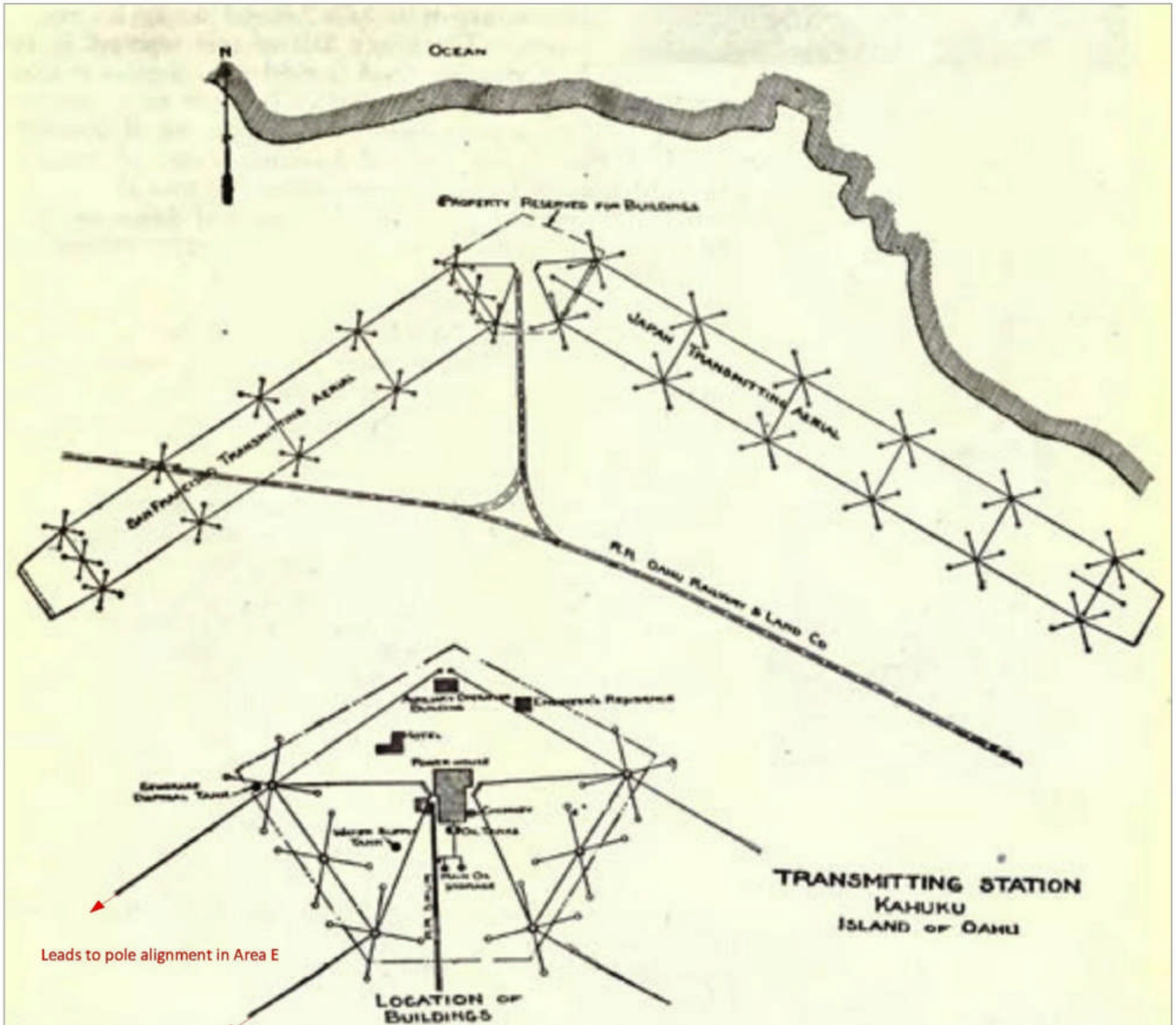


Fig. 310—General Plans of Transmitting Aerials at Marconi Station, Kahuku, Hawaiian Islands.

Figure 57. Transmitting aerials at Marconi Station (from terrastories.com)

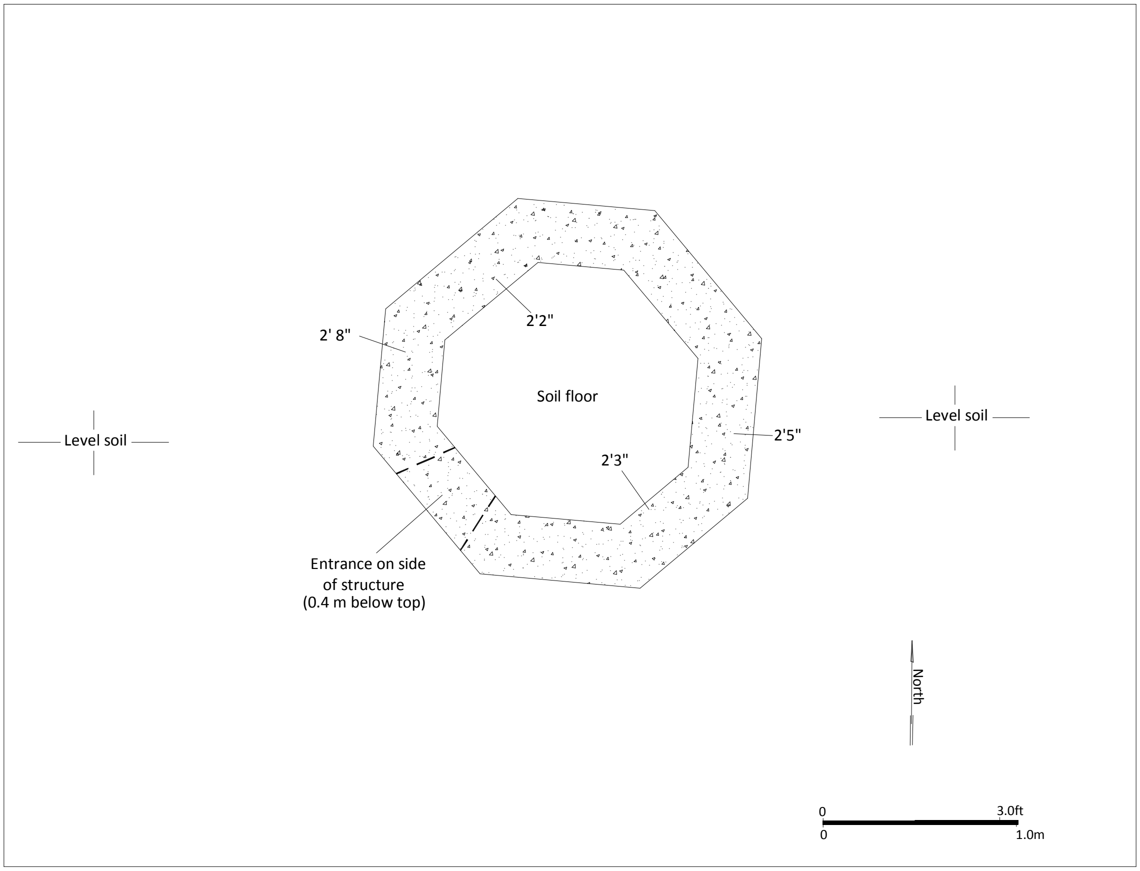


Figure 58. Site 7280 plan map

Figure 59. Site 7280 concrete structure, view to northeast

Site 7281 consists of a predominantly buried pile of concrete structural elements in an area 16 m long (north-northwest by south-southeast) by 4 m wide. The debris pile is located adjacent to a dirt road on level ground in the south portion of Area E. Some concrete structural elements are similar in form and appearance to the standing concrete structure documented at Site 727. Visible elements consist of three wall segments 1' thick with the same 2'10" wide overhanging interior eaves as those at Site 7278, and the same two parallel grooves on the underside of the overhanging eave-like projections (*Figure 60*). The broken walls vary in length from 13' to 14'. A displaced concrete slab is positioned on top of one of the disturbed walls adjacent to the dirt road. The slab is 12' square and 1' 4" thick, with reinforcing rebar visible along the edges (*Figure 61*). A similar slab was not present at Site 7278, which suggests it could represent a displaced element of a second structure.

Site 7281, like Site 7278, is also located in the area between the barracks and the revetments on the south of the main runway. The two sites are located 300' apart. Site 7278 was interpreted as a possible gun position or ordnance storage facility for the WW II-era Airfield. Based on the similarity of the structural elements previously documented at Site 7278, the destroyed concrete structural elements at Site 7281 probably represent a similar feature used in the same capacity. Obviously, efforts to destroy the structure at Site 7278 were only partially successful; Site 7281 also might have been intentionally destroyed, possibly quite near to its original location. The site is in poor condition and no longer retains physical integrity.

Site 7282 is a square concrete block located on a low knoll in the east-central portion of Area E. The block is nearly identical to the block documented at Site 7279, located 192 m (630') to the southeast, although it lacks a conical concrete mound on the upper surface. The Site 7282 block appears to be intact and measures 9'10" on each side (*Figure 62*). The southern two-thirds of the upper surface is level and 3' to 3'3" high. The northern side slopes to the ground surface. An 8" wide metal strap is embedded into the sloped surface of the block. A 3½" metal bracket is welded onto the strap with a series of rusted metal projections extending along the length of the strap. The same strap is present at 7279, but the bracket and projections have rusted away (see *Figure 53*). Site 7279 was interpreted as a possible base for a power pole with a 1933 inscription. The Site 7282 block is nearly identical to Site 7279 and it is likely of similar age and function. The site is in fair condition and retains substantial physical integrity.

Test Area F

Test Area F encompasses 26.6-acres and is located south of Test Area E, bordered on the west by Punahoʻolapa Marsh and by the Palmer golf course on the north and south (*Figure 63*). A series of dirt roads cross Area F, which provide off-fairway access to various parts of the property. Area F was extensively disturbed during construction of the golf course. Nine large bulldozer push-piles of soil, stone, pieces of concrete and other debris are attributable to golf course construction activities and cover 1.89-acres (*Figure 64*). Concrete remains are similar in appearance to the concrete used in the World War II era military structures elsewhere in Area F. Examples of the displaced concrete elements are presented in *Figure 65* and *Figure 66.*

Several small water-filled limestone sinkholes are located within and adjacent to the northwest end of Test Area F and peripheral to the marsh. These sinkholes were carefully examined during the project but no cultural material or evidence of previous use was identified.

A portion of the Site 5791 OR&L railroad grade once extended through portions of Area F. No surface evidence of the railroad grade was identified in Area F, although an intact section of the grade was identified to the west where it crosses Punahoʻolapa Marsh. A large enclosure with a possible house inside is depicted on the 1890 Loebenstein map of the area (see *Figure 64*), but no evidence of the enclosure or house was identified during the surface survey.

The surface survey of Area F identified seven sites described below: a concrete slab (Site 7265), an agricultural clearing mound (Site 7283), a complex of concrete structures (Site 7284), a pair of metal gateposts (Sites 7285), an asphalt pavement (Site 7286), a displaced concrete structure (Site 7287), and an historic rock wall (Site 7299).

Figure 60. Site 7281 concrete structural remnant, view to northeast

Figure 61. Site 7281 concrete structural remnant, view to south

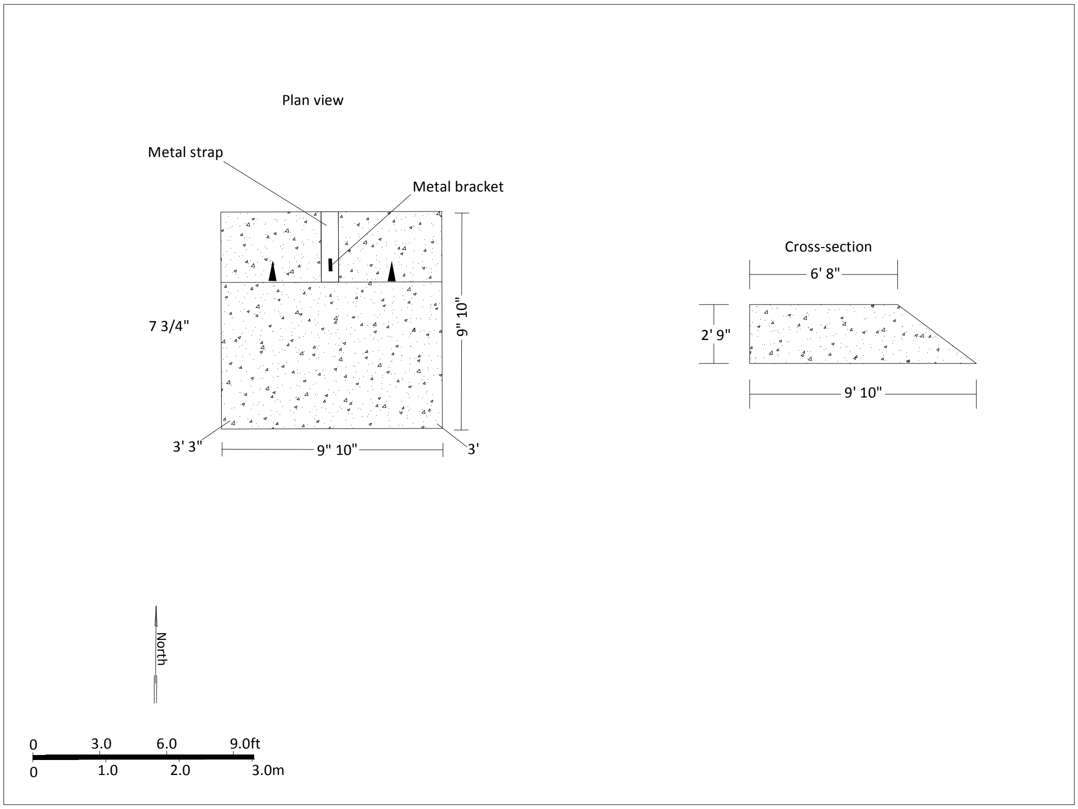


Figure 62. Site 7282 plan map

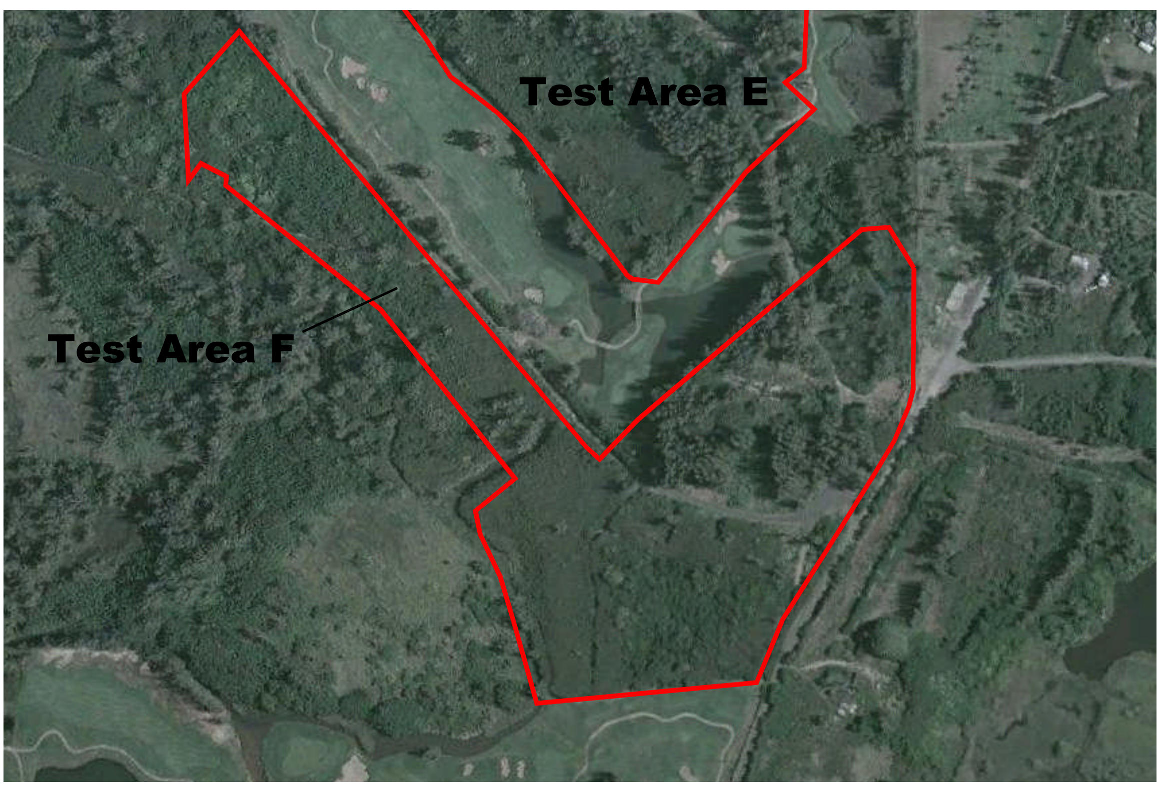


Figure 63. Aerial view of Test Area F (from Google Earth)

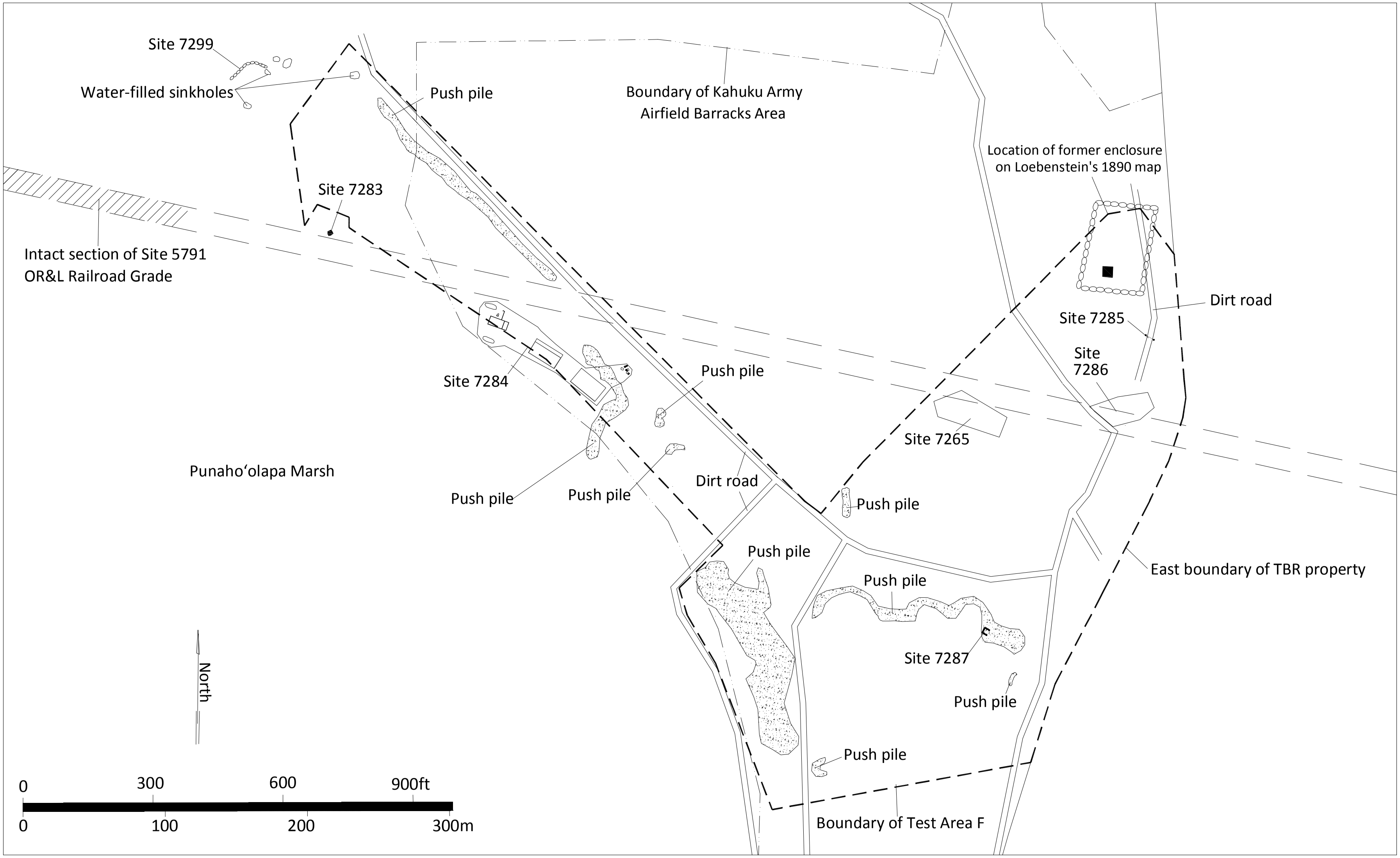


Figure 64. Surface of Test Area F

Figure 65. Push piles with concrete debris, view to south

Figure 66. Push piles with concrete debris, view to southwest

Site 7265 is a large disturbed concrete slab covered with fallen trees and vegetation, located in the southeast portion of Area F, on level ground in an ironwood grove. The exposed portion of the slab is 168′ 7″ long (west-northwest by east-southeast) and 49′6″ to 74′5″ wide (*Figure 67*). Intact edges are present on the south and east sides. The remaining sides have been damaged by a bulldozer and are characterized by broken concrete rubble or are buried beneath soil push piles. The intact sides of the slab vary in height from 5″ to 8″. No artifacts are present on or around the slab. The Site 7265 slab is located within the former army airfield barracks facility depicted in Figure 64. The slab likely served as the foundation for a barracks or other military support structure. The slab is in fair condition and retains limited physical integrity.

Site 7283 is an irregularly shaped stone mound located on the eastern periphery of Area F, 5.0 m north of a dirt road. The mound is built of roughly stacked and piled weathered limestone boulders and cobbles on a surface of undulating terrain characterized by limestone outcrops (*Figure 68*). The mound is 3.0 m long (east-west) by 2.6 m wide and 0.95 m high with an uneven irregular surface. No artifacts were observed in association with the feature. The mound is interpreted as possible agricultural clearing feature based on its formal type and informal construction. It is in poor to fair condition and retains limited physical integrity.

Site 7284 is a complex of five features located on the southwest side of Area F, adjacent to Punahoʻolapa Marsh (*Figure 69*). The features consist of two large slabs (Features A and C), a concrete structure (Feature D) and two concentrations of historic debris (Features B and E). The site covers an area 111 m long (northwest by southeast) by 38 m wide.

Feature A is a rectangular concrete slab 73′6″ long (northwest by southeast) and 40′ wide, located at the southeast end of the site (*Figure 70*). The sides vary in height from 1′11″ to 3′8″ above the surrounding ground surface. The northwest quarter of the slab is raised 4″ above the rest of the surface. A second, 10″ high raised surface is located in the eastern corner. Two ½″ bolts are present in the north and east corners, while two ¾″ bolts are present at the south and west corners. A recessed channel 3 5/16″ wide extends along the southwest side and portions of the northwest and southeast sides. A dense stand of Christmas berry covers and obscures the slab surface; it is possible that the channel continues but is obscured. The surface of the main slab is 10″ above the channel (*Figure 71*). A second set of recessed channels extends at least 16′ toward the center of the slab, but is buried beneath soil and Christmas berry so its full extent might be greater. A 1 ¾″ metal pipe is suspended from the side of the slab along the northwest side. One-half inch diameter steel rebar is visible in broken edges of the slab. A mound of soil and a large boulder are located on the southwest side of the large slab. A smaller concrete slab adjoins the west-central side of the main structure and is 25′ long (northwest by southeast) by 6′4″ wide and 1″ above the surrounding ground surface. The surface of the main slab is 2′6″ higher than the surface of the smaller slab. A large displaced slab fragment is present on the east end of the surface of the lower slab. A backhoe trench was excavated on the southwest side of Feature A. Excavation of BT-F-9-1, a 5.0 m long trench, documented 0.2 m of fill over weathered limestone (see *Figure B-320* in **Appendix B**). A 2″ galvanized metal pipe in the northwest wall of the trench likely originated at the slab. No other cultural remains were present.

Feature B is a concentration of discarded historic structural elements, predominantly fragments of concrete, located 18 m northeast of Feature A (see *Figures 69-70*). A large bulldozed push pile of soil, stones, asphalt and concrete fragments separates Feature B and Feature A. Debris is scattered over an area 7 m long (north-northwest by south-southeast) by 4 m wide. Feature B consists of two concrete pads (each is 4′3″ long by 3′1″ wide), a cluster of twisted metal pipes, a concrete block with a 4″ metal pipe extending from the top (3′ long by 2′8″ wide) and two small concrete pads with four raised, roughly hemispherical projections (*Figure 72*). The pads at the north end of the concentration are 4′ square and 10″ thick with the projections averaging 1′4″ in diameter and 5″ in height. The broken pad with projections is 4′ long and 2′9″ wide. A large basalt boulder is located on the northwest edge of the discarded structural elements.

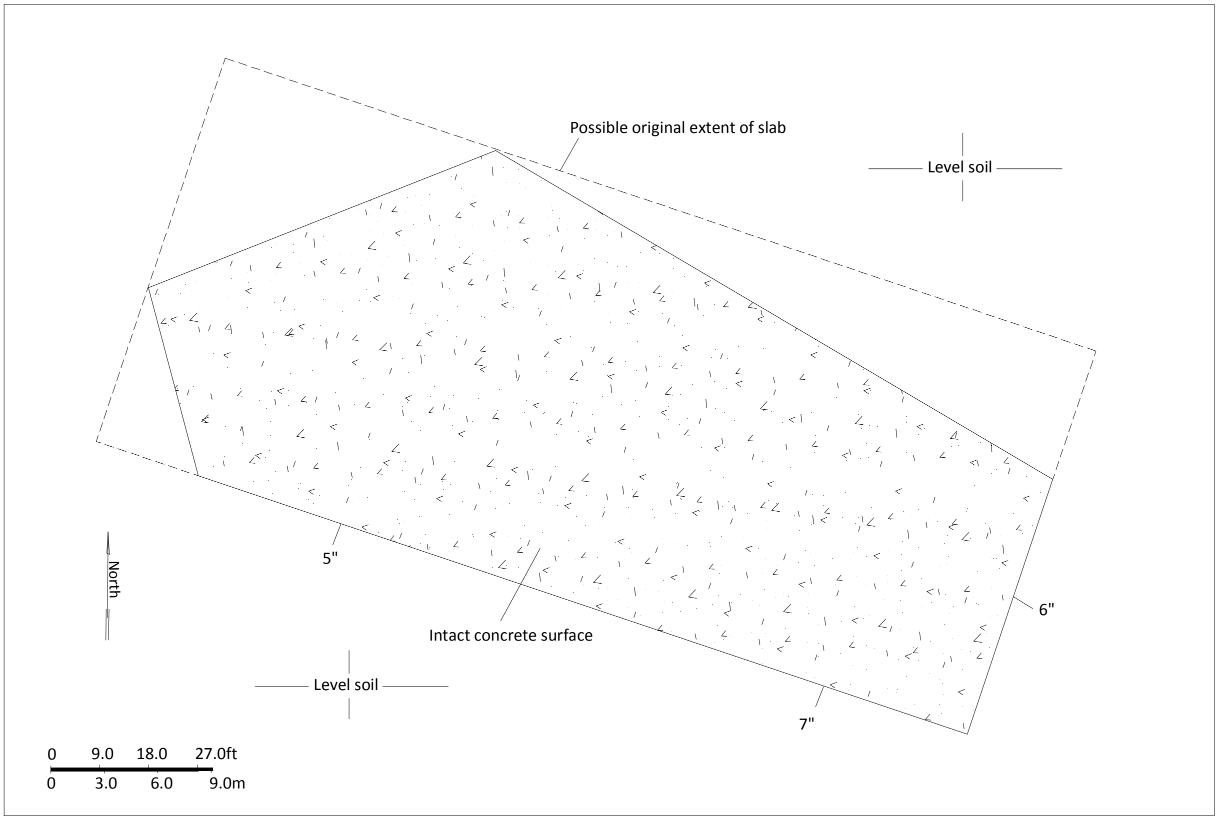


Figure 67. Site 7265 plan map

Figure 68. Site 7283 stone mound, view to north

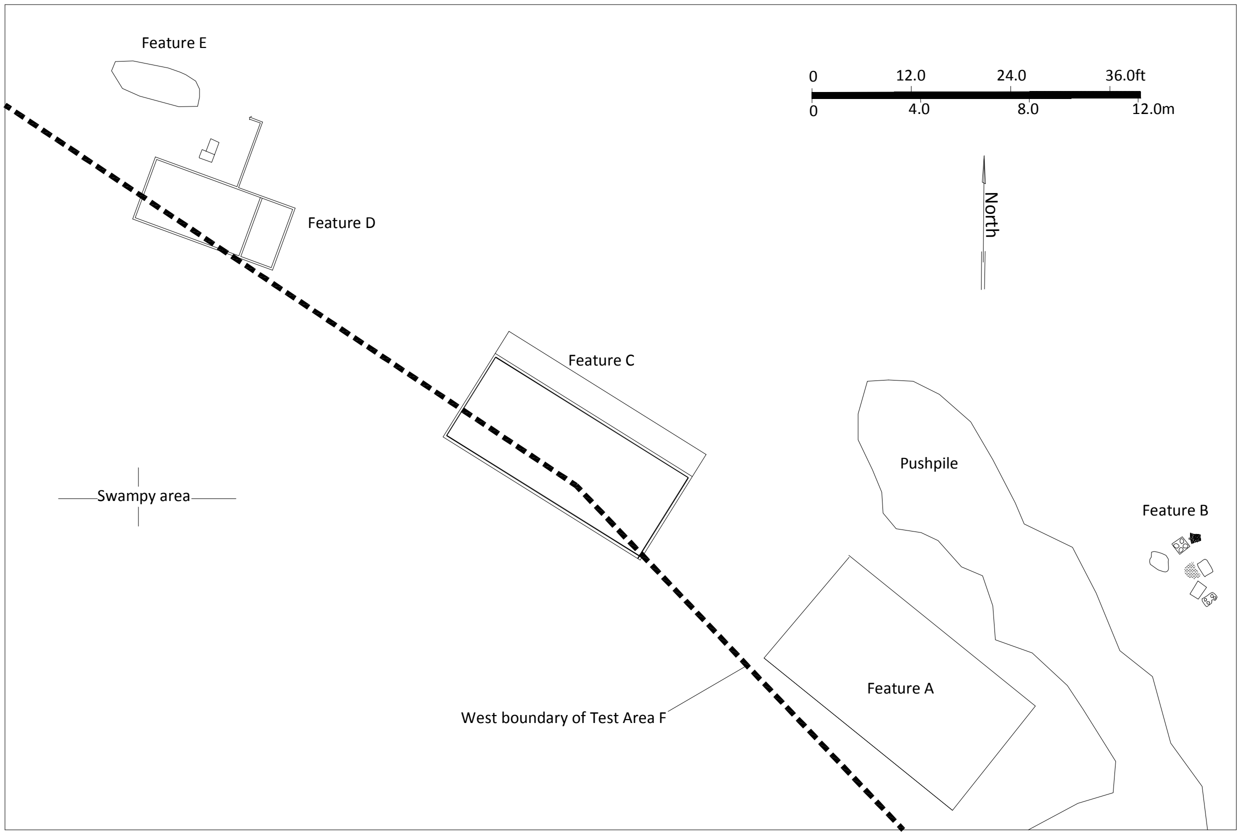


Figure 69. Site 7284 plan map

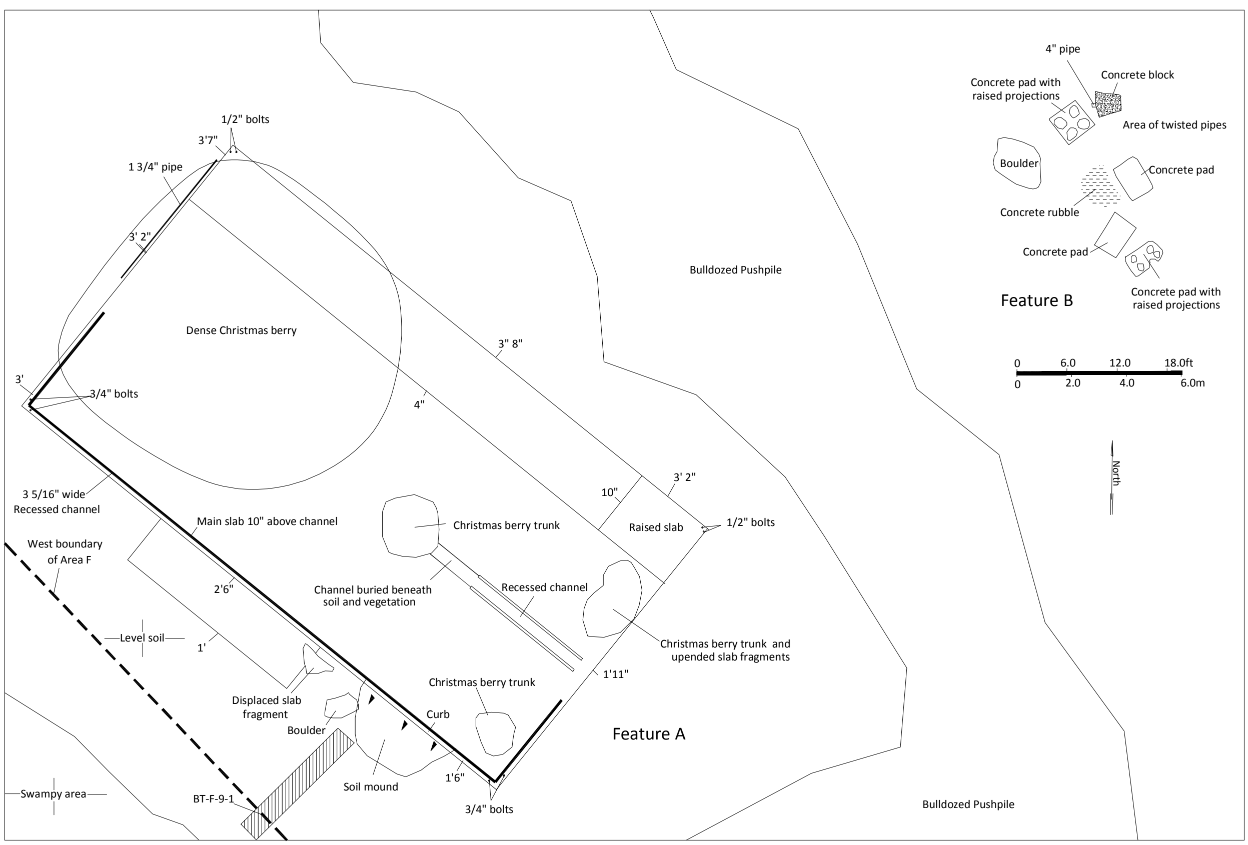


Figure 70. Site 7284, Feature A and B plan map

Figure 71. Site 7284, Feature A channel, view to northeast

Figure 72. Site 7284, Feature B concrete pad with projections, view to northwest

Feature C is a rectangular concrete slab 70'2" long (northwest by southeast) and 37'6" wide, located 15 m northwest of Feature A (*Figure 73*). The slab is 1'10" to 2'6" high and was constructed using 7" wide form boards (*Figure 74*). The northeast side of the slab is raised 4" above the rest of the slab surface. A recessed (10" deep) channel, identical to one at Feature A, frames the lower portion of the slab. A series of ½" threaded metal bolts spaced 4' apart extend from the northeast side of the raised portion of the slab (*Figure 75*). Numerous Anchor Hocking brown and colorless glass bottles are scattered around the slab.

Feature D is a complex concrete structure situated 22 m northwest of Feature C. The structure is densely overgrown with Christmas berry and is composed of three adjoining rooms. The overall structure is 44'2" long (west-northwest by east-southeast) and 19'8" to 40'8" wide (*Figure 76*). The walls are 1' thick and were constructed using 7" wide form boards. Broken edges reveal metal reinforcing rods. The smallest room on the east side is 19'8" long by 10'9" wide with a concrete floor, but no roof or obvious entrance. Half-walls are present on the north and east sides, 2'3" to 2'6" high. A metal ladder is attached to the southwest interior wall of the smallest room (*Figure 77*). The central room is 33' 4" long by 19'10" wide; wall heights vary from 5'4" to 5'7" and the floor is concrete (*Figure 78*). The floor and the lower half of the interior walls are coated with tar. The central room also lacks a roof and obvious entrance. A northern extension of the central room consists of a rectangular concrete slab that adjoins the north side of the central room. The northern extension is 26'11" long by 20'10" wide and is only partially walled, but not roofed. A half-wall, 1' thick and 1'11" to 2' high, extends along the east side and northeast corner. A raised concrete platform in the center of the slab has two levels (*Figure 79*). The lower level is 3'11" long, 2'8" wide and 6" high, with a metal bracket at both ends. The upper level is 4' long, 2'6" wide and 1'5" high. A metal electrical panel is located on the wall near the southeast corner. Modern trash is scattered within and adjacent to the structure.

Feature E is trash dump of historic and modern debris covering an area 8.5 m long (east-west) by 3 m wide, c. 3.5 m northwest of Feature D (see *Figures 69* and *76*). The oldest items are colorless glass containers, Anchor Hocking bottles and jugs, brown glass beer bottles, and rusted metal cans (*Figure 80*). Modern debris includes a lawn mower, plastic bottles, a small refrigerator, an enamel sink and two porcelain toilets.

Site 7284 is part of the World War II Kahuku Army Airfield barracks complex (see *Figure 64*). Features A and C likely functioned as foundations for military structures. The Feature D structure probably was a water storage and distribution facility based on the tar-coated interior main room that lacks a door. The small platform on the northern slab at Feature D potentially supported a pump. The Feature B and E artifact scatters represent trash dumps. The site is in fair condition and retains limited physical integrity.

Site 7285 consists of a pair of metal posts located on opposite sides of a dirt road in the northeast portion of Area F. The posts are 4" in diameter and are set vertically in the ground, spaced 21' apart (*Figure 81*). Each post has two hinges fabricated from 4" by 3" metal plates with 1" rods welded to the sides. The remnants of a gate frame are attached to the hinges on the southeastern post. The posts are set in concrete and are supported by two 2" galvanized pipes welded to the sides. No artifacts were observed in association with the site. Site 7285 is located within the former barracks area of the Kahuku Army Airfield (see *Figure 64*) and could represent the remains of a gate used to control access to the barracks complex. Site 7285 is in poor condition and lacks physical integrity.

Site 7286 is a roughly rectangular section of asphalt pavement located on the east boundary of Area F. The exposed portion of pavement is 134'6" long (east-west) by 67' wide (*Figure 82*). A dirt road borders southwest side of the pavement along; low berms of soil and stone frame the other sides. A second dirt road, which leads to the Site 7285 gateposts, is located on the north side of the berm framing the north end of the pavement. A barbed wire fence is located adjacent to the east side of the pavement and parallels Marconi Road. Modern trash is scattered on an around the pavement. Site 7286 is located within the former Kahuku Army Airfield barracks area, 40 m south of the Site 7285 gateposts. The location of the asphalt pavement at an intersection of two roads potentially indicates that it may be a paved intersection. The site is in poor condition and retains limited physical integrity.

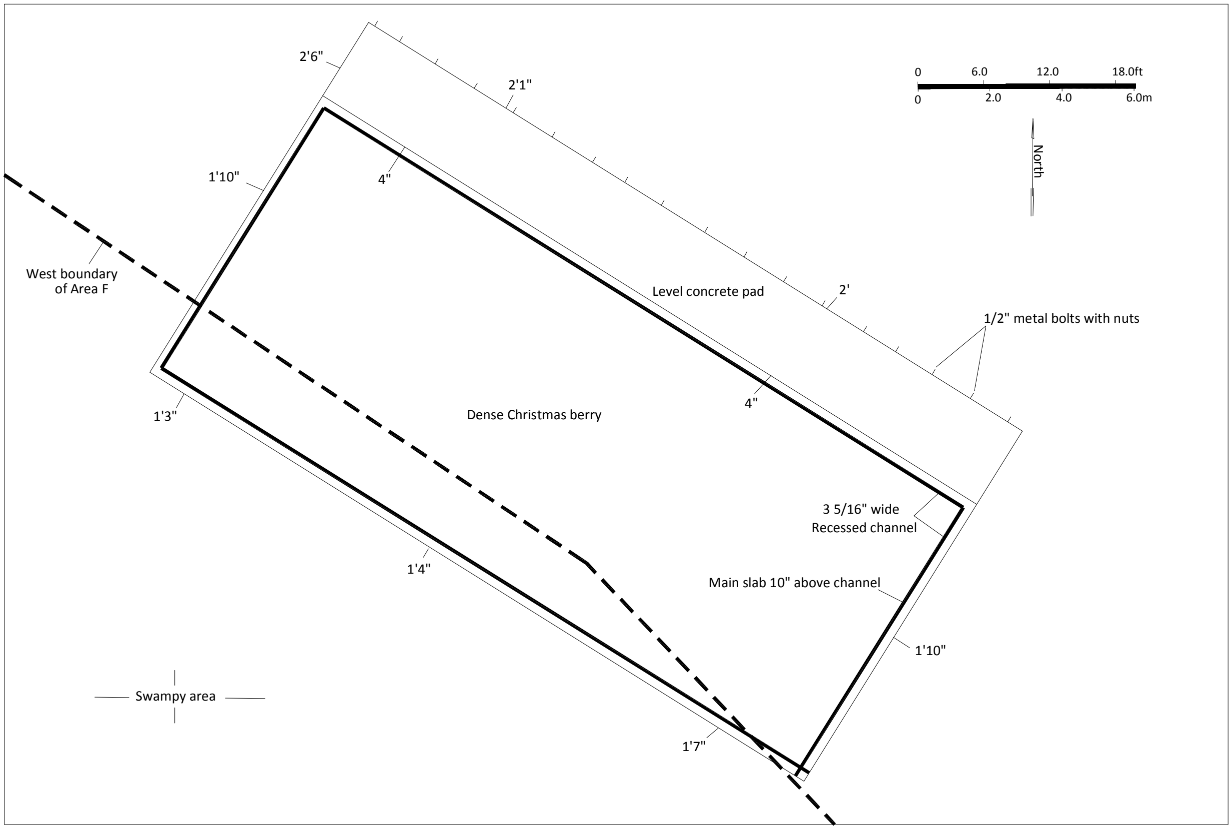


Figure 73. Site 7284, Feature C plan map

Figure 74. Corner of Site 7284, Feature C showing form board marks, view to northeast

Figure 75. Bolts on side of Site 7284, Feature C, view to southwest

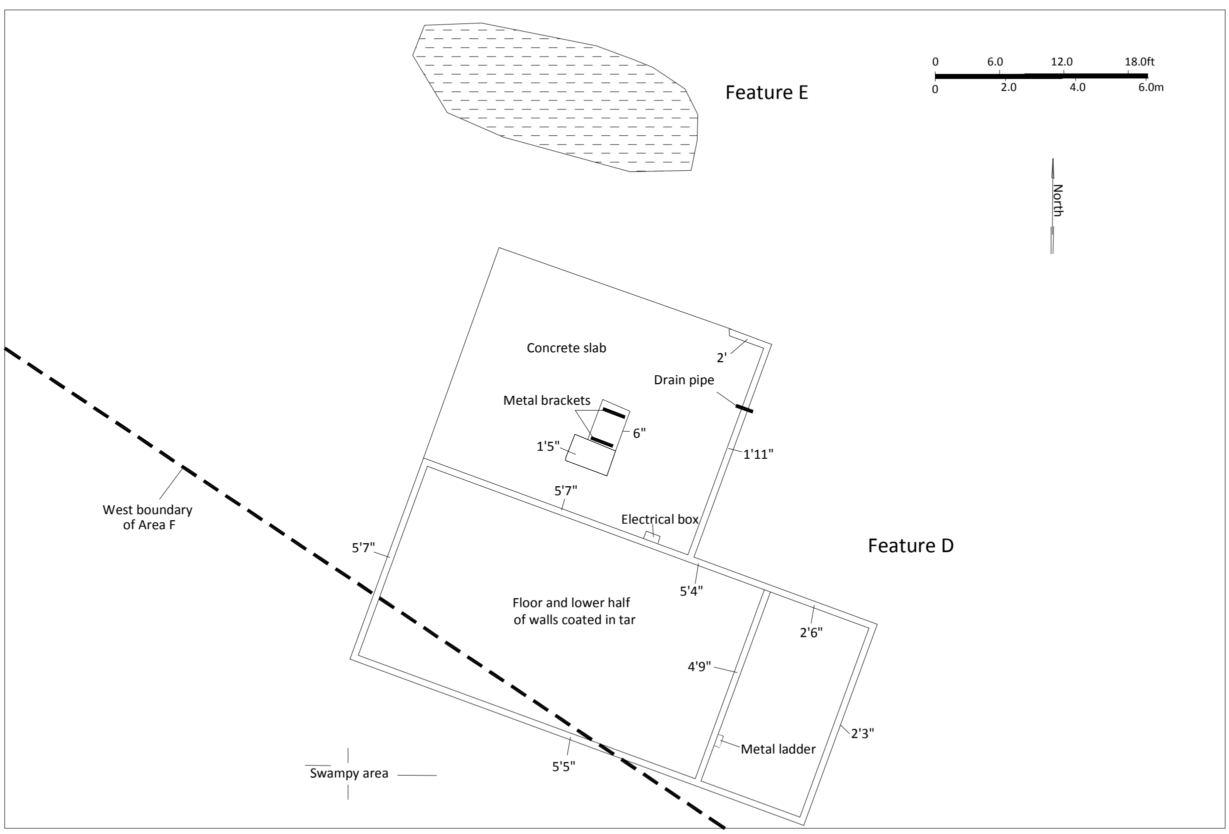


Figure 76. Site 7284, Feature D and E plan map

Figure 77. Metal ladder at Site 7284, Feature D, view to west

Figure 78. Site 7284, Feature D wall, view to northeast

Figure 79. Concrete platform at Site 7284, Feature D, view to west

Figure 80. Site 7284, Feature E artifact scatter, view to north

Figure 81. Site 7285 metal gateposts, view to south

Figure 82. Site 7286 asphalt pavement, view to west

Site 7287 is a displaced U-shaped concrete structure located upside-down and on top of a large bulldozed debris pile near the southeast corner of Area F. The structure is identical in size and shape to the 7278 concrete structure documented in Area E. It is 15'10" long (north-south) by 14'2" wide. The structure walls have the same 2'10" wide overhang sections with two parallel grooves on the underside. The walls are 1' thick, constructed with 6" wide form boards and reinforcing steel bars (*Figure 83*). The corners of this structure are also blown outward in the same pattern as the 7278 structure's corners. Site 7287 is interpreted as a displaced a military gun position, or ordnance storage facility. The site is in poor to fair condition and lacks substantial physical integrity.

Site 7299 is a curvilinear rock wall located on the northwest periphery of Test Area F near Punahoʻolapa Marsh, in an area characterized by limestone outcrops and water-filled sinkholes (see *Figure 64*). The location roughly corresponds to that reported for an historic rock wall documented as Site T-5, but few specific details of the T-5 wall are presented in the Bath *et al.* report (1984:19 – Table 1). The Site 7299 wall is 29.2 m long and constructed of roughly stacked and piled limestone cobbles and small boulders. Most of the wall is collapsed and is currently 2.0 m wide and 0.4-0.5 m high. An intact section is 0.9 m wide at the base, 0.7 m wide at the top and 1.1 m high (*Figure 84*). No artifacts were observed in association with the wall. Site 7299 is interpreted as an historic ranch wall used to restrict the movement of cattle, based primarily on the height of the intact wall section. It is in poor to fair condition and retains limited physical integrity.

Test Area G

No surface sites were identified in Area G. This area encompasses 9.9-acres and is located at the southeast corner of the TBR property. It is bordered by golf course to the north and west, by Kamehameha Highway to the south and by Marconi road to the east (*Figure* 85). This area is located south of the boundary of the Kahuku Army Airfield barracks complex (*Figure 86*). The surface of Area G has been extensively disturbed by historic and modern agricultural activity. A bulldozed push pile of soil, stones and concrete rubble, probably created during the construction of the adjacent golf course, is located near the northwest edge of Area G.

Figure 83. Site 7287 displaced concrete structure remnant, view to northeast

Figure 84. Site 7299 wall, view to northwest

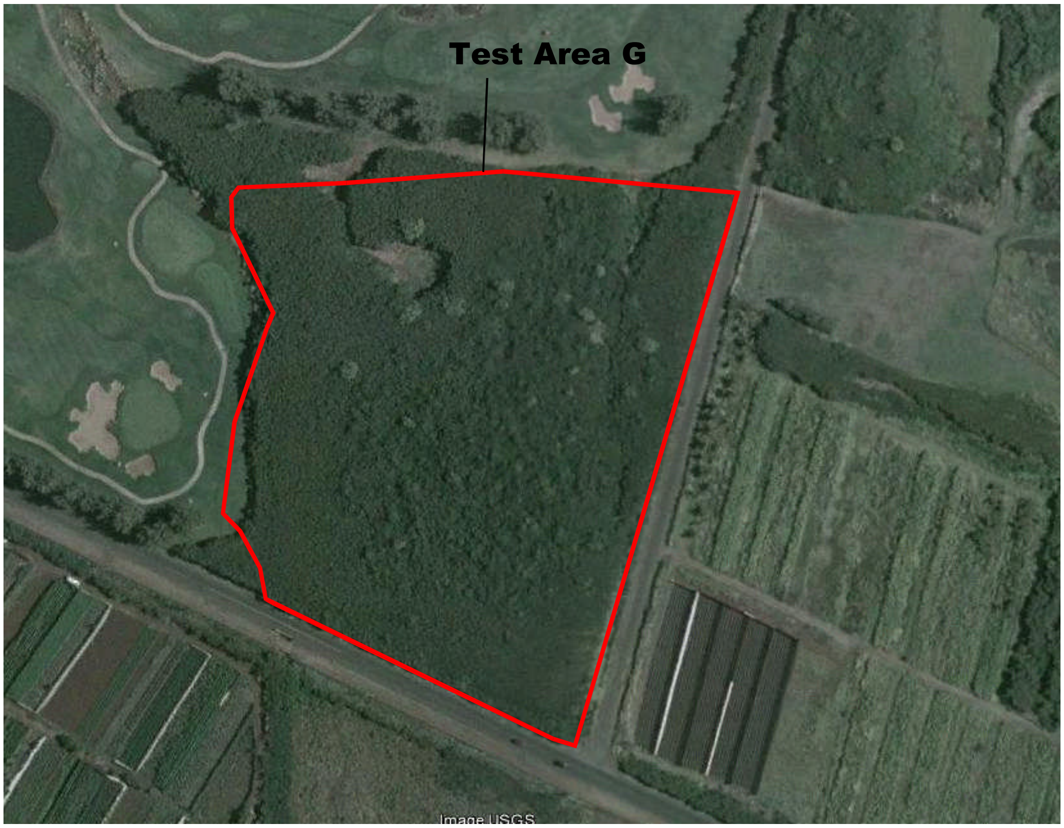


Figure 85. Aerial view of Test Area G (from Google Earth)

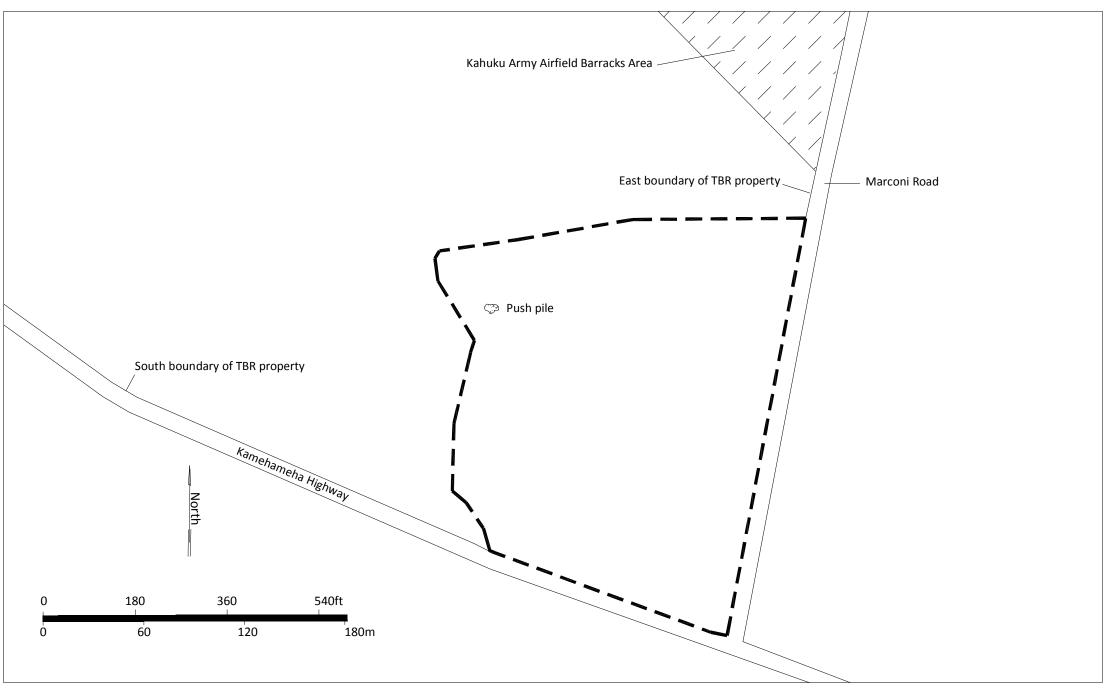


Figure 86. Surface of Test Area G

Subsurface Testing

Subsurface testing was accomplished by mechanically excavating 345 trenches and manual excavation of 10 profile exposures in sand pits. Most trenches were 5-6 m long, but the length was variable and the longest trench was 23 m. A total of 2,040.1 linear meters (1.27-miles) represents the majority of the subsurface testing data. Most trenches (n=322) were systematically placed along a pre-determined grid and the rest (n=23) were excavated to identify the areal extent of buried cultural deposits and to sample areas missed by systematic placement.

Ten subsurface sites were identified during the subsurface testing phase of the project. These consist of seven prehistoric cultural deposits (Sites 7290 and 7291 in Area D; Sites 7292-7296 in Area E), two prehistoric cultural deposits with human burials (Site 7288 in Area B; Site 7289 in Area D) and one isolated human skeletal element (Site 4488; Area C). In addition, widespread evidence of tsunami-related deposits, fill episodes associated with military and resort related land modifications, and evidence of plantation era features were identified. Fill is present in most test areas as a result of prior land modification during World War II in the vicinity of the Kahuku Army Air Field and barracks, and subsequently during the development of Turtle Bay Resort facilities.

In the following test trench excavation descriptions, sediment layers are described in terms of deposit types based on depositional processes. Alluvial deposits are sediments derived from weathered igneous rock on the uplands inland of the project area. These sediments are eroded and transported by water, and deposited on coastal plains and alluvial fans. Humus refers to the uppermost organic-rich layer of the soil and frequently in this report includes the overlying deposit of decaying organic material or duff. Buried A horizons are reported for deposits in several test areas and refer to alluvium that appears to be former ground surfaces denoted by the presence of a humic, or organic-stained zone at the upper boundary of the deposit. In addition, most layers identified as cultural deposits are associated with A horizon deposits.

Marine-deposited sands are typically characterized by coarse to fine-grained calcareous sand mixed with fragments of weathered limestone, coral and shells. These sands are deposited on shorelines by storms and inland by extreme tsunami events. In marine contexts, such sands are deposited in sheltered lagoon settings during higher stands of the sea and during more recent infilling of coastal bays and coves. Aeolian sands are wind-deposited fine-grained sediments of silt and sand that often exhibit horizontal or diagonal bedding planes.

Limestone bedrock underlies most of the project area and is usually the basal deposit in the test trenches unless the water table was encountered first. The upper portion of the limestone bedrock readily decomposes to very coarse calcareous sand mixed with limestone rock fragments when it is subjected to saturation by the water table. The limestone bedrock is a fossil remnant of former coralline and detrital reef structures, often characterized by crevices, fissures and cavities. These voids are occasionally filled with terrigenous silt and clay sediments.

Carbonate zones and layers were identified in a number of trenches. These are usually narrow bands and lenses of calcium carbonate precipitated from a deposit, cementing the matrix, usually sand. The carbonate zones are undoubtedly attributable to episodes of water saturation and subsequent evaporation that precipitated dissolved calcium carbonate.

The research design provided for a sampling strategy of two trenches per acre based on the previously mapped locations of Jaucus Sand and Pearl Harbor Clay deposits and one trench per acre in areas where these deposits do not occur (Areas A and G). Based on the results of the sampling strategy, the areal extent of soil deposits with increased potential to contain significant intact subsurface cultural deposits can be identified. Data collected during subsurface testing will be a valuable tool for future planning and development. Individual trench profiles are summarily illustrated in Appendix B, while specific details of individual trench stratigraphy and sedimentology are tabulated in Appendix C. Cultural material recovered and analyzed during documentation of subsurface cultural deposits are tabulated in the project Accession Record in Appendix D. The raw data presented in the appendices form the scientific basis for the inferences, observation and recommendations made in this report.

Test Area A

Test Area A occupies the coastal lowland immediately inland of Kawela Bay. The terrain is nearly level and was formerly farmed, initially for sugarcane and later, vegetables (Haun *et al.* 2011). The soils series described by Foote *et al.* (1972) for the area consist of a narrow strip of Jaucus Sand paralleling the shoreline (see *Figure 7*). Mokuleia Loam covers the seaward half of the area and Mokuleia Clay Loam covers the inland portion.

Test excavations did not encounter the seaward strip of Jaucus sand, but did confirm the presence of Mokulei series soils throughout the parcel. Foote *et al.* (1972) describe Mokuleia series soils as formed in alluvium from weathered igneous rock deposited over sand on coastal plains. The typical surface layer is a dark grayish brown clay loam approximately 40 cm thick, overlying 86 to 122 cm, or more, of dark brown to light gray single grain sand and loamy sand.

Testing in Area A consisted of mechanically excavating 24 systematically placed trenches (*Figure 87*). The trenches ranged from 5.5 to 8.0 m in length (average 6.6 m) and averaged 1.5 m in width. A total of 159.6 linear meters of trench were excavated in Area A (**Appendix B** *Figures B-1* through *B-24*; **Appendix C**). A photograph depicting the typical stratigraphy in Test Area A is presented in *Figure 88*. Excavations documented three to six layers overlying basal weathered limestone (n=10), or were terminated upon encountering the water table (n=14).

Figure 89 shows the maximum depth excavated in Area A trenches. *Figure 90* illustrates the deposit types by layer. Together these two figures convey vertical (*Figure 89*) and horizontal (*Figure 90*) data. Both figures divide the test area into cells that average just under an acre in area (low density sampling). Each cell represents stratigraphic data obtained from a corresponding trench (see *Figure 87*). Layers and depths are trench-specific (**Appendix C**).

Figure 90 shows the horizontal mosaic of deposit types layer by successive layer, where Layer I is the surface deposit. Cells in the successive layer panels in *Figure 90* are coded based on the deposit type alone, regardless of depth. For visual purposes, coding for the terminal layer in a given cell/trench is repeated in successive layer panels, even if no successive deposits were excavated. For example, in Trench A-10-1, the terminal layer is an alluvial deposit Layer IV, in which excavation was terminated upon encountering the water table. The red color-coding for this deposit is repeated in subsequent panels for Layers V and VI, even though no Layers V or VI were encountered in the trench. In this way, the terminal Layer VI panel illustrates the basal deposit type for each cell across Area A.

No intact cultural deposits or human remains were identified in the Area A trenches. All except one trench exhibited stratigraphic evidence of an agricultural plow zone. The remaining trench (BT-5-1) lacked a plow zone but exhibited four layers of fill. The plow zone was the surface layer in 13 trenches (Layer I) and fill was the surface layer in 11 trenches. The plow zone exhibits evidence of mixing and the introduction of organic material. The plow zone deposits are dark brown to very dark brown loam to loamy sand and vary in thickness from 0.2 to 1.45 m, with an average thickness of 0.37 m.

Cultural material from the Area A trenches was usually confined to the upper two strata, unless recovered from deeper fill deposits. Basalt aggregate was noted in Layer I of BT-A-1-1, A-1-2 and A-2-1. Limestone aggregate was noted in Layer I of BT-A-3-1 and in Layer II of BT-A-5-1. A volcanic glass multidirectional core (Acc. 1.001) was collected from Layer II in BT-A-1-2. A waterworn basalt pebble was noted in Layer I of BT-A-3-2. Plastic trash was associated with Layer I of BT-A-4-3. A chromed handle (Acc. 2.001), asphalt and sparse charcoal were associated with Layer IV in BT-A-5-1. Plastic trash and charcoal flecks were noted in the buried plow zone of Layer III in BT-A-5-3. A *Conus* sp. shell was noted in the buried Layer II plow zone from BT-5-4; Plastic trash was associated with Layer I in BT-A-8-1 and sparse marine shells were noted in Layer II. A waterworn basalt pebble was noted in the Layer III buried plow zone of BT-A-9-1, overlying a large trash pit containing historic domestic debris. The trash pit is 1.9 m wide, 0.9 m thick and 0.5 m below ground surface (bgs; see *Figure B-23*, **Appendix B**). Artifacts in the pit consist of glass condiment, medicine and cosmetic bottles, a Japanese glazed ceramic teacup, butchered pig and goat bones, sanitary cans, metal and plastic screw caps (post-1936).

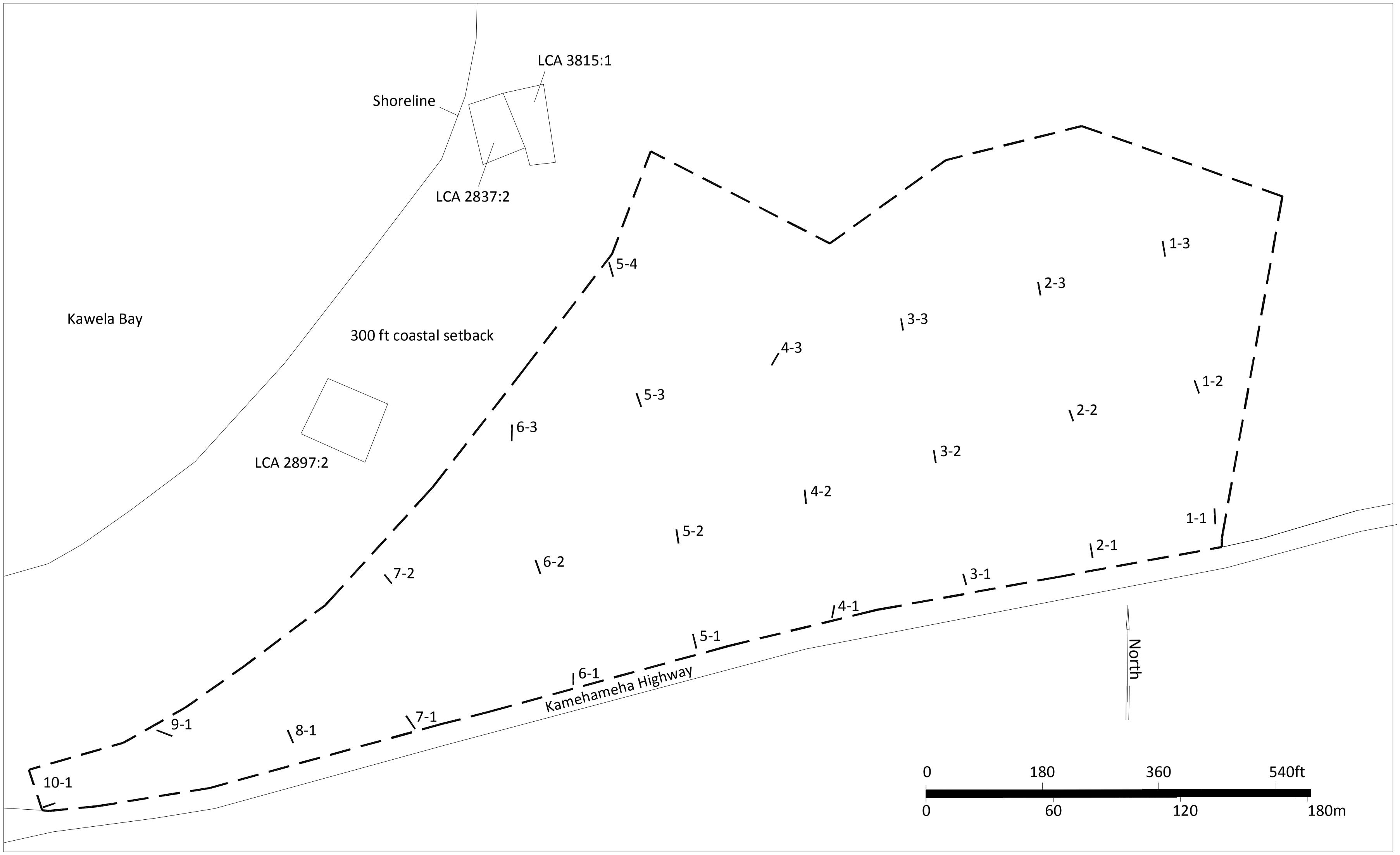


Figure 87. Location of trenches in Test Area A

Figure 88. Photograph of BT-A-1-3 showing typical Test Area A stratigraphy, view to west

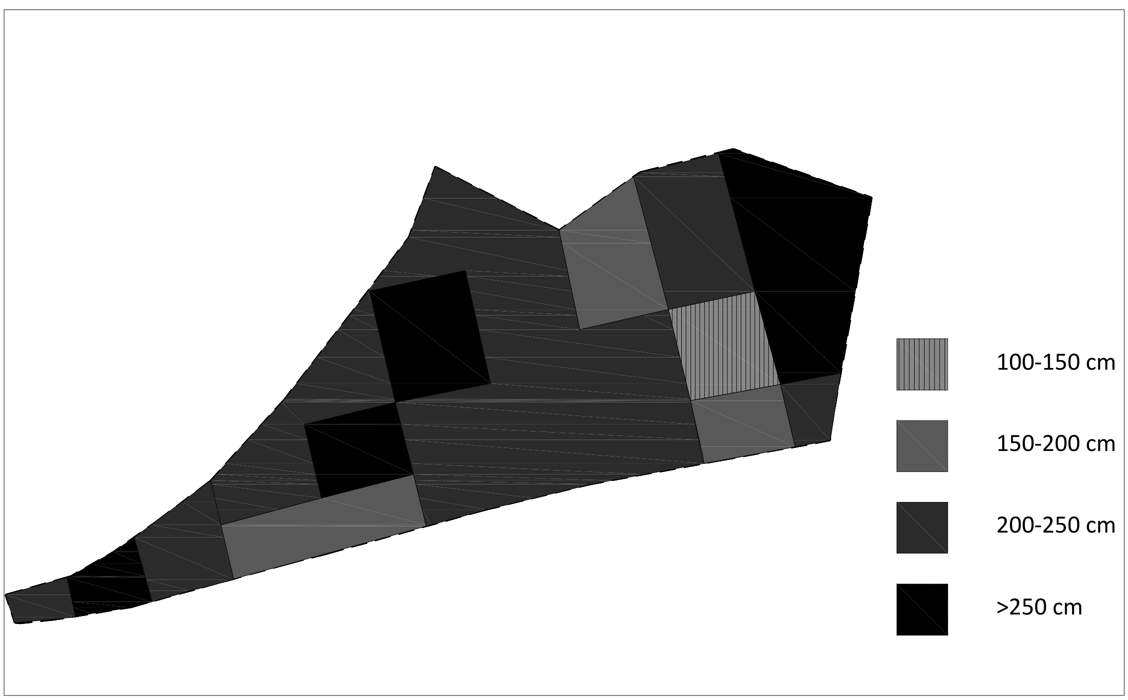


Figure 89. Test Area A trenches – maximum depths

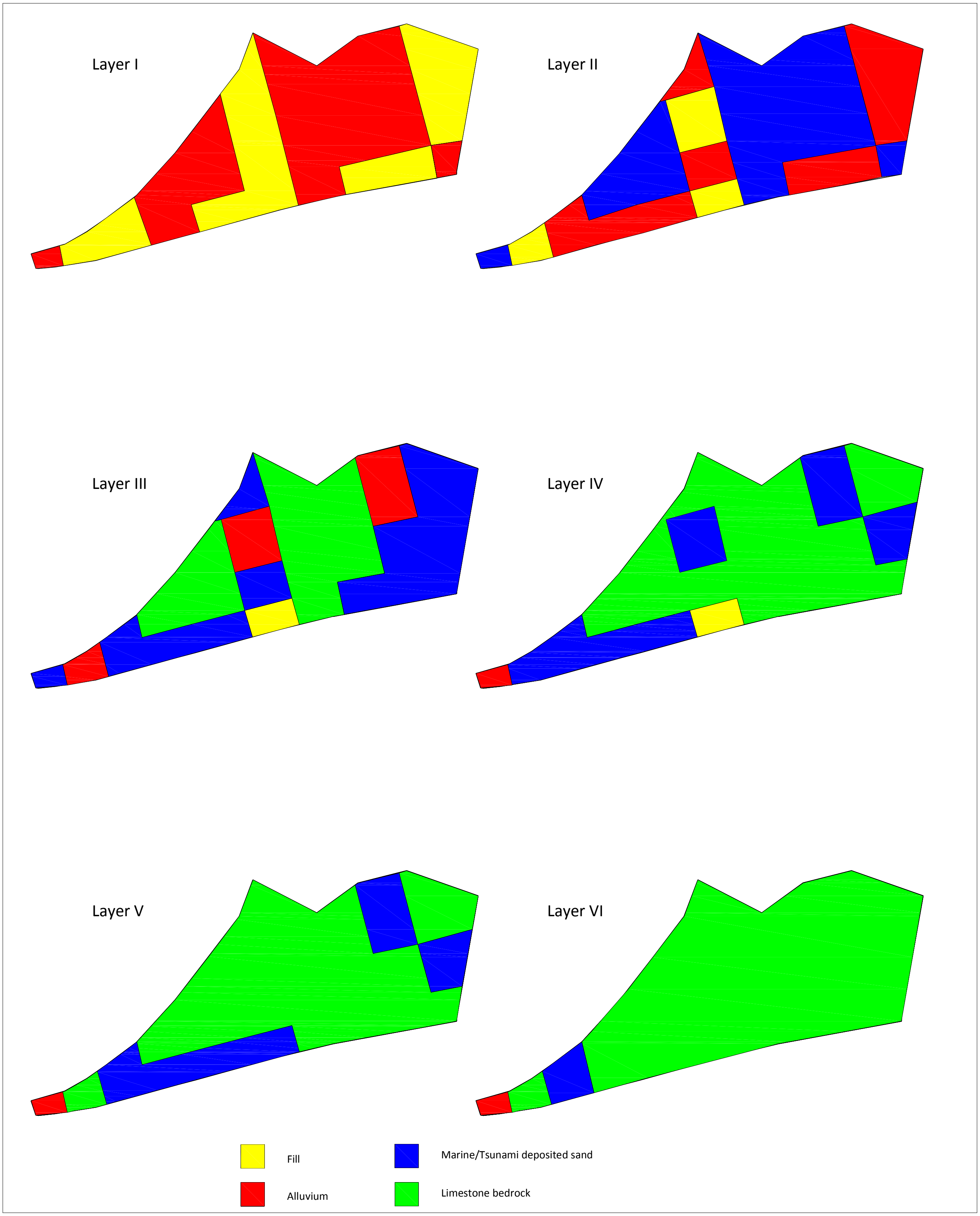


Figure 90 Test Area A deposit types by layer

Layer II in BT-A-7-1 was identified as a buried A horizon, consisting of 0.22 m of very dark gray and black loose single grain silty sand beneath the plow zone (see *Figure B-20* in **Appendix B**). No cultural material was noted in association with this layer, but the deposit represents an older ground surface, subsequently buried.

Many Area A trenches exhibited one to two layers of alluvial sandy clay loam that was extensively plowed for farming, overlying one to three layers of coarse sand. A layer of fill overlies the plow zone in several trenches along trench transect 1 (2 trenches), transect 5 (3 trenches) and along the Kamehameha Highway (5 trenches). Many surface and near-surface fill deposits contained crushed limestone or crushed basalt aggregate in the matrix.

Coarse sand layers probably represent material that was deposited in water indicating that Kawela Bay was formerly much larger and extended across much of Test Area A. These coarse sand deposits vary from very pale brown to yellowish red in color and from 0.04 to 1.95 m in thickness. Waterworn reef rubble, consisting of shell and coral fragments, was present in the coarse sand deposits in 23 of the 24 trenches, a further indication that deposition occurred in a marine environment. The marine-deposited sand layers are thicker in proximity to Kawela Bay and decrease in thickness with distance from the ocean. The elevation of Area A is only c. 2 m amsl and the terrain is essentially featureless with no topographic relief. These facts support the inference that the buried sand deposits probably represent perched beach sands derived from reef truncation and date from the Late Holocene (1500 to 5000 years BP) when sea level was 1-2 meters higher than it is today (Grossman 1998). Alluvial infilling over the Area A lagoon sediments occurred as sea-level fell.

A thin zone of calcium carbonate precipitate is present in the coarse sand deposits in six trenches (BT-A-1-2, 4-1, 4-2, 4-3, 5-2 and 5-3). Most of these trenches are located in the central portion of Area A, with BT-A-1-2 located along at the east end. The precipitate is generally expressed as a 2-4 cm band of calcium carbonate cemented sand. Calcium carbonate is the principal component of marine organisms, which are the constituent parts of limestone. As the underlying limestone substrate dissolves from contact with fresh water from the water table, calcium carbonate becomes suspended in solution as fine particles or precipitate. The precipitate lenses and bands probably denote the high stand of the Late Holocene sea level, resulting in evaporation from increased aridity.

Most of the Test Area A trenches were terminated at a basal deposit of weathered limestone. *Figure 91* is a composite stratigraphic profile for Area A. Most trenches selected for this profile lack surface fill layers and so are especially suited to illustrate the area's natural stratigraphy. The profile shows that the underlying limestone extends throughout Test Area A, although it was not documented in every trench profile obtained from Area A if the water table was encountered first. The profile shows the surface layer of alluvium that was plowed as a result of commercial agriculture after 1890, when land use switched from ranching to sugarcane plantation agriculture.

Figure 92 depicts the extent of the former Kahuku Plantation sugarcane fields in the project area and shows that the plantation covered most of Area A. The area seaward of the sugarcane fields, up to the forested shoreline of Kawela Bay, was also subsequently cultivated, perhaps by later lease-holders, as is evident in a 1970 aerial photograph of the TBR property just prior to development (Haun *et al.* 2011:41, Figure 23). The only possible subsurface evidence of the OR&L railroad grade was encountered in Layer I of BT-A-5-3, where the matrix consists of 80% limestone and 5% basalt fill. It is probable that the railroad grade was used as a farm road after 1946.

There is a low probability of encountering intact subsurface cultural deposits or human remains in Area A during future excavations based on the results of subsurface testing. All cultural deposits in Area A will be confined to the alluvial sediments overlying the marine-deposited sand. The alluvial deposits are no more than 0.66 m thick and most are substantially less, but the average thickness is 0.37 m. The alluvial deposits are surficial in some places and in others are buried by fill. Testing documented that the entire area has been disturbed by historic agricultural activity that would have destroyed the physical integrity of prehistoric cultural deposits. Prehistoric agricultural use of the alluvial land along Kawela Bay is probable, but evidence for agricultural use is negligible.

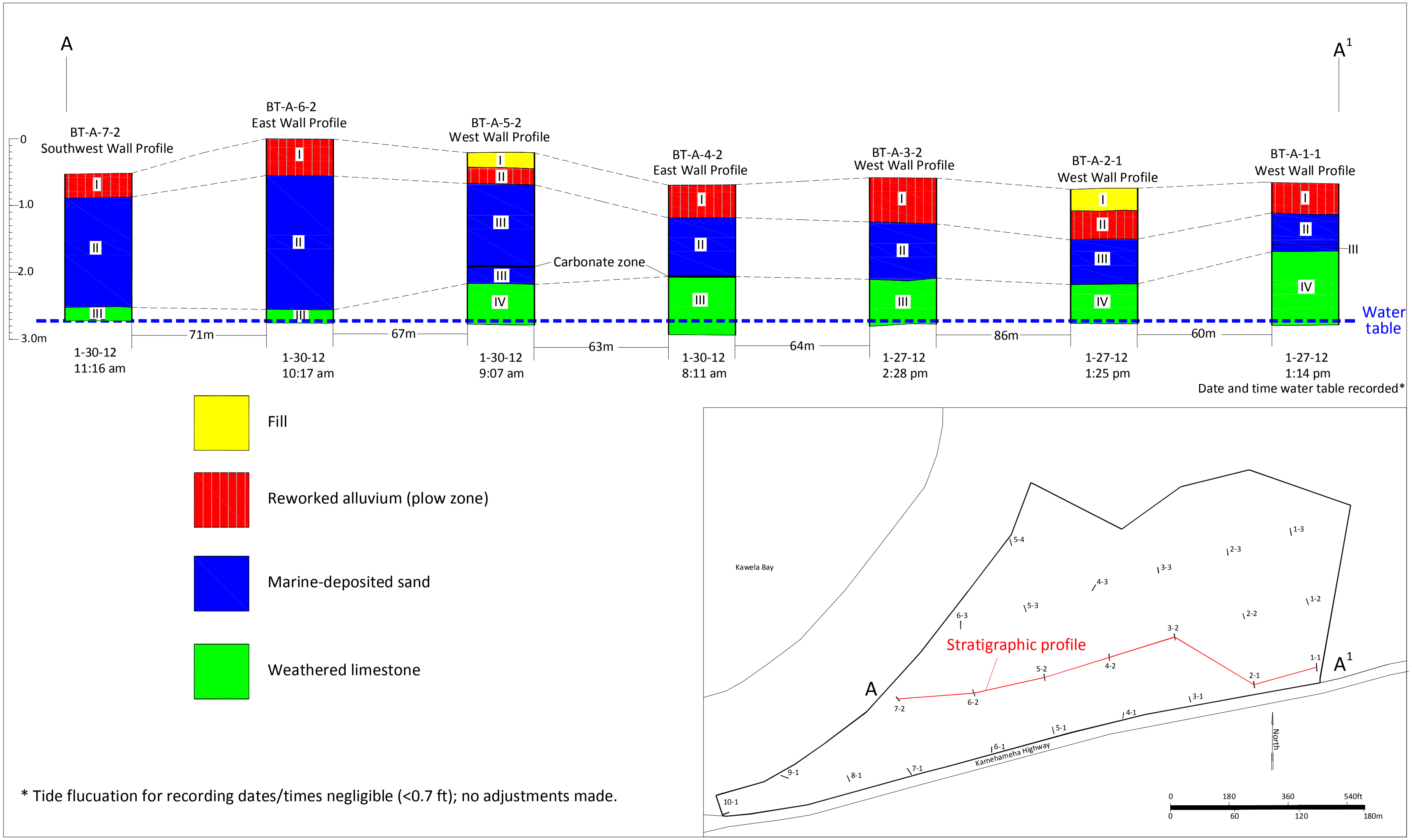


Figure 91. Test Area A stratigraphic profile

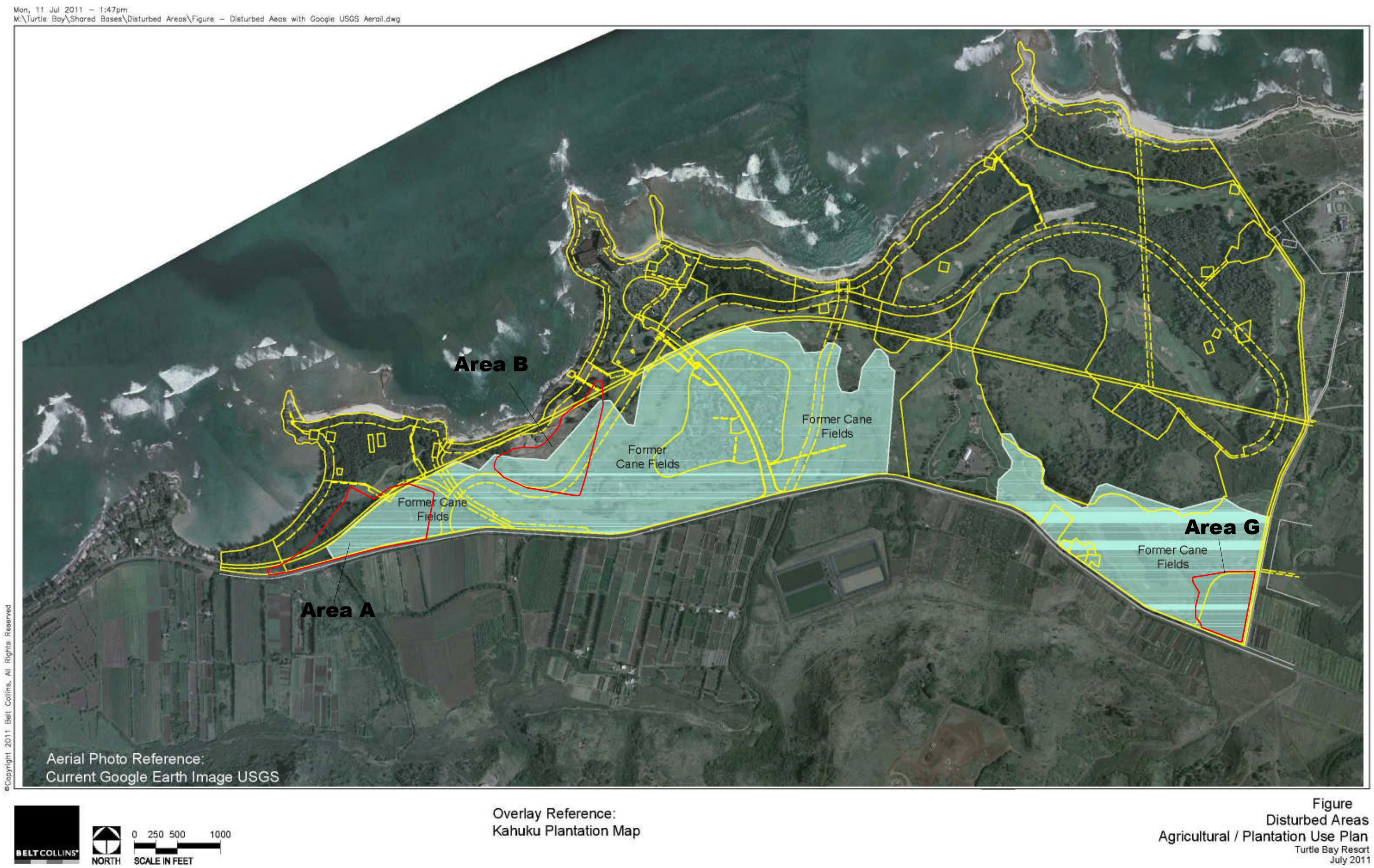


Figure 92. Aerial photograph of TBR property showing former extent of sugarcane fields

Test Area B

Test Area B occupies the coastal lowland between Kawela Bay and the TBR hotel at Kuilima Point. The terrain is fairly level with a low dunal ridge fronting the shoreline. Most of the area is landscaped and was formerly farmed for sugarcane (Haun *et al.* 2011; see *Figure 92*). The west portion of Area B is currently used by TBR for a stable and corrals for horses and ponies.

The soil series described by Foote *et al.* (1972) for Area B consist of Jaucus Sand paralleling the shoreline (see *Figure 7*). Kaloko Clay and Waialua Silty Clay soils are present along the inland side of the area. Waialua series soils develop on alluvial fans and are derived from weathered igneous rock (*ibid*.: 128-129). The surface layer in a representative profile is c. 30 cm of dark reddish brown silty clay overlying c. 66 cm of dark reddish brown silty clay with a sub-angular blocky structure. Kaloko series soils are poorly drained and formed on coastal plains from alluvium that overlie marly lagoon deposits (*ibid*.: 58-59). A typical profile is characterized by 30 cm of dark brown clay overlying 20 cm of dark reddish brown to weak red clay subsoil; these deposits overlie 33 cm of light gray to white mottled platy silty clay over dark greenish gray to dark gray massive silty clay.

Thirty-seven systematically placed trenches were excavated in Test Area B (*Figure 93*). Trenches varied in length from 3.0 to 7.2 m (average 5.4 m) and averaged 1.5 m in width. A total of 201.1 linear meters of trench were excavated. Trenches were excavated either to weathered limestone (n=29) or the water table (7) and the profiles document one to eight layers. Excavation of one trench was terminated when human remains were identified. The trench profiles are illustrated in **Appendix B** (*Figures B-25* through *B-61*). Trench dimensions and detailed stratigraphic data are presented in **Appendix C**. No cultural material was collected from Area B.

Site 7288 consists of an intact primary human burial encountered in BT-B-6-2, located in the north-central portion of Area B. Human skeletal elements were observed in the second bucket of material excavated from the trench and excavation was halted. The crown of the cranium was visible *in situ* in the trench wall. SHPD was notified immediately upon the identification of human remains. As a result of SHPD consultation, all of the excavated soil was screened using ⅛" mesh hardware cloth to recover displaced skeletal elements; the recovered skeletal elements were reburied with the *in situ* skeletal elements. The recovered bones were in very poor, fragmented condition. Recognizable elements recovered from the screen include portions of the cranium, a mandible fragment and long bone fragments. Most of the remaining bone was in very small pieces that could not be readily identified in the field. Although no burial pit was evident, the volume of bone and inventory of identifiable elements indicate that the remains likely represent a primary burial. The estimated age of the individual is 6-8 years of age, based on the mandibular dentition.

Two layers were exposed in the Trench B-6-2 profile before excavation was terminated at a depth of 0.6 m (*Figure 94*). Layer I consists of 0.24 m of brown to pale brown moderately compacted slightly silty sand with sparse limestone gravel and pebble inclusions. Layer II underlies Layer I from 0.2 to 0.6 m and consists of very pale brown loose, single grain aeolian sand with no inclusions. A human cranium was observed in the northeast trench wall at 0.34 m below surface in Layer II. Cultural materials identified as a result of screening the excavated sediments consisted of a volcanic glass flake, marine shells and burned *kukui* nutshells; these were reburied. It is inferred that cultural materials identified from the screened sediments were probably associated with Layer I, because Layer II is a homogenous sand deposit with no inclusions. Alternatively, it is possible that the cultural materials were derived from the burial pit. Site 7288 is in fair condition and retains substantial physical integrity.

Figure 95 shows the maximum depths of the excavated trenches in Test Area B. Soil accumulation in the south-central portion are relatively shallow. The deepest deposits are located along the northwest and northeast sides. *Figure 96* illustrates deposit types by layer. The uplifted limestone reef represents bedrock in this area, but several trenches encountered the water table before reaching the limestone substrate. Alluvium covers the limestone in the east and south sections of Area B. The northwest side is characterized by deposits of wave- and wind-deposited sand interbedded with alluvium in the north-central section. Surface fill deposits overlie the east half and west tip of Area B.

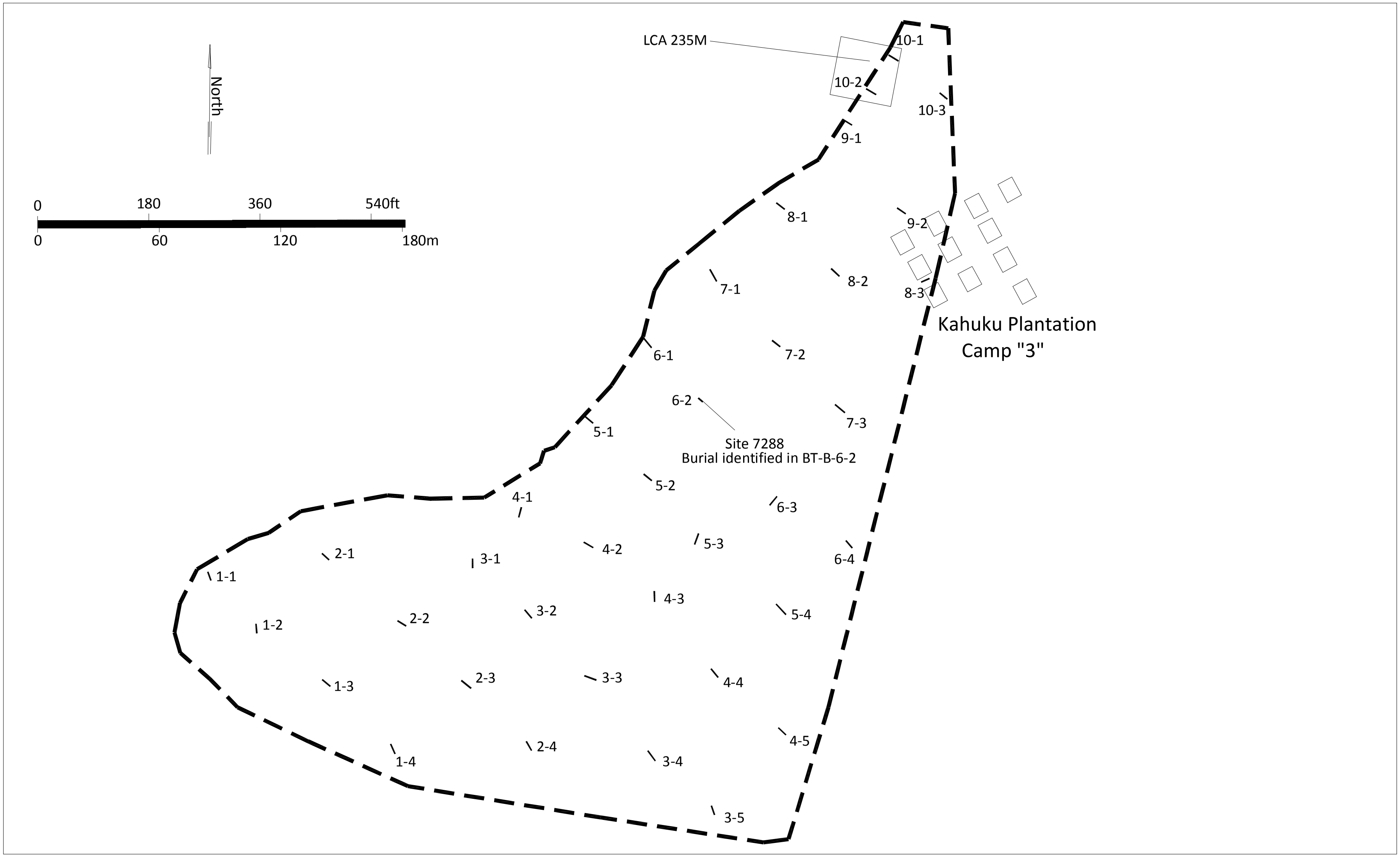


Figure 93. Location of trenches in Test Area B

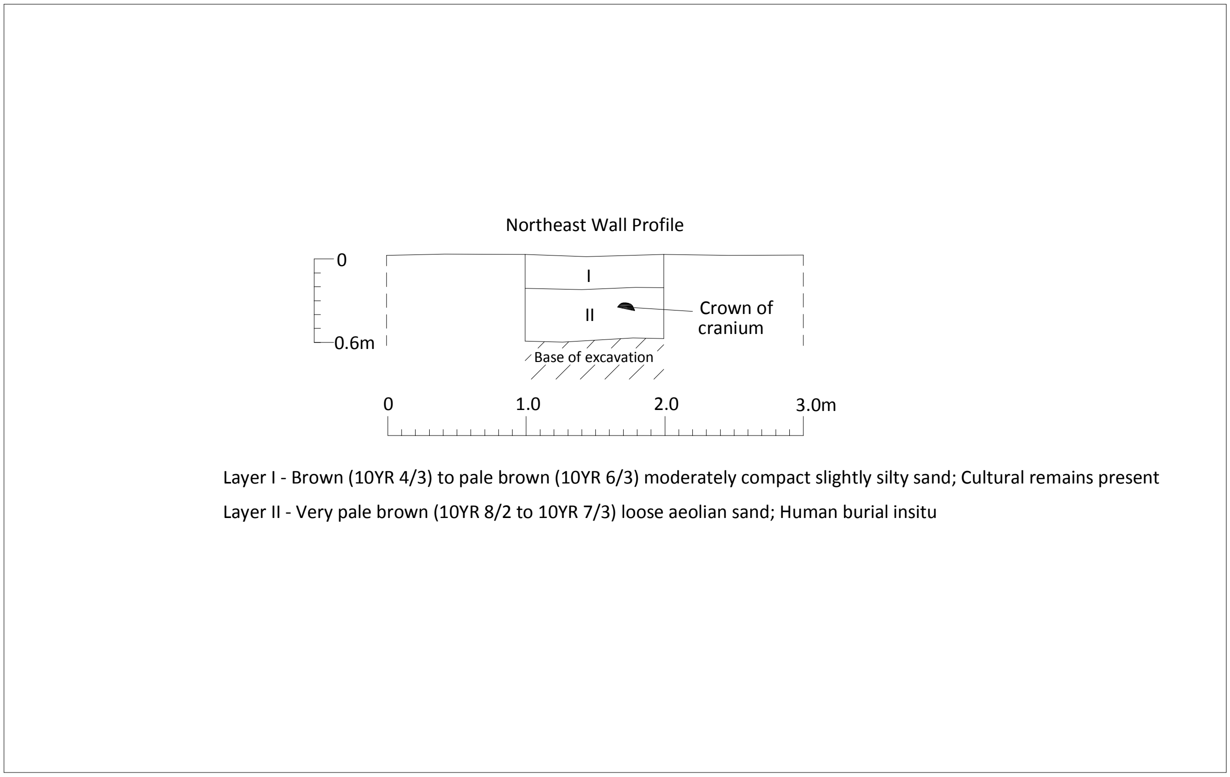


Figure 94. Site 7288 in BT-B-6-2

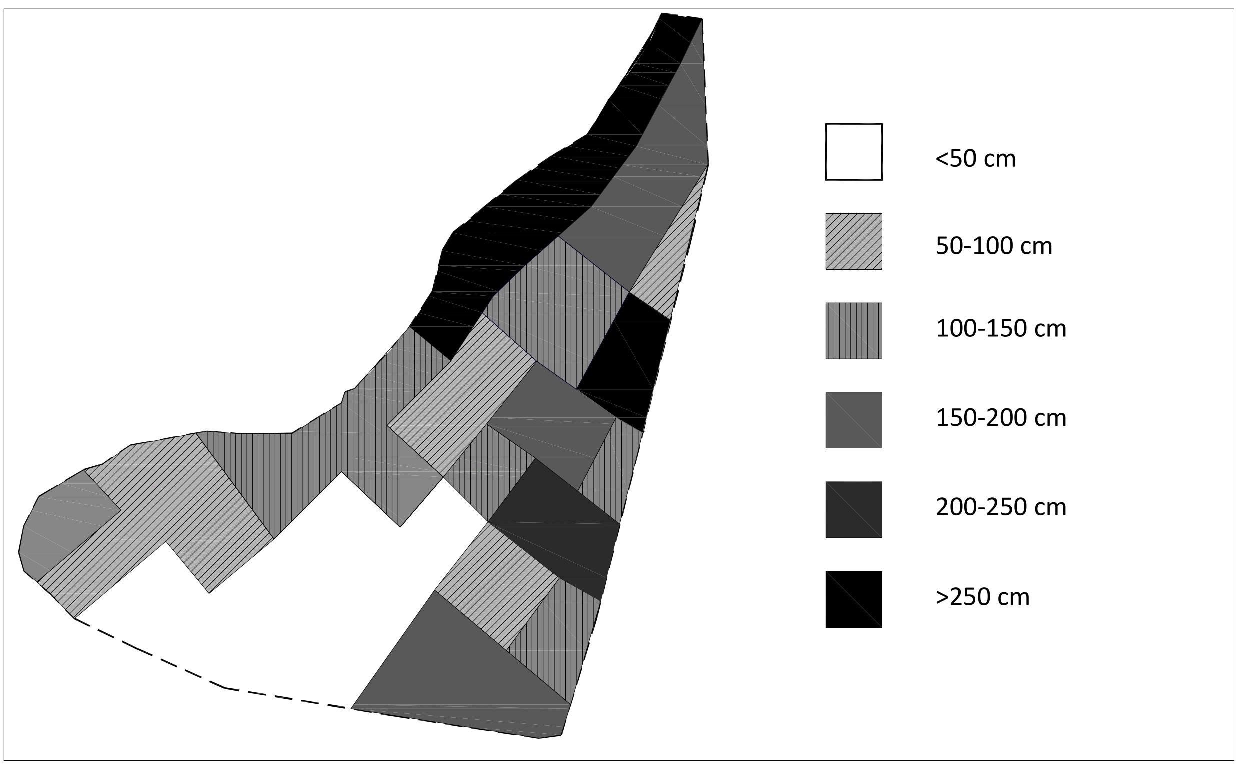


Figure 95. Test Area B trenches - maximum depths

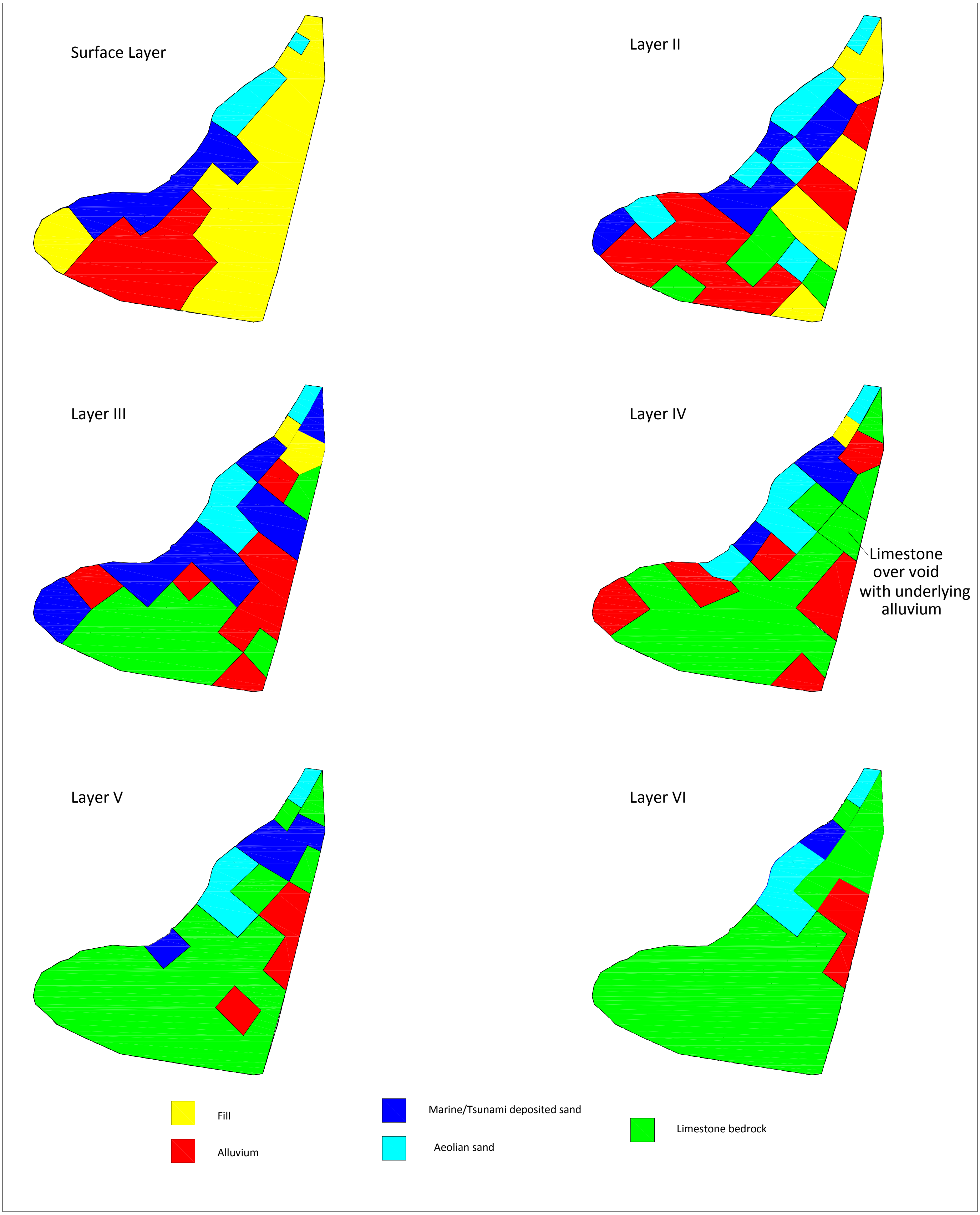


Figure 96. Test Area B deposit types by layer

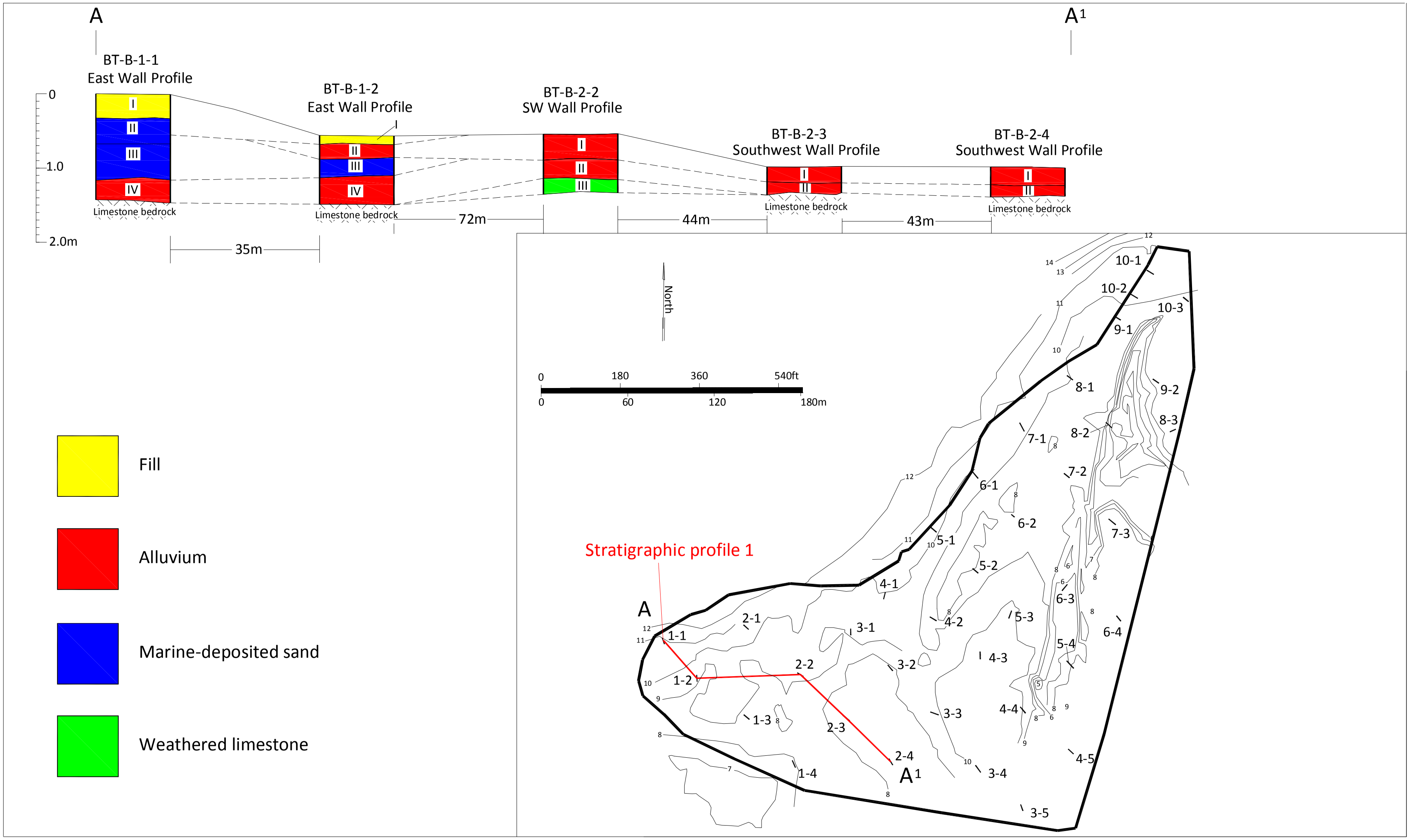


Figure 97. Test Area B stratigraphic profile 1

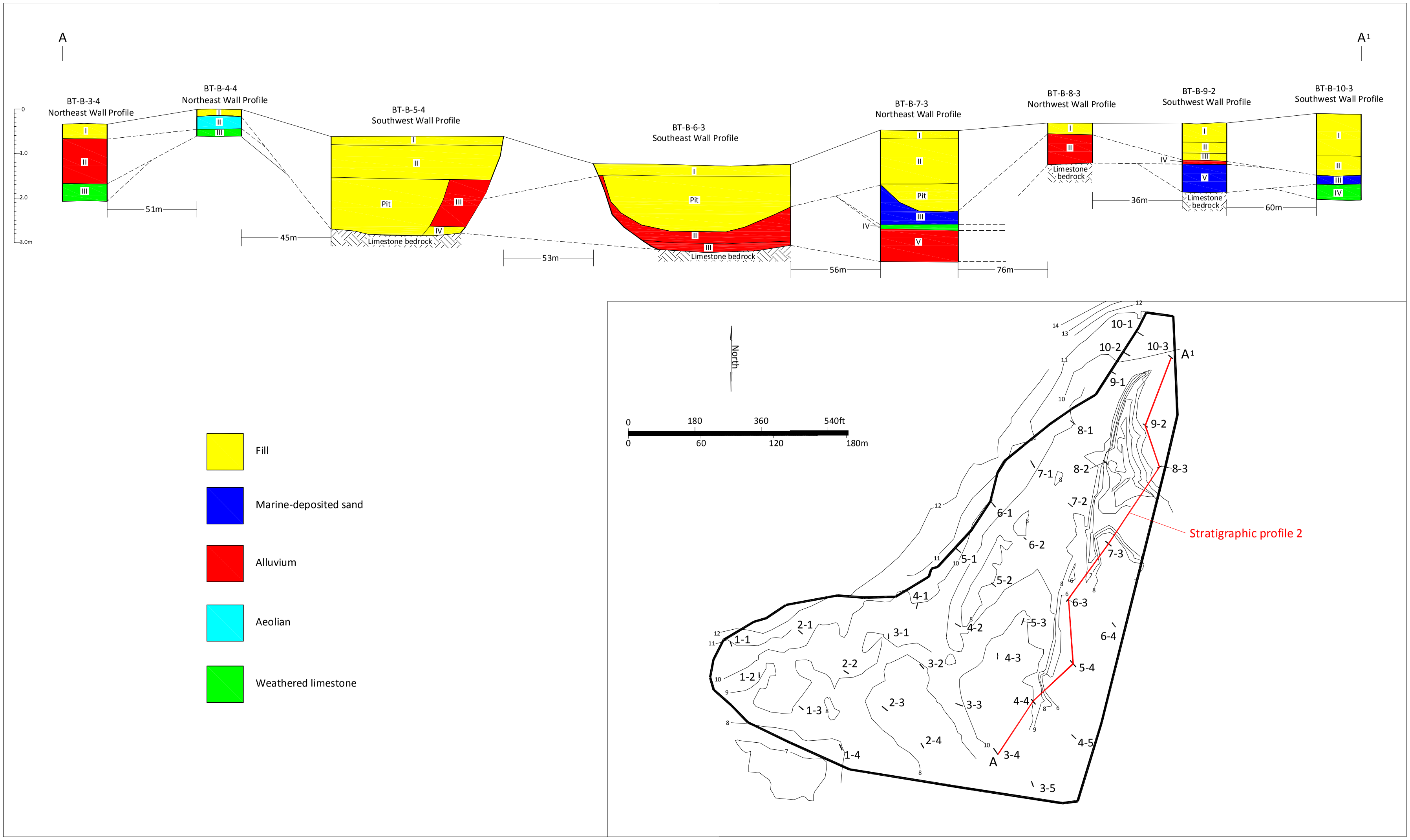


Figure 98. Test Area B stratigraphic profile 2

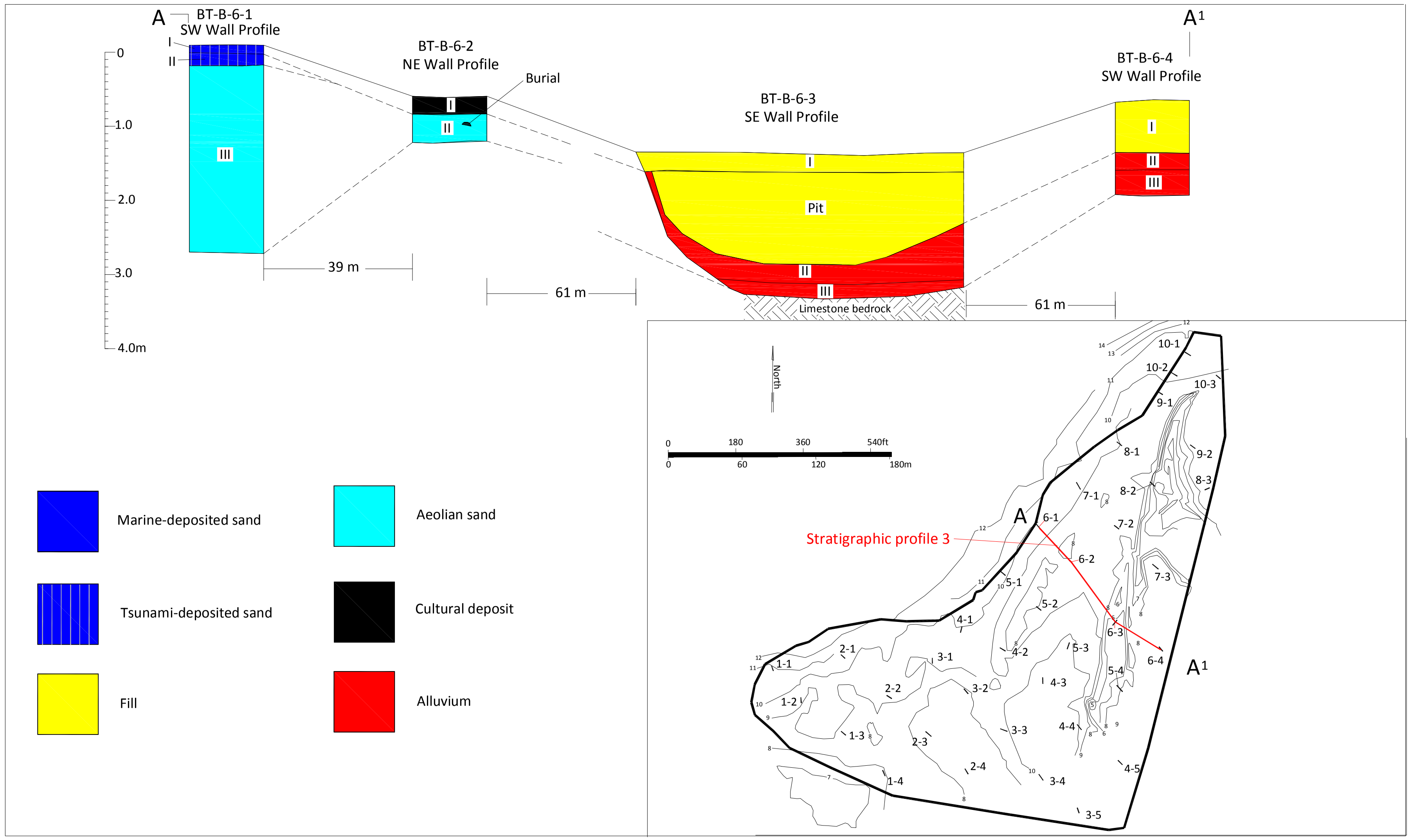


Figure 99 . Test Area B stratigraphic profile 3

Figure 97 is the first of three composite stratigraphic profiles (Profile 1) and illustrates the depositional sequence for the south-central portion of Area B. Profile 1 shows the relatively shallow alluvial deposits overlying limestone bedrock. Alluvial deposits are separated by marine-deposited sand in BT-B-1-2. In the seaward-most trench (B-1-1), where marine-deposited sand overlies alluvium, the corresponding upper alluvial deposit is missing, having been replaced by two layers of fill containing modern trash consisting of a rubber hose fragment and aluminum can.

Figure 98 is the second of three composite stratigraphic profiles (Profile 2) and shows the eastern boundary of Test Area B, illustrating the extensive fill deposits encountered here. Eighteen trenches in the eastern half of Area B documented fill deposits. Nine contained a single fill layer, seven contained two fill layers and two contained three fill deposits. These deposits varied in thickness from 0.1 to 1.8 m, and averaged 0.46 m. The majority of the fill deposits consist of dark brown to dusky red clays, clay loams and silty clay loams; the rest consist of silty to loamy sands. One trench contained limestone gravel fill (BT-B-3-4). Modern debris was noted in the fill layers of six trenches, consisting of asphalt (BT-B-3-5, B-4-5, B-5-3), plastic (B-3-5, B-5-2, B-8-2), ceramic tile (B-3-5) and irrigation pipes (B-5-2, B-8-3 and B-10-1). In the south portion of Profile 2 fill overlies alluvium or limestone bedrock. To the north, marine-deposited sand overlies the limestone substratum.

Figure 99 is the third of three composite stratigraphic profiles (Profile 3) and bisects the central portion of Test Area B. It includes Trench B-6-2 where the Site 7288 burial was identified. The inland two trenches (BT-B-6-3 and B-6-4) in this profile show deep fill deposits overlying alluvium developed on limestone bedrock. Trench B-6-2 shows the aeolian sand deposit where the excavation was terminated when the Site 7288 burial was identified. The seaward-most trench, BT-B-6-1, shows two wave-deposited sand layers overlying an aeolian sand deposit of more than 2.5 m. The water table was encountered 2.8 m below the surface, preventing excavation to bedrock. It is likely that the aeolian sand deposit in Trench B-6-2 is nearly 2 m deep based on the stratigraphic data from the adjacent trenches.

Intrusive pit features are present in six trenches (BT-B-4-1, 5-1, 5-4, 6-3, 7-1 and 7-3). A globular pit, truncated by a probable tsunami deposit was identified in the west wall of BT-B-4-1 (see *Figure B-38*, **Appendix B**). The pit intrudes into an aeolian sand deposit (Layer IV). The pit is 0.97 m wide and 0.24 to 0.41 m in thickness. The pit fill is a banded deposit of brown to pale brown silty sand. Pit fill was excavated and screened through 1¼" mesh but no cultural materials were recovered, potentially indicating a natural origin.

A large pit feature with stratified fill was documented in the southwestern wall of BT-B-5-1 (see *Figure B-43*, **Appendix B**). This pit is 2.45 m wide at the top with tapering sides. The base of the feature is 0.17 m wide and is 1.2 m in depth below ground surface. The pit intrudes into an aeolian sand deposit (Layer II) that lacks cultural materials. There are three strata in the pit. The upper layer (a) is a 0.4 m thick deposit of dark gray slightly silty sand containing a *Conus* shell. The second pit fill layer (b) is a 0.27 m thick deposit of grayish brown and light gray sand containing compacted ash. The basal fill layer (c) is a 0.28 m thick deposit of grayish brown and white slightly silty sand, containing juvenile pig bones. The side deposit (pit fill Layer Id) represents a draft or dig out deposit. The compacted ash and pig bones indicate the pit was used as an underground cooking feature (*imu*). The pit originated in Layer I, which contained plastic fragments and electrical wire, indicating that the pit is a modern feature.

A large pit feature was documented in the southwestern wall of BT-5-4 (see *Figure B-46,* **Appendix B**)*.* This pit originates in a clay fill deposit (Layer II) 0.95 m below the ground surface. The portion exposed in the trench is 2.6 m long and 1.25 m thick. Pit fill is brown to dark brown friable clay containing recent materials including milled lumber, a garden hose and plastic fragments. The pit was excavated to the limestone substrate through two intact alluvial clay deposits.

Another large pit feature was identified in BT-6-3 (see *Figure B-49,* **Appendix B**). This feature originates at the base of a clay fill deposit (Layer I) 0.24 m bgs and intrudes into an intact alluvial clay deposit (Layer II). The pit is greater than 4.2 m wide, 1.2 m thick. Pit fill is black to very dark grayish brown fine friable clay containing recent garbage.

Two former utility trenches and a possible post mold were documented in BT-B-7-1 (*Figure B-51,* **Appendix B**). The trenches are visible in both walls of the test excavation and are 0.34 to 0.77 m wide and 0.39 to 0.53 m deep. The possible post mold is 0.21 m wide and 0.38 m deep. The features all originate at the interface between Layers I-II, and are intrusive into Layer II, indicating their recent origin. The fill in all three features is very dark grayish brown silty sand and none contain visible cultural material.

A large basin-shaped pit was identified in the northeast wall of BT-B-7-3 (see *Figure B-53*, **Appendix B**) 1.2 m below the ground surface. The northern half was profiled, where it is 1.0 m-wide and 0.65 m thick. The pit originates at the interface of Layers II-III, and intrudes into Layer III, an intact deposit of marine-deposited loamy sand. The pit contains recent trash consisting of plastic bags, a Gatorade bottle and aluminum cans. The pit is capped by Layer II fill.

LCA 235M is located at the north end of Area B (see *Figure 93*). This land claim of 0.41-acres was awarded to Kaili (Waihona 'Aina 2000). A house lot and 5 *kalo* patches are described in the claim testimony. Kaili died in 1849 and left his property to his daughter Nahuli. Two trenches (BT-B-10-1, B-10-2) were excavated in the vicinity of the LCA. In BT-B-10-1, 0.1 m of imported fill overlies an aeolian sand layer and in BT-10-2 two layers of aeolian sand were documented. No cultural materials were recovered from either trench.

A Kahuku Plantation workers' camp (Camp 3) was formerly located adjacent to the OR&L Railroad in the northeast portion of Area B (Haun *et al*. 2011: 25, 27). BT-B-8-3 and B-9-2 were excavated in the vicinity of the camp, but no evidence of it was identified. Trench B-8-3 exposed a surface layer of fill over an alluvial clay deposit. An irrigation pipe is present in the fill layer (see *Figure B-56,* **Appendix B**). Trench 9-2 revealed three layers of fill overlying an alluvial deposit. The alluvium overlies marine-deposited sand on limestone bedrock (see *Figure B-58,* **Appendix B**). It is probable that any deposits once associated with Camp 3 were destroyed during the late 20th Century development of the property as a resort.

There was no surface evidence in Area B of the OR&L Railroad bed in the location plotted on historic maps. Its alignment was generally on the seaward side of Test Area B, but entered Area B in the vicinity of BT-B-9-1 and exited between BT-B-10-2 and B-10-3. The rail bed was constructed on fill of limestone and basalt aggregate. The subsurface deposits in trench B-9-1 did not contain limestone in sufficient quantity to identify as railroad bedding material. BT-B-10-1 contained 50% limestone gravel inclusions in the Layer I fill and BT-B-10-3 contained 50% crushed limestone and basalt aggregate in the Layer I fill, which could be associated with railroad bedding; however, six other trenches (BT-B-3-4, B-3-5, B-5-4, B-7-2, B-8-2 and B-9-2 also contained upper layer fill deposits composed of 40% to 95% basalt and/or limestone inclusions and these trenches do not correspond to the historically mapped location of the railroad. It is possible that the exact location of the former railway right-of-way in this part of TBR property is not accurate and that it formerly was located within Test Area B.

Test Area B is relatively flat with a perceptible but gentle rise toward the shore. The presence of deeply buried sediments was unexpected. The limestone substrate at the south end is shallow and overlain by minimal alluvial deposition. Fill deposits, extending 1.80 m deep in some places, are extensive in the *mauka* half of Test Area B. On the *makai* side, which is the back slope of the coastal dune, aeolian sand deposits exceed 2.5 m and are capped by marine-deposited sand. Alluvial sediments behind the bay front were covered by aeolian sand. Episodically deposited marine sand covered the dune and some alluvial deposits on the *mauka* side of the dune. Marine deposited sand is the result of giant surf and tsunami events but it would require high-resolution techniques to determine specific origin and periodicity (Keating *et al*. 2011).

An intact human burial (Site 7288) was encountered in an aeolian sand deposit 44 cm below the surface, capped by c. 25 cm of marine deposited sand. Cultural material characteristic of habitation deposits was recovered from the screened excavation deposits containing mixed Layer I and II sand while recovering bone fragments. Cultural materials are either associated with the burial or with the marine deposited sand, possibly but not necessarily in secondary context, since the burial is presumably in a pit underlying a cultural surface. Intact marine or aeolian sand deposits in Area B can be expected to contain additional prehistoric cultural deposits.

Test Area C

Test Area C is a forested sand dune situated between the TBR hotel at Kuilima Point and the mouth of ʻŌiʻo Stream, fronting the west side of Kaihalulu Bay (see *Figure 37*). The soils series described by Foote *et al.* (1972) for Area C consist of a small section in the southwest corner of coral limestone outcrop, while Jaucus Sand covers the rest of the area. During resort development TBR used the Jaucus Sand deposits to augment the beach in front of the hotel. Twelve sand pits indicate the areas mined for sand in the central and eastern portions of the dune. These pits are designated Sand Pit 1 (SP-1) through 12 (see *Figure 38*). The pits were excavated with heavy equipment to an average depth of nearly 4.0 m and occupy a combined area of approximately 1,500 sq m (0.37 ac). A dirt road parallels the shoreline on the seaward side of Test Area C and a paved golf cart path cuts through the inland side. The terrain slopes moderately to steeply south, toward a golf course fairway (*Figure 100*). A grove of Norfolk pine trees was planted in the central portion of Area C as part of a nursery, now abandoned.

Aside from historic trash pits, the only archaeological material identified in Test Area C was a secondarily deposited human metatarsal on the surface of SP-7. After consultation with SHPD permission was obtained to temporarily curate the isolated bone in a secure location at the adjacent TBR office trailer. Human remains from Area C were previously discovered in sand mined from an Area C sand pit and spread elsewhere on the resort property in 1992. When identified, the remains were transported to the Kahuku Police Station and eventually to the Medical Examiner's office in Honolulu. Kennedy (1992) examined the mined and secondarily deposited sand, as well as the dune from which the sand was obtained. The secondarily deposited sand was screened and additional skeletal elements were recovered. The sand pit in the dune was examined but no other skeletal elements were found. Analysis of the remains indicated that four individuals were represented: an adult female and three sub-adults of indeterminate sex. The remains were assigned State Inventory of Historic Places (SHIP) number 4488 and were transferred to SHPD for curation. The burials were subsequently designated as Burials 11-14 (Maly and Rosendahl 1992, O'Hare and Hammatt 2006).

In 1996, additional human remains were discovered during sand mining in the Site 4488 area (Carson *et al*. 1996, 1999). The initial finds made by SHPD staff included "a child's left tibial diaphysis…[and] the facial bones and a scapular bone fragment of an adult" (*ibid*. 1996: 4). Subsequent archaeological excavations by Archaeological Consultants of the Pacific, Inc. recovered additional skeletal elements from two adults (Burials A and B), wood fragments and square nails. The wood and nails were inferred to represent historic coffin remnants. Carson *et al*. (*ibid.:* 4-8) conclude that adult Burials A and B are not the same as the remains of an adult and a child initially recovered by SHPD staff. The remains were turned over to SHPD for curation and subsequently designated as Burial 17 by O'Hare and Hammatt (2006).

Burials A and B were found in a "concretized" layer of sand 90 cm below the ground surface (Carson *et al*. 1996:7). Incompleteness of both burials and fragmentation were cited as evidence of earlier disturbance, prior to the sand mining activity that led to their discovery. The initial disturbance also pre-dated the "concretization" process based on the disarticulation of one individual. Carson *et al*. (*ibid.*) describe intrusive "gravelly lenses… suggesting that tidal action may have been responsible for the [initial] disturbance of the burials". The authors note the presence of a "sheet of fully oxidized corrugated metal (probably tin) and a large cement block" within the sand pit vicinity as possible evidence of a subsequent episode of disturbance prior to the sand mining (*ibid*.). The "concretized" layer containing the burials was underlain by a deposit of "loose" sand of undetermined depth, and overlain by two additional "concretized" sand layers separated between three layers of loose sand.

The human metatarsal recovered during the SAIS fieldwork comes from the same vicinity as the previously discovered skeletal remains, according to TBR Senior Planner Ralph Makaiau. It is likely that this bone is from one of the previously identified individuals that were subsequently reburied elsewhere on the property. Skeletal remains from at least eight individuals have been recovered from the Site 4488 area. All individual burials except Burial B are incomplete and missing numerous skeletal elements.

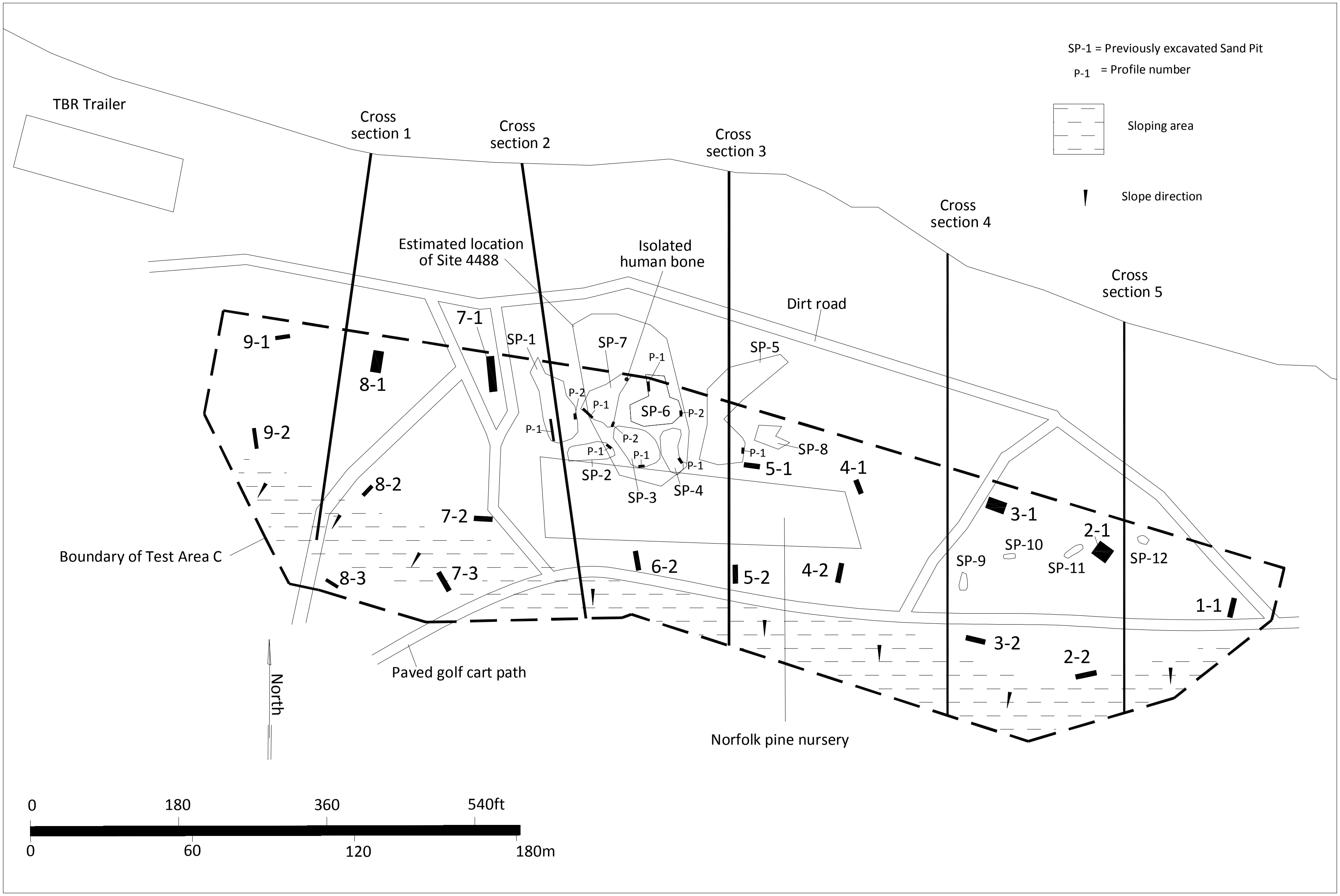


Figure 100. Location of trenches in Test Area C

The SAIS fieldwork in Area C included instrument mapping of five dune surface cross-sections, manual excavation and profiling of ten sand pit walls, mechanical excavation and documentation of 18 systematically-placed trenches, and mechanical excavation of two trenches at the base of two manually-profiled sand pits (SP-1 and SP-7; see *Figure 100*). Dune cross-sections were prepared using a transit and stadia rod and are illustrated in *Figures 101-105*. The cross-sections show that the dune extends 88 m (290 ft) to 136 m (445 ft) inland from the shoreline and rises from 13.5' (4.11 m) to 16.5' (5.03 m) above sea level. Limestone bedrock is exposed at approximately 3 ft (0.91 m) amsl along the shore (see *Figure 101*).

The 18 trenches varied from 5.3 to 13.2 m in length (average 7.12 m) and in width from 1.25 to 6.4 m (average of 2.45 m wide). A total of 125.7 linear meters of trench were excavated. The trenches varied in depth from 1.03 to 4.9 m (average of 2.65 m) and exposed two to seven layers. Only two systematically placed trenches were excavated to the limestone substrate (BT-C-8-2 and C-8-3). Two pits, which were mechanically excavated in conjunction with obtaining manual profiles in Sand Pits 1 and 7, also reached limestone bedrock (see *Figure 39)*.

Mechanical excavation to bedrock was not consistently attempted in most of Area C because the depth and loose, single grain texture of the sand presented logistical and safety issues. Mechanical excavation deeper than c. 2.5 to 3.0 m required digging a hole large enough for the excavator to drive into and dig deeper. Unstable trench walls were especially hazardous, not only from the danger (and undesirability) of wall collapse but also for the potential to destabilize surrounding ironwood trees. These factors also precluded safe access to document the deepest portions of the excavations. It was readily apparent from the initial excavations that at depths below approximately 1-1.5 m the dune deposits consisted of relatively homogenous aeolian sand with faintly visible fine bedding planes and variable degrees of calcium carbonate cementation (*Figure 106*). Complete profiles from the surface to limestone bedrock were obtained in Trenches BT-C-8-2 and C-8-3, which were both located on the lower elevation, inland side of the main dune, and in Sand Pits 1 and 7 where mechanical excavations to reach bedrock were combined with manual profiles of previously excavated pit walls.

The systematically placed, mechanically excavated trench profiles are illustrated in **Appendix B** (*Figures B-62* through *B-79*). The trench dimensions and stratigraphic data are presented in **Appendix C**. *Figure 107* shows the maximum depths reached in the trenches. No excavations reached the water table, which is probably quite deep and likely to be below the surface of the underlying limestone substrate. *Figure 108* illustrates the deposit types by layer. Since no trench was excavated at the Transect 6, number 1 position, data from SP-7 was used for this cell in *Figure 108*

Layer I throughout most of Area C is an organic humic, or duff layer, encountered in 14 of the 18 trenches; fill deposits were encountered on the west and east sides of Test Area C. PVC pipe and electrical wires were observed in association with the humic layer in BT-C-9-1. Five trenches exhibited a surface layer of imported fill (BT-C-4-2, C-8-2, C-8-3, C-9-2). Limestone and basalt aggregate and asphalt fragments are associated with the Layer I fill in BT-C-8-3. Plastic, glass and milled lumber are associated with the Layer I fill in BT-C-9-2.

Layer II across most of Area C consists of aeolian sand deposits. Deeply buried intact aeolian deposits were documented throughout much of Area A in Layers III-VI. BT-C-7-1 is the only trench containing more than six layers, where Layer VII also consists of aeolian sand (not depicted in *Figure 108*). The only trench where aeolian sand deposits were not documented is BT-C-8-3, where fill deposits directly overlie the limestone substrate. Aeolian deposits consist of loose (unstabilized dune), moderately compacted (stabilized dune) to semi-lithified (fossilized dune) single grain sand that varies in color from gray to very pale brown. Bands of calcium carbonate precipitate are evident in the Layer III aeolian sand deposits in BT-C-1-1, at the interface between Layers II and IV in BT-C-2-1, and in Layer IV of BT-C-2-2.

Layer II along the south and east edges of Area C also consists of several fill deposits. Redeposited sediments are present beneath the surface layer in 7 trenches (BT-C-1-1, C-2-2, C-3-2, C-7-2, C-7-3, C-8-1, C-8-3). These deposits were likely imported into the area as road bedding. Fill extended into Layers III and IV in BT-C-7-1 and C-7-3. Collectively, the fill deposits consist of compact to friable clays, sand, or sand and gravel deposits that vary in color from very pale brown to dark reddish brown.

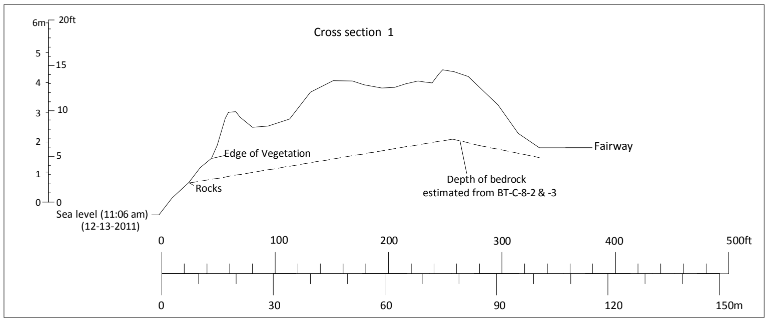


Figure 101. Test Area C cross section 1 (8:1vertical scale – 1:1 horizontal scale)

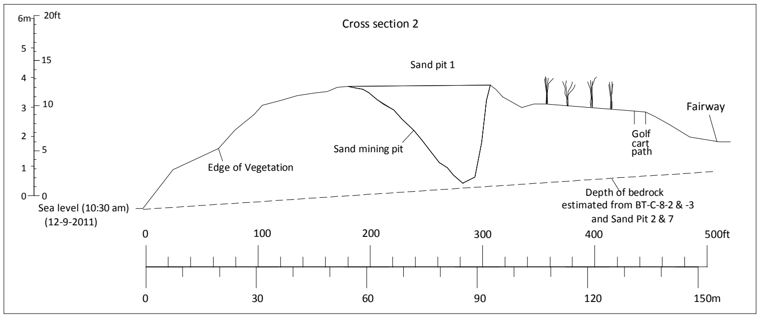


Figure 102. Test Area C cross section 2

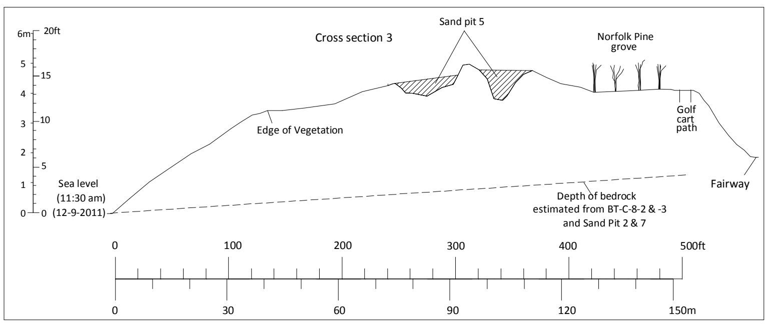


Figure 103. Test Area C cross section 3

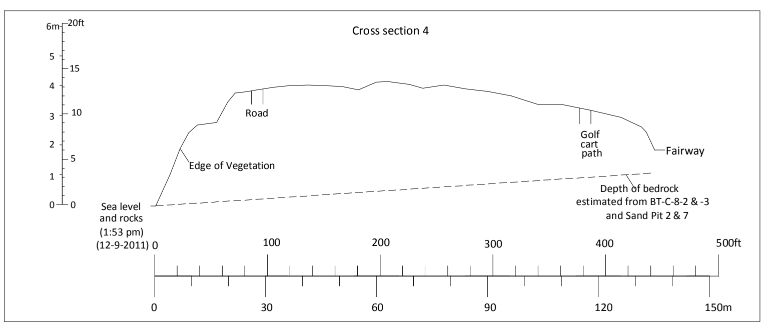


Figure 104. Test Area C cross section 4

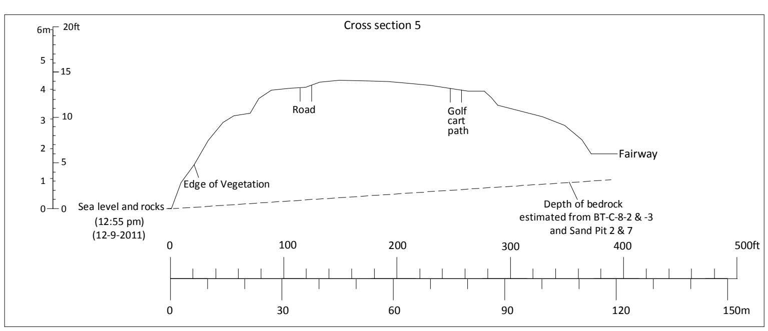


Figure 105. Test Area C cross section 5

Figure 106. Wall of BT-C-2-1 showing bedding planes, view to view to southeast

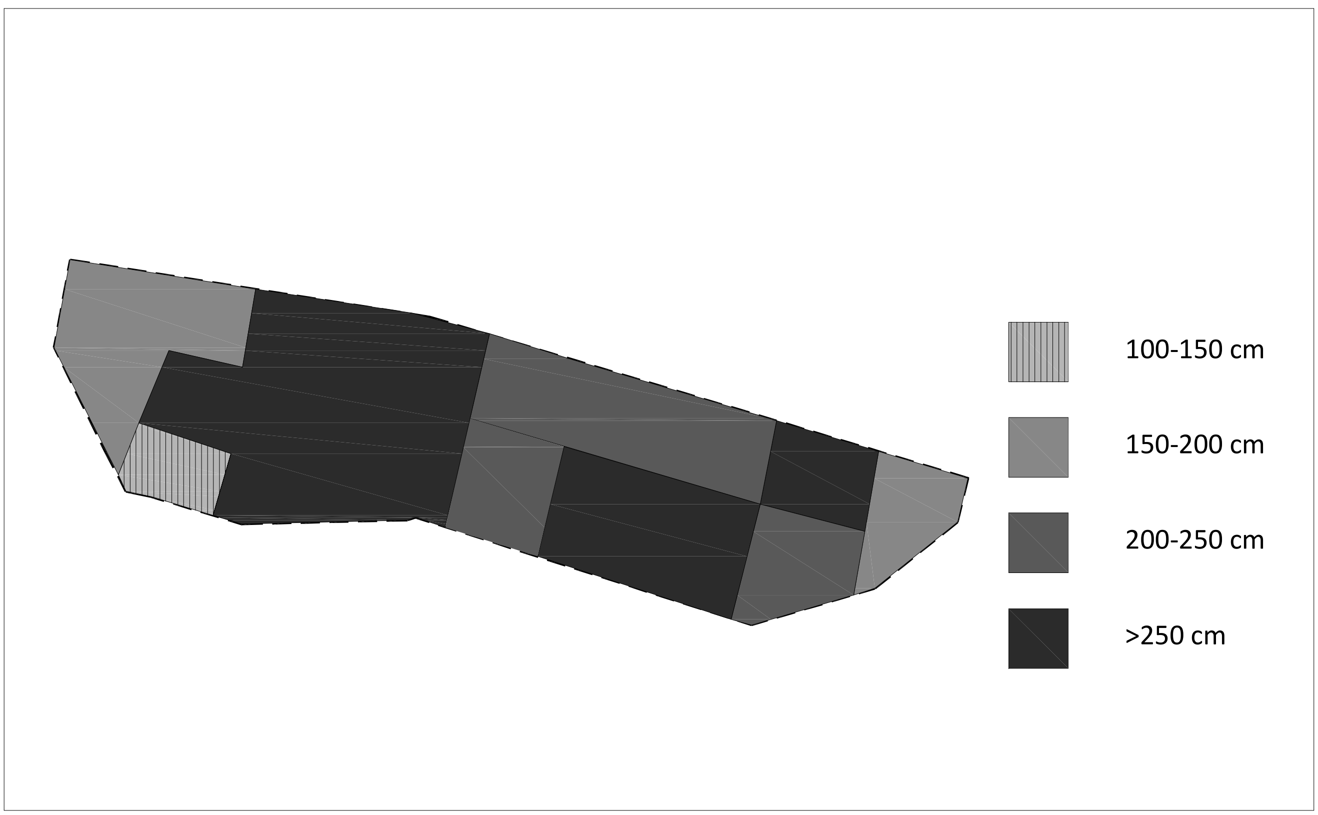


Figure 107. Test Area C trenches – maximum depths

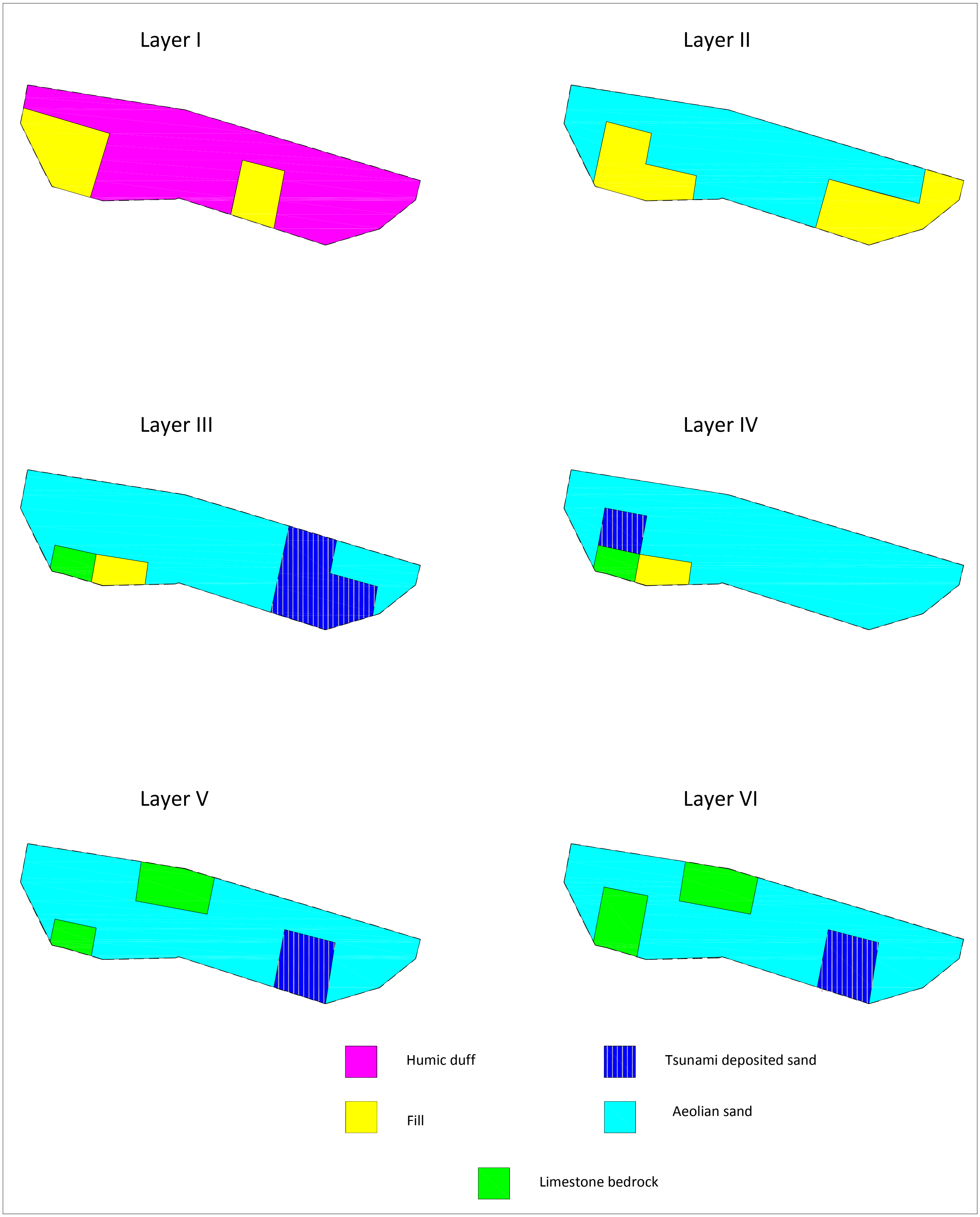


Figure 108. Test Area C deposit types by layer

Beneath Layer II aeolian deposits in two trenches in the west section of Area C (BT-C-7-1 and C-8-1), five to eight layers of aeolian in-fill represent either historic or modern infilling of road cuts or possible old sand mining pits. On *Figure 108* these are coded as aeolian deposits.

Three WW II-era trash pits underlie Layer II and Layer III deposits at the east end of the dune. The trash pit beneath the sand fill Layer II in BT-C-1-1 (see *Figure B-62* in **Appendix B**) is 2.5 m wide by 2.4 m deep and contains a large quantity of glass bottles (1943 date on base), in addition to ceramic tiles, batteries and a railroad rail. Crown cap colorless and brown glass beverage bottles were noted in the WW II pit fill deposit beneath Layer II aeolian sand in BT-C-2-1. A third large WW II-era trash pit, 5.0 m wide and 1.15 to 2.2 m deep, beneath Layer II fill in BT-C-2-2 (see *Figure B-64* in **Appendix B**) contained fragments of United States Quarter Master Corps glazed ceramic tableware stamped "USQMC 1941", cosmetic, beverage, and condiment glass bottles, bricks and a large casing. The presence of the WW II trash pits beneath fill and aeolian sand at the east end of the dune closest to the Kahuku Army Airfield, indicates that parts of the dune were probably mined for Airfield materials and in-filled with trash to stabilize the dune when the Airfield was decommissioned at the end of the war.

Layer III contained evidence of possible tsunami deposits in three trenches at the east end of Test Area C (BT-C-2-2, C-3-1, C-3-2). In Layer III in BT-C-2-2 and C-3-2 the potential tsunami deposits are more than 1.0 m thick and contain broken glass throughout (see *Figures B-64 and B-66*; **Appendix B**). The tsunami deposit in BT-C-2-2 overlies a military trash pit full of glass containers. If the broken glass in Layer III of BT-C-2-2 and C-3-2 is from reworking the World War II-era trash pit material, then the Layer III tsunami deposits in those trenches date to the tsunami events of either 1946 or 1957. In BT-C-3-1 the Layer III possible tsunami deposit consists of light brownish gray and very pale brown-banded loose sand between two aeolian deposits (see *Figure B-65* in **Appendix B**).

Layer IV in BT-C-8-2 at the west end of Area C consists of a probable tsunami deposit (see *Figure B-76* in **Appendix B**). In this trench Layer IV (a/b) consists of gray and dark gray compacted sand and slightly loamy sand deposits, with sparse charcoal flecking and waterworn marine shells associated with Layer IVa. The deposit is identified as a tsunami deposit on the basis of color and the inclusion of sparse charcoal and shells.

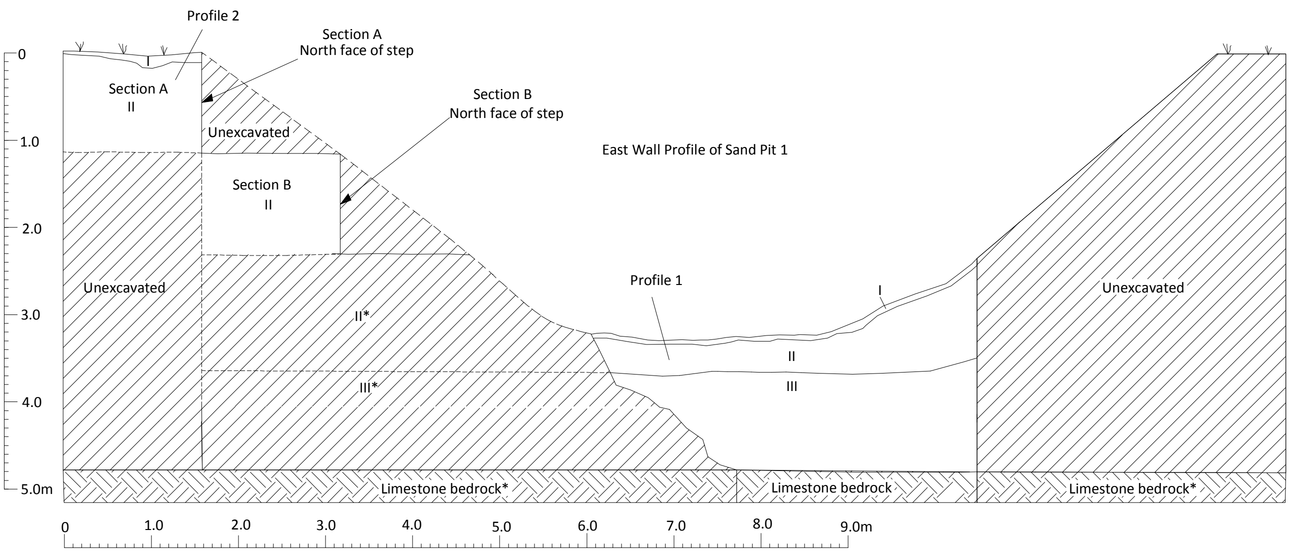
Layer V in BT-C-3-2 was identified as a possible pre-1946 tsunami deposit. In that trench a second possible tsunami deposit is separated from the Layer III tsunami deposit by 0.53 m of homogeneous very pale brown aeolian sand (Layer IV). The older Layer V tsunami deposit is represented by more than 1.4 m of very pale brown and light gray compacted sand. Layer V could have been deposited by the 1923 tsunami or during any of the five tsunamis known to have affected the North Shore in the 19th Century (Walker 1994:32).

Manual excavation of eight or more 1.0 by 1.0 m test units to document the stratigraphy in and around Site 4488 was proposed in the SAIS Plan (Haun *et al*. 2011: 88). The depth and large quantity of unstable aeolian sand made this proposal untenable. Instead, stratigraphic profiles were obtained by manually facing large exposures of existing sand pit walls using shovels to obtain relatively vertical surfaces (see *Figure 40*). In an effort to identify deposits reported by Carson *et al. (*1996, 1999) where burials were previously discovered, ten profiles were obtained from previously mined sand pits in Test Area C. Manually-excavated profiles were documented at 6 of the 12 sand pits, with one profile completed in SP-2, -3, -4 and -5 and two profiles in SP-1, -6 and -7 (see *Figure 100*). The profiled faces varied in length from 1.5 to 8.3 m and in depth from 1.3 to 6.5 m below the surface of the sand pits. Layer descriptions for the sand pit profiles are presented in *Table 3*; the profiles are illustrated in *Figures 109-117*.

Wall slump was removed and the sand pit walls were shaved back to produce a clean vertical face for stratigraphic documentation. In the deepest sand pit (SP-1) two steps were excavated for a total vertical exposure of 2.3 m. The profiling work in SP-1 and SP-7 was supplemented by mechanical excavation in the bottom of each pit (see *Figure 39*). In both pits the basal limestone and overlying strata were exposed (see *Figures 109* and *116*) and these strata were correlated with the manual profiles from the upper portions of the pits.

Table 3. Summary of Manual Profiles in Test Area C

Profile	Profile length (m)	Max. Trench Depth (m)	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Disturbance	Cultural remains
Sand Pit 1, Profile 1	8.30	4.75	I	0.0-0.1	0.10	Pale brown	10YR 6/3	Sand	Loose, unconsolidated	90% organic material	Distinct/wavy	Recent duff	Intact	-
			II	0.1-4.1	4.00	Very pale brown	10YR 8/3	Sand	Unconsolidated	Ironwood roots	Distinct/wavy	Aeolian dune	Intact	-
			III	4.1-4.75	0.65	Very pale brown	10YR 8/3	Bedded Sand	Consolidated	Root concretions	Abrupt/wavy	Aeolian dune	Intact	-
			IV	4.75+	-	-	-	Limestone	-	-	-	Bedrock	Intact	-
Sand Pit 1, Profile 2	1.60	2.40	I	0.0-0.15	0.15	Very dark brown	7.5YR 2.5/2	Sand	Unconsolidated	90% organic material (ironwood cones, needles, roots)	Distinct/wavy	Recent duff	Intact	-
			II	0.05-2.4	2.35	Very pale brown	10YR 8/4	Sand	Unconsolidated, single grain	sparse roots, lamination	Unexcavated	Aeolian dune	Intact	*Felis catus* tibia radius, 2 vertebrae, 3 phalanges
Sand Pit 2, Profile 1	1.50	1.50	I	0.0-0.3	0.30	Very pale brown & light gray	10YR 8/2 & 10YR 7/2	Sand	Unconsolidated, single grain	-	Distinct/wavy	Aeolian	Disturbed during sand mining	Fish vertebra
			II	0.3-1.5	1.20	White	10YR 8/1	Sand	Unconsolidated to slightly compacted,	Root concretions increase with depth; up to 7 cm in diameter	Unexcavated	Aeolian dune	Intact	-
Sand Pit 3, Profile 1	1.50	1.30	I	0.0-0.85	0.80	Very pale brown	10YR 7/4	Sand	Unconsolidated, single grain, loose	Rootlets	Diffuse/wavy	Aeolian	Disturbed (slump)	-
			II	0.75-1.3	0.55	Very pale brown	10YR 8/3	Sand	Slightly compacted / consolidated; laminated	Sparse concretions & lithified chunks	Unexcavated	Aeolian dune	Intact	-
Sand Pit 4, Profile 1	1.60	1.40	I	0.0-0.2	0.20	Very pale brown	10YR 8/2	Sand	Unconsolidated, single grain, loose	Root mat	Diffuse/smooth	Aeolian	Disturbed	-
			II	0.2-0.93	0.73	Very pale brown	10YR 8/3	Sand	Unconsolidated, single grain, loose	Sparse concretions & small chunks of lithified sand	Abrupt/wavy	Aeolian dune	Intact	-
			III	0.93-1.4	0.47	Very pale brown	10YR 8/3	Sand	Slightly compacted; laminated	Sparse concretions & small chunks of lithified sand	Unexcavated	Aeolian dune	Intact	-
Sand Pit 5, Profile 1	1.80	1.50	I	0.0-0.1	0.10	Dark brown	7.5YR 3/3	Clay	Compact, very fine friable crumb	-	Abrupt/discontinuous	Imported Fill	Redeposited	-
			II	0.1-0.32	0.22	Light gray to pale brown	Mottled 10YR 7/2 to 10YR 6/3	Sand	Slightly to moderately compacted, fine, single grain	Sparse root concretions	Distinct	Aeolian	Disturbed w/buried pockets of Layer I material	-
			III	0.32-1.5	1.18	Very pale brown	10YR 8/2 & 10YR 8/3	Sand	Loose, fine, single grain & thin continuous lenses of coarser sand	Sparse root concretions suspended in matrix	Unexcavated	Aeolian dune	Intact	-
Sand Pit 6, Profile 1	3.70	1.90	I	0.0-0.68	0.44	Light gray to gray	10YR 7/1 & 10YR 6/1	Sand	Moderately compacted	10% semi-lithified sand chunks	Distinct/wavy	Storm Deposit?	Recently stabilized surface	-
			II	0.36-1.80	0.95	Light gray, gray & light brownish gray	10YR 7/2, 10YR 5/1, & 10YR 6/2	Sand	Moderately compacted; banded	waterworn marine shells throughout	Distinct/wavy	Storm surge or tsunami	Intact	earthenware slipped ceramics, mammal bones (pig, cow or horse), avian bone, charcoal
			III	1.12-1.9	0.43	Very pale brown	10YR 8/3	Sand	Slightly compacted	Root concretions	Unexcavated	Aeolian	Intact	-
			IV	0.44-1.9	1.45	Very pale brown	10YR 8/2 & 10YR 8/3	Sand	Extremely loose, single grain	Sparse coral	Unexcavated	Aeolian & Marine Deposited	Intact	-
Sand Pit 6, Profile 2	2.40	2.00	I	0.0-0.2	0.20	Light gray to grayish brown	10YR 7/2 & 10YR 5/2	Sand	Loose	organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
			II	0.2-1.6	1.40	Very pale brown	10YR 8/2	Sand	Very loose, very fine	dense small roots	Diffuse/wavy	Aeolian	Intact	-
			III	1.6-2.0	0.40	Very pale brown	10YR 8/2	Sand	Moderately compacted; banded	laminated bedding planes	Unexcavated	Aeolian dune	Intact	-
Sand Pit 7, Profile 1	2.50	6.70	I	0.0-0.1	0.10	Pale brown	10YR 6/3	Sand	Loose	50% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
			II	0.1-0.20	0.10	Very pale brown	10YR 8/2	Sand	Moderately compacted	semi-lithified sand chunks & discontinuous carbonate lenses	Diffuse/wavy	Aeolian	Intact?	-
			-	0.2	0.02	-	-	Calcium carbonate	Cemented; laminated, discontinuous	-	Distinct/wavy	Precipitate	Intact	-
			III	0.20-2.8	2.60	White to very pale brown	10YR 8/1 & 10YR 8/2	Sand	Moderately compacted	Sparse root concretions increasing with depth	Diffuse/wavy	Aeolian dune	Intact	-
			IV	2.8-6.7	3.90	White to very pale brown	10YR 8/1 & 10YR 8/2	Sand	Semi-lithified	semi-lithified sand chunks & root concretions	Abrupt	Aeolian dune	Intact	-
			V	6.7+	-	-	-	Limestone	-	-	-	Bedrock	Intact	-
Sand Pit 7, Profile 2	1.90	1.80	I	0.0-1.3	1.30	Very pale brown	10YR 8/2	Sand	Loose, single grain, unconsolidated	Roots	Diffuse/wavy	Aeolian dune	Intact	-
			II	1.3-1.8	0.50	Very pale brown	10YR 8/2	Sand	Moderately compacted, single grain	-	Unexcavated	Aeolian dune	Intact	-



Layer I - Pale brown (10YR 6/3) to very dark brown (7.5YR 2.5/2) loose sand and recent duff

Layer II - Very pale brown (10YR 8/3) unconsolidated aeolian sand; No cultural remains

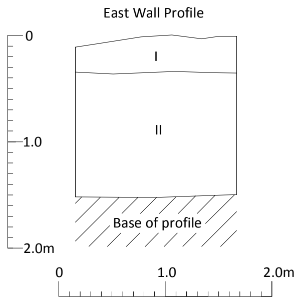
Layer III - Very pale brown (10YR 8/3) consolidated bedded aeolian sand; No cultural remains

Layer IV - Limestone substrate

* - Estimated extent of stratum

Figure 109. Test Area C – SP 1 profiles 1 and 2

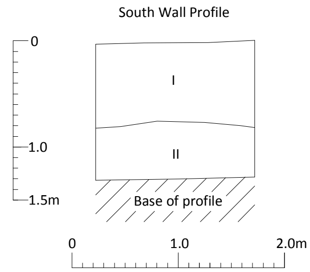
Figure 110. Profile 1 of SP-2



Layer I - Very pale brown (10YR 8/2) to light gray (10YR 7/2) unconsolidated aeolian sand; Fish vertebra

Layer II - White (10YR 8/1) unconsolidated aeolian sand; No cultural remains

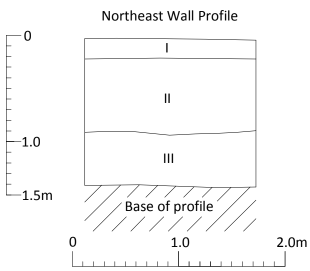
Figure 111. Profile 1 of SP-3



Layer I - Very pale brown (10YR 7/4) unconsolidated aeolian sand; No cultural remains

Layer II - Very pale brown (10YR 8/3) slightly compacted, laminated aeolian sand; No cultural remains

Figure 112. Profile 1 of SP-4

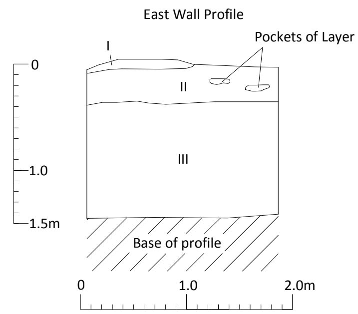


Layer I - Very pale brown (10YR 8/2) unconsolidated aeolian sand; root mat; No cultural remains

Layer II - Very pale brown (10YR 8/3) unconsolidated aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 8/3) slightly compacted, laminated aeolian sand; No cultural remains

Figure 113. Profile 1 of SP-5

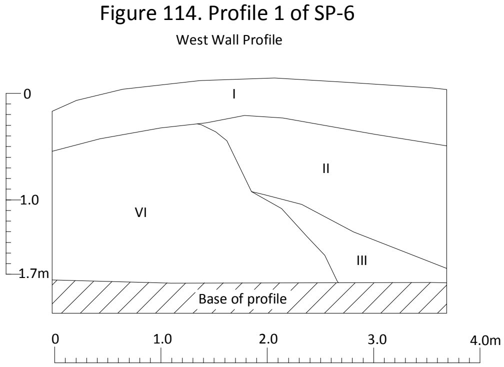


Layer I - Dark brown (7.5YR 3/3) compacted clay fill; No cultural remains

Layer II - Light gray (10YR 7/2) to pale brown (10YR 6/3) slightly to moderately compact, disturbed aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 8/2 to 10YR 8/3) loose aeolian sand; No cultural remains

Figure 114. Profile 1 of SP-6



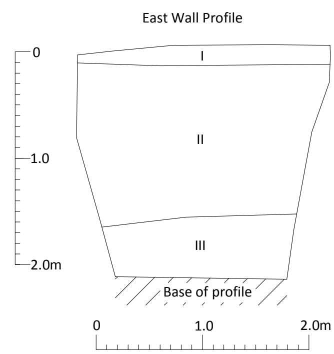
Layer I - Light gray (10YR 7/1) to gray (10YR 6/1) moderately compacted sand storm deposit; No cultural remains

Layer II - Light gray (10YR 7/2) to gray (10YR 5/1) moderately compacted sand tsunami deposit; Bird and cow bones and glazed ceramics

Layer III - Very pale brown (10YR 8/3) slightly compacted aeolian sand; No cultural remains

Layer IV - Very pale brown (10YR 8/2 to 10YR 8/3) loose aeolian and marine deposited sand; sparse coral present

Figure 115. Profile 2 of SP-6

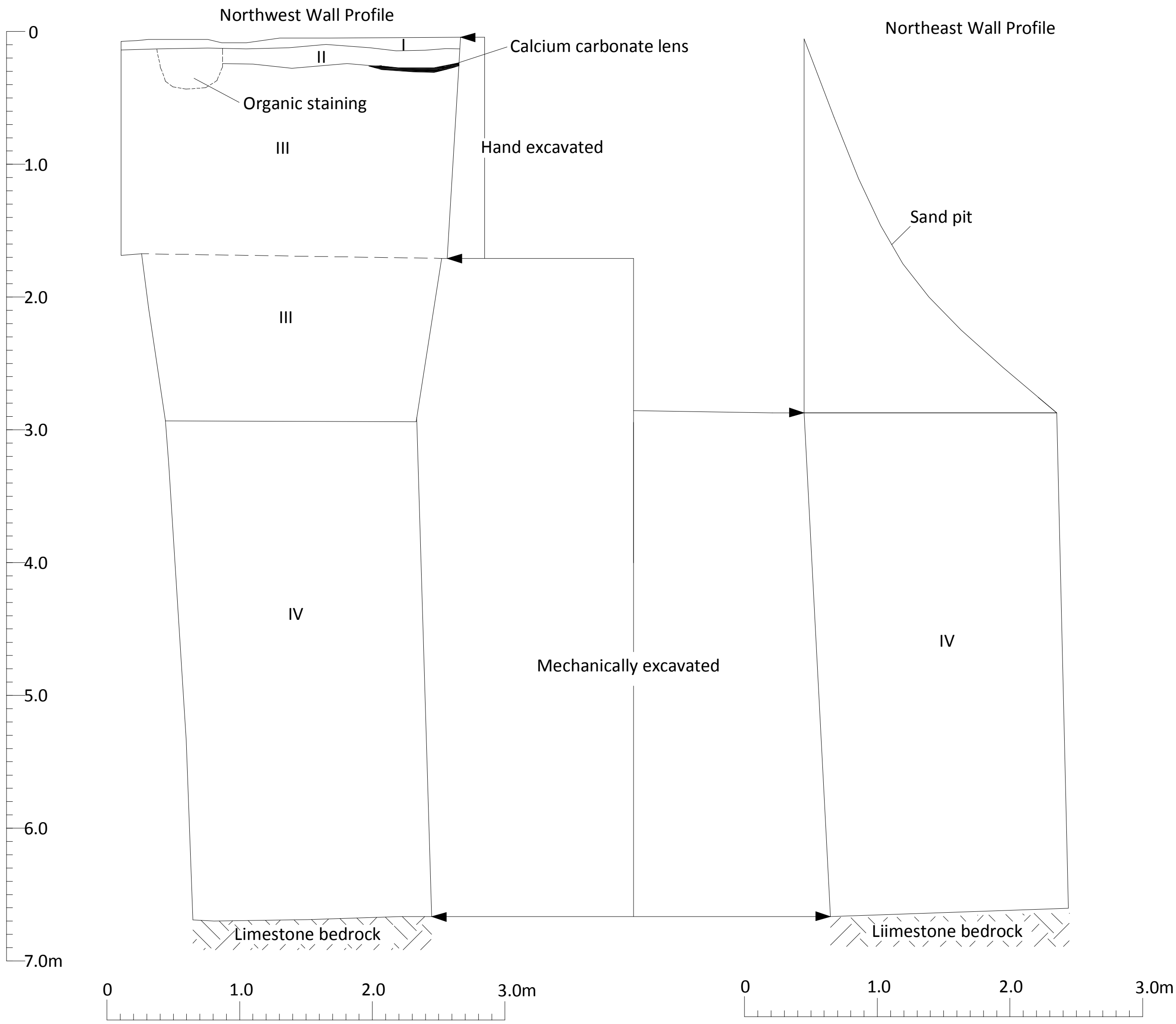


Layer I - Light gray (10YR 7/2) to grayish brown (10YR 5/2) loose sand with organics (recent duff); No cultural remains

Layer II - Very pale brown (10YR 8/2) loose very fine aeolian sand; No cultural remains

Layer II - Very pale brown (10YR 8/2) moderately compacted and banded aeolian sand; No cultural remains

Figures 110-115. Test Area C profiles of Sand Pits 2-6



Layer I - Pale brown (10YR 6/3) loose sand with organics (recent duff); No cultural remains

Layer II - Very pale brown (10YR 8/2) moderately compacted aeolian sand; No cultural remains

Layer III - White (10YR 8/1) to very pale brown (10YR 8/2) moderately compacted aeolian sand; No cultural remains

Layer IV - White (10YR 8/1) to very pale brown (10YR 8/2) semi-lithified aeolian sand; No cultural remains

Figure 116. Test Area C profile 1 of SP- 7

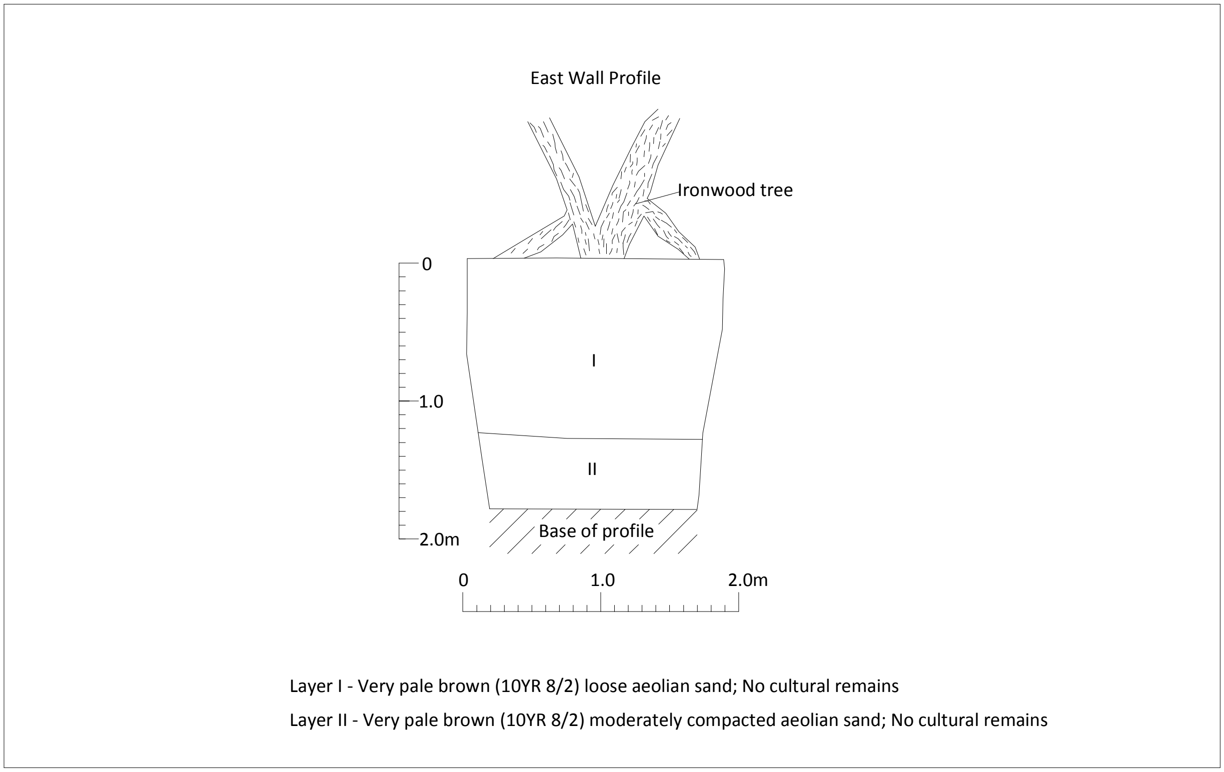


Figure 117. Test Area C profile 2 of SP-7

The sand pit profiles documented a surface layer of recent duff in five sand pits (SP-1-1, 1-2, 4-1, 6-1, 7-1), imported fill in one sand pit (SP-5-1), a storm deposit in one sand pit (SP-6-1) and surface aeolian sand in three profiles (SP-2-1, 2-2, 7-2). A fish bone was noted in the Layer I aeolian deposit of SP-2-1. The fill layer in SP-5-1 is compacted clay devoid of cultural material.

The storm deposit in Layer I of SP-6-1 is moderately compacted sand, containing 10% semi-lithified sand chunks; Layer I is underlain by a second probable tsunami layer of banded light gray, gray and light brownish gray moderately compacted sand containing earthenware slipped ceramic fragments, large mammal bones (pig, cow, or horse), avian bones and charcoal. Layer III aeolian sand overlies Layer IV and marine deposited sand containing sparse coral.

Figure 118 is the first of three stratigraphic profiles (profile 1) and illustrates a composite north-south transect across the west half of Area C. A surface layer of humic duff overlies 4.75 m of aeolian sand (SP-1) and is indicative of the coastal dune's depth on the west side of Kaihalulu Bay. Mixed sand deposits underlie the humic duff and overlie intact aeolian deposition on the seaward (north) side of the composite transect, where in BT-C-7-1 the aeolian infill deposits are interpreted as episodic infilling of an area occupied by a dirt road (see *Figure 38*). On the south end of the composite transect fill underlies the surface duff and truncates the underlying intact aeolian sand deposits in BT-C-7-2 and C-7-3.

Figure 119 is the second of three stratigraphic profiles (profile 2) and illustrates a composite north-south transect across the east half of Area C, where possible storm deposits were documented in BT-C-3-1 on the seaward (north) side and BT-C-3-2 on the inland (south) side. Both profiles show a surface layer of humic duff. On the seaward side in BT-C-3-1, the surface duff caps a shallow deposit of intact aeolian sand (Layer II), which overlies a shallow (0.09 m) deposit of banded sand identified as a storm deposit (Layer III). The shallow tsunami deposit overlies a semi-lithified (calcium carbonate-cemented) aeolian sand deposit (Layer IV), which overlies 2.08+ m of fine, loose single grain aeolian sand. The semi-lithified aeolian Layer IV deposit, at 0.29-0.62 cm below the ground surface, was probably super-saturated with seawater and compressed during the Layer III storm or tsunami event. On the south end of the composite transect in BT-C-3-2, a layer of intact aeolian sand (Layer IV) separates the tsunami deposits (Layers III and V), which are both characterized by undulating bands of multi-hued sand deposits; the upper deposit contains broken glass throughout, but the lower deposit contains no inclusions.

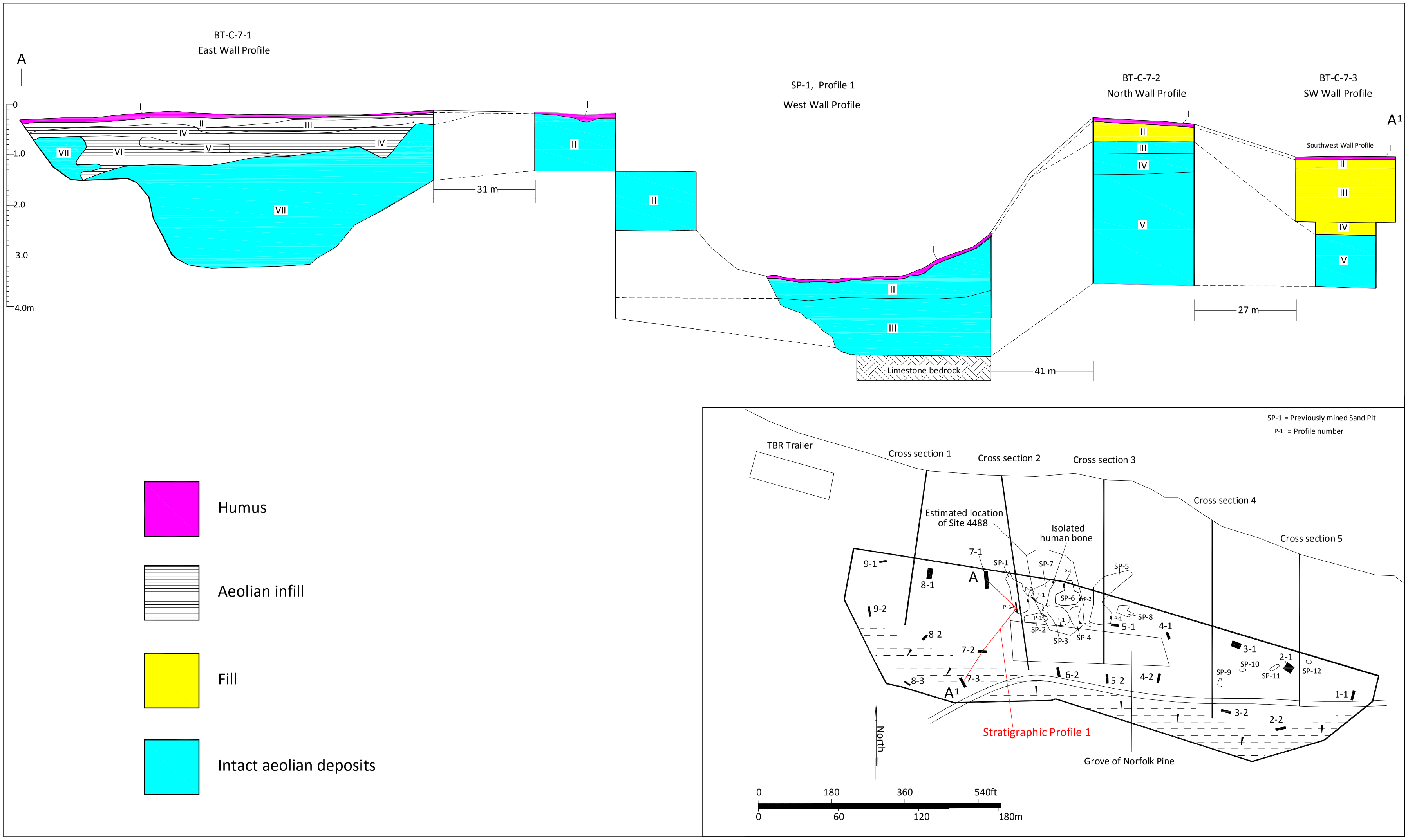


Figure 118. Test Area C stratigraphic profile 1

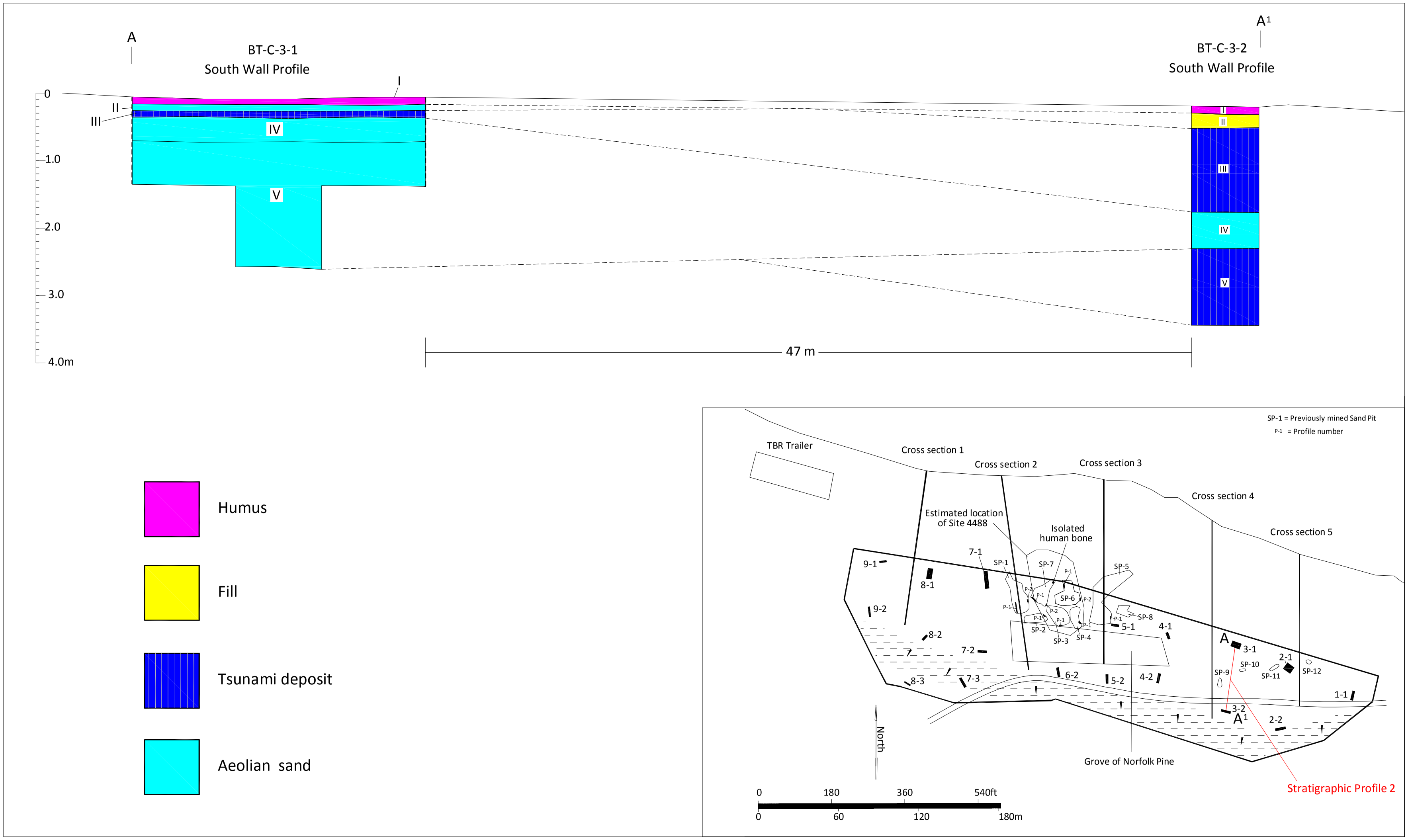


Figure 119. Test Area C stratigraphic profile 2

Together these profiles show the erosional effect of the tsunami in BT-C-3-1, where the volume of Layer IV aeolian sand is reduced by 40%, compared to Layer IV in BT-C-3-2, while the volume of tsunami deposition in Layer III increases by more than a factor of 10 in BT-C-3-2. The Layer III tsunami deposits represent either the 1946 or 1957 tsunami, when shoreline inundation or runup (maximum observed height of the sea surface, measured relative to mean sea level) at Kahuku Point was 8.2 m (27 ft) in 1946, and 7.0 m (23 ft) in 1957 (Walker 1994: 6, 32). Runup was of sufficient height to completely inundate the Area C dune, the maximum height of which is slightly less than 7.0 m (c. 22 ft). At the east end of the dune, the height above sea level is currently only 4.25 m (c. 14 ft). While there is no data on file for runup heights at Kahuku Point during the 1923 tsunami, runup measured at Hale'iwa was 3.7 m (*ibid*.: 32) and by extrapolating from the known Hale'iwa and Kahuku Point runups for 1946 (3.4 m Hale'iwa) and 1957 (5.2 m Hale'iwa), the 1923 tsunami at Kahuku Point might have resulted in a runup of 5.0 m to 7.0 m, or more. The volume of the Layer V tsunami deposit in BT-C-3-2 was probably the result of an event equal to, or possibly greater than the Layer III tsunami episode.

Figure 120 is the last of three stratigraphic profiles (Profile 3) and illustrates a composite north-south transect across the approximate center of Area C, where intact deposits across the dune show the humic duff differentially overlying sequential aeolian deposition. Stratigraphic Profile 3 shows SP-7, at the north end of the composite transect, encountered the limestone substrate at 6.7 m below the ground surface. Layer II in SP-7 consists of aeolian sand containing semi-lithified sand chunks and discontinuous calcium carbonate lenses at the interface with Layer III. The calcium carbonate horizon probably resulted from seawater inundation from either the 1946 or 1957 tsunami, or both; the semi-lithified sand chunks could result from super compaction or, less probably from secondary deposition of fossilized dunal remnants from an exposure closer to the shoreline. The 10-cm thick Layer II aeolian sand in SP-7 could represent a severely eroded and truncated aeolian deposit. In contrast, Layer IV in SP-7 is a 4.0 m deposit of semi-lithified aeolian sand that is the fossilized dune over which the upper dunal deposit (Layer III) coalesced.

Sand Pit-2, in the center of the composite transect, while only faced to a depth of 1.5 m specifically to locate buried cultural deposits, shows continuous unconsolidated to slightly compacted aeolian deposition from the surface to the base of the truncated profile. Layer I in SP-2 was noted to be disturbed as a result of sand mining activity, and a single fish vertebra noted in the deposit could be displaced as a result of recent cultural or tsunami or storm activity. Layer II contained root concretions of calcium carbonate commonly up to 7 cm in diameter, which provides additional evidence of seawater inundation.

The BT-C-6-2 profile shows shallow sandy duff overlying 2.6 m of intact aeolian sand. Layer II consists of semi-lithified banded or bedded aeolian sand deposit that slopes 10-degrees north from horizontal, toward the sea. Similar horizontal bedding was documented in Layer II of SP-6, where it was tentatively interpreted as cyclical storm surge or tsunami depositional sequences. No calcium carbonate lenses, root concretions or differential sand coloration was observed in the Layer II deposit of BT-C-6-2 so it is not specifically identified as a tsunami or storm surge deposit, but the semi-lithification of this deposit could have resulted from inundation because it is unlikely to represent the fossilized dunal core. Layer II overlies Layer III, a homogeneous 0.70+ m deposit of semi-lithified single grain aeolian sand devoid of obvious bedding planes or inclusions. Semi-lithification in Layer III could be the result of pre-20th Century seawater inundation and compaction, or the fossilized dunal core; excavation was not deep enough to make a more specific determination.

3est Area C is a forested coastal sand dune on the west side of Kaihalulu Bay, c. 90-135 m from the shoreline. The central *makai* side of the dune contains 4.75 to 6.7 m of aeolian sand overlying the limestone substrate and is the location of previous TBR sand mining operations, where at least 8 burials were encountered at Site 4488. An isolated human bone was recovered from the ground surface near one of the open sand pits during SAIS fieldwork, presumably displaced from one of the eight burials. The southwest side of the dune contains 1.0 to 2.60 m of aeolian sand and fill overlying limestone. The southeast side of the dune was probably mined for sand during WW II, and the pits subsequently filled with trash of the same era. Testing documented disturbance across the dune, but deep, intact aeolian and marine-deposited sand deposits remain. The upper 1.5 m of the intact portions of the dune exhibit an increased potential for encountering additional cultural deposits.

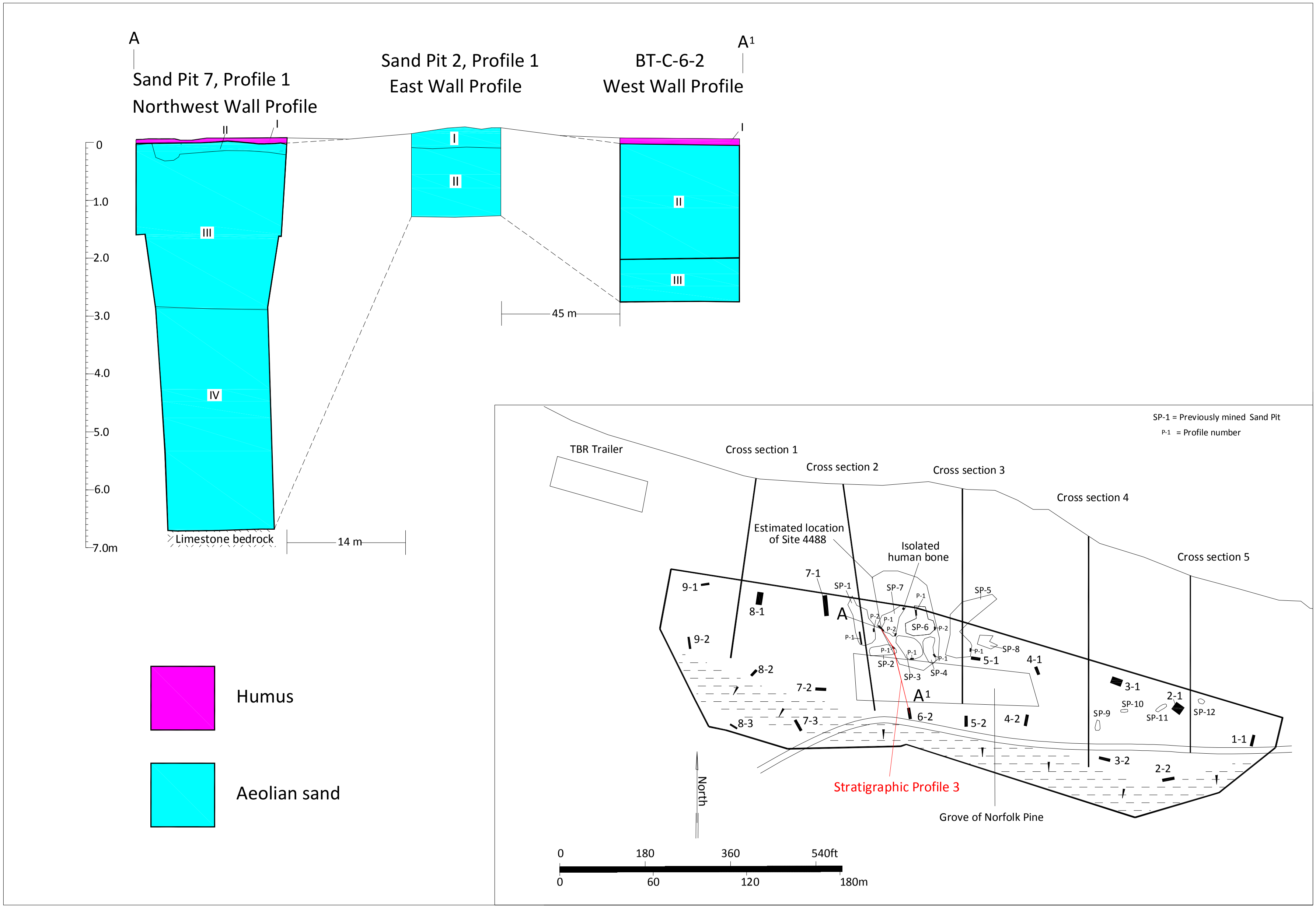


Figure 120. Test Area C stratigraphic profile 3

Test Area D

Test Area D occupies the inland side of the forested sand dunes situated parallel to the shoreline along the west side of Kaihalulu Bay, between the mouth of ʻŌiʻo Stream on the west and the 17th fairway of the Palmer golf course on the east (see *Figure 41*). The 18th Fairway forms the inland (south) boundary of Test Area D. Previously recorded Site 6411-Feature C (formerly Site 50-OA-2911; Walker *et al*. 1988b, Corbin 2003) and Site 6419 (Corbin 2003) are located on the seaward side of Area D (*Figure 121*). The terrain is fairly level, except for a dunal ridge fronting the shoreline that is mostly seaward of the test area. The Jaucus Sand described by Foote *et al.* (1972) was mapped throughout the entire area. Test Area D varies in elevation from c. 4 ft to 16 ft. The Kahuku Army Airfield runway formerly occupied south-central part of Area D (see *Figures 17* and *42*). Associated taxiways and aircraft storage revetments were formerly located on the north side of the runway, in the northeast half of Area D. Most of Test Area D is currently undeveloped, except for a swath of landscaped lawn that spans the southeast end of the test area, providing an ocean vista from the 18th Green.

Thirty-six systematically placed trenches were excavated in Test Area D. Three discretionary trenches were excavated to define the extent of the subsurface cultural deposit. One trench (BT-D-0-1) was excavated outside the original boundary of Area D in a forested area to the west. Trench length varied from 4.8 to 8.0 m (average 6.5 m) and averaged 1.5 m in width. A total of 259.20 linear meters of trench were excavated. Trenches were excavated either to the water table (N=23) or to the weathered limestone substrate (16) and the profiles document three to nine layers. Excavation of one trench was terminated when human remains were identified. The trench profiles are illustrated in **Appendix B** (*Figures B-80* through *B-118*). Trench dimensions and detailed stratigraphic data are presented in A**ppendix C**.

Testing identified three prehistoric cultural deposits (Sites 7289, 7290 and 7291), one of which contained a human burial (BT-D-2-1b in Site 7289). In addition, buried asphalt pavements were encountered in seven trenches (BT-D-4-1, D-5-1, D-8-3, D-9-1, D-9-2, D-9-3 and D-15-3); these are sections of the Kahuku Army Airfield runway (Site 7275) and ancillary pavements north of the main runway.

Site 7275 is the Kahuku Army Airfield, a large military complex. Construction on the runway began in December 1941 and the airfield was in use until March 1946 (Bennett 2011: 52). The main (NE-SW) runway, located within 300 ft of the shoreline south of Kahuku Point, had a number of building phases, including modification in 1943/1944 to accommodate B-29 aircraft, which included covering the runway in "pierced steel planking (Marston Mat)" and paving both Kahuku Point runways with "asphaltic concrete…with compacted coral shoulders 100 feet on either side of its 200 foot width" (*ibid*.: 54). Regarding the construction of the air base, Bennett (*ibid*.: 53) notes:

> Early attempts at building a single runway on the limestone, lithified dunes, sand dunes and wetlands at Kahuku Point by Hawaiian Constructors were foiled by poor drainage, which necessitated…the runway being relocated three times before a suitable location was found. To mitigate drainage problems at the location, a system of canals, subterranean drain pipes and culverts were built.

In addition to the runways, "32 earthen revetments were constructed between both runways" to protect aircraft and maintenance crews; the revetments were "sprayed with gunite to prevent erosion…[and were] trapezoidal in cross section requiring 5,000 cubic yards of earth for a traverse 14 feet high" (*ibid*.: 54).

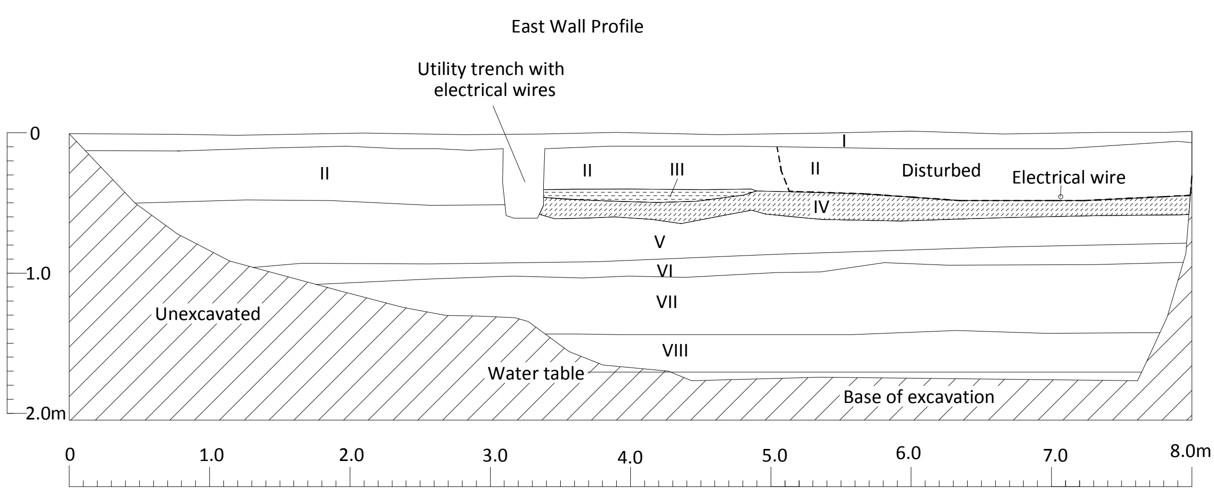
Test Area D partially overlaps the area formerly occupied by the Kahuku Army Airfield runway and revetment area north of the runway (see *Figures 17* and *42*). Widespread evidence of modification for the Airfield facilities was encountered throughout much of Test Area D. These are noted in the descriptions of individual Test Area D trenches in **Appendix C**. All of the Airfield modifications in Test Area D consist of intact asphalt pavement and/or limestone aggregate fill deposits. Only a small section of the former location of the Airfield runway coincides with south-central portion of Test Area D. The revetment area north of the Airfield runway coincides with the north half of Area D. The problem with making specific correlations with specific Airfield features stems partially from the lack of a fully annotated Airfield map identifying features and construction phases; identification of specific

Figure 121. Location of sites and trenches in Test Area D

exposures of asphalt pavement as runway or revetment area features, is based on the inferred location of the runway shown on Figure 17, and in some cases, on the fill deposits underlying a specific section of pavement. As a result of the uncertainty regarding specific identification of Airfield features, none of the Airfield modifications documented in Test Area D were assigned specific feature numbers or separate site numbers, and all were treated as elements of Site 7275.

Pavements north of the runway in the revetment area could represent taxiways, pavement inside revetments or roads leading to revetments. Limestone fill deposits without an overlying asphalt pavement could represent runway shoulders, gravel roads, revetment construction material, or locations where the overlying asphalt was stripped away by the 1946 tsunami. Keating (2008) describes and illustrates the extremely destructive force of the 1946 tsunami on the Kahuku Army Airfield and provides invaluable information for interpreting the deposits encountered in the Test Area D trenches; her geophysical analysis of the depositional and erosional processes on structures and landforms at Kahuku Point were used as the basis of interpretation of the tsunami deposits in Test Area D. In order to properly identify individual features of the Airfield in Test Area D and to be able to specify precisely what elements of the Airfield the deposits represent, horizontal exposure would be more useful than the vertical exposures provided by subsurface trenching.

Site 7289 is a subsurface cultural deposit located at the west end of Test Area D. This deposit was initially encountered in BT-D-2-1, where eight deposits were documented in the trench wall (*Figure 122*). The upper layers consist of humic duff (Layer I) and an aeolian sand layer (Layer II) that contains 80% lithified sand chunks and slight organic staining characteristic of tsunami disturbance. A utility trench containing electrical wires was excavated from Layer I and is intrusive into Layers II-V. More extensive disturbance was noted c. 2.0 m south of the utility trench in Layer II, where an electrical wire was noted at the interface of Layer II and IV. Layer III is a shallow basin-shaped cultural deposit, probably representing a feature on the surface of the Layer IV



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Dark grayish brown (10YR 4/2) compacted aeolian loamy sand; Electrical wires and utility trench present
Layer III - Black (7.5YR 2.5/1) very fine friable loamy sand; Site 7289 cultural deposit
Layer IV - Brown (10YR 4/3 to 7.5YR 5/4) single grain aeolian slightly loamy sand; Site 7289 cultural deposit
Layer V - Very pale brown (10YR 8/2) compacted aeolian sand; No cultural remains
Layer VI - Light gray (10YR 7/2) compacted semi-lithified aeolian sand; No cultural remains
Layer VII - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains
Layer VIII - White (10YR 8/1) very fine single grain aeolian sand; No cultural remains

Figure 122. Site 7289 subsurface deposit in BT-D-2-1

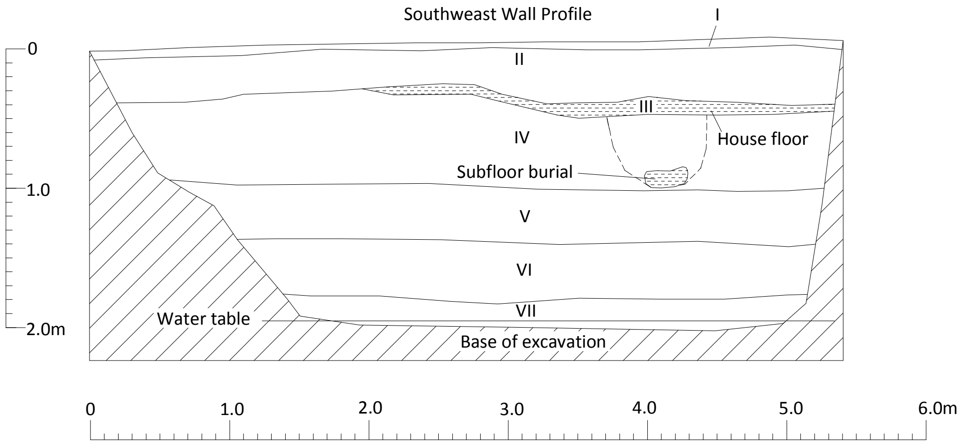
cultural deposit. Layer III is characterized by black very fine friable loamy sand and is partially truncated on the north side by the utility trench. Layer III is 0.07 m thick and 1.44 m wide. Four basalt flakes and a *Cellana* shell were recovered from Layer III (Acc. 10.001-10.002, **Appendix D**). The Layer IV cultural deposit underlies Layer III and is also truncated on the north side by the electrical utility trench; additional disturbance in Layer II at the south end of BT-D-2-1 might have also disturbed the upper portion of Layer IV in that area. Layer IV consists of compacted brown slightly loamy charcoal-flecked sand and is visible in both walls of the trench; it varies in thickness from 0.10 to 0.20 m. Layer V underlies Layer II on the north side of the electrical utility trench and underlies Layer IV on the south side of the electrical utility trench. Layers V-VIII are intact aeolian sand deposits that underlie the cultural Layer IV to a depth of 1.7 m below the ground surface (bgs), where the water table was encountered.

Three discretionary trenches (BT-D-2-1b, D-2-1c, D-2-1d) were excavated around BT-D-2-1 to determine extent of the subsurface Site 7289 cultural deposit. BT-D-2-1c, located 15 m northwest of BT-D-2-1 contained no intact subsurface cultural layers (see *Figure B-85* in **Appendix B**). Subsurface evidence of the Site 7289 cultural deposit was also documented in BT-D-2-1b and D-2-1d.

BT-D-2-1b was excavated 25 m west of the subsurface cultural deposit encountered in BT-D-2-1 (*Figure 123*). The trench bisected a subsurface prehistoric house floor, which was visible in both walls of the trench. In addition, the trench exposed a subfloor burial visible only in the southeast wall of the trench. In BT-2-1b the humic duff (Layer I) overlies slightly loamy aeolian sand (Layer II). Layer II overlies Layer III, a house floor exposed in cross-section. The house floor itself is c. 20 cm below the associated prehistoric ground surface (elevated section on left) and the diagonal slope connecting the two represents the location of the former house wall; the sloping wall section indicates that the house was shallowly subterranean, as an adaptation to windy conditions. Layer III is very brown to dark grayish brown loamy sand with charcoal flecks throughout, exposed over a distance of 3.3+ m. The upper and lower boundaries of the deposit are wavy and vary in thickness from 5-16 cm, and average c. 8 cm in thickness. Cultural materials recovered from Layer III consist of marine shells (*Conus* sp., *Nerita polita*, unidentified marine shell fragments and waterworn marine shells), unidentified small mammal bone fragments, urchin and crustacean exoskeleton fragments, a burned *kukui* nutshell fragment and 74 fragments of charred wood (Acc. 11.001-12.007; **Appendix D**).

The subfloor primary burial was exposed 44 cm beneath the north end of the house floor, intrusive through Layer IV to the interface with Layer V. The burial pit sides are indistinct and were not visibly distinguishable from the surrounding Layer IV matrix; pit outlines in the profile are presumed and it is possible that the burial predates and is unrelated to the overlying structure. The distal end of a left humerus, a cervical vertebra and rib were exposed in the southeast wall of BT-D-2-1b, from 0.92-1.10 m bgs. Additional cervical vertebrae and the cranium also remain buried *in situ*. SHPD was notified immediately upon the identification of human remains. After consultation with SHPD, the excavated soil was systematically screened and scanned to recover displaced skeletal elements. The bones were in very good condition. Skeletal elements of a single individual were accounted for except those already mentioned that remain *in situ* and a tarsal cuneiform, 3 intermediate tarsal phalanges, 4 distal tarsal phalanges and a patella. These elements are presumed to also remain *in situ*. Inspection of the innominates indicates the burial is an adult male. All of the recovered remains were carefully returned to the trench and the excavation was backfilled, with appropriate cultural protocols provided by members of the Kahuku Burial Committee. Layers IV-VII are intact aeolian sand deposits, none of which contained associated cultural material, other than the burial.

BT-2-1d was excavated 29 m north-northeast of BT-2-1. Additional evidence of the Site 7289 subsurface cultural deposit was designated as Layer IV (*Figure 124*). The cultural deposit is overlain by humic duff (Layer I), loose sand representing either fill or possibly a storm surge deposit (Layer II), and compacted loamy sand containing 50% crushed basalt aggregate (Layer III). The south terminal end of Layer IV pinches out, which appears to be a natural termination of the deposit, rather than mechanical truncation, based on the depth of the deposit at the north end of the trench; if the deposit was mechanically truncated Layer III would overlie Layer V c. 20 cm deeper. Layer IV is characterized by grayish brown loamy sand with sparse limestone gravel inclusions that varies in thickness from 0.04 m on the south end to 0.24 m on the north end and is 2.80+ m long. Cultural materials recovered Layer IV consist of 15 juvenile *Sus scrofa* (pig) bone fragments and a charred wood fragment (Acc. 13.001- 13.002; Appendix



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Grayish brown (10YR 5/2) and brown (7.5YR 4/3) loose slightly loamy sand; No cultural remains

Layer III - Grayish brown (10YR 5/2) and Dark grayish brown (10YR 4/2) and brown (10YR 5/3) moderatelysit compacted loamy sand; Site 7289 cultural deposit

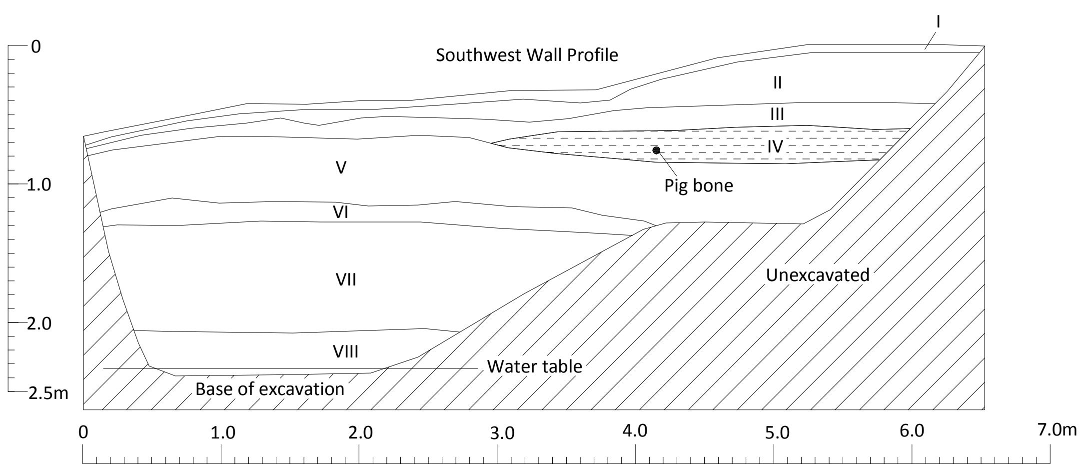
Layer IV - Very pale brown (10YR 8/2) loose aeolian sand; Human remainsin sub-floor burial pit

Layer V - Very pale brown (10YR 8/2) semi-lithified aeolian sand; No cultural remains

Layer VI - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Layer VII - White (Gley 1 8/N) single grain aeolian sand; No cultural remains

Figure 123. Site 7289 subsurface deposit in BT-D-2-1b



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) loose sand; No cultural remains

Layer III - Gray (10YR 5/1) compacted loamy sand; 50% basalt aggregate

Layer IV - Grayish brown (10YR 5/2) compacted loamy sand; Site 7289 cultural deposit (pig bones and charcoal)

Layer V - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer VI - Grayish brown (10YR 5/2) calcium carbonate precipitate - cemented aeolian sand; No cultural remains

Layer VII - Very pale brown (10YR 8/3) loose aeolian sand; No cultural remains

Layer VIII - Light gray (10YR 7/1) loose aeolian sand; No cultural remains

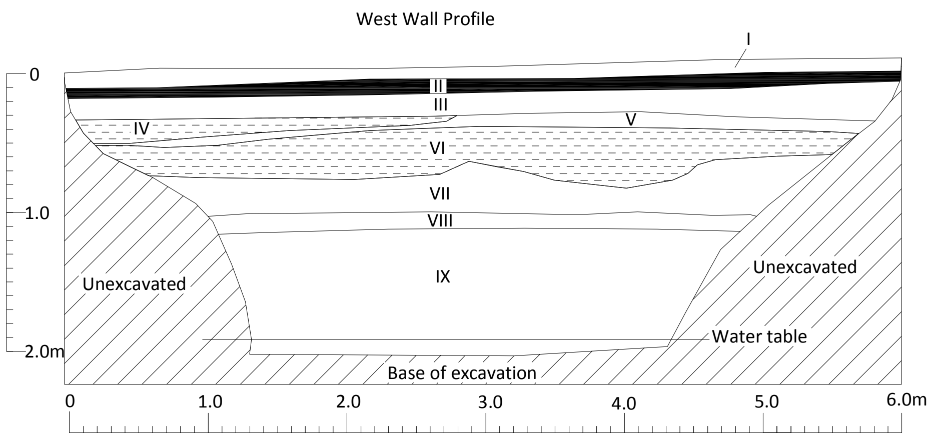
Figure 124. Site 7289 subsurface deposit in BT-D-2-1d

D). Four intact aeolian sand deposits (Layers V-VIII), one with heavy calcium carbonate lensing (Layer VI) underlie the cultural deposit and contain no inclusions or associated cultural material.

No testing was undertaken to the northeast of BT-2-1, where a paved cart path and portion of the golf course are located. Based on the testing, Site 7289 is estimated to encompass an area of at least c. 2,901 sq m. The cultural assemblages indicate the site was used for prehistoric habitation and burial. The site is in excellent condition and retains substantial physical integrity.

Site 7290 contains stratified subsurface prehistoric cultural deposits that were initially observed in BT-D-5-1 on the seaward side of Test Area D, and subsequently also identified in two other trenches (BT-D-6-1, -D-7-1) in the central portion of Test Area D. In BT-D-5-1 two prehistoric cultural layers were identified (*Figures 125-126*). Layer I consists of redeposited loamy sand fill or tsunami-deposited sand (Layer I) overlying an intact asphalt pavement that represents a portion of the Kahuku Army Airfield runway (Layer II) constructed on a secondary deposit of limestone aggregate fill (Layer III). The asphalt pavement is 11 cm thick and is buried 10 cm beneath the Layer I surface deposit. Layer III is 12-28 cm thick and consists of banded very dark grayish brown and yellowish brown, very fine friable crumb, clay loam with 80% limestone gravel inclusions and represents the bedding material for the runway. Layer III overlies Layer IV on the south side of the trench wall and overlies Layer V on the north side, and exhibits an abrupt and smooth boundary at the contact with Layers IV and V, indicating Layer III probably truncated the upper surfaces of both deposits. At its north end Layer IV truncates Layer V and has the appearance of a shallow basin-shaped deposit over a distance of 3.0+ m; the deposit is 16 cm thick at the south end of the trench and gradually pinches out to 2 cm at the north end. Layer IV consists of very dark gray to very dark grayish brown carbon-stained loamy sand with sparse limestone gravel inclusions and waterworn marine shells; cultural material recovered from Layer VI consists of a fragment of charred wood (Acc. 14.001- 14.002; **Appendix D**). Layer V consists of pale brown loose, clean sand containing sparse limestone gravel and deposited in thin wavy bedding planes, interpreted as a storm surge or tsunami deposit. A third cultural deposit (Layer VI) underlies Layer V, except at the very south end of the trench, where it underlies Layer IV. Layer VI varies from 16-40 cm in thickness, characterized by very dark gray to grayish brown mottled carbon-stained slightly loamy sand containing sparse limestone gravel inclusions and waterworn marine shells. Cultural remains recovered from Layer VI consist of a volcanic glass core, marine shells (*Trochus intextus*) and 3 fragments of charred wood (Acc. 15.001- 15.004). Three intact aeolian beach sand deposits (Layers VII-IX) underlie Layer VI to a depth of 2.06+ m bgs; Layer VII contained sparse patches of calcium carbonate lenses, but none of the aeolian deposits contained cultural or other natural inclusions.

In BT-D-6-1, located 42 m northeast of BT-D-5-1, a single subsurface prehistoric cultural deposit associated with Site 7290 was identified (*Figure 127*). Layer I consists of 20-40 cm of compacted brown sandy clay loam containing 80% limestone gravel, pebble and cobble aggregate, and could be runway fill or part of the runway shoulder adjacent to the north side of the runway. Layer II unconformably underlies the Layer I secondary fill deposit and is the subsurface prehistoric cultural deposit. Layer II consists of banded black and very dark brown compacted single grain loamy sand that varies in thickness from 2-18 cm. The abrupt and wavy boundary between Layer I and Layer II indicates that the upper surface of Layer II has been truncated by surface preparation prior to laying down the limestone fill, and at the north end of the trench Layer II is reduced to a 2-cm stain, which could be smeared from the south end of the deposit. Cultural materials collected from Layer II consist of marine shells (*Conus* sp., *Tellina palatam* and indeterminate bivalve shell) and 3 fragments of charred wood (Acc. 16.001- 16.004; **Appendix D**). Layer III underlies Layer II across most of the trench, except at the very north end, where surface preparation prior to laying the fill (Layer I) has completely stripped away Layer II so that Layer I overlies Layer III. Layer III consist of banded dark grayish brown, pale brown and grayish brown single grain sand, representing multiple storm surge deposits. The distinct wavy boundary at the interface between Layers III and IV indicate at least minor truncation of the upper surface of the Layer IV deposit. Layer IV is the third cultural deposit and underlies Layer III, except at the very north end of the trench, where it underlies Layer I. Layer IV is 0.46 to 0.86 m bgs and varies in thickness from 16-32 cm, characterized by very dark grayish brown, very fine friable sandy loam containing sparse limestone gravel inclusions and waterworn marine shells. Cultural material recovered from Layer IV consists of marine shells (*Cypraea caputserpentis*) and charred wood (Acc 17.001- 17.003; **Appendix D**). Layer V underlies cultural Layer IV and consists of 0.82+ m of very fine,



Layer I - Dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2) single grain loamy sand fill; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer; WWII airfield pavement

Layer III - Very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4) very fine friable clay loam fill; Aggregate for Airfield pavement bedding

Layer IV - Very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) single grain loamy sand; Site 7290 cultural deposit

Layer V - Pale brown (10YR 6/3) single grain sand; No cultural remains

Layer VI - Very dark gray (10YR 3/1) to grayish brown (10YR 5/2) mottled single grain carbon stained slightly loamy sand; Site 7290 cultural deposit

Layer VII - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer VIII - White (10YR 8/1) calcium carbonate precipitate; No cultural remains

Layer IX - Very pale brown (10YR 8/3) single grain aeolian sand; No cultural remains

Figure 125. Site 7290 subsurface deposit in BT-D-5-1

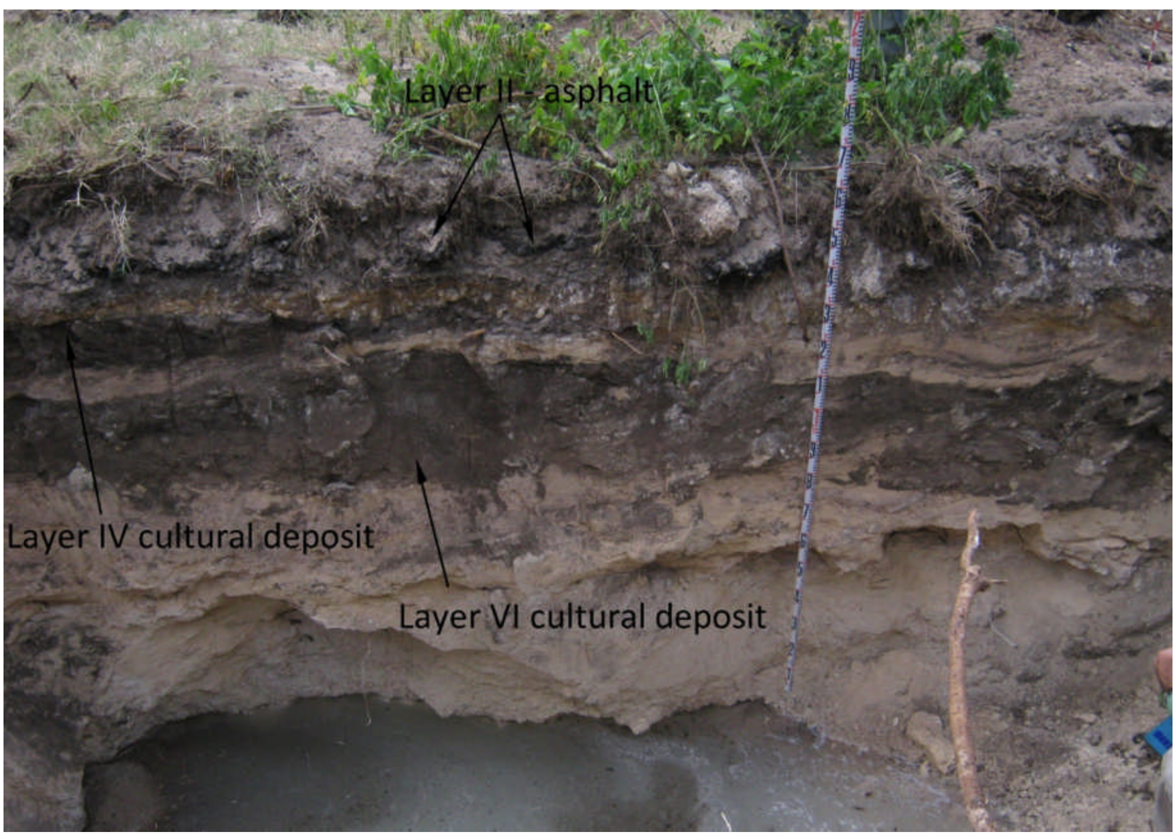


Figure 126. Site 7290 subsurface deposit in BT-D-5-1

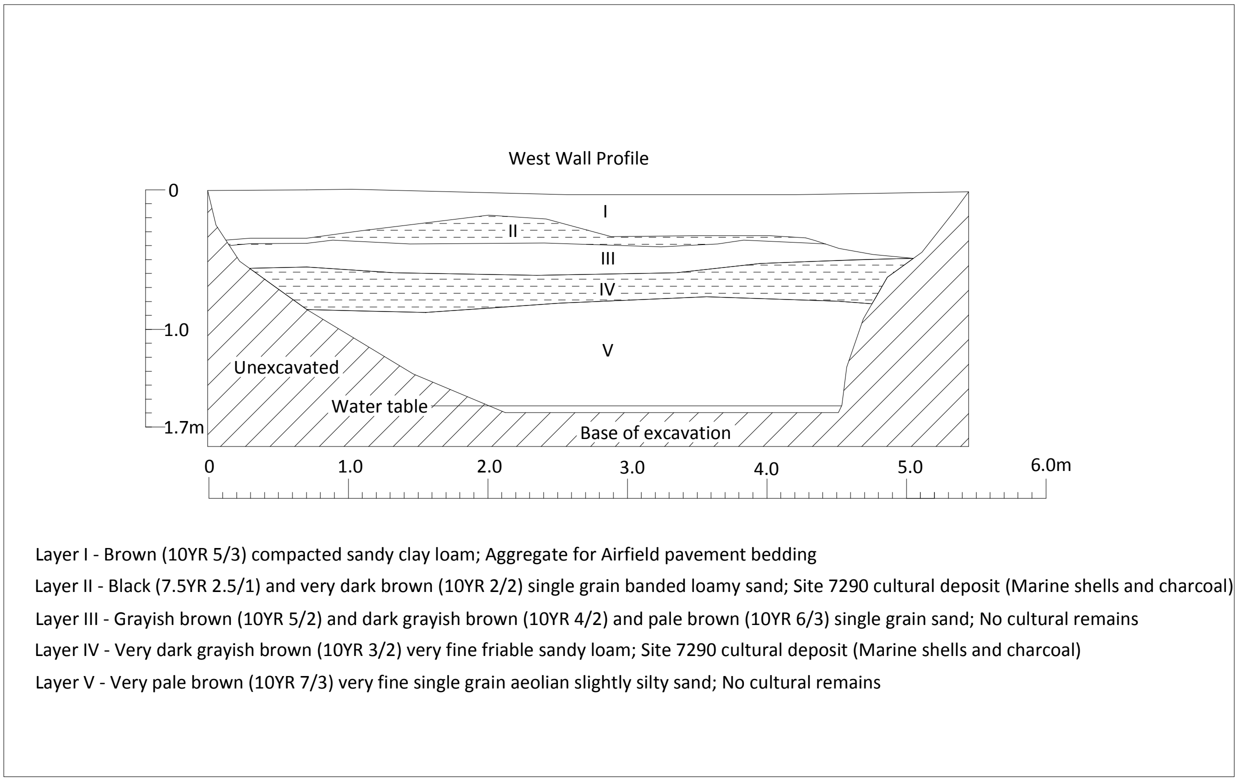


Figure 127. Site 7290 subsurface deposit in BT-D-6-1

single grain slightly silty aeolian sand with weathered coral, sparse carbonates, and 20% limestone gravel and pebble inclusions to a depth of 1.55+ m bgs.

In BT-D-7-1, located 64 m east of BT-D-6-1, another prehistoric subsurface cultural deposit associated with Site 7290 was encountered (*Figure 128*). Layer I consists of 8 cm of humic duff overlying Layer II, composed of 100% crushed limestone gravel aggregate that is probably part of the runway shoulder adjacent to the north side of the runway. The fill varies in thickness from 16 cm at the north end of the trench to 8 cm at the south end and overlies Layer III, which consists of dark grayish brown fine friable crumb compacted sandy clay loam alluvium containing sparse limestone gravel and pebble inclusions. Layer III varies in thickness from 36 cm at the north end of the trench, to 20 cm at the south end, and overlies Layer IV over most of the exposure, except for a small area near the south end of the trench, where it overlies an unconformity in the limestone substrate. Layer IV exhibits a similar, but more pronounced increased thickness at the north end of the trench, noted in Layers II and III, where it is 28 cm thick but is reduced to 10 cm at the south end of the trench, following the topography of the underlying Layer V limestone substrate. Layer IV is the prehistoric cultural deposit characterized by very dark gray, fine friable sandy clay loam with sparse limestone gravel and pebble inclusions and waterworn marine shells. Cultural materials recovered from Layer IV consist of a *Cypraea caputserpentis* shell and probable avian bone fragments (Acc. 18.001-18.003; **Appendix D**).

Site 7290 is estimated to encompass a subsurface areal extent of c. 4,918 sq m. Two intact stratified subsurface prehistoric cultural deposits were identified BT-D-5-1, consisting of two habitation deposits sealed by the WW II-era Kahuku Army Airfield runway. Northeast of BT-D-5-1, in -D-6-1 and -D-7-1 the limestone aggregate shoulder on the north side of the runway seal single prehistoric cultural deposits. In the coastal setback on the seaward side of Site 7290, the adjacent Site 6419 was identified “as a cultural deposit discovered on July 10, 1990 following the mining of sand on the south side of the beach berm within the Hotel-5 area…The shovel test pits and trench indicated the area was highly disturbed, and would yield no useable information, and further testing was abandoned” (Corbin 2003:264). That is essentially the sum total of the information documented for Site 6419; no specific subsurface layer is identified as the cultural deposit, no information is provided regarding what cultural material the deposit contained, and no “highly disturbed” deposits are discussed or documented. Site 6419 also

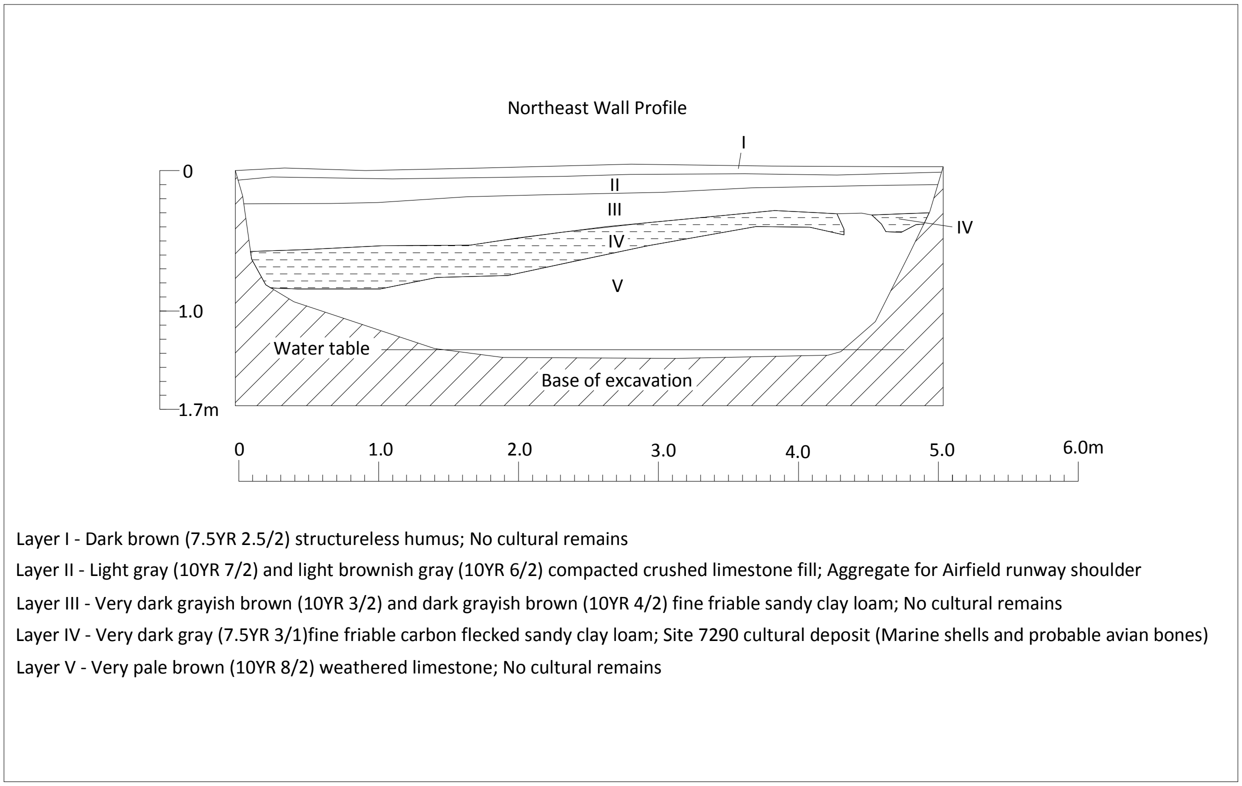


Figure 128. Site 7290 subsurface deposit in BT-D-7-1

encompassed a concrete slab, probably associated with the former Kahuku Army Airfield, which was not identified or discussed. Five stratigraphic layers were documented in the single trench excavated at the north end of Site 6419, but only three layers were described. The documentation for Site 6419 is inadequate for correlation with the subsurface data collected for Site 7290. Subsurface elements of Site 7290 possibly exist seaward in the area defined as Site 6419 and beyond.

Site 7290 is an extensive stratified subsurface site containing intact prehistoric habitation deposits characterized by artifacts and subsistence debris. Intact WW II deposits, representing elements of the Site 7275 Kahuku Army Airfield, overlie and seal the prehistoric deposits, and in limited areas have truncated the cultural deposits. Overall, the prehistoric deposits are in good condition and retain substantial physical integrity.

Site 7291 is a prehistoric subsurface cultural deposit identified in five trenches (BT-D-12-2, -D-13-3, -D-14-2, -D-14-3, -D-15-3) at the north end of Test Area D, in an area north of the Kahuku Army Airfield runway that was formerly occupied by revetments and associated roads. The prehistoric cultural deposit was initially identified in BT-D-12-2.

In BT-D-12-2, 63 cm of Layer I limestone aggregate, representing a secondary deposit of WW II fill, overlies the Layer II cultural deposit to a depth of 63 cm on the north and south ends of the trench and to a depth of 38 cm in the center of the trench (*Figure 129*). Layer II is characterized by 12-40 cm of very dark gray to black, very fine friable silt loam containing sparse limestone gravel inclusions and waterworn marine shells. Cultural material recovered from Layer II consists of marine shells (*Conus abbreviatus*, *Nerita picea*), unburned *kukui* nutshells, a waterworn coral pebble and fragments of charred wood (Acc. 20.001- 20.005; **Appendix D**). The lower boundary of the cultural deposit cultural deposit is not level, but rather descends toward the south end of the trench, where the base of the deposit is 1.05 m bgs and the deposit is 40 cm thick. At the north end of the trench Layer II is only 12 cm thick and the base of the deposit is 72 cm bgs. It is possible, but not certain that the upper surface of Layer II was truncated at the north end of the trench. A conical pit originates in Layer II and is intrusive into the underlying Layer III deposit. The pit is 36 cm wide at the interface with Layer II and 40 cm deep; it potentially represents a

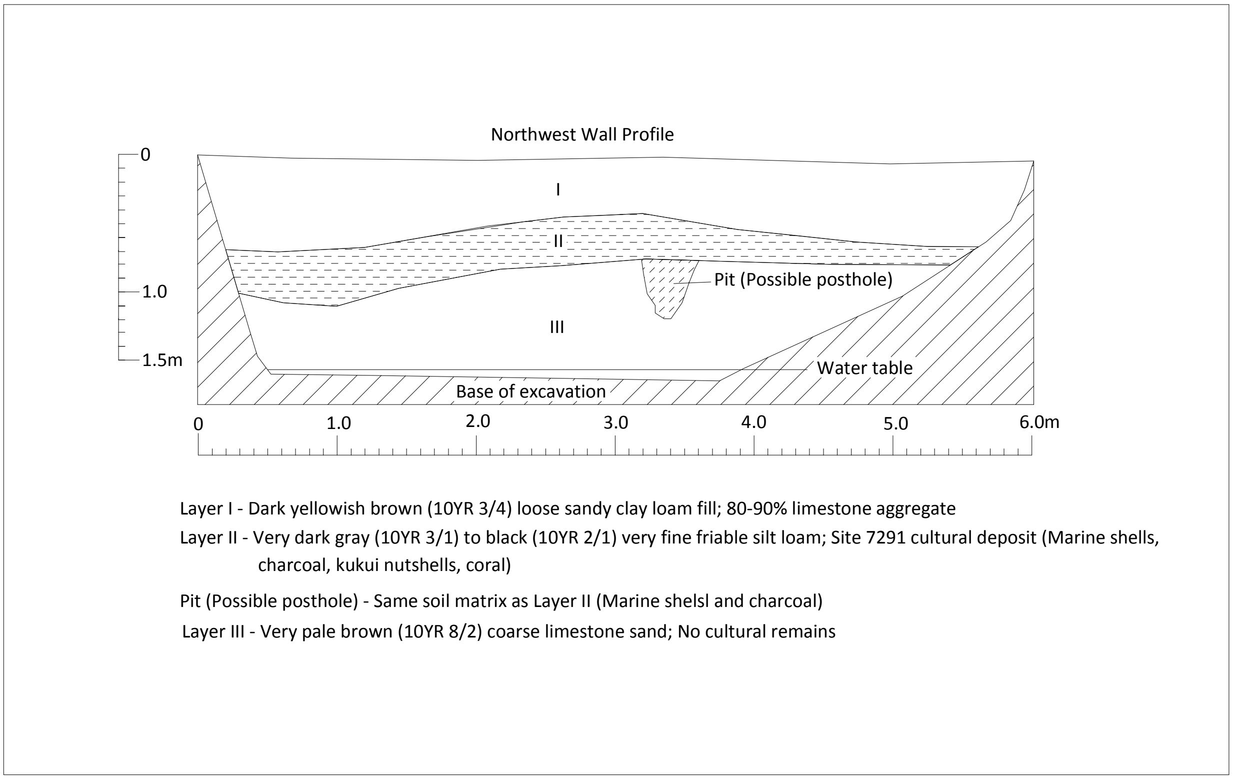
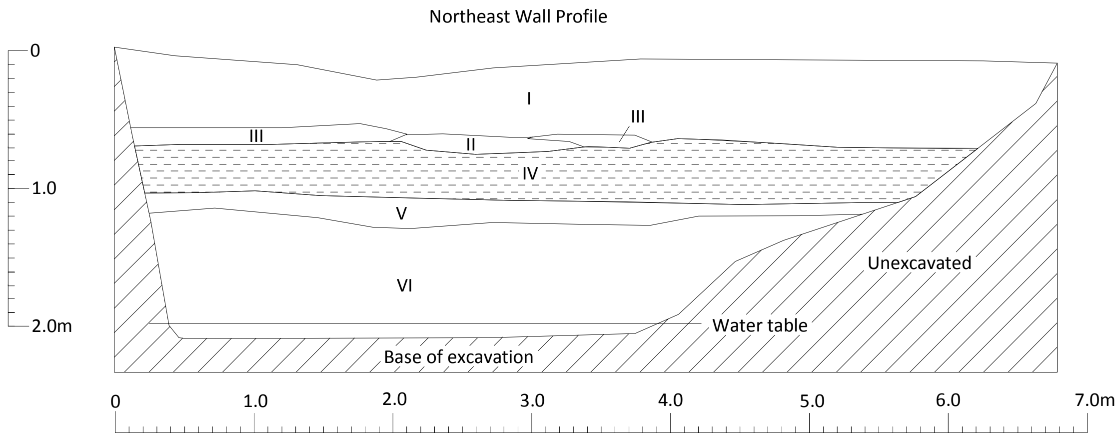


Figure 129. Site 7291 subsurface deposit in BT-D-12-2

post mold. Pit fill is the same as the Layer II matrix. Cultural materials recovered from the pit consist of marine shells (*Nerita picea*) and charred wood fragments (Acc. 21.001- 21.003). Layer III underlies Layer II and is characterized by 100% limestone sand representing the decomposing residual bedrock.

In BT-D-13-3, located 62 m north of BT-D-12-2, the subsurface cultural deposit associated with Site 7291 was identified at c. 65 cm bgs (*Figure 130*). Layer I is a 38-63 cm deposit of dark grayish brown unconsolidated very sandy loam containing 30% limestone gravel and pebble inclusions and pieces of Marston matting from the runway. It probably represents the 1946 tsunami out-flow deposit, since the runway is located c. 150 m south. The lower boundary of Layer I is distinct and wavy. Layer II is a pocket of light gray unconsolidated clean beach sand, and likely represents a tsunami in-flow deposit from a different phase of the tsunami event that deposited the Layer I material. In the center of the trench, Layer II underlies Layer I and cuts Layer III. Layer III also underlies Layer I and consists of a truncated and discontinuous 12 cm deposit of 100% limestone aggregate, representing secondarily deposited fill associated with the WW II revetment area. Layers I, II and III overlie Layer IV in different parts of the trench. All three of the upper layers sealed, but probably also truncated the upper surface of Layer IV. Layer IV consists of 30-42 cm of very dark grayish brown very fine friable sandy clay loam containing 60% limestone gravel, pebble and cobble inclusions and waterworn marine shells. Cultural materials recovered from Layer IV consist of marine shells (*Cypraea*, *Nerita picea*, Mytilidae), urchin and crustacean exoskeleton fragments, a probable *Canis* bone fragment, a burned *kukui* nutshell fragment and charred wood fragments (Acc. 22.001-22.010; **Appendix D**). Layer IV overlies Layer V, an intact alluvial deposit consisting of 17 cm of pinkish gray very compacted silty clay overlying weathering residual limestone.

In BT-D-14-2 the subsurface cultural deposit associated with Site 7291 underlies 60 cm of upper deposits (*Figure 131*). Layer I consists of 10 cm of loose sandy clay loam and duff and overlies Layer II, which consists of 50 cm of compacted clay fill containing 30% limestone gravel, pebbles and cobbles. The fill deposit either represents tsunami-displaced sediments containing limestone aggregate from the revetment area north of the Kahuku Army Airfield runway, or intact WW II deposited fill; the uncertainty results from the percentage of aggregate, which in



Layer I - Dark grayish brown (10YR 4/2) loose very sandy loam; Marston matting from runway

Layer II - Light gray (10YR 7/2) unconsolidated clean beach sand; No cultural remains

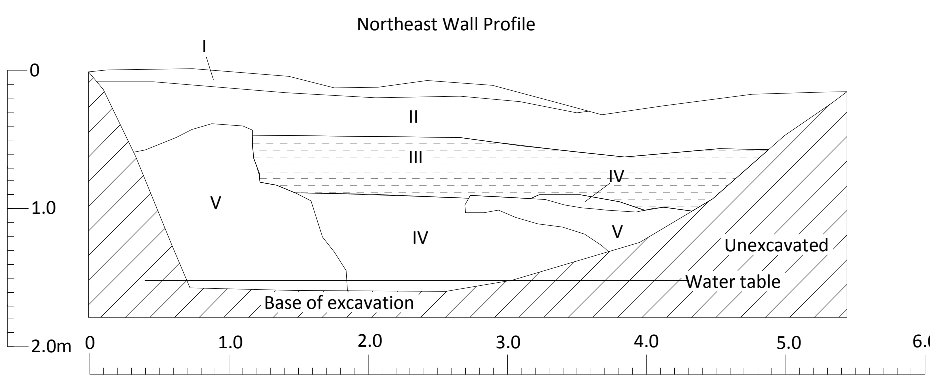
Layer III - Very pale brown (10YR 7/3) to pale brown (10YR 6/3) compact crushed limestone fill; 100% aggregate

Layer IV - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; Site 7291 cultural deposit (Marine shells, urchin, crab, Canis bone, kukui nutshell, charcoal)

Layer V - Pinkish gray (7.5YR 6/2) very compacted alluvial silty clay; No cultural remains

Layer VI - White (10YR 8/1) weathered limestone; No cultural remains

Figure 130. Site 7291 subsurface deposit in BT-D-13-3



Layer I - Brown (10YR 5/3) loose sandy clay loam with humus; No cultural remains

Layer II - Strong brown (7.5YR 4/6) compacted clay fill; Limestone aggregate

Layer III - Black (7.5YR 2.5/1)very fine friable clay loam; Site 7291 cultural deposit (Marine shells, fishbone and charcoal)

Layer IV - Light brown (7.5YR 6/3) and grayish brown (10YR 5/2) massive clay; No cultural remains

Layer V - White (10YR 8/1) weathered limestone; No cultural remains

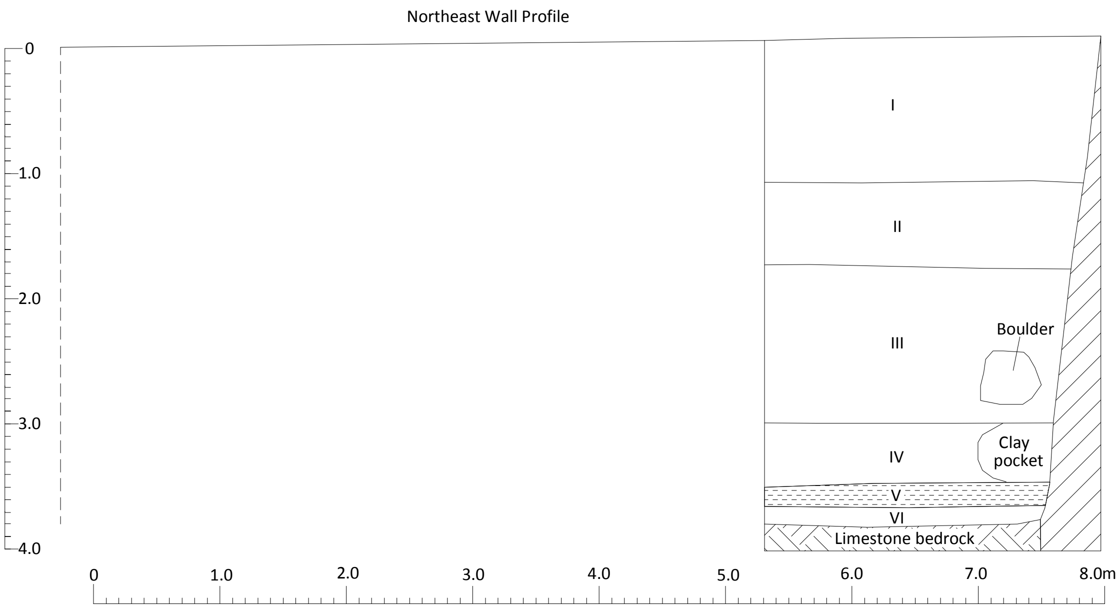
Figure 131. Site 7291 subsurface deposit in BT-D-14-2

Layer II is significantly less compared to other intact WW II fill secondary deposits. Layer II overlies the limestone substrate at the south end of the trench and overlies Layer III across the rest of the trench. Layer III is an intact cultural deposit, possibly truncated at the interface with Layer II, characterized by 28-50 cm of black carbon-stained very fine friable clay loam containing 30% limestone gravel and pebble inclusions. Cultural materials recovered from Layer III consist of marine shells (*Conus pennaceus, Cypraea caputserpentis*, unidentified shell fragments), a fish cranial bone and fragments of charred wood (Acc. 23.001 -23.005; **Appendix D**). Layer III overlies the limestone substrate and Layer IV, a 60+ cm alluvial deposit of massive clay that fills a void in the limestone.

In BT-D-14-3 the subsurface cultural deposit associated with Site 7291 underlies 3.53 m of tsunami-deposited sediments (*Figure 132*). Layer I is a 1.14 m deposit of pale brown and dark grayish brown coarse, compacted loamy sand containing 50% limestone gravel, pebble and cobble inclusions; its lower boundary is indistinct due to stepping the trench to permit access for documentation, and it is uncertain whether this deposit represents redeposited fill, an intact storm surge deposit, or an intact tsunami draw back deposit. Layer II consists of 66 cm of banded pale brown and dark grayish brown coarse, compacted loamy sand containing 50% limestone gravel, pebble and cobble inclusions; it is essentially similar to the overlying Layer I deposit, excepted that it is banded, representing episodic deposition and is probably an intact storm surge or tsunami deposit. Layer III is characterized by 1.23 m of grayish brown and dark grayish brown very fine friable sandy clay loam with 50-60% limestone gravel, pebble, cobble and boulder inclusions; this is unmistakably an intact tsunami deposit and probably represents material deposited during the drain back phase of the event. Layer III overlies Layer IV, which consists of 50 cm of very pale brown unconsolidated beach sand with pockets of dark grayish brown massive clay containing 40% limestone gravel and pebble inclusions; this probably represents the intact tsunami inundation phase of the event. Layer IV overlies Layer V, which is the prehistoric cultural deposit and Layer IV probably truncates the upper surface of Layer V, which is exposed at 3.53 m bgs. Layer V is characterized by 13 cm of an intact deposit of black carbon-stained loam containing sparse limestone gravel. Cultural materials recovered from Layer V consist of marine shells (*Conus* sp., *Nerita picea*, Mytilidae, *Tellina palatam*), urchin spines, urchin and crustacean exoskeleton fragments, a waterworn coral pebble and a fragment of charred wood (Acc. 23.006- 23.015; **Appendix D**). Layer V overlies Layer VI, characterized by a 14 cm intact alluvial deposit of dark grayish brown very fine friable sandy clay loam that overlies the limestone substrate.

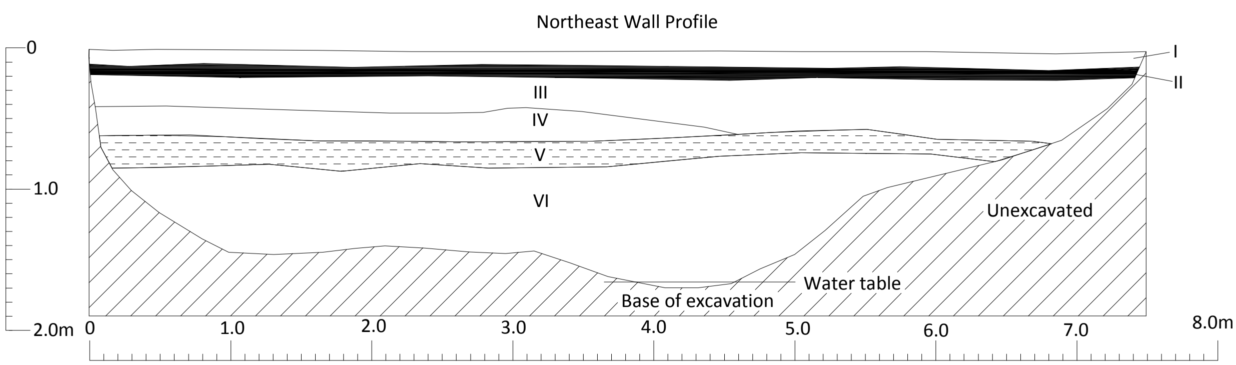
In BT-D-15-3 the subsurface cultural deposit associated with Site 7291 underlies 50-60 cm of upper layer deposits (*Figure 133*). Layer I is redeposited fill from golf course construction characterized by 10-12 cm of dark reddish brown compacted clay containing sparse limestone gravel. Layer II consists of an intact asphalt pavement preserved in the revetment area north of the Kahuku Army Airfield runway. Layer III is a secondary deposit of fill used as bedding material for the pavement and consists of 24-40 cm of 100% crushed limestone aggregate. Layer III overlies Layer IV at the south end of the trench and overlies Layer V at the north end of the trench. Layer IV is a 4-20 cm aeolian deposit of compacted brown silty sand containing 10% limestone gravel and pebble inclusions and charcoal flecks; the deposit represents the intact leading edge of the leeward side of the back beach dunal deposit. Layer IV overlies the cultural deposit Layer V across much of the trench. The upper surface of Layer V possibly was truncated by deposition of the Layer III pavement bedding, depending on whether the surface was graded prior to fill deposition. Layer V is an intact alluvial deposit characterized by 12-20 cm of compacted black carbon-stained sandy clay loam. Cultural remains recovered from Layer V consist of marine shells (*Conus* sp. and *Nerita picea*; Acc. 24.001- 24.002; **Appendix D**) and pencil urchin spine (not collected). Layer V overlies 54-92 cm of Layer VI residual decomposing limestone substrate.

Intact subsurface prehistoric cultural deposits associated with Site 7291 were identified in 5 trenches (BT-D-12-2, D-13-3, -D-14-2, -D-14-3, -D-15-3) and the areal extent of the subsurface is estimated to encompass c. 10,151 sq m. Intact subsurface cultural deposits also are potentially preserved on the seaward side of Test Area D where the poorly documented subsurface cultural deposits in Site 6411, Feature C were noted (Corbin 2003). A single cultural deposit was encountered in all five trenches, varying in depth generally from 50-75 cm bgs. The exception is the cultural deposit encountered in BT-D-14-3, where 3.53 m of tsunami deposited layers overlie the cultural deposit, and potentially indicate the former location of a pit or channel that was filled during the 1946 tsunami. Only one trench (BT-D-15-3) contained a shallow deposit of Jaucus Sand, which overlies the cultural deposit. All of the subsurface cultural deposits in Site 7291 are intact, but most show at least minor truncation of the upper



Layer I - Pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) coarse loamy sand; No cultural remains
Layer II - Pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) coarse banded, wavy interbedded loamy sand; No cultural remains
Layer III - Grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains
Layer IV - Very pale brown (10YR 7/3) unconsolidated beach sand and dark grayish brown (10YR 4/2) clay pockets; No cultural remains
Layer V - Black (7.5YR 2.5/1) compacted carbon rich loam; Site 7291 cultural deposit (Marine shells, urchin, crab, charcoal, coral)
Layer VI - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Figure 132. Site 7291 subsurface deposit in BT-D-14-3



Layer I - Dark reddish brown (5YR 3/3) compacted clay fill; No cultural remains
Layer II - Black (10YR 2/1) intact asphalt layer; Intact pavement in Site 7275 revetment area
Layer III - Very pale brown (10YR 7/3) compacted crushed limestone fill; 100% aggregate
Layer IV - Brown (10YR 4/3 to 10YR 5/3) compacted silty sand; No cultural remains
Layer V - Black (7.5YR 2.5/1) compacted sandy clay loam; Site 7291 cultural deposit (Marine shells and urchin)
Layer VI - Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure 133. Site 7291 subsurface deposit in BT-D-15-3

boundary. Cultural material was recovered from the deposits during trench facing for documentation and no excavation was undertaken; other than coral manuports, cultural materials consist of subsistence debris. Site 7291 is interpreted as a prehistoric habitation site. The site is in good condition, with most cultural layers having been sealed by tsunami or Kahuku Army Airfield deposits, and retains substantial physical integrity.

Figure 134 shows the maximum excavated depths attained in the Test Area D trenches. Trenches located along the transects from D-0 through D-6 at the southwest end of Test Area D encountered the water table before exposing the underlying limestone substrate. North of transect D-6, the limestone substrate was encountered more consistently before encountering the water table. Sediment accumulation overlying the limestone substrate or water table is differentially deepest on the seaward side and differentially shallowest at the north end. The very deep deposits in BT-D-14-3, located at the north end of Test Area D, potentially result from a WW II-excavated channel or pit, inferred from the unusual depth of the deposits there, where 3.8 m of deposition, the majority of it tsunami-related, overlies the limestone substrate.

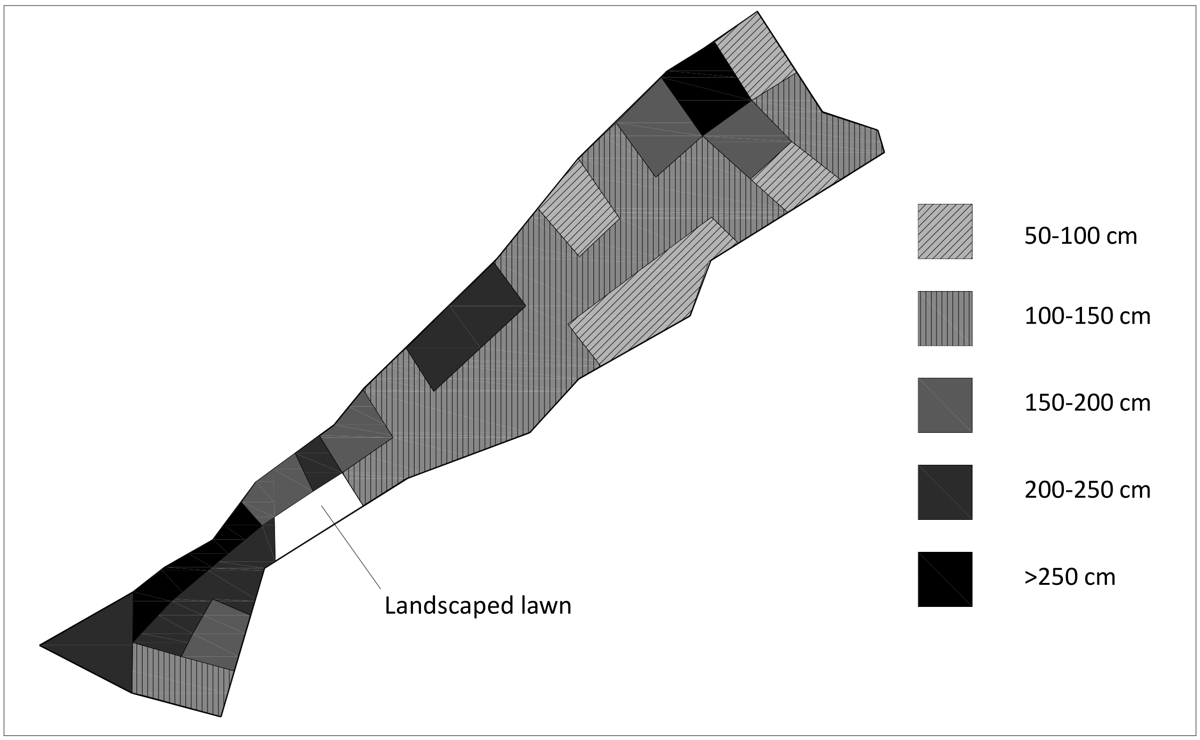


Figure 134. Test Area D trenches – maximum depths

Figure 135 illustrates deposit types by layer. The uplifted limestone reef substrate is bedrock throughout this area, but nearly half of the trenches encountered the water table before reaching the limestone substrate. Deep deposits of aeolian sand were encountered across the south end of Test Area D (BT-D-0-1 through D-4-1). Cultural deposits are associated with the aeolian sand deposits in the south half of Test Area D. Alluvium probably covered most of the limestone substrate in the central and northern sections of Test Area D; however, reconstructing the stratigraphic development of this area is complicated by extensive modification resulting from construction of the Kahuku Army Airfield facilities. Alluvium once formed a stable surface north of the dunal deposits, as indicated by buried A horizons and cultural alluvial deposits in the central and northernmost portions of the area. Marine-deposited sand from seasonal storms and tsunami deposits, are evident along seaward side of Test Area D, in some cases pre-dating, but in most cases postdating airfield fill and asphalt pavement deposits.

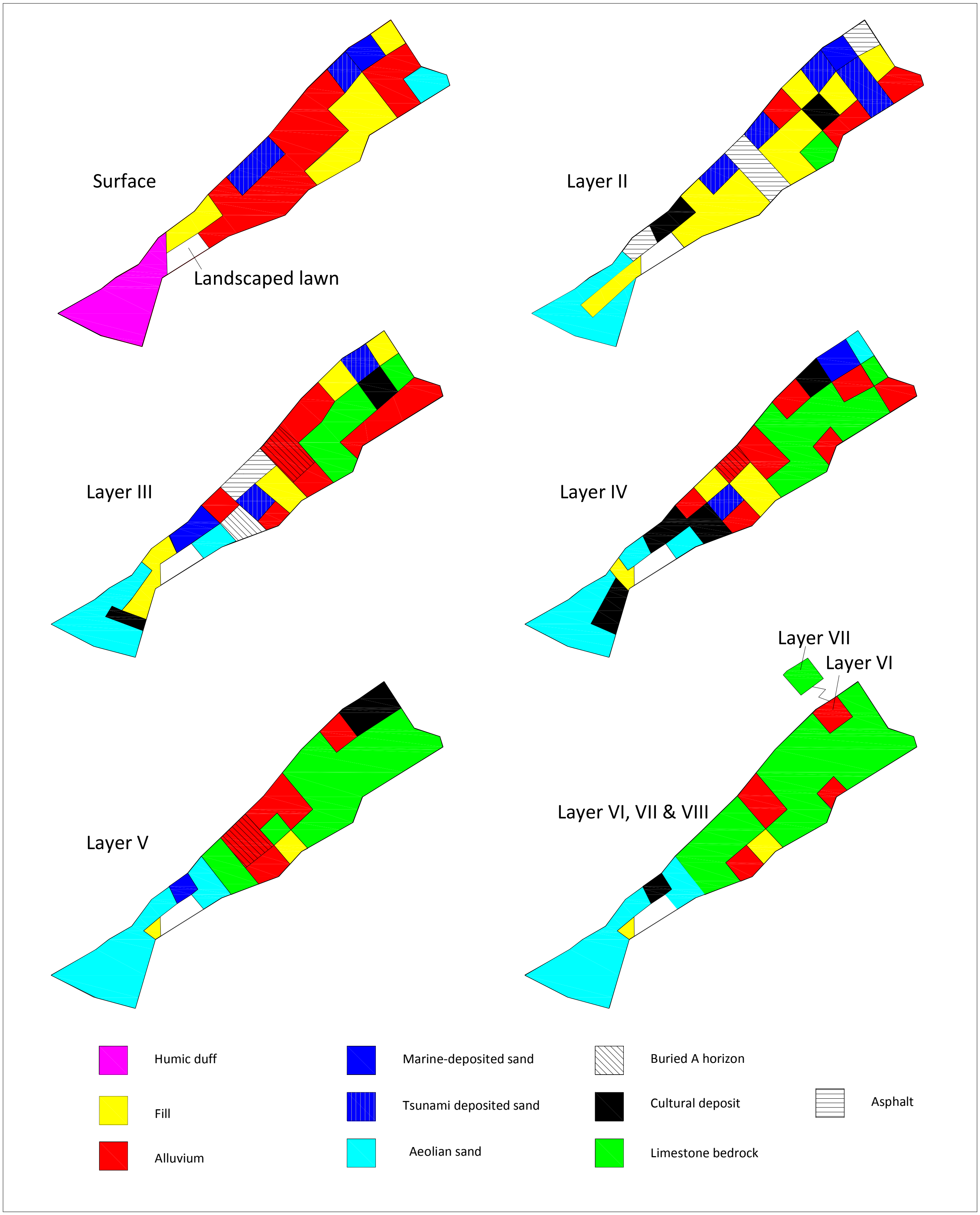


Figure 135. Test Area D deposit types by layer

Figure 136 is the first of three stratigraphic profiles (profile 1) and illustrates a composite *mauka-makai* transect through the south portion of Test Area D. The *mauka* end of Profile 1 shows a partially truncated portion of the Site 7289 cultural deposit at the interface of intact aeolian sand deposits; aeolian deposition continues to below the water table in BT-D-2-1. The *makai* profiles showing BT-D-2-1c and D-2-2 show the inland slope of the dunal ridge that parallels the shoreline. The profile also illustrates the distance between the Site 7289 subsurface cultural deposit and the back beach dune. Calcium carbonate precipitate layers in the dune crest deposit (BT-D-2-2) and the leeward dunal deposit (BT-D-2-1c) indicate episodic seawater inundation events, whether from seasonal storms or tsunami episodes. Corresponding calcium carbonate lenses were observed in Layer IV in BT-D-2-1.

Figure 137 is the second of three stratigraphic profiles (profile 2) and illustrates a composite *mauka-makai* transect across the central portion of Test Area D. Profile 2 shows the extensive, World War II-era asphalt pavement and fill deposits for pavement bedding associated with the Kahuku Army Airfield (Site 7275) runway and revetment area north of the runway. On the inland side of the composite transect, BT-D-9-1 is probably located on the runway; the asphalt runway pavement overlies three layers of fill that are increasingly coarse with depth and that extend below the water table; the basal course of fill in this profile is composed largely of limestone boulders. The central trench (BT-D-9-2) is located in the revetment area north of the runway and shows the asphalt pavement constructed over two layers of fill that are increasingly coarse with depth; these deposits overlie alluvial clay that extends below the water table. The seaward trench (BT-D-9-3) is also located in the revetment area north of the runway, but here a tsunami drain back deposit (Layer I) dumped its sediment load on top of the asphalt pavement, losing sediment at a significant rate with proximity to the sea. “Drain back” is the term Keating (2008:160) uses to describe the tsunami out flow(s) and which is the depositional mechanism in tsunami events; the inundation phase is a largely erosional mechanism. A single fill bedding deposit underlies the asphalt pavement depicted in the seaward trench, which overlies a buried alluvium A horizon (Layer IV) formed over alluvial clay (Layer V). The buried A horizon represents soil of the former ground surface that was covered by fill, in contrast to the alluvial clay deposit (Layer V) in BT-D-9-2 that probably was graded prior to filling as implied by the absence of an A horizon and the presence of additional fill.

Figure 138 is the third of three stratigraphic profiles (profile 3) and illustrates a composite *mauka-makai* transect across the north end of Test Area D, in the revetment area north of the Airfield runway. It includes BT-D-14-2 and D-14-3 where the Site 7291 subsurface cultural deposits were identified. The inland trench (BT-D-14-1) shows Layer II as a probable tsunami deposit (less possible as an Airfield fill deposit) overlying intact alluvium on the limestone substrate. BT-D-14-2 shows a probable tsunami deposit (less possible as an Airfield fill deposit) overlying an intact cultural deposit overlying alluvial clay formed on the limestone substrate. The seaward trench, BT-D-14-3, shows a 3.53 m deposit of episodic tsunami deposits in a channel, trench or pit, overlying an intact cultural deposit; the Layer V cultural deposit overlies 15 cm of alluvium formed on the limestone substrate.

Test Area D is located on the east side of Kaihalulu Bay inland of the shoreline sand dunes. The terrain varies in elevation from c. 4 ft to 16 ft. The southwest end of Test Area D contains aeolian sand deposits to depths exceeding 2.8 m above the water table. The northeastern two-thirds of Test Area D contain c. 0.1 to 3.8 m of tsunami deposits overlying alluvial deposition, formed on tropical peat or the limestone substrate. The absence of surface sites in Test Area D can be attributed to widespread land modification associated with the Kahuku Army Airfield and the destructive effects of the 1946 and 1957 tsunami. Subsurface cultural deposits were identified between 1988-1992 on the north side of Area D at Site 6411-Feature C and Site 6419. SAIS fieldwork identified stratified subsurface prehistoric habitation deposits, including an adult burial, in association with the aeolian deposition at the south end of Test Area D. These deposits are exposed from 0.30 to 0.80 m bgs at Site 7289. Intact stratified subsurface prehistoric habitation deposits were also documented in alluvial deposits in the center of Test Area D at Site 7290 from 0.17 to 0.85 m bgs; Kahuku Army Airfield deposits (Site 7275) seal the underlying prehistoric deposits. Similarly, widespread subsurface prehistoric habitation deposits were documented at the north end of Test Area D, where Site 7291 is preserved from 0.38 to 3.53 m bgs in association with alluvial deposition and sealed by Airfield deposits or tsunami deposits. Buried alluvial A horizons that could contain subsurface cultural deposits were identified between Sites 7290 and 7291. The intact cultural deposits and buried A horizons indicate that significant subsurface cultural deposits can be anticipated across much of Test Area D.

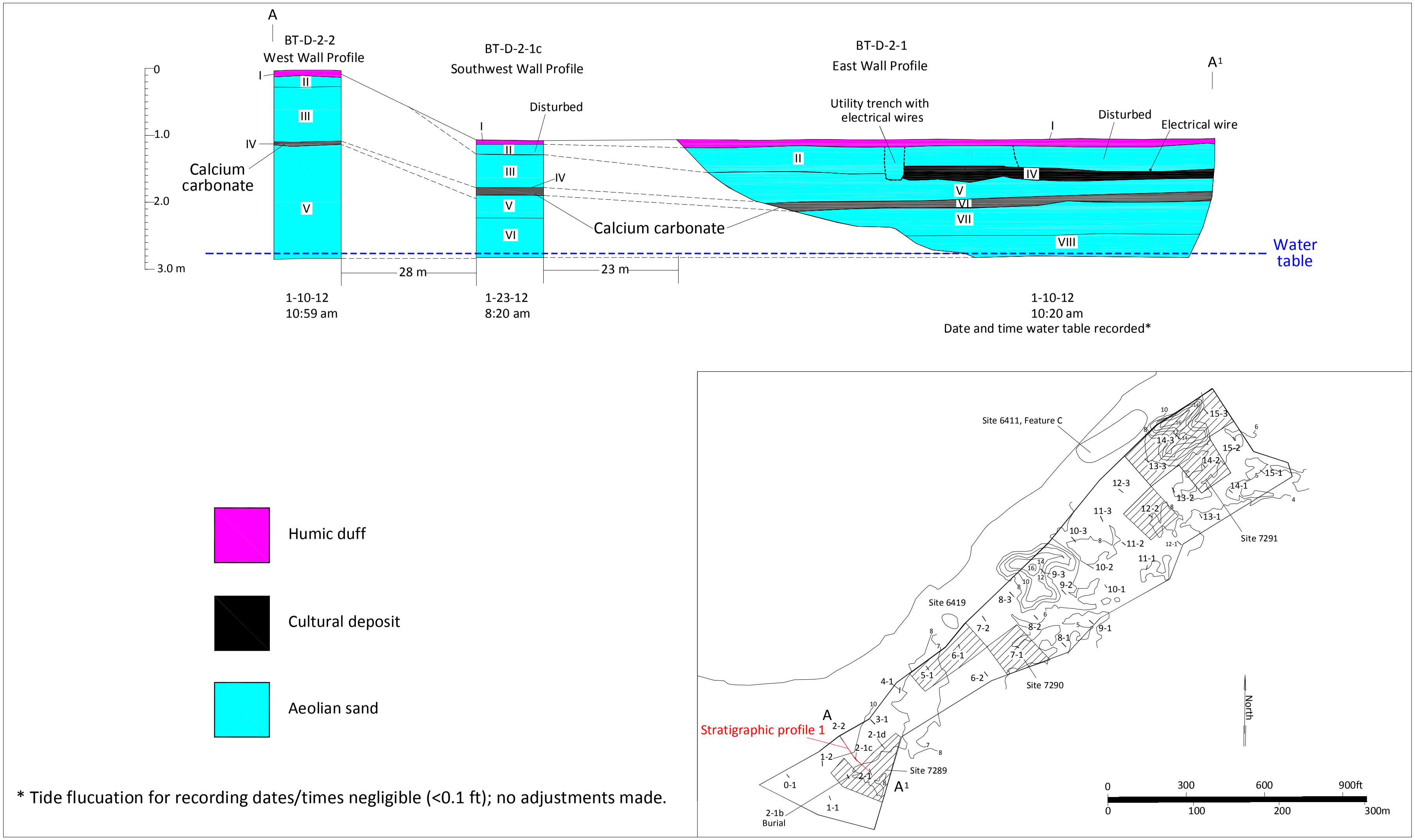


Figure 136. Test Area D stratigraphic profile 1

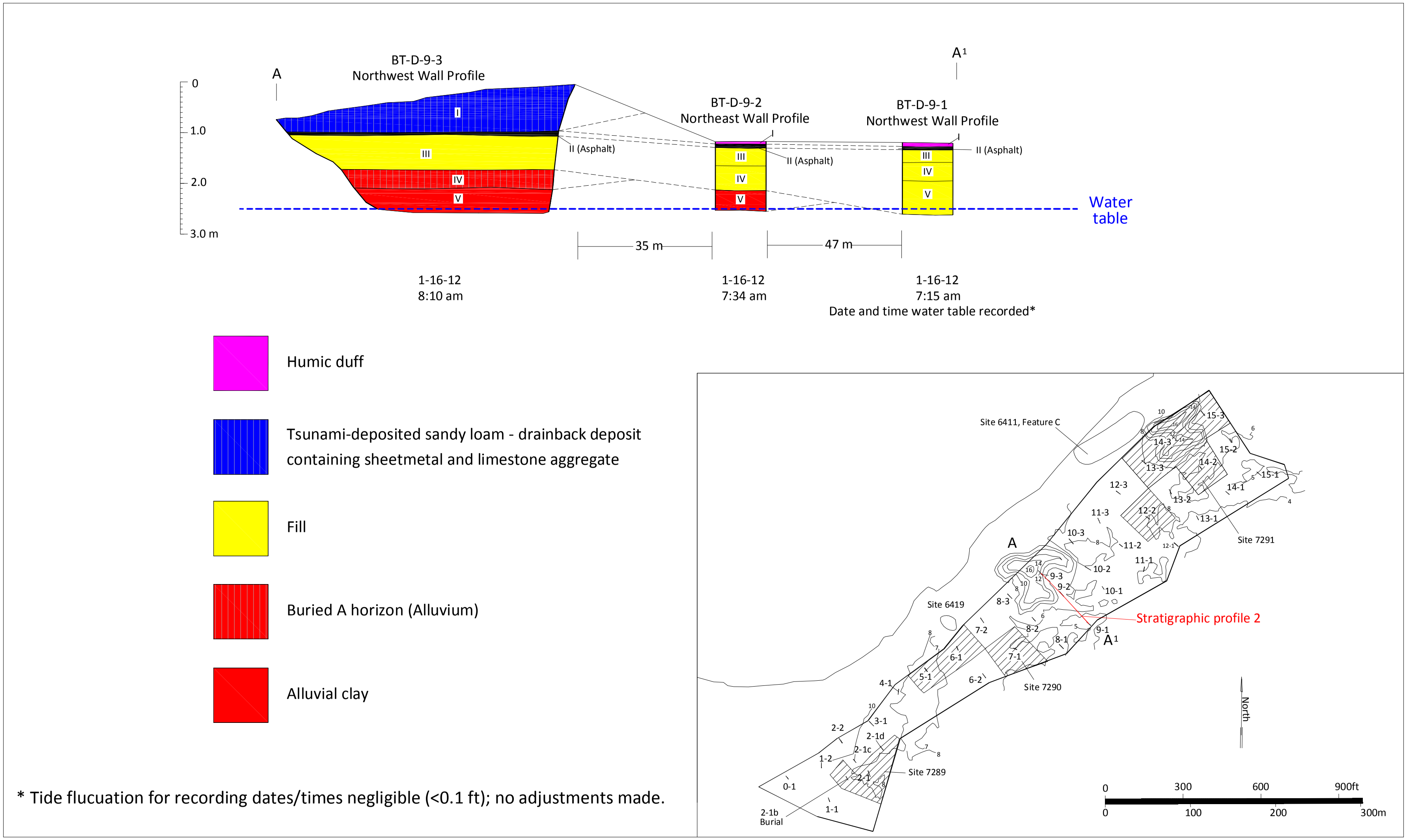


Figure 137. Test Area D stratigraphic profile 2

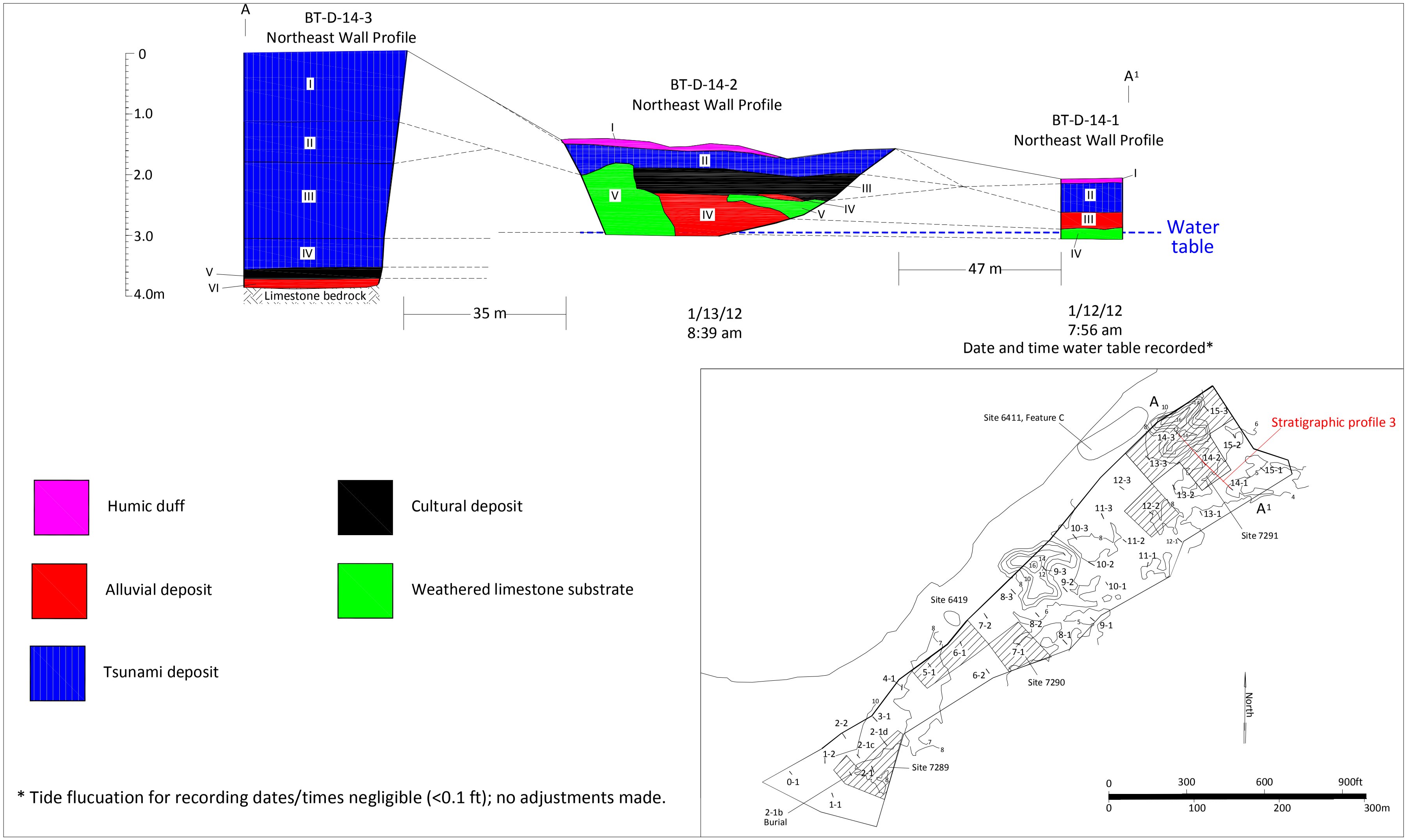


Figure 138. Test Area D stratigraphic profile 3

Test Area E

Test Area E is a relatively level, low lying ironwood and *haole koa* forest surrounded on all sides by fairways of the back nine holes of the Palmer Golf course (see *Figures 43-44*). The tree cover consists of invasive and intentionally planted species that are less than 50 years old. Punahoʻolapa Marsh is located on the west of Test Area E, on the west side of the 11th and 12th Fairways. The northwest end of Test Area E is contiguous with the southeast corner of Test Area D, which was mapped as Jaucus Sand, and the spatial distribution of soils described for Test Area E consists of Jaucus Sand covering the northwest half of the area and Pearl Harbor Clay in the southeast half (see Figure 7; Foote *et al.* 1972). The terrain is now level, having undergone extensive modification in the past when the north half was occupied by the main NW-SE runway of the Kahuku Army Airfield (Site 7275) and peripheral revetments on the south side of the runway. Barracks were formerly located at the south end and east side of Test Area E. In addition, a sod farm occupied the south end of Test Area E in the recent past. Test Area E encompasses 68.9 acres and was sampled with two trenches per acre, based on the soil map.

Testing in Area E consisted of excavating 157 trenches, of which 137 were systematically placed and 20 of which were discretionary trenches (*Figure 139*). Trenches varied in length from 3.0 to 23.0 m (average 5.8 m) and averaged 0.8 m wide. A total of 917 linear meters of trench were excavated. These excavations revealed from two to eight layers. Of the 157 trenches, 134 were excavated to a basal weathered limestone deposit, 22 were terminated at the water table, and one was terminated in an unstable layer of boulder fill. The trench profiles are illustrated in **Appendix B** (*Figures B-119* through *B-275*). The trench dimensions and detailed stratigraphic data are presented in **Appendix C**. Testing in Area E identified six subsurface prehistoric cultural deposits (Sites 7275 and 7292-7296). These sites are described below.

Site 7275 is the Kahuku Army Airfield, a large WW II-era military complex, components of which include surface features and subsurface deposits dating to 1942-1946 (see *Figure 43*). The northwest half of Test Area E was extensively modified for construction of the main NE-SW runway, which evolved over its four-year life span to include a number of poorly documented building phases. Revetments were located on the north and south sides of the runway, at the northwest end and central section of Test Area E. Barracks were formerly located at the south end of Test Area E. Widespread evidence of mass grading, followed by deposition of fill characterized by limestone aggregate, often laid down in two courses, was documented in numerous trenches across Test Area E. The WW II-era fill deposits are identified in the stratigraphic descriptions for Test Area E trenches in **Appendix C**.

Fifty-five trenches were excavated within the area encompassed by the main NE-SW runway. Intact asphalt pavement for the main NE-SW runway was located in only 18 trenches (33%), from Transect 2 through Transect 12. Runway pavement was underlain by two fill deposits composed predominantly of limestone aggregate in half of the trenches, while 8 pavement deposits were underlain by a single course of fill. In BT-E-9-4 the paved runway was constructed directly on the underlying limestone substrate. Evidence for multiple runway construction phases was encountered in BT-E-4-2b, where the surface pavement overlies a single base course of limestone aggregate fill, which overlies a truncated section of intact pavement also constructed on a single course of limestone aggregate fill.

In addition, 25 trenches from Transect 4 through Transect 13 contained runway base course fill deposits, but lacked the capping pavement. Twelve trenches documented two runway fill deposits with no overlying pavement, while 13 contained a single runway fill deposit with no associated pavement. Limestone aggregate fill deposits associated with the runway shoulders and in the areas of revetments north and south of the runway were encountered in 17 trenches along Transects 2-3 and 13-16; these generally consist of a single course of fill where the limestone aggregate component is a large part but not always the dominant constituent of the matrix. In three trenches two courses of fill were documented. In BT-E-13-8 asphalt pavement overlies the pulverized limestone substrate in the revetment area south of the runway, and might represent a section of paved road. Along Transects 16-17 in the area between the revetments and the barracks, 5 trenches documented single fill deposits associated with airfield infrastructure. At the very south end of Test Area E two trenches in Transect 21 encountered fill deposits in the barracks area both consisting of two courses of limestone aggregate fill.

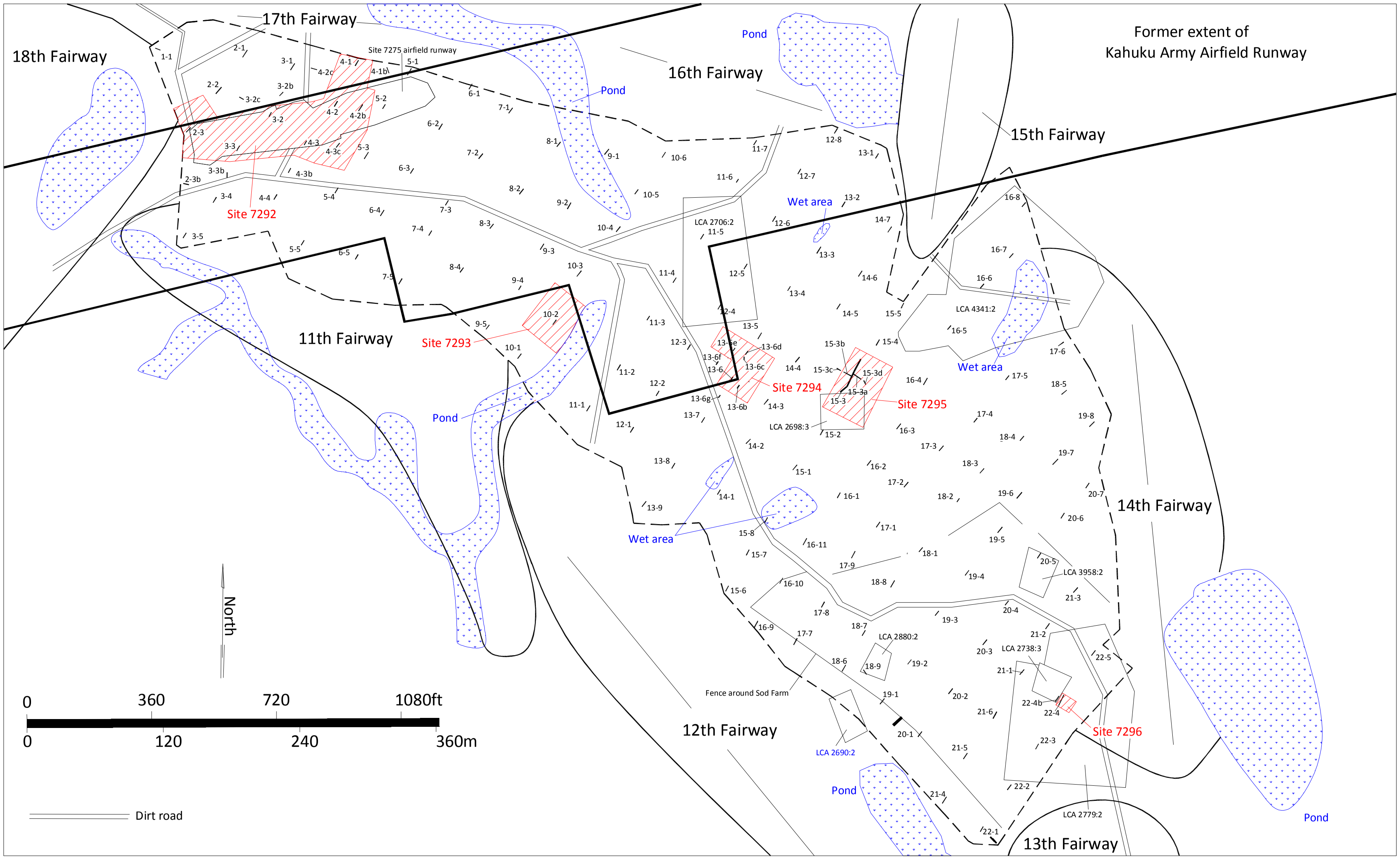


Figure 139. Location of sites and trenches in Test Area E

It is unknown whether the 1946 tsunami stripped the pavement surface from the runway or whether it was removed in the course of periodic vegetation clearing associated with post-military use. A portion of the north side of the runway was used for civilian aviation after the war and the runway was also used for automobile racing. Push piles of debris were noted on and peripheral to the runway and along roads, indicating use of heavy earth-moving equipment. Mass grading associated with subsequent golf course development occurred along the edges of Test Area E and in the area encompassed by the sod farm. There is extensive evidence of fill deposits associated with golf course, road and sod farm construction but little to no evidence of intact tsunami deposits in Test Area E. Concrete blocks dated 1933 and associated with the Marconi Station are preserved in place at Site 7282 and 7279 on the east side of Area E, between the revetments and the barracks. Likewise, the concrete structure at Site 7278 is intact at the entrance to the sod farm, and the concrete slab at Site 7277 is also intact and flush with the ground surface between the 14th and 15th Fairways, indicating that at least some portions of Test Area E are relatively undisturbed and not covered by tsunami debris.

A large historic trash pit was encountered in BT-E-18-1 at the entrance to the former sod farm in the area between the revetments on the south side of the runway and the barracks at the south end of Test Area E. The trash pit underlies two surface deposits of fill (Layers I and II) and is 3.4 m wide and 1.0 m deep, composed of three layers of historic debris (see *Figure B-240* in **Appendix B**). WW II-era debris in the upper layer consists of beverage bottle glass and charred wood. The basal deposit contains porcelain, nails, and burned milled lumber that potentially represent Plantation-era debris. The trash pit containing WW II-era debris could be evidence of post-1946 clean up of this area.

A large section of the former location of the Airfield runway coincides with the northwest half of Test Area E. Specific identification of Airfield features, such as the runway, were made whenever possible, but none of the Airfield modifications documented in Test Area E were assigned specific feature numbers or separate site numbers, and all were treated as elements of Site 7275. Pavements even in the area formerly occupied by the runway could represent taxiways or other specific subfeatures of the runway. Limestone fill deposits were identified as runway base courses when located within the area encompassed by the runway, but other aggregate deposits could represent runway shoulders, gravel roads, revetment construction material, or locations where the overlying asphalt was stripped away by the 1946 tsunami. Aerial photos of the 1946 tsunami aftermath clearly show the effects to the Airfield would have included Test Area E, but little evidence of identifiable intact tsunami deposits were encountered.

Land Commission Awards in Test Area E, previously discussed under the Surface Survey section of this report identified eight historic period parcels. Trenches were excavated in seven of the eight LCAs during subsurface testing of Area E. LCA 2690:2, awarded to Luiki (Luihi), is located on the west periphery of Area E and was not tested. The locations of three LCAs coincide with subsurface prehistoric cultural deposits identified during trenching. LCA 2698:3, awarded to Waanui and listed in the Waihona ʻAina database (2000) as "open flat lands", partially overlies Site 7295, documented in four trenches. No subsurface cultural deposits were encountered in the vicinity of LCA 2706:2, a 0.25-acre parcel awarded to Holoaia for a house lot, but the Site 7294 subsurface prehistoric cultural deposits located 15 m to the south, could indicate the actual former location of LCA 2706:2. LCA 2738:3 is a house lot of 0.25-acres awarded to Paiu; the Site 7296 subsurface prehistoric cultural deposit was documented near the southeast corner of this LCA.

Site 7292 is a subsurface prehistoric cultural deposit identified in the northwest corner of Test Area E. The cultural deposit is located primarily beneath an extant surface portion of the Kahuku Army Airfield (Site 7275) main runway, documented during the pedestrian surface survey of Test Area E. The prehistoric subsurface cultural deposit was identified in six systematically placed trenches (BT-E-2-3, E-3-2, E-3-3, E-4-1, E-4-2 and E-4-3) and in two (BT-E-4-2b, E-4-3c) discretionary trenches. Nine discretionary trenches (BT-E-2-3b, E-3-2b, E-3-2c, E-3-3b, E-4-1b, E-4-2b, E-4-2c, E-4-3, E-4-3c) were excavated adjacent to the systematically placed trenches to determine the horizontal extent of the subsurface deposit.

In BT-E-2-3 (see *Figure B-122*) the prehistoric cultural deposit underlies 86 cm of pavement and fill for the Kahuku Army Airfield runway (Layers I-III, Site 7275). Layer IV is a 5 cm cultural deposit of very dark gray and black massive alluvial clay containing sparse limestone gravel and pebble inclusions that overlies 27 cm of Layers V and VI alluvial clays formed on the limestone substrate.

In BT-E-3-2 (see *Figure B-125*) the prehistoric cultural deposit underlies 56 cm of pavement and fill for the Kahuku Army Airfield runway (Layers I-III, Site 7275). Layer IV is a 8 cm cultural deposit of black very fine friable alluvial sandy clay loam containing 30% limestone gravel and pebble inclusions that overlies 28 cm of Layer V aeolian silty sand formed on the limestone substrate. Cultural materials recovered from Layer IV consist of a *Cypraea* shell (Acc. 25.001; **Appendix D**); basalt debitage was noted in the deposit but not collected.

In BT-E-3-3 (see *Figure B-128*) the prehistoric cultural deposit underlies 43 cm of pavement and fill for the Kahuku Army Airfield runway (Layers I-III, Site 7275). Layer IVa is a 16 cm cultural deposit of very dark gray and dark gray moderately compacted alluvial clay loam containing 20% limestone gravel and pebble inclusions that overlies 8 cm of Layer IVb, which is differentiated from Layer IVa by color, texture and inclusion content. Layer IVb is a cultural deposit of black very compacted carbon-stained alluvial clay containing sparse limestone gravel and pebble inclusions. The Layer IV cultural deposits overlie 18 cm of alluvial clay formed on the limestone substrate.

In BT-E-4-1 the prehistoric cultural deposit underlies 29 cm of Layer I humic duff and Layer II intact alluvial sandy clay loam (*Figure 140*). Layer III is a 10 cm cultural deposit of mottled very dark grayish brown and dark brown compacted alluvial charcoal-flecked clay loam containing 10% limestone gravel and pebble inclusions that overlies the limestone substrate.

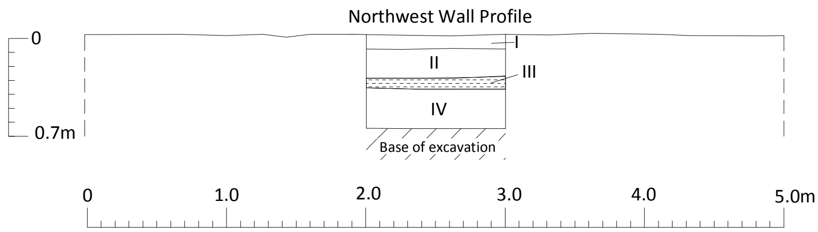
In BT-E-4-2 (see *Figure B-134*) the prehistoric cultural deposit underlies 49 cm of pavement and fill for the Kahuku Army Airfield runway (Layers I-III, Site 7275). Layer IV is a 14 cm cultural deposit of very dark gray very fine friable alluvial sandy clay loam containing 10% limestone gravel inclusions and waterworn marine shells that overlies 8 cm of Layer V alluvial sandy clay loam formed on the limestone substrate and terrigenous clay that fills a void in the substrate. Cultural materials recovered from Layer IV consist of marine shell (*Nerita picea*) and fragments of charred wood (Acc. 26.001- 26.003; **Appendix D**).

In BT-E-4-2b the prehistoric cultural deposit underlies 50 cm of pavement and fill for two construction phases of the Kahuku Army Airfield runway (Layers I-IV, Site 7275; *Figure 141*). Layer V is a 15 cm cultural deposit of very dark gray and black fine friable alluvial clay loam containing 20% limestone gravel and pebble inclusions that overlies the limestone substrate and the underlying terrigenous clay that fills a void in the substrate. Cultural material associated with Layer V consists of fragments of charred wood, which were not collected.

In BT-E-4-3 (see *Figure B-138*) the prehistoric cultural deposit underlies 29 cm of pavement and fill for the Kahuku Army Airfield runway (Layers I-III, Site 7275). Layer IV is a 5 cm cultural deposit of dark grayish brown very fine friable alluvial sandy clay loam containing 10% limestone gravel and pebble inclusions that overlies the fissured and weathered limestone substrate. Charred wood fragments noted in Layer IV but were not collected. Cultural material recovered from Layer IV consists of a *Cypraea caputserpentis* shell (Acc. 27.001; **Appendix D**).

In BT-E-4-3c (see *Figure B-139*) the prehistoric cultural deposit underlies 50 cm of recent duff and 100% limestone fill for the Kahuku Army Airfield runway (Layers I-II; Layer II is Site 7275). Layer III is a 44 cm cultural deposit of very dark gray and dark gray fine friable crumb alluvial clay loam containing 20% limestone gravel and pebble inclusions that overlies 35+ cm of Layer IV massive alluvial clay. Charred wood fragments were noted in association with Layer III, but were not collected.

The subsurface prehistoric cultural deposits associated with Site 7292 cover an estimated area of approximately 8,193 sq m. Only BT-E-4-1 encountered intact alluvial deposits not sealed or truncated by overlying WW II runway deposits. The deposits are preserved beneath 29-86 cm of overlying deposition, indicating a much more varied topography than is characteristic of the extensively modified surface of today. Most of the prehistoric cultural deposits vary in thickness from 5 to 20 cm. One trench (BT-E-3-3) encountered a 24 cm thick cultural deposit, the



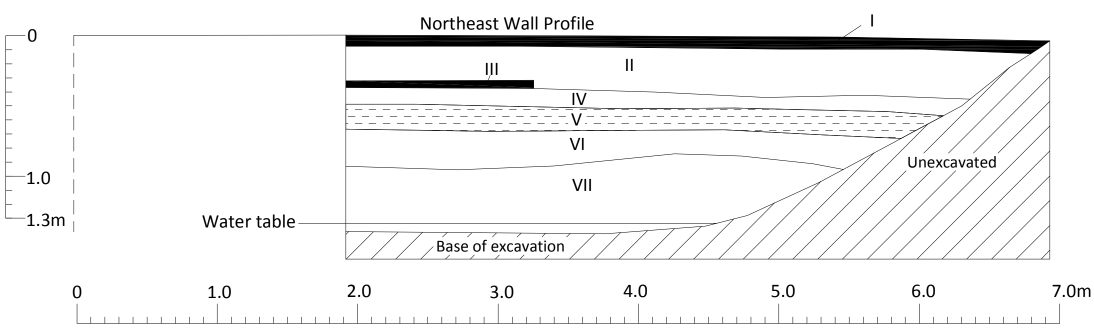
Layer I - Black (10YR 2/1) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) loose sandy clay loam; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) and dark brown (7.5YR 3/4) compacted clay loam; Site 7292 cultural layer (charcoal flecks)

Layer IV - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure 140. Site 7292 subsurface deposit in BT-E-4-1



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Dark yellowish brown (10YR 4/4) fine friable clay; 90% limestone aggregate

Layer III - Black (10YR 2/1) intact asphalt layer (Site 7275 runway)

Layer IV - White (10YR 8/1) compacted limestone fill; 100% limestone aggregate

Layer V - Very dark gray (10YR 3/1) and black (10YR 2/1) fine friable clay loam; Site 7292 cultural deposit (charcoal)

Layer VI - White (10YR 8/1) weathered limestone; No cultural remains

Layer VII - Brown (10YR 4/3) massive clay; No cultural remains

Figure 141. Site 7292 subsurface deposit in BT-E-4-2b

upper and lower portions (Layer IVa and IVb) of which are different enough to suggest that two different episodes could be preserved. Site 7292 is interpreted as a prehistoric habitation site based on the cultural assemblage, which consists of artifacts and subsistence debris. The site is in fair to good condition, with minor truncation of the upper surface of some deposits noted. Site 7292 retains substantial physical integrity.

Site 7293 is a subsurface prehistoric cultural deposit identified in BT-E-10-2 situated in the northwestern portion of Area E, 225 m southeast of Site 7292 (*Figure 142* and *Figure B-166*). No discretionary trenching was conducted because the deposit was not encountered in other systematically placed trenches, and appears to be restricted in areal extent. A large artificial pond borders BT-E-10-2 on the southeast and it is located on the southwest edge of former location of the Kahuku Army Airfield runway (Site 7275). The subsurface cultural deposit (Layer II) underlies 40-45 cm of redeposited fill (Layer I) associated with construction of the east extension of the pond in Fairway 11. During pond construction the overlying Kahuku Army Airfield deposits associated with Site 7275 and the upper surface of the prehistoric deposit were removed during mass grading to recontour the ground surface around the pond. In BT-E-10-2 only a remnant of the prehistoric cultural deposit remains, where it overlies a depression in the limestone substrate. The basin-shaped deposit is 1.50 m long and a maximum of 14 cm thick, and consists of black to brown very fine friable clay loam and clayey sand, containing urchin, charcoal and heat-altered rock, none of which was collected. The limited horizontal extent of the deposit suggests that the associated site has largely been obliterated during construction of the golf course. Subsurface evidence of Site 7293 was encountered in only one trench. The site is estimated to encompass a maximum area of approximately 1,768 sq m; however, it is likely that its actual extent is much smaller. Site 7293 is interpreted as a prehistoric habitation site, based on the associated subsistence debris. The subsurface deposit has been truncated during late 20th Century development activities and retains limited physical integrity.

Site 7294 is a subsurface prehistoric cultural deposit located in the central portion of Area E, 115 m southeast of Site 7293, and overlaps a southern extension of the Kahuku Army Airfield runway and the revetment area south of the runway. The deposit was first identified during excavation of BT-E-13-6. Six discretionary trenches were excavated around BT-E-13-6 to determine the horizontal extent of the cultural deposit, which was encountered in four of the six trenches (BT-E-13-6b, E-13-6c, E-13-6d, E-13-6e).

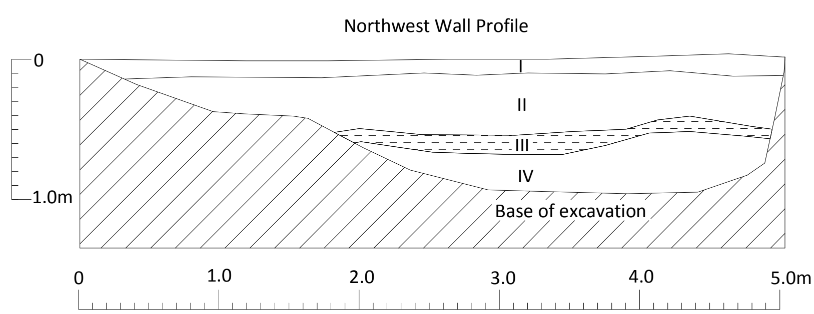
In BT-E-13-6 (*Figure 143*) the prehistoric cultural deposit underlies 50-70 cm of recent duff (Layers I) and redeposited fill associated with road construction (Layer II). Layer III is an 8-15 cm cultural deposit of black fine friable crumb alluvial loam containing 10% limestone gravel inclusions that overlies the decomposing limestone substrate and terrigenous clay that fills pockets in the substrate. Cultural materials associated with Layer III consist of fire-altered rock and flecks of charcoal that were not collected; a basalt flake, crustacean exoskeleton, and fragment of charred wood were recovered for analysis (Acc. 29.001- 29.003; **Appendix D**). The upper surface of the cultural deposit is likely to be truncated as a result of surface grading associated with road construction because the WW II-era deposits that should overlie the prehistoric cultural deposit have been completely destroyed and displaced.

In BT-E-13-6b (*Figure 144*) the prehistoric cultural deposit underlies 30-52 cm of recent duff (Layer I) and two deposits of fill for the Kahuku Army Airfield revetment area south of the main runway (Layers II-III; Site 7275). Layer IV is a 40-60 cm cultural deposit of brown very fine friable crumb alluvial clay loam containing 50% limestone gravel, pebble and cobble inclusions that overlies 17+ cm of Layer V alluvial clay and the decomposing limestone substrate. A *Theodoxus neglectus* shell was recovered from Layer IV (Acc. 30.001; **Appendix D**); charred wood fragments were noted in association with Layer IV, but were not collected.

In BT-E-13-6c (see *Figure B-193*) the prehistoric cultural deposit underlies 40 cm of Layer I humic duff and Layer II intact alluvial clay loam. Layer III is a 45 cm cultural deposit of dark grayish brown very fine friable crumb alluvial clay loam containing 20% limestone gravel, pebble and cobble inclusions that overlies the limestone substrate. Charcoal fragments were noted in Layer III but were not collected.

In BT-E-13-6d (see *Figure B-194*) the prehistoric cultural deposit underlies 40-50 cm of Layer I humic duff and Layer II intact alluvial clay loam. Layer III is an 18-20 cm cultural deposit of dark grayish brown very fine friable crumb

Figure 142. Site 7293 subsurface deposit in BT-E-10-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humic duff; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Black (10YR 2/1) fine friable loam; 7294 cultural deposit (Basalt flake, crustacean, charcoal, fire-altered rock)

Layer IV - Dark gray (10YR 4/1) to light gray (10YR 7/2) weathered limestone with clay pockets; No cultural remains

Figure 143. Site 7294 subsurface deposit in BT-E-13-6

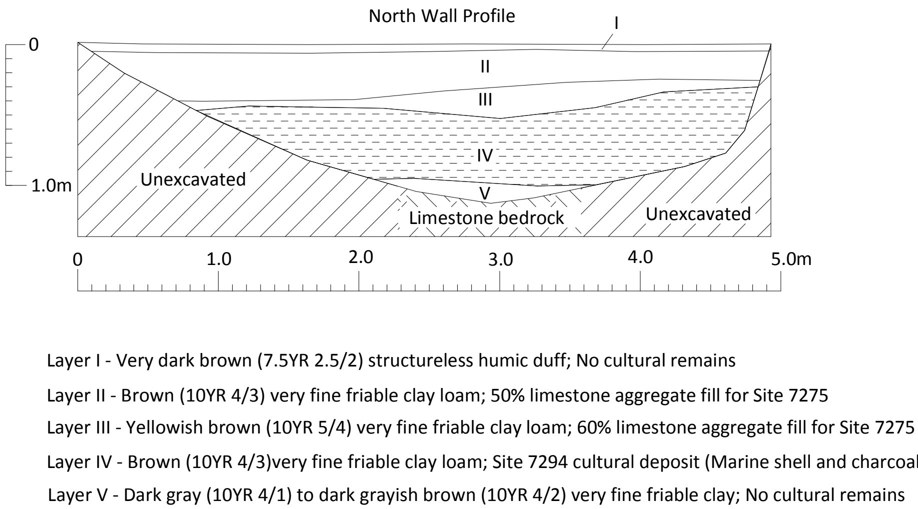


Figure 144. Site 7294 subsurface deposit in BT-E-13-6b

alluvial clay loam containing 40% weathered limestone gravel, pebble and cobble inclusions that overlies the limestone substrate. A *Cypraea caputserpentis* shell was recovered from Layer III (Acc. 31.001; **Appendix D**); charred wood fragments were noted in association with Layer III, but were not collected.

In BT-E-13-6e (see *Figure B-195*) the prehistoric cultural deposit underlies 36-44 cm of Layer I humic duff and Layer II intact alluvial clay loam. Layer III is a 10 cm cultural deposit of very dark grayish brown and dark grayish brown very fine friable crumb alluvial clay loam containing 10% limestone gravel and pebble inclusions that overlies 15-25 cm of alluvial clay formed on the limestone substrate. Very sparse charcoal flecking was noted in Layer III.

Site 7294 is estimated to encompass a subsurface areal extent of c. 1,903 sq m. The site is interpreted as a prehistoric habitation deposit, based on the limited artifact and subsistence assemblage recovered during testing. Intact deposits were identified in 5 trenches. Even though the site underlies the south edge of the Kahuku Army Airfield runway and revetment area, WW II-era fill deposits associated with Site 7275 were only encountered in BT-E-6b. The prehistoric subsurface deposits associated with Site 7294 are preserved 30-70 cm bgs and all but two deposits directly overlie the limestone substrate; two overlie alluvial clay deposits formed on the limestone substrate. The subsurface deposits are in excellent condition, with the possible exception of the deposit exposed in BT-E-13-6, the upper surface of which is probably truncated as a result of grading associated with construction of the Fairway 11 pond. The site retains substantial physical integrity.

Site 7295 is a subsurface prehistoric cultural deposit located in the central portion of Area E, 60 m southeast of Site 7294, on the northeast side of LCA 2698:3 and in the southeast quadrant of the Kahuku Army Airfield (Site 7275) area of revetments on the south side of the main runway. The subsurface cultural deposit was initially identified during excavation of BT-E-15-3, which was expanded from 5.3 m to 23 m in length to more fully expose the deposit in an east-west direction. Four discretionary trenches were excavated to determine the north-south extent of the deposit. Additional cultural deposits were encountered in three of the four trenches (BT-E-15-3a, E-5-3b, E-15-3d).

In BT-E-15-3c fill for the Kahuku Army Airfield revetment area (Layer III) overlies the limestone substrate and destroyed any prehistoric cultural deposit that might have extended northwest of the other trenches.

In BT-E-15-3 (*Figure 145*) the prehistoric cultural deposit underlies 48-84 cm of recent duff (Layer I) and two deposits of fill for the Kahuku Army Airfield revetment area south of the main runway (Layers II-III; Site 7275). Layer IV is an 8-28 cm cultural deposit of very dark grayish brown fine friable crumb alluvial slightly sandy clay loam containing 10% limestone gravel and pebble inclusions and waterworn marine shells that overlies 10-45 cm of Layer V alluvial clay and Layer VI gley at the north end of the trench and overlies the decomposing limestone substrate at the south end of the trench. A volcanic glass core, *Nerita picea* shell and fragments of charred wood were recovered from Layer IV (Acc. 32.001- 32.003; **Appendix D**).

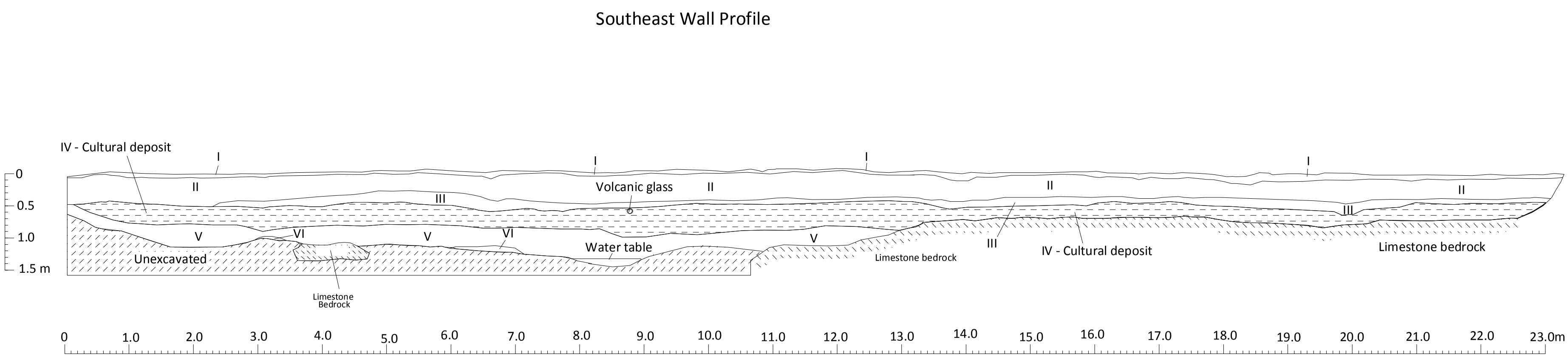
In BT-E-15-3a (see *Figure B-211*) the prehistoric cultural deposit underlies 44-52 cm of recent duff (Layer I) and two deposits of fill for the Kahuku Army Airfield revetment area south of the main runway (Layers II-III; Site 7275). Layer IV is an 8-25 cm cultural deposit of dark gray and very dark gray very fine friable alluvial clay loam containing 40% weathered limestone gravel and pebble inclusions overlying 68+ cm of Layer V alluvial clay. The water table was encountered in this trench before the limestone substrate was exposed.

In BT-E-15-3b (see *Figure B-212*) the prehistoric cultural deposit underlies 44-60 cm of recent duff (Layer I) and two deposits of fill for the Kahuku Army Airfield revetment area south of the main runway (Layers II-III; Site 7275). Layer IV is an 8-28 cm cultural deposit of dark gray and very dark gray fine friable alluvial clay loam containing very sparse charcoal flecks and 40% weathered limestone gravel and pebble inclusions overlying 60+ cm of Layer V alluvial clay on the limestone substrate.

In BT-E-15-3d (see *Figure B-214*) the prehistoric cultural deposit underlies 44-52 cm of recent duff (Layer I) and two deposits of fill for the Kahuku Army Airfield revetment area south of the main runway (Layers II-III; Site 7275). Layer IV is an 8-12 cm cultural deposit of dark gray and very dark gray very fine friable alluvial clay loam containing 40% weathered limestone gravel and pebble inclusions overlying alluvial clay at the extreme north end of the trench and the limestone substrate across most of the exposure. The upper surface and south end of the deposit was truncated by the Layer III WW II fill deposit.

Site 7295 is estimated to encompass a subsurface areal extent of c. 2,296 sq m. Site 7295 is interpreted as a prehistoric habitation deposit, based on the limited artifact and subsistence assemblage recovered during testing. Intact deposits were identified in 4 trenches. The site underlies the revetment area south of the Kahuku Army Airfield runway and WW II-era fill deposits associated with Site 7275 were encountered beneath the duff in every trench. The prehistoric subsurface deposits associated with Site 7295 are preserved 44-48 cm bgs and the deposits overlie alluvial clay or the limestone substrate. The subsurface deposits are generally in good condition, having been sealed by the overlying WW II deposits. The exception is the deposit exposed in BT-E-15-3d, where the deposit is truncated as a result of grading associated with filling the WW II revetment area. The site retains substantial physical integrity.

Site 7296 is a subsurface prehistoric cultural deposit identified in BT-E-22-4, located at the southeast end of Area E within a former sod farm (*Figures 146* and *147*). The prehistoric cultural deposit underlies 104-130 cm of recent duff (Layer I), redeposited fill associated with the sod farm (Layer II) and two deposits of fill for the Kahuku Army Airfield barracks area south of the main runway (Layers IIIa and IIIb; Site 7275). Layer IV is a 28-44 cm cultural deposit of black fine friable crumb alluvial clay loam containing 15% weathered limestone gravel and pebble inclusions and waterworn marine shells, overlying a burned and oxidized alluvial clay loam deposit formed on fissured limestone containing voids filled with terrigenous clay. A shallow basin-shaped hearth originates at the upper surface of the Layer IV cultural deposit and slightly intrudes into the upper surface of the underlying Layer V deposit. The hearth is 60 cm long and 16 cm deep. Disturbance within the overlying Layer IIIa deposit, consisting of redeposited asphalt within the matrix and concrete intruding into the upper surface of Layer IV, could be responsible for truncation of the south end of the Layer IV deposit. Cultural materials recovered from Layer IV consist of 2 basalt flakes, marine shells (*Nerita picea*, *Trochus intextus*, Mytilidae, indeterminate bivalve), urchin



Layer I - Very dark brown (10YR 2/2) structureless humic duff; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable sandy clay loam; 20% limestone aggregate for Site 7275

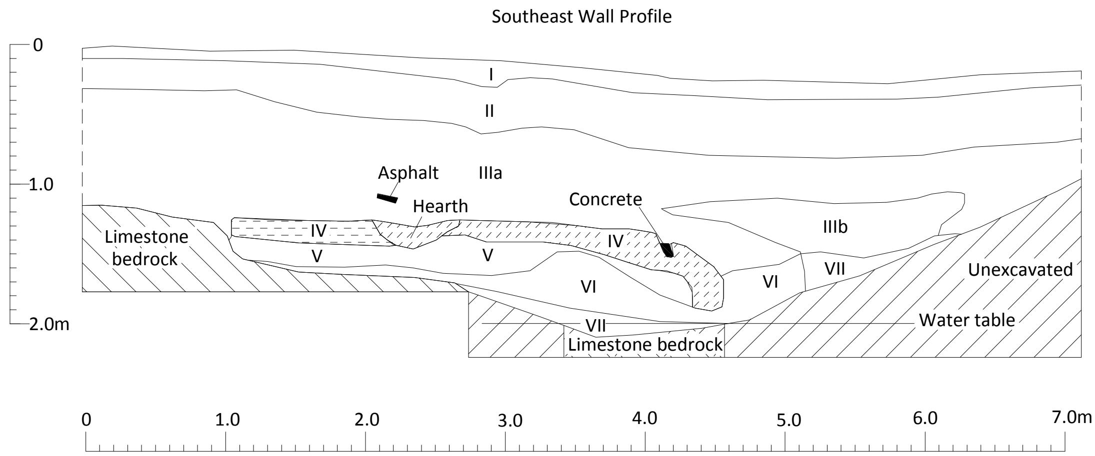
Layer III - Yellowish brown (10YR 5/4) moderately compacted silty sand; 75% limestone aggregate for Site 7275

Layer IV - Very dark grayish brown (10YR 3/2) fine friable slightly sandy clay loam; Site 7295 cultural deposit (Marine shell, volcanic glass core and charcoal)

Layer V - Brown (10YR 4/3) massive clay; No cultural remains

Layer VI - Dark grayish brown (10YR 4/2) and black (10YR 2/1) compacted saturated clay/gley; No cultural remains

Figure 145. Site 7295 subsurface deposit in BT-E-15-3



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) to dark brown (10YR 3/3) loose clay loam; Copper wire and 20% limestone aggregate for Site 7275

Layer IIIa - Dark grayish brown (10YR 4/2) to dark brown (10YR 3/3) moderately compacted clay loam; Copper wire, asphalt, concrete and 70% limestone aggregatefor Site 7275

Hearth - Black (10YR 2/1) fine friable clay loam hearth; Charcoal

Layer IIIb - Light yellowish brown (10YR 6/4) loose sand; 80% limestone aggregate for Site 7275

Layer IV - Black (7.5YR 2.5/1) fine friable clay loam; 7296 cultural deposit (Basalt flakes, marine shells, urchin, kukui nutshells and charcoal)

Layer V - Brown (7.5YR 4/4) very fine friable oxidized clay loam; No cultural remains

Layer VI - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Layer VII - Brown (10YR 5/3) non-sticky, plastic clay; No cultural remains

Figure 146. Site 7296 subsurface deposit in BT-E-22-4

Figure 147. Site 7296 subsurface deposit in BT-E-22-4

exoskeleton, a burned *kukui* nutshell fragment and abundant charred wood fragments (Acc. 33.001- 33.008; **Appendix D**).

The total excavated length of BT-E-22-4 was 10.4 m, so no discretionary trenches were located to the northeast or southwest. An attempt was made to excavate a discretionary trench to the southeast, but buried utility lines were encountered and the excavation was abandoned. A discretionary trench (BT-E-22-4b) was excavated 3.8 m to the northwest, and encountered extensive disturbance but no evidence of the Site 7296 cultural deposit. The subsurface prehistoric cultural deposit associated with Site 7296 was encountered in one trench. The subsurface areal extent of the site is estimated to encompass c. 165 sq m. Site 7296 is interpreted as a prehistoric habitation site, based on the associated hearth, associated artifacts and subsistence assemblage. The subsurface deposits are in good to fair condition, and the site retains moderate physical integrity.

Sediment stratigraphy in Test Are E differed from the pre-trenching expectations. Although Foote *et al.* (1972) indicate that Test Area E is almost evenly divided between Pearl Harbor Clay and Jaucus Sand soil series, stratigraphic data from test trench excavations indicate that Pearl Harbor Clay characterizes most of the intact sediments. The reason for the Foote *et al*. soil mapping unit discrepancy is unclear, but could be attributable to two factors. The first is that the Kahuku Army Airfield runway formerly occupied the northwest half of Test Area E, and required extensive land modifications for its construction and sand for concrete building material. The second factor could be attributed to a mapping error by Foote *et al*., if the sediment map for the area was based on aerial photographs taken after WW II, which show massive sheets of sand covering the runway in the aftermath of the 1946 tsunami.

According to Foote *et al.* (1972:112-113) Pearl Harbor Clay series soils are found on low coastal plains adjacent to the ocean. The soil series consists of poorly drained soils developed in alluvium overlying organic material. The surface layer in a representative profile is very dark gray mottled clay c. 30 cm thick. The underlying sediment is a c. 48 cm-thick layer of very dark gray and very dark grayish brown mottled clay with an angular to sub-angular blocky structure. The substratum is muck or peat at approximately the same depth as the water table. The water table is very shallow in much of Area E, especially in the central portion of the area where muddy areas and standing water are observable on the surface.

Figure 148 is the first of three stratigraphic profiles (Profile 1) and illustrates the northeast-southwest Transect 6, excavated across the northwest end of Test Area E. Profile 1 shows relatively shallow alluvial clay deposits overlying limestone bedrock in BT-E-6-2. In BT-E-6-5, the excavation was terminated at the water table in alluvial clay. Fill layers are present in all trenches. The double fill deposits in BT-E-6-1 and E-6-5 represent intact base course layers for the Kahuku Army Airfield main runway; the upper fill base course has been stripped away in BT-E-6-4, where an intact duff deposit is buried by redeposited fill unrelated to the Airfield runway. In BT-E-6-2 and E-6-3 these runway fill deposits are missing and instead are replaced with redeposited fill in which the limestone aggregate composition is significantly lower (10-20%) than the runway base courses. Two trench profiles (BT-E-6-2 and E-6-5) show fill deposits overlying intact alluvial clay deposits formed on the limestone substrate, but mass grading for runway construction mostly obliterated the underlying alluvial deposits elsewhere.

Figure 149 is the second of three stratigraphic profiles (Profile 2) and illustrates the northeast-southwest Transect 13, excavated across the center of Test Area E, including the subsurface cultural deposits of Site 7294. At the northwest end of Profile 2 in BT-3-1, fill redeposited during golf course construction overlies the limestone substrate. In BT-E-13-2 fill associated with the Airfield revetment area overlies the limestone substrate and caps a small intact deposit of alluvium, preserved in a depression in the substrate, and indicating that the surface was graded prior to deposition of the overlying WW II-era fill; terrigenous alluvial clay fills a void in the limestone substrate at the base of BT-E-13-2. In BT-E-13-3, E-13-4 and E-13-5, the percentage of limestone inclusions is so low (10-20%) that the deposits appear to represent intact alluvial deposition unmodified, except for probable truncation of the upper surfaces. In BT-E-13-6c and E-13-6d intact cultural deposits of Site 7294 are preserved beneath intact alluvial clay loam deposits, containing low percentages (10-15%) of limestone inclusions. In BT-13-6 redeposited fill from road construction overlies the cultural deposit of Site 7294, and grading prior to filling has undoubtedly truncated the upper surface of the cultural deposit; the cultural deposit, composed of alluvial loam,

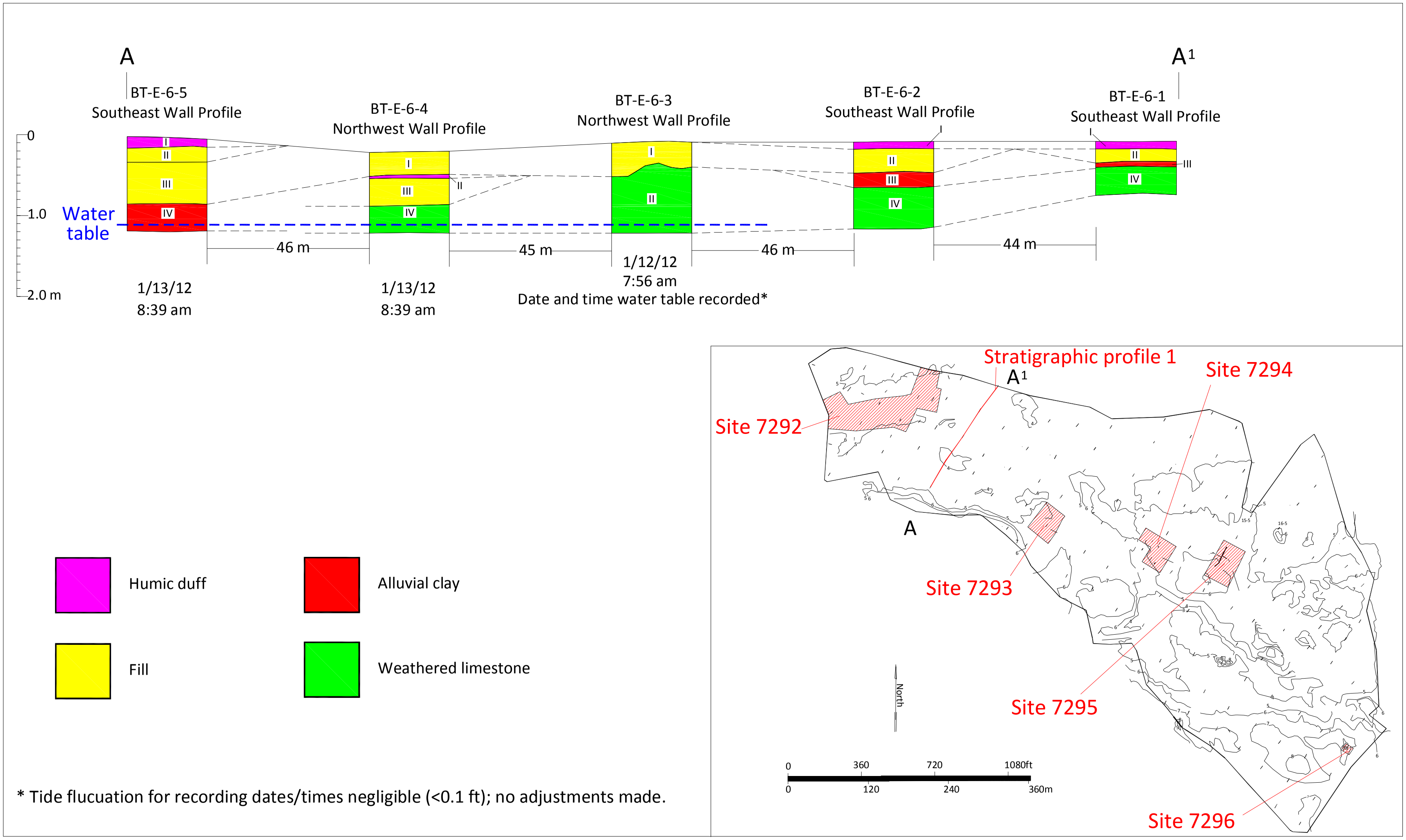


Figure 148. Test Area E stratigraphic profile 1

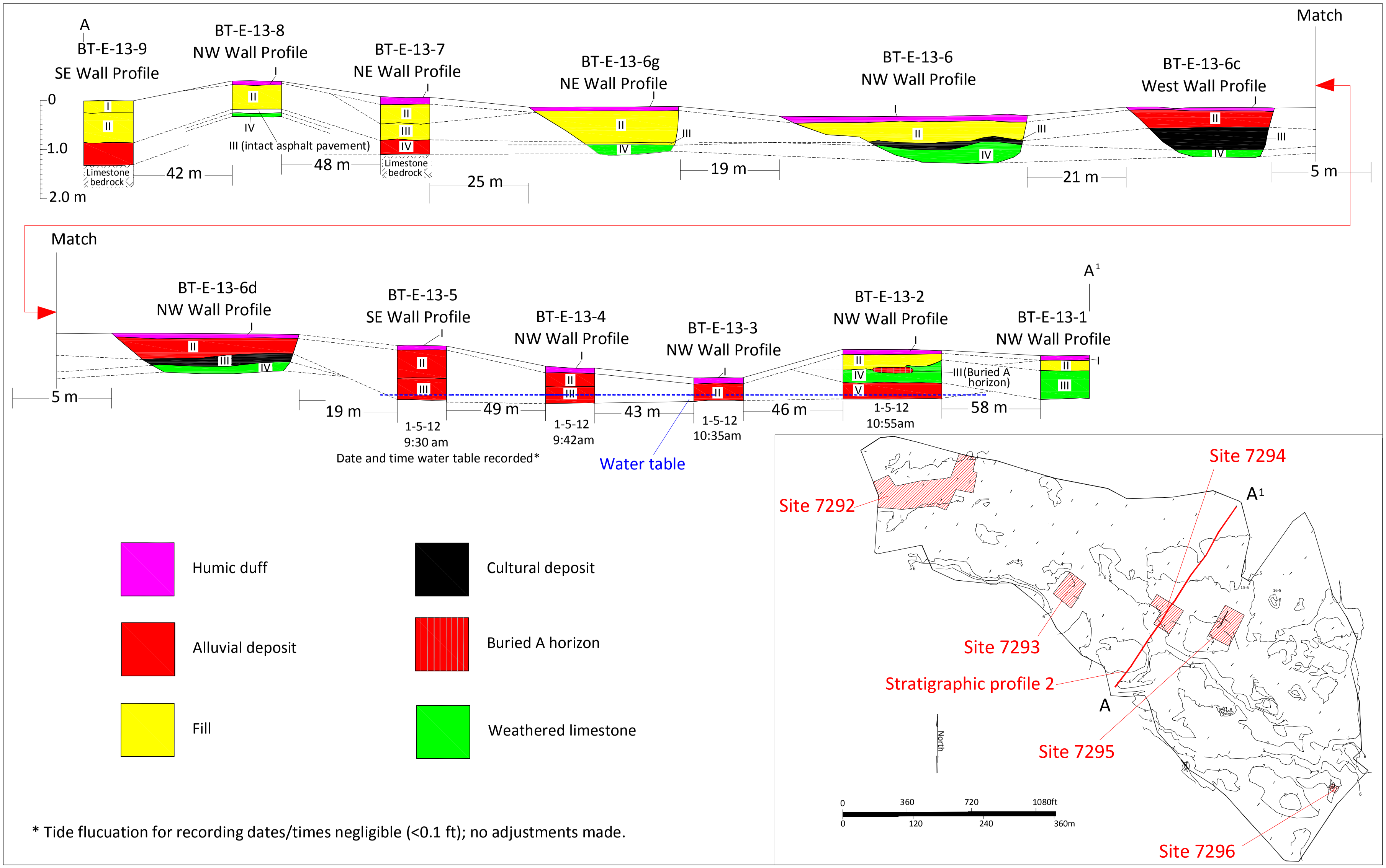


Figure 149. Test Area E stratigraphic profile 2

overlies the limestone substrate. In BT-E-13-6g two layers of WW II-era fill in the revetment area south of the runway overlie the limestone substrate. In BT-E-13-7 two layers of WW II-era fill in the revetment area south of the runway overlie intact alluvial sandy clay formed on the limestone substrate. In BT-E-13-8, redeposited fill containing asphalt fragments and plastic bags overlie an intact section of asphalt pavement constructed directly over the limestone substrate. In BT-E-13-9 at the southwest end of the sample transect, two layers of redeposited fill associated with golf course construction overlie intact alluvial clay formed on the underlying limestone substrate.

Figure 150 is the third of three stratigraphic profiles (Profile 3) and illustrates the northeast-southwest Transect 20, excavated across the southeast end of Test Area E, which crosses the former sod farm and the Kahuku Army Airfield barracks area. All but one trench in this transect were excavated to limestone bedrock; the other, BT-E-20-4, encountered the water table before the limestone substrate was reached. Gley deposits were encountered in BT-E-20-4, E-20-6 and E-20-7; the last two trenches the gley deposits overlie the limestone substrate. In all of the Transect 20 trenches, except BT-E-20-5, the fill deposits consist of redeposited material associated with golf course construction (E-20-6 and E-20-7) or the sod farm. The fill deposit in BT-E-20-5 consists of 95% basalt aggregate and probably represents a stockpile of crushed material for resort hardscaping or landscaping aggregate. The fill deposits overlie intact alluvial sandy loam, sandy clay loam, clay loam or clay; only the fill deposit in BT-E-20-6 overlies the limestone substrate and it is presumed the original alluvial deposits in this area were removed during golf course construction.

Test Area E is a relatively level, low-lying flat east of Punahoʻolapa Marsh. The ground surface was extensively modified during construction of the main NW-SE runway of the Kahuku Army Airfield (Site 7275) and peripheral support facilities. Fieldwork for the SAIS documented widespread fill deposits associated with the Airfield overlying alluvial deposits and gley developed on the limestone substrate. WW II-era fill deposits vary in depth from 0.25 to 1.38 m bgs. Where preserved, alluvial deposition was encountered 0.16 to 0.82 m bgs, overlying gley or limestone. Many fill deposits directly overlie bedrock, but where no fill deposits were encountered, alluvial deposits overlying gley or limestone were at least 0.45 to 0.82 m deep. In addition, five subsurface prehistoric habitation sites were identified as a result of testing (Sites 7292-7296). The prehistoric cultural deposits are associated with buried alluvial deposition. Overlying fill seals many of the cultural deposits. Prehistoric subsurface cultural deposits cover approximately 14,325 sq m (3.5-acres) or 5% of Test Area E.

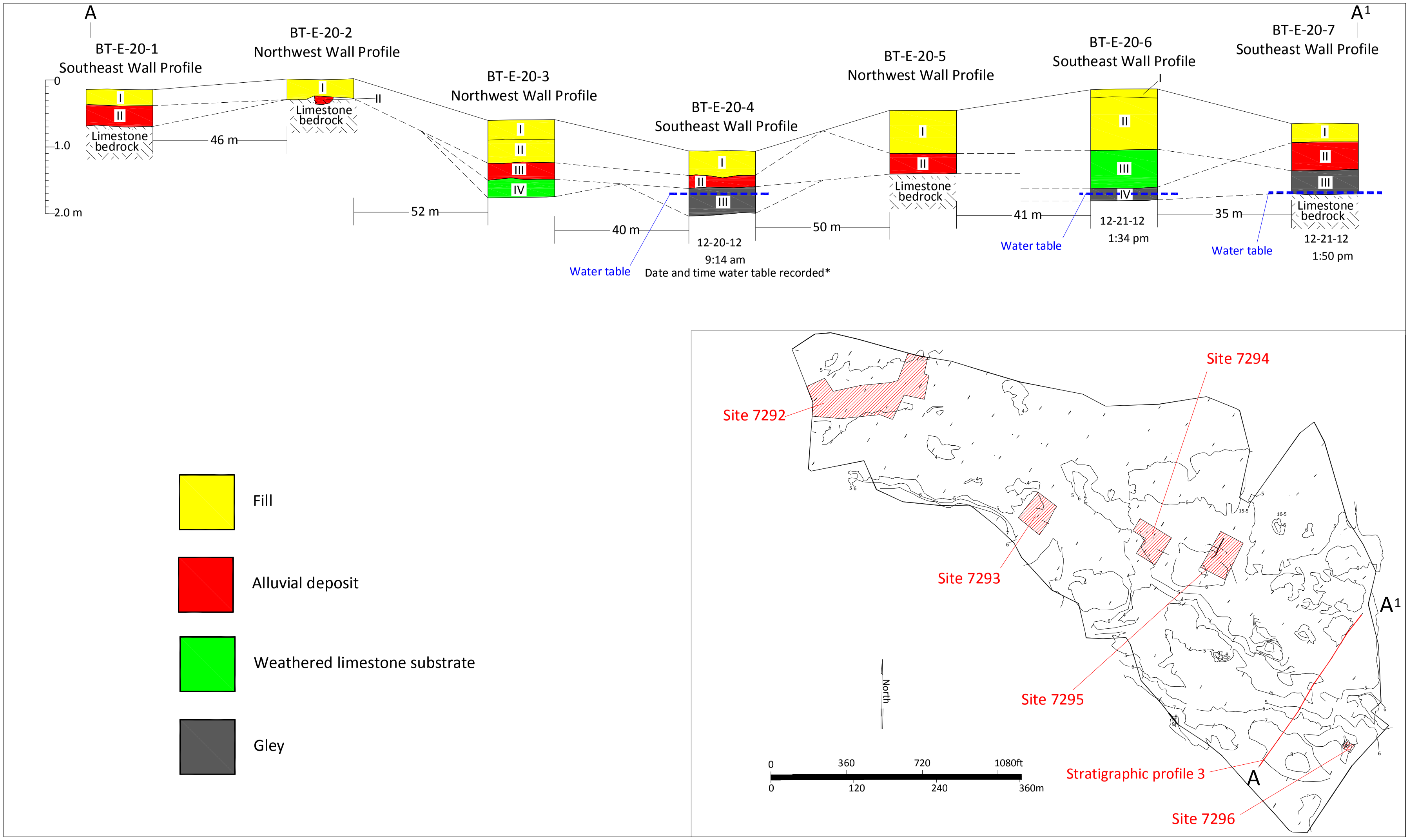


Figure 150. Test Area E stratigraphic profile 3

Test Area F

Test Area F is a level, low lying flat now covered by an invasive *haole koa* forest. Punahoʻolapa Marsh borders Test Area F on the west, while the 12th and 13th Fairways of the Palmer Golf Course border it on the north (see *Figure 63*). Marconi Road borders the east side along the TBR property line, and the 5th and 6th holes of the Palmer course border the south side. The ground surface of Test Area F has undergone extensive disturbance. Numerous push piles of boulders, earth, and other debris were deposited by heavy earth-moving equipment. The soils series for Area F is Pearl Harbor Clay (Foote *et al.* 1972; see Figure 7).

Subsurface testing in Area F consisted of excavating 58 systematically placed trenches that varied from 4.5 to 9.0 m in length (average 5.48 m) and averaged 0.8 m wide (*Figure 151*). A total of 318.25 linear meters of trench were excavated. One to seven deposits were encountered in the trenches. Forty-four trenches were excavated to the limestone substrate, 13 were excavated to the water table, and one trench excavation was terminated when immovable boulder fill was encountered. Trench depths varied from 10 cm to 2.54 m, and averaged 95 cm deep. Trench profiles are illustrated in **Appendix B** (*Figures B-276* through *B-333*). Trench dimensions and stratigraphic data are presented in **Appendix C.**

Site 5791 is the OR&L Railroad grade, which is no longer extant on the surface in Test Area F. The rail bed bisected the north end of Test Area F and crossed the south ends of the 12th and 13th Fairways of the Palmer golf course. Subsurface deposits in BT-F-3-9, F-4-7 and F-12-1 encountered subsurface deposits associated with the rail bed (see *Figures B-294, B-301, B-326*). Where the bedding fill was encountered, it was overlain by asphalt pavement. In BT-F-3-9 the section corresponds with a railroad crossing for a road no longer extant. Redeposited fill overlies the pavement in BT-F-3-9 and F-4-7, but the asphalt pavement is exposed on the ground surface in F-12-1.

Site 7265 is a WW II-era surface feature consisting of a concrete slab, associated with the barracks area of the Kahuku Army Airfield (see *Figure 67*). Excavation of BT-F-5-6 encountered 24 cm of crushed limestone aggregate fill beneath the concrete slab. The fill was laid directly on the limestone substrate.

Site 7284 is a WW II-era surface site consisting of 5 features. Excavation of BT-F-9-1 encountered a surface deposit of 20 cm of limestone fill associated with the foundation for the Feature A concrete slab and underlying pipeline trench. Excavation of BT-F-10-1 encountered 45 cm of limestone fill associated with the foundation of the Feature C slab.

No intact traditional Hawaiian cultural deposits or human remains were identified in any Test Area F trenches. The absence of subsurface prehistoric cultural deposits is probably attributable to extensive disturbance and the relatively shallow soil depth. Widespread disturbance occurred during World War II in conjunction with construction of the Kahuku Army Airfield barracks facilities located throughout Test Area F, and during the subsequent construction of the Palmer Golf Course in 1990-1991. The area indicated as a house enclosure on the 1890 Loebenstein map was tested with two trenches, but no intact subsurface cultural deposits were encountered.

Figure 152 is the first of two stratigraphic profiles (Profile 1) and illustrates the northeast-southwest Transect 4, across the center of the east half of Test Area F. In all except BT-F-4-2 and F-4-4, one or more layers of fill overlie intact alluvial deposits formed on the limestone substrate. In BT-F-4-2 there is no fill deposit and in F-4-4 fill overlies the limestone substrate. In BT-F-4-7 fill overlies asphalt pavement that overlies the OR&L railroad bedding fill deposits, and shows a potential railroad crossing.

Figure 153 is the second of two stratigraphic profiles (Profile 2) and illustrates a northwest-southeast transect across the east half of Area F. Ten of the eleven trenches in this profile show one to three layers of fill overlying intact alluvial deposits or the limestone substrate. The exception is BT-F-5-3, where no fill deposits were encountered. Fill deposits contained a variety of recent and historic trash, including barbed wire, black plastic, a plastic switch cover, bottle glass, a metal pipe, glazed ceramics, bottle glass, copper wire, concrete fragments, a steel cable, plastic hose, a tire, fiberglass and fabric. Crushed limestone and basalt aggregate was frequently encountered in fill deposits. A utility trench feature was noted in BT-F-15-1**.** Gley deposits were commonly

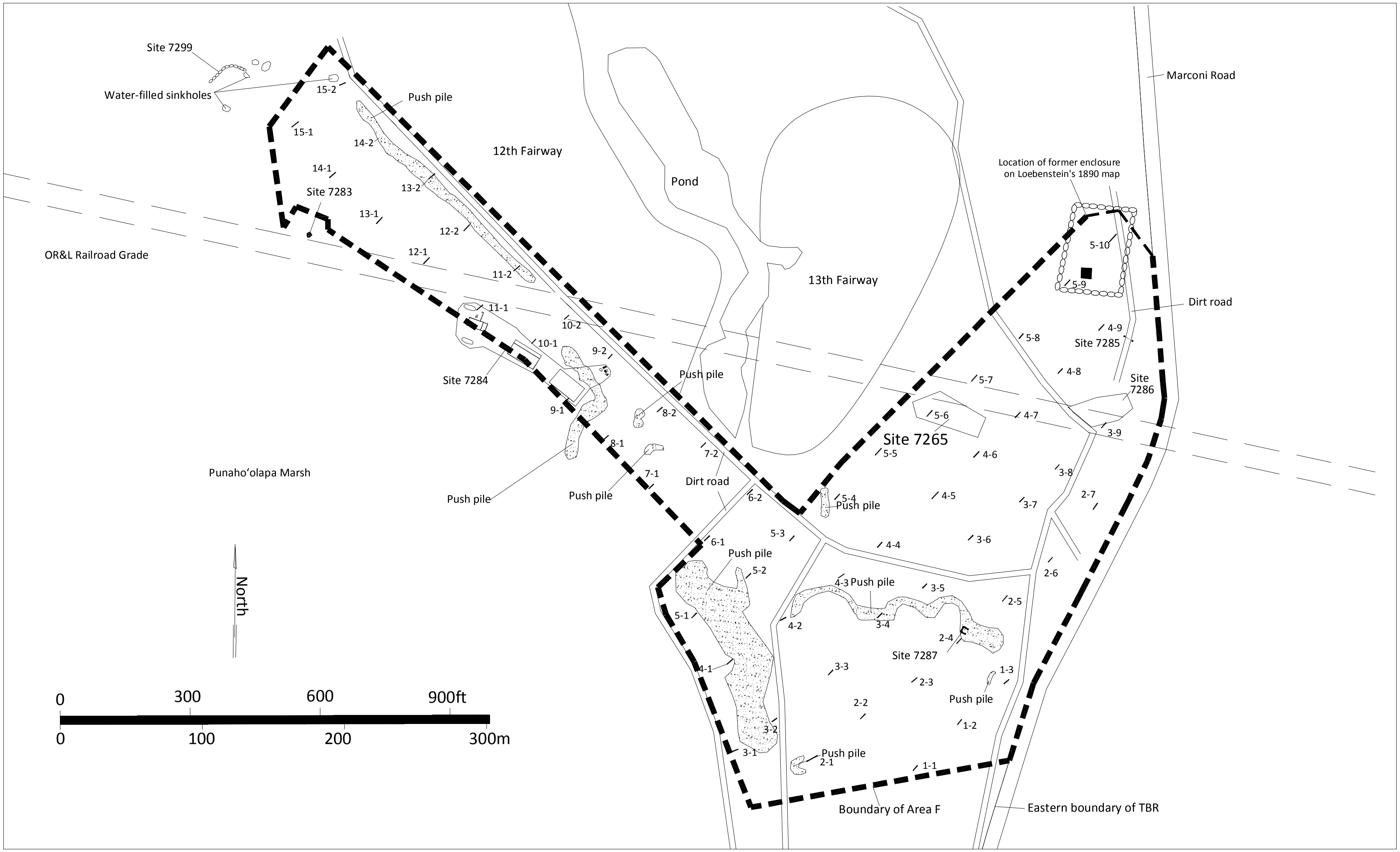


Figure 151. Location of Sites and trenches in Test Area F

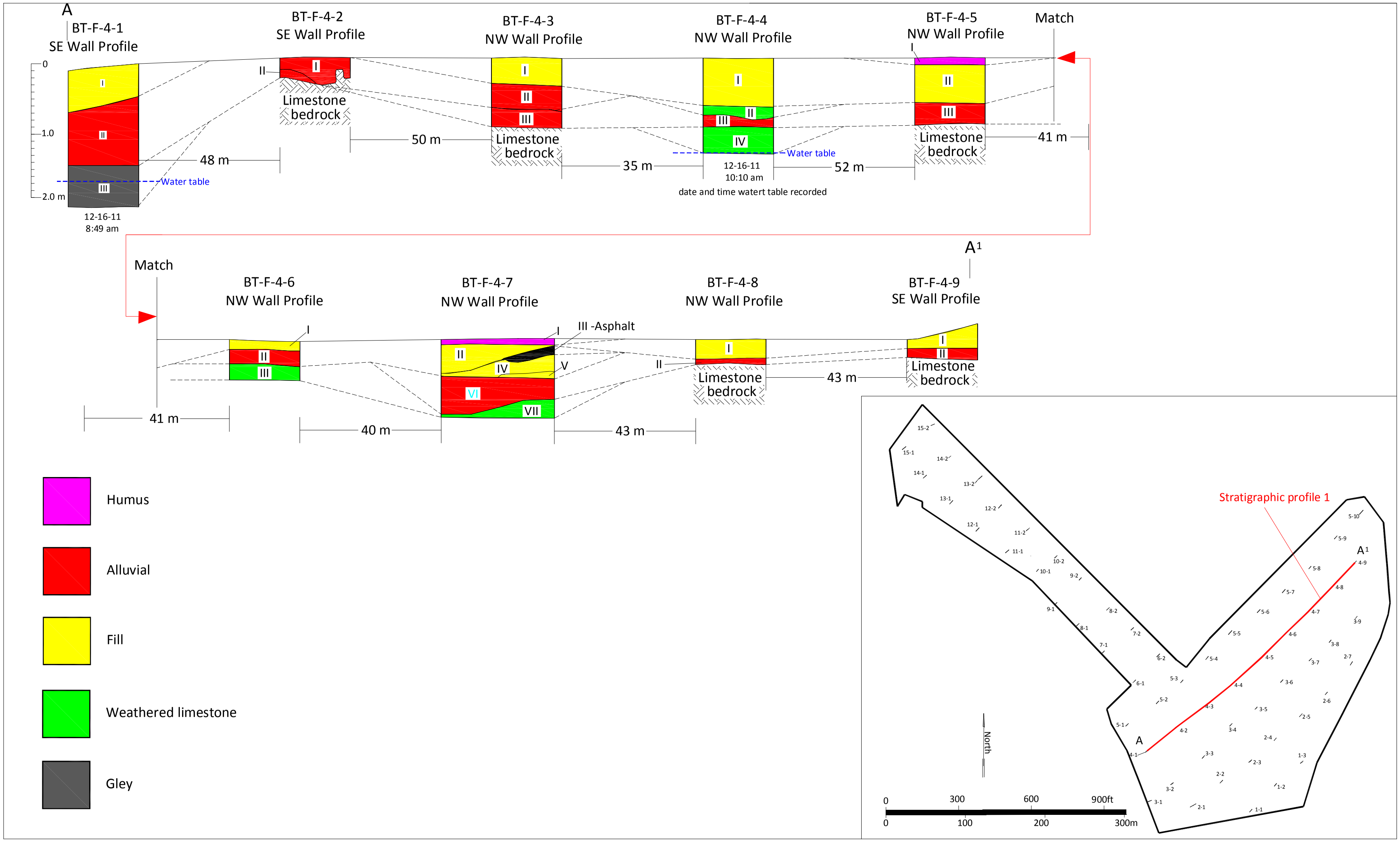
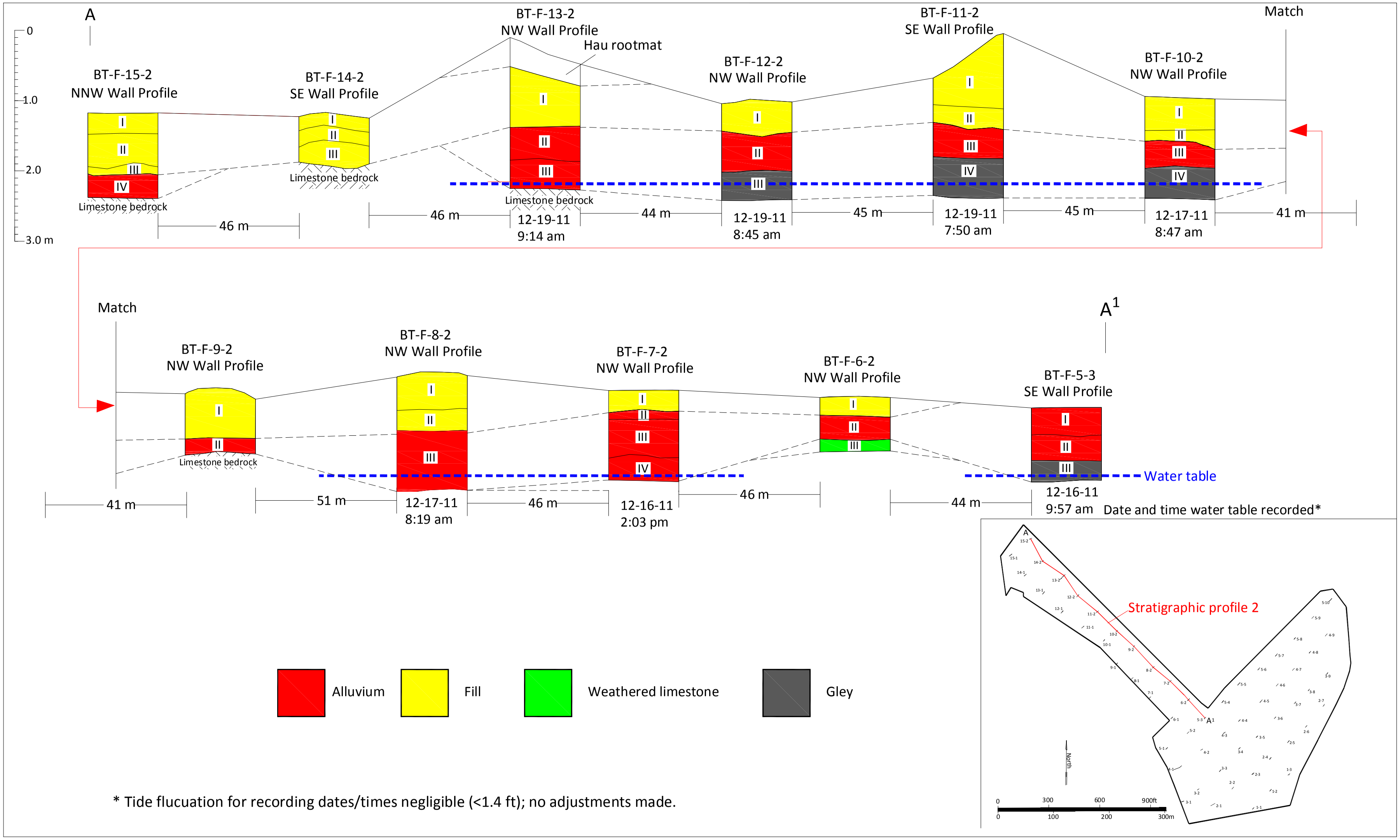


Figure 152. Test Area F stratigraphic profile 1



* Tide flucuation for recording dates/times negligible (<1.4 ft); no adjustments made.

Figure 153. Test Area F stratigraphic profile 2

encountered in trenches where the water table overlies the limestone substrate (*Figure 154*) and a single deposit of tropical peat was encountered in BT-F-2-2 (*Figure 155*).

Test Area F is characterized by widespread surface disturbance associated with 20th Century infrastructure for the OR&L railroad, the Kahuku Army Airfield barracks, the Palmer golf course and ancillary access roads. Although intact alluvial deposits are preserved across much of Test Area F, no evidence of prehistoric subsurface cultural deposits was encountered. It is possible that prehistoric cultural deposits were destroyed as a result of 20th Century land modification, but the potential to encounter intact prehistoric cultural deposits in Test Area F is negligible.

Test Area G

Test Area G is located in gently sloping terrain and is covered by an invasive *haole koa* forest (see *Figure 85*). Marconi Road forms the east boundary, Kamehameha Highway the south, and by the 4th, 5th, and 6th holes of the Palmer Golf Course on the north and west. A single push pile was noted on the surface of Test Area G, but otherwise, the area did not contain surface evidence of 20th Century disturbance, except for agricultural use. No surface sites were identified in Test Area G and no LCAs were located in this part of the property. The former location of the Kahuku Army Airfield barracks is located north of Test Area G.

The soil series for Area G is Waialua Silty Clay (see *Figure 7*). Waialua series soils develop on alluvial fans and are derived from weathered igneous rock (Foote *et al.* 1972: 128-129). The surface layer in a representative profile is 30 cm of dark reddish-brown silty clay overlying c. 66 cm of dark reddish-brown silty clay subsoil with a sub-angular blocky structure. The substratum is dark reddish-brown silty clay.

Testing in Area G consisted of excavating 12 systematically placed trenches that varied in length from 4.5 to 6.4 m (average 5.35 m) and averaged 1.0 m wide (*Figure 156*). A total of 64.15 linear meters of trench were excavated. Trench excavation exposed two to five layers. Five trenches were excavated to the weathered and decomposing limestone substrate and 7 were terminated in the clay substratum; one trench reached the water table at 2.40 m bgs. Trench profiles are illustrated in **Appendix B** (*Figures B-334* through *B-345*). Trench dimensions and stratigraphic data are presented in **Appendix C**.

No historic or prehistoric cultural deposits or human remains were identified as a result of excavation of the Test Area G trenches. All trenches exhibited a surface plow zone deposit characterized by dark brown to dark reddish brown loose clay loam or silty loam (Layer I), varying in depth from 0.38 to 0.6 m (average 0.44 m). Modern debris was noted in BT-G-2-3 and G-4-3 along Marconi Road. The plow zone overlies 0.05 to 1.95 m (average 0.78 m) of one to four layers of alluvial clay or clay loam deposited during the development of the Kahuku Plain alluvial fan. The deposits consist predominately of dark brown compacted to blocky clays. Several deposits consist of gravelly clay and silty clay loam. The subsoil overlies the limestone substrate. A representative example of the soil stratigraphy documented in Test Area G is presented in *Figure 157.*

Figure 158 is a composite *mauka-makai* stratigraphic profile depicting the main strata by deposit type within Test Area G. The profile illustrates the deep alluvial deposits that cover the area. The number of recognizable layers in the trenches increases in relation to decreasing elevation, and reflects the increased amount of deposition as the gradient decreases toward to north.

Test Area G consists entirely of alluvial Waialua Silty Clay and was sampled by excavating one-trench per acre. The soil is more suitable for agricultural use than habitation and not surprisingly, no evidence of historic or prehistoric habitation was encountered. Test Area G exhibits very low potential for encountering subsurface cultural deposits.

Figure 154. Gley deposit in BT-F-2-3, view to southeast

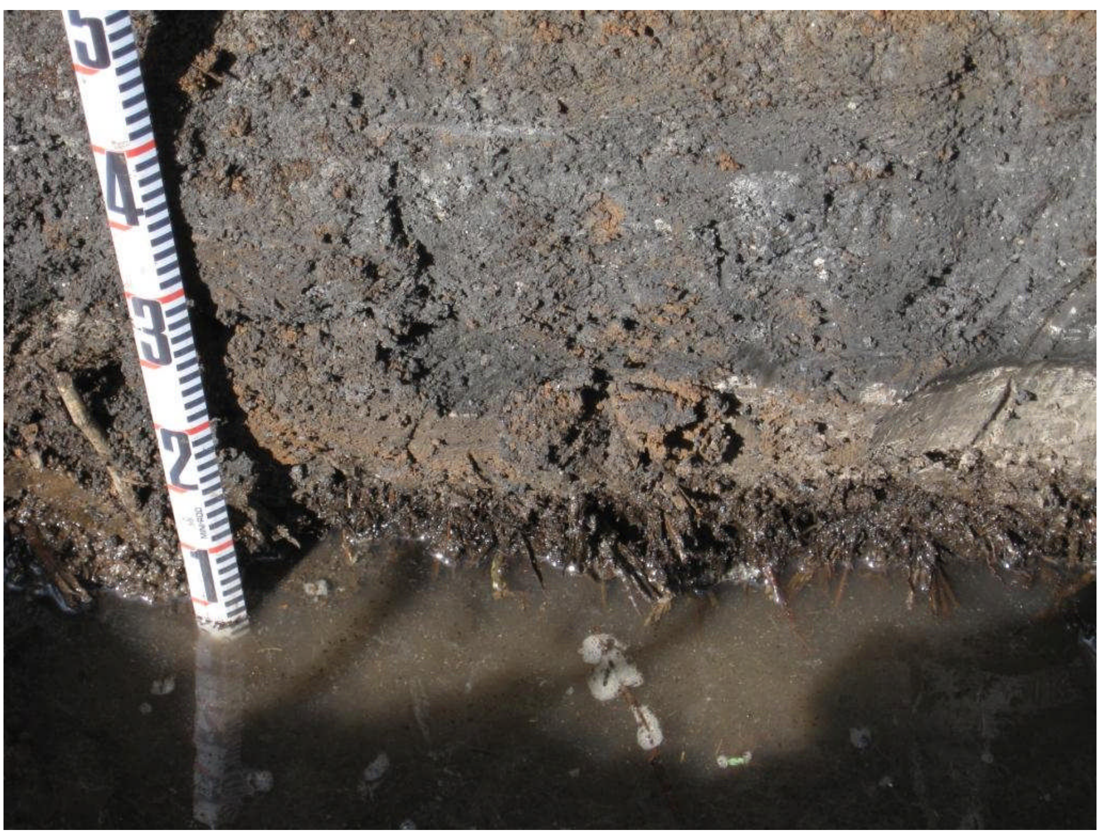


Figure 155. Tropical peat deposit in BT-F-2-2, view to northwest

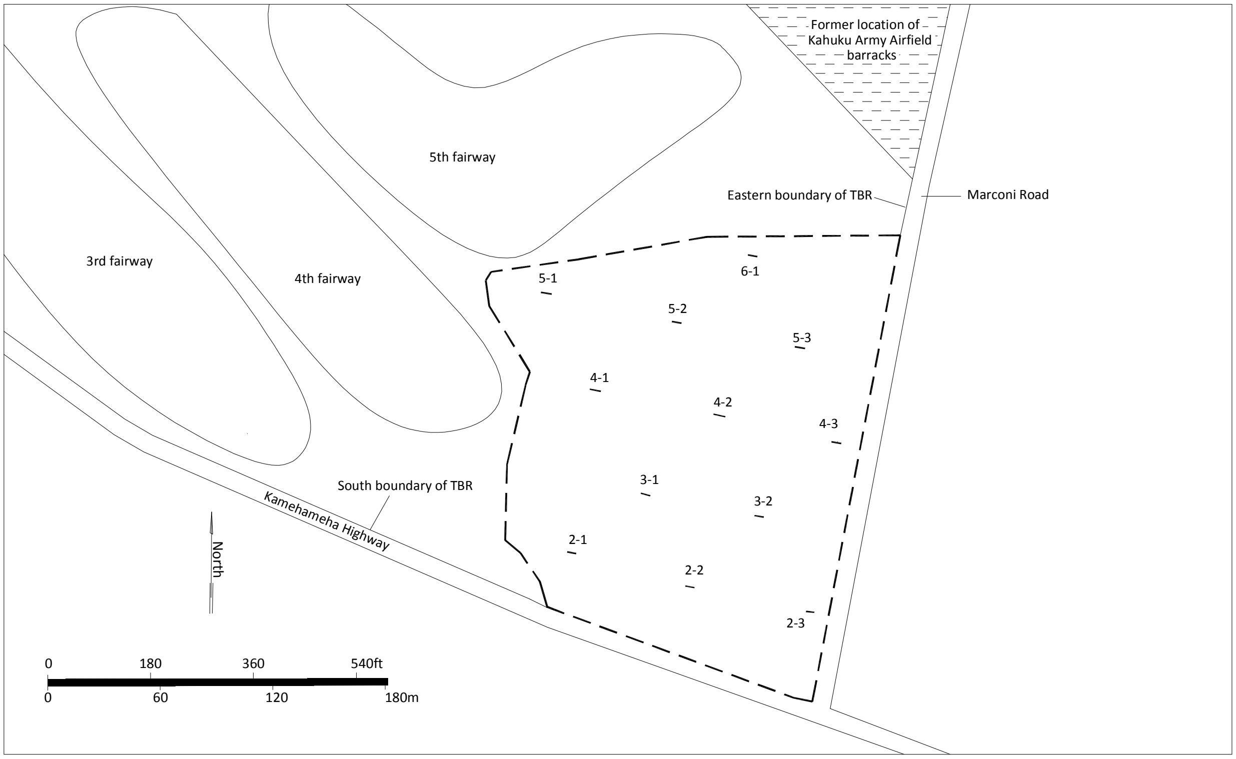


Figure 156. Location of Trenches in Test Area G

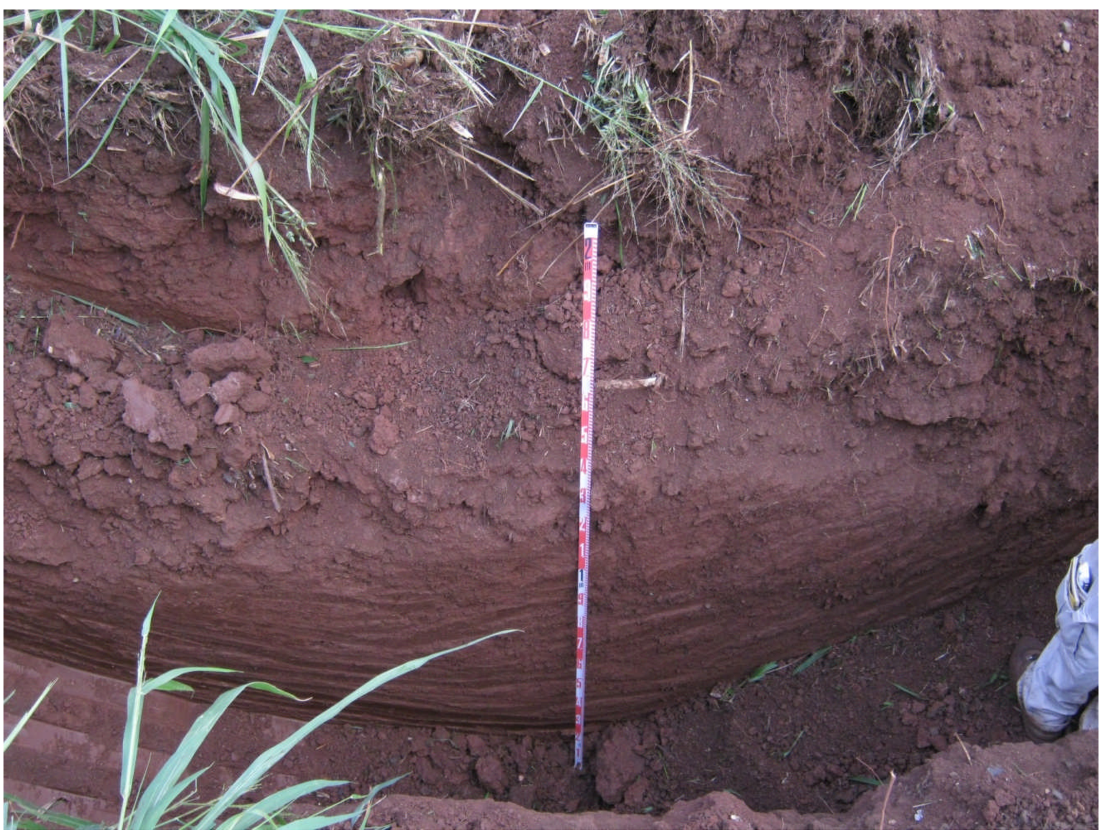


Figure 157. Typical Test Area G soil stratigraphy

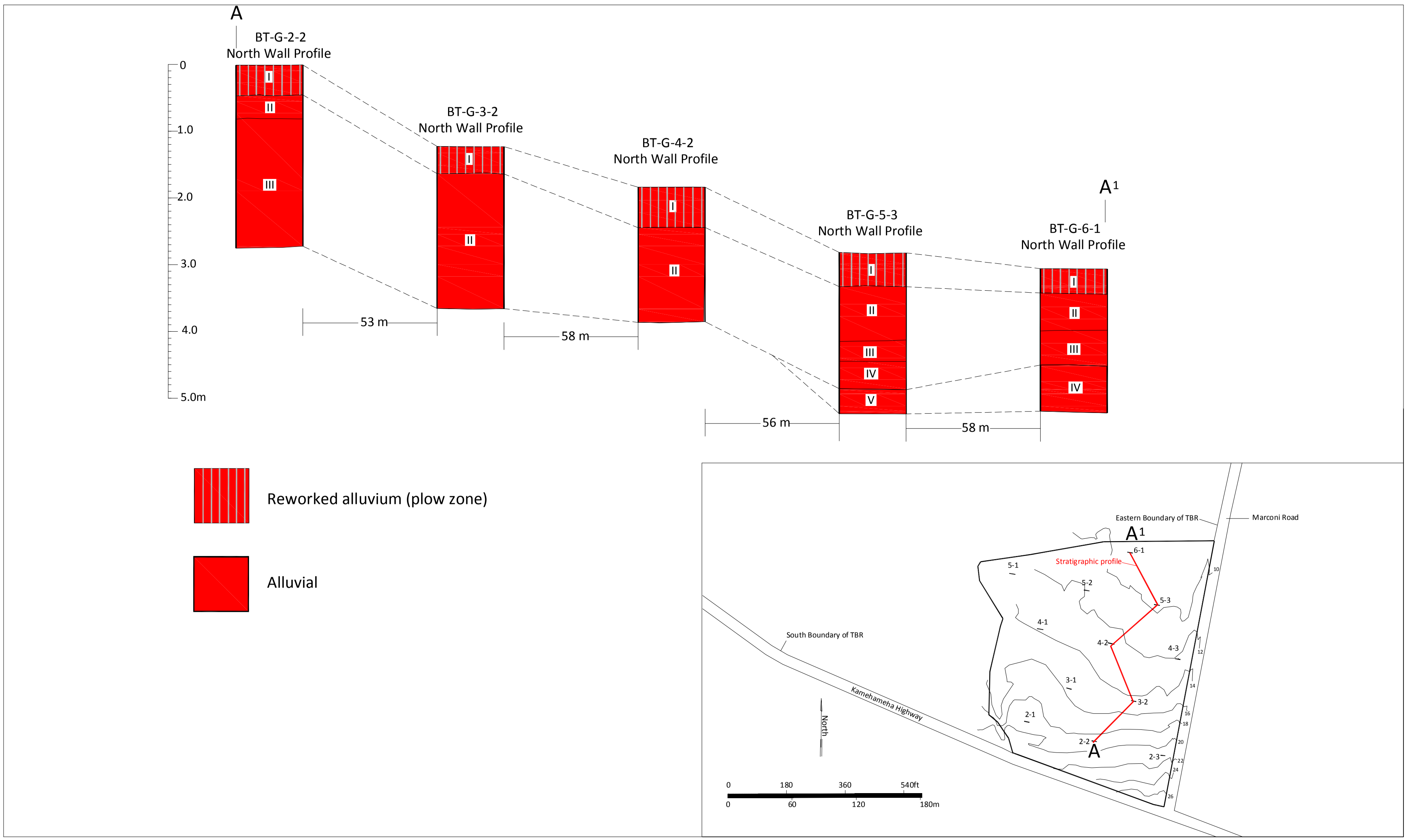


Figure 158. Test Area G stratigraphic profile

CONCLUSION

The SHPD-approved SAIS Plan (Haun *et al.* 2011) includes a thorough summary of previous land use for the TBR property, beginning with traditional Hawaiian land use through World War II and subsequent developments. The Plan was prepared in advance of the SAIS fieldwork, in accordance with the requirements for an Archaeological Inventory Survey Plan detailed in Hawai'i Administrative Rules (HAR) §13-13-284-5(c) and §13-13-276-5 (a) and (b). The Plan presents the results of historical documentary and archaeological background research for the general Kahuku area and specifically for the project area. The Plan also provides a synthesis of the background information and provides a research design with a methodology to guide the proposed SAIS fieldwork. As provided for in HAR §13-13-276-5(b)(3) the historic documentary and archaeological background research portions are not repeated in this document and the reader is referred to the Plan for this background information.

The SAIS Plan made predictions regarding expected site types based on previous archaeological research and historical documentary evidence. As expected, prehistoric to early historic remains documented in the project area include subsurface cultural deposits and subsurface features including a house floor, fire pit, post molds, and burials. Also as expected, historic remains dating to the 1800s to 1900s were documented, including the OR&L railroad and at least one probable Kahuku Ranch-related wall. Other expected sites are the extensive WW II military-related remains of Kahuku Army Airfield including the main runway, revetments, defensive fortifications and a variety of support facilities.

The SAIS fieldwork documented the extensive disturbance that has occurred throughout the TBR property. The only surface archaeological sites or features in Test Areas A, B, C, D or G are an abandoned 1950s-era transit bus in Test Area A and an isolated human skeletal element in Area C. The land altering impacts to the project area begin with historic cultivation of sugarcane that occurred throughout the inland portions of the project area (see *Figure 92*). Coastal areas where sand was unsuitable for cultivation and areas that were too wet in the vicinity of Punaho'olapa Marsh were the focus of World War II-era development including the construction and use of the expansive Kahuku Army Airfield complex (see *Figure 11*) and the subsequent development of the Turtle Bay resort and golf course facilities. Despite this extensive disturbance, extant surface sites were documented in Test Areas E and F, the Kahuku Point Preserve, and shore of Kawela Bay; and subsurface archaeological remains were identified in Test Areas B, D and E.

The SAIS Plan guided-surface and -subsurface surveys documented thirty-nine sites consisting of 10 traditional Hawaiian habitation sites, 2-3 sites dating to the late 1800s, 3 sites associated with 1930s operation of Marconi Wireless Station, 22 sites that were part of the United States Army Airfield at Kahuku, and an abandoned 1950s Honolulu City and County transit bus (*Figure 159* and *Table 4*). These sites include four sites identified by prior studies, including three that were not formally assigned site numbers by previous TBR studies (5791, 7275, 7299; *Table 5*)

Prehistoric Sites

The ten traditional Hawaiian sites documented are all likely prehistoric in age. Human remains were identified at three of these sites. Two sites (7288 and 7289) have intact, primary burials. The third site is Site 4488 where an isolated skeletal element was identified on the ground surface. Human remains representing at least 8 individual burials were previously discovered and recovered from Site 4488. At least one of these burials is likely historic based on probable coffin remains consisting of wood fragments and square nails and it is probable that most of the other burials are prehistoric. One site with a burial (7289) and seven other sites (7290-7296) have intact subsurface cultural deposits indicative of habitation-related occupations.

Archaeological and historical background research presented in the SAIS Plan (Haun *et al.* 2011:79-81) indicates that in late prehistory the Kahuku Point vicinity was well populated and extensively cultivated. There were permanent residences scattered along the coast. Larger settlements were present in areas such as Kahuku and Kawela Bay where sheltered ocean access was available. Temporary habitation, probably associated with

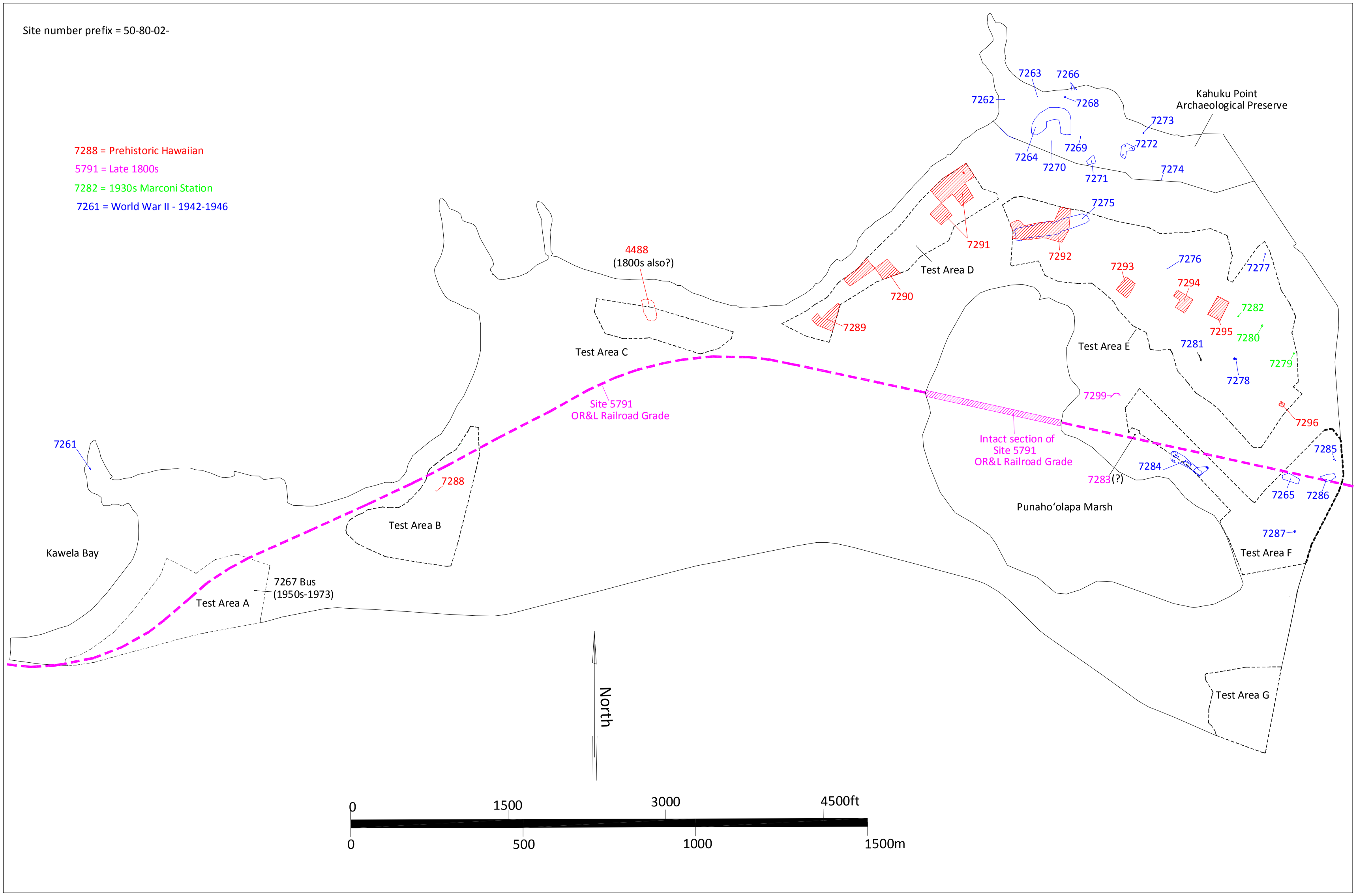


Figure 159. Location of sites identified during SAIS Fieldwork

Table 4. SAIS identified and relocated sites

SIHP Site No.	Formal type	Function	Area	Age	No. of Features
4488*	Human remains	Burial	C	Prehistoric and early historic	1
5791*	OR&L Railroad grade	Transportation	Punahoʻolapa Marsh	1899-1946	1
7261	Concrete structure	Gun position	Kawela Bay	1942-1946	1
7262	Concrete slab	Indeterminate	Kahuku Point	1942-1946	1
7263	Concrete pier block	Antenna support?	Kahuku Point	1942-1946	1
7264	Revetment	Storage	Kahuku Point	1942-1946	1
7265	Concrete slab	Foundation	F	1942-1946	1
7266	Concrete pier blocks	Antenna support?	Kahuku Point	1942-1946	3
7267	Transit Bus	Transportation	A	1950s-1973	1
7268	Concrete structure	Indeterminate	Kahuku Point	1942-1946	1
7269	Concrete structure remnant	Indeterminate	Kahuku Point	1942-1946	1
7270	Metal tank	Storage	Kahuku Point	1942-1946	1
7271	Asphalt area	Transportation	Kahuku Point	1942-1946	1
7272	Concrete structure	Gun position?	Kahuku Point	1942-1946	1
7273	Concrete block	Indeterminate	Kahuku Point	1942-1946	1
7274	Concrete cylinder	Possible light fixture base	Kahuku Point	1942-1946	1
7275	Asphalt area	Runway remnant	E	1942-1946	1
7276	Concrete block	Anchor base	E	1942-1946	1
7277	Concrete slab	Foundation	E	1942-1946	1
7278	Concrete structure	Gun position?	E	1942-1946	1
7279	Concrete block	Antenna support?	E	1933	1
7280	Concrete structure	Antenna support?	E	1930s	1
7281	Concrete structure	Gun position?	E	1942-1946	1
7282	Concrete block	Antenna support?	E	1930s ?	1
7283	Stone mound	Possible agricultural	F	Prehistoric	1
7284	Complex	Barracks complex	F	1942-1946	5
7285	Metal posts	Gate	F	1942-1946	1
7286	Asphalt area	Pavement	F	1942-1946	1
7287	Concrete structures	Gun position?	F	1942-1946	1
7288	Human remains	Burial	B	Prehistoric	1
7289	Cultural deposit w/ burial	Habitation/Burial	D	Prehistoric	2
7290	Cultural deposit	Habitation	D	Prehistoric	1
7291	Cultural deposit	Habitation	D	Prehistoric	1
7292	Cultural deposit	Habitation	E	Prehistoric	1
7293	Cultural deposit	Habitation	E	Prehistoric	1
7294	Cultural deposit	Habitation	E	Prehistoric	1
7295	Cultural deposit	Habitation	E	Prehistoric	1
7296	Cultural deposit	Habitation	E	Prehistoric	1
7299*	Wall	Livestock control	Punahoʻolapa Marsh	pre-1900	1

*Relocated Sites

Table 5. Previously identified sites

SIHP Site No.	Other Site No. /Name	Site Type	McAllister (1933)	Dye (1977)	Bath et al. (1984)	Neller (1984)	Walker et al. (1988a)	Walker et al. (1988b)	Davis et al. (1986)	Kennedy (1992)	Kennedy (1996)	Sullivan (1990, 1991), Dunn (1991), Donohue (1991)	Haun and Henry (2001)	Corbin (2003)	Current Status
4488	-	Cultural deposit with burials								X	X				Burials removed and reinterred
5791/ 9714	-	Railroad Grade											X		Intact segment present across Punahoʻolapa Marsh
6410	-	Cultural deposit with burials			X		X							X	Mitigated through Data Recovery; Burials removed and reinterred
6411	T-1	Cultural deposit with burials		X	X	X		X						X	Preserved
6412	-	Cultural deposit in Marsh with 3 sinkholes		X	X				X						Preserved
6413	TM-1	Cultural deposit										X		X	Mitigated through Data Recovery
6414	TM-2	Cultural deposit										X		X	Mitigated through Data Recovery
6415	TM-3	Enclosure										X		X	Mitigated through Data Recovery
6416	TM-4	Cultural deposit										X		X	Mitigated through Data Recovery
6417	TM-5	Cultural deposit										X		X	Mitigated through Data Recovery
6418	TM-6	Cultural deposit										X		X	Mitigated through Data Recovery
6419	TM-7	Cultural deposit										X		X	Mitigated through Data Recovery
6420	TM-8	Alignment										X		X	Mitigated through Data Recovery
6421	TM-9	3 pools with walls										X		X	Destroyed prior to SAIS
6422	TM-10	Cultural deposit										X		X	Mitigated through Data Recovery
6423	TM-11	Cultural deposit with burials										X		X	Mitigated through Data Recovery; Burials removed and reinterred
6424	TM-12	Stone wall										X		X	Destroyed prior to SAIS
6425	TM-13	Cultural deposit										X		X	Mitigated through Data Recovery
6426	TM-14	Stone wall										X		X	Destroyed prior to SAIS
7275*	Kahuku Army Air Field														Intact runway identified in Test Areas D and E
7299*	T-5	Stone wall			X										Preserved as part of Site 6412
	262	Kukio Pond	X					X							Destroyed prior to 1977
	T-2	Stone wall			X										Destroyed prior to SAIS
	T-3	Cattle enclosure			X										Destroyed prior to SAIS
	T-4	Antenna Support?			X										Destroyed prior to SAIS
	T-7	Gray sand layer in dune (determined to be historic)		X	X										Status undetermined, located within coastal setback

agricultural activity and natural resource exploitation, occurred in inland overhangs, caves and walled shelters. Fishponds were present in sheltered areas and salt was collected from depressions along the shore. Fishing shrines and rock formations of legendary, and probably ritual significance were scattered along the coast. *Heiau* were sited on prominent topographic features overlooking the coast. Sand dunes and cliff face caves were used for burial.

Agricultural use included cultivation of taro in pond fields wherever topographically suitable locations could be provided with sufficient freshwater. The abundance of freshwater around Punahoʻolapa Marsh provided Ideal conditions for wet taro cultivation with minimal labor investment compared to pond field development of stream drainages. Dryland gardens were present around the coastal residences and on the lower volcanic slopes where bananas, sweet potatoes, *wauke*, sugar cane, gourds, breadfruit, and other crops were cultivated. Upland areas were also farmed. Food remains from archaeological excavations include dog, pig, birds, and a wide variety of fish and marine invertebrates, representing activities such as animal husbandry, hunting, fishing and gathering.

Previous archaeological studies of TBR property produced 77 radiocarbon age range determinations on charcoal from cultural deposits that fall within the timeframes associated with Polynesian cultural occupation and later (Haun *et al.* 2011:71-77). Of these 77 results, 23 (30%) are from the Kawela Bay Archaeological Area (Site 6410), 25 (32%) are from the Kahuku Point Archaeological Preserve (Site 6411), and 29 (38%) are from Punahoʻolapa Marsh (Site 6412) and its environs (Sites 6414, 6416, 6417, 6422, and 6423). The earliest cultural deposits (*i.e.* prior to c. A.D. 1000) are to be found on the periphery of the Marsh. These early age ranges support the inference that the wetland was a highly desirable locale for initial settlement. The earliest cultural age range determinations were recovered from Site 6412 where a sample obtained from the east trench spans A.D. 645 to 979 and a sample from the north trench spans A.D. 785 to 1160 (*Figure 160*). A second early cluster was obtained within and east of the Marsh from Site 6423. Age ranges from Site 6423 span A.D. 793 to 1105.

The A.D. 1000 to 1200-age ranges show continued use of the area east of Punahoʻolapa Marsh, along with settlements in the sand dunes east and west of Kahuku Point and around Kawela Bay. Settlement in these areas intensified in the period between A.D. 1200 and 1400. The earliest cultural deposits sampled along Turtle Bay post-date A.D. 1200. Sites dating to the period between A.D. 1400 to 1600 have been documented on the west and southwest of Punahoʻolapa Marsh, as well as southwest of Kahuku Point. Use of the area east of Punahoʻolapa Marsh, Kawela Bay and Kahuku Point continued as a population focal point into the A.D. 1600 to 1800s.

More than 100 Land Commission Awards (LCA) claims were awarded in the mid-1800s in the area spanning the region from Kawela to Kahuku (*ibid*.: 2011:17-27). Thirty-five LCA claims with at least 24 house lots were awarded in the project area. The LCA claim testimonies refer to numerous *loʻi* (taro pond fields) and cultivated plots of bananas, sweet potatoes, *wauke* (paper mulberry*)*, sugar cane, bitter melon, *noni* (*Morinda citrifolia*) and an orange tree. Other named plants are *hala* (*Pandanus*) groves and *koa* trees for canoes. A brackish spring and a fishery also are mentioned in the testimonies.

Figure 161 depicts the distribution of traditional Hawaiian sites and *Figure 162* illustrates the distribution of mid-1800s LCAs. The two distributions show a high degree of correlation and demonstrate that the historic LCA pattern reflects the earlier prehistoric settlement pattern. The only exception to this correlation is the lack of prehistoric sites on the coast immediately south of Kaleokaunui (Kuilima) Point where five LCAs are present. It is likely that prehistoric sites were also present there, but were destroyed by 1800s-1900s sugarcane cultivation and early 1970s resort development that occurred before any systematic archaeological surveys were conducted. The late prehistoric to early historic (mid-1800s) settlement pattern likely extends back to at least the 13th Century based on radio-carbon dating results (see *Figure 160*) and potentially to the 11th Century.

The traditional Hawaiian sites primarily consist of subsurface cultural deposits. Previously identified Hawaiian sites at Kawela Bay, Kahuku Point and the areas surrounding Punahoʻolapa Marsh were, with the exception of Kahuku Point previously mitigated through data recovery. After initial data recovery work the landowner elected to preserve the Kahuku Point site. The data recovery work documented stratified, cultural deposits at Kawela Bay and Kahuku Point that contained numerous soil features including post molds, burials and hearths; and abundant and diverse assemblages of artifacts and food remains. Data recovery at the inland sites generally encountered either isolated subsurface features or remnant subsurface deposits with limited quantities of food remains and artifacts.

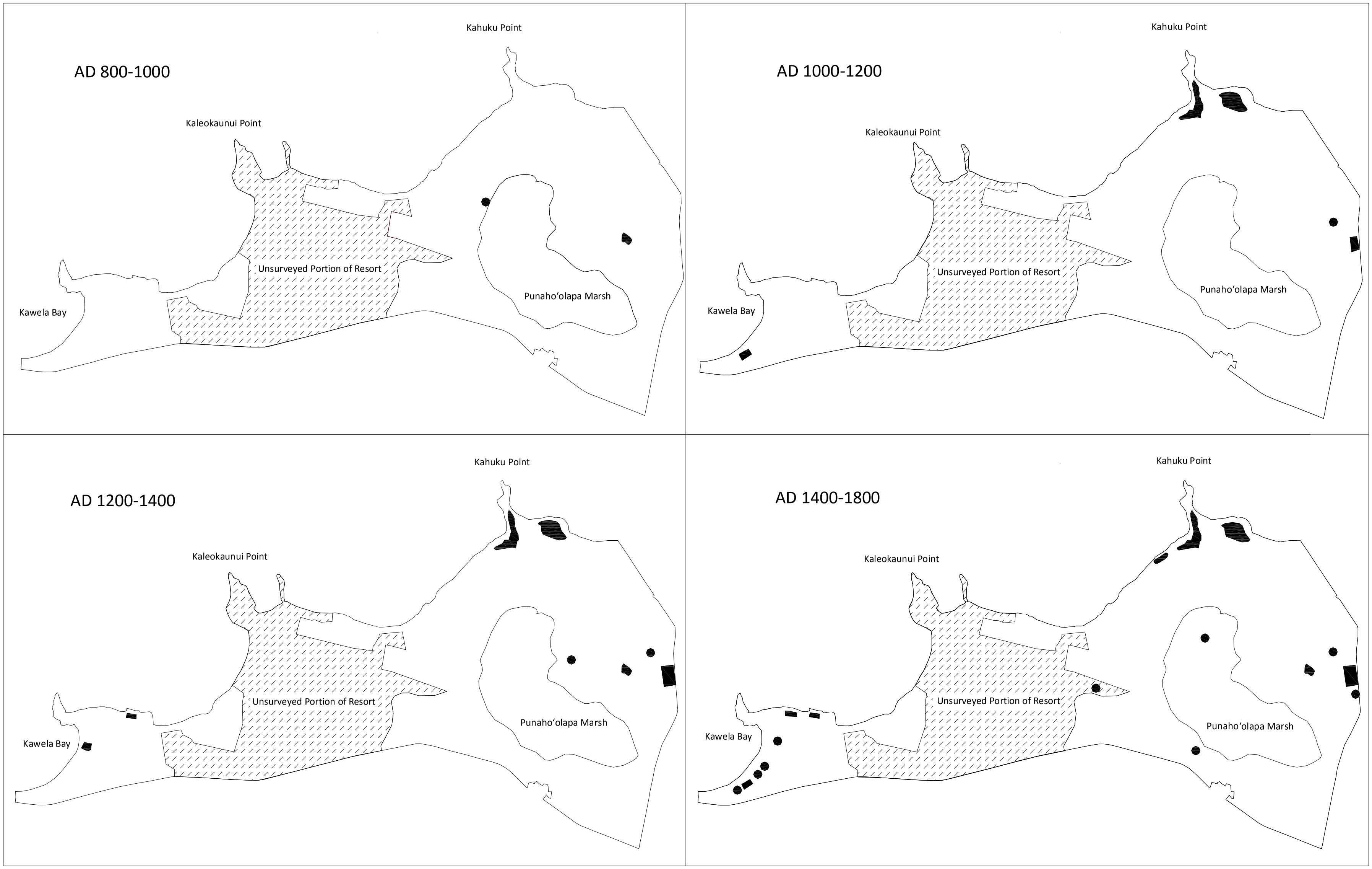


Figure 160. Pre-1800 chronology of occupation within project area

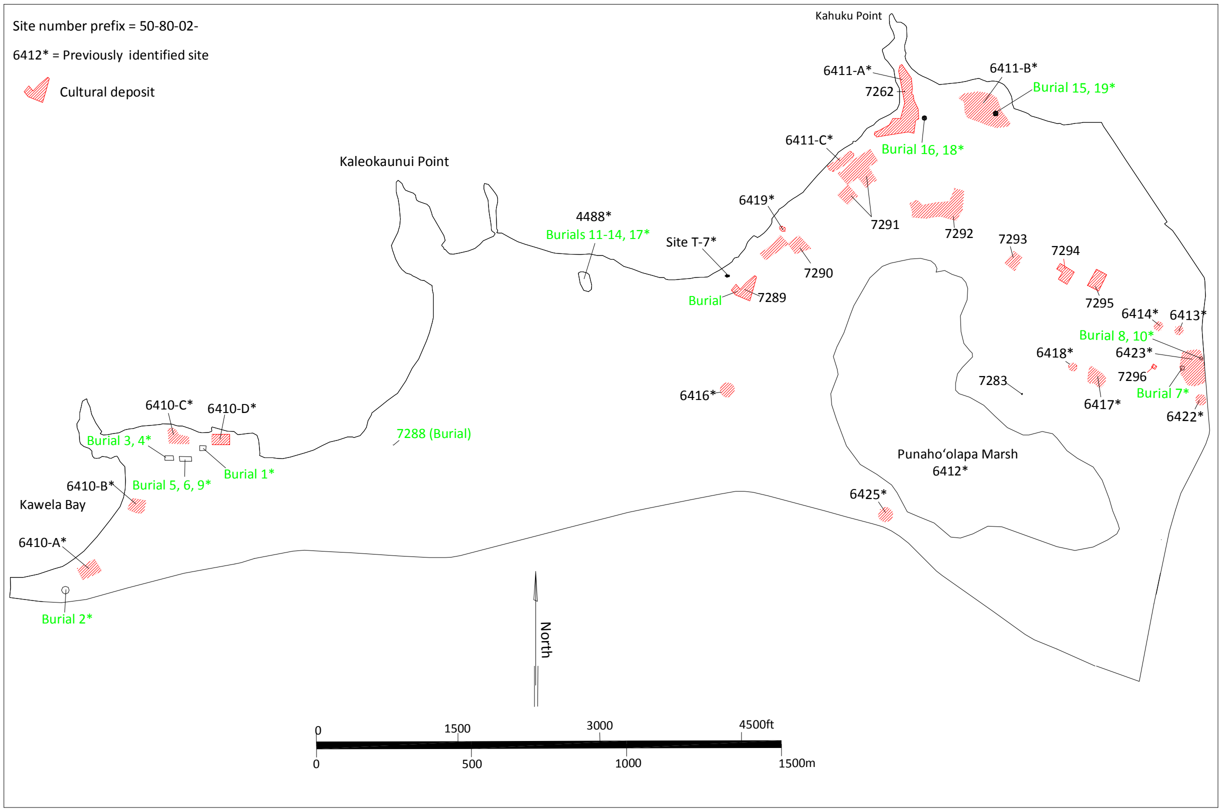


Figure 161. Prehistoric sites

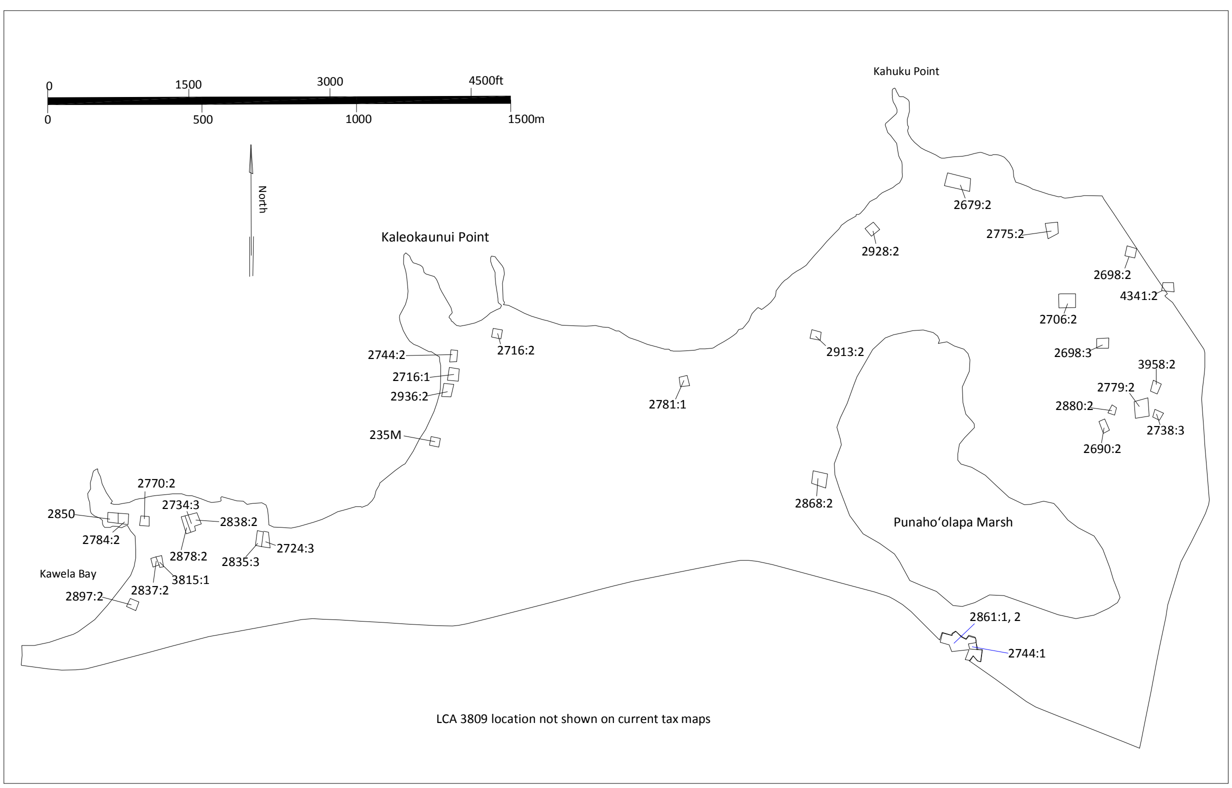


Figure 162. Land Commission Awards within project area

The eight sites with cultural deposits documented by the SAIS study comprise more than 32,000 sq m and are situated in the remnant dunes along the coast southwest of Kahuku Point (Test Area D) and the lowlands northeast of Punahoʻolapa Marsh (Test Area E). The deposits in the dunes are usually stratified with two cultural layers and the inland ones typically have a single cultural deposit that was vertically truncated by World War II or subsequent land modification. The very limited sampling of these subsurface deposits recovered artifacts (basalt and volcanic glass stone debitage and tools), charcoal, *kukui* nutshells, and food remains including marine invertebrates (gastropods, bivalves, sea urchins, crustacean), fish bone and terrestrial vertebrate bone (dog, pig, bird).These cultural deposits reflect traditional Hawaiian habitation. Mortuary use was also documented. In Test Area B, an intact primary burial of probable Hawaiian ancestry was identified during subsurface testing (Site 7288). An isolated human metatarsal was identified in Test Area C that is likely from one of the eight individual burials that were previously discovered at Site 4488. Another intact primary burial was identified in Test Area D at Site 7289. This brings the total number of burials identified at TBR to 27 (*Table 6*). The majority of the burials were found in coastal Jaucus Sand deposits near Kawela Bay and Kahuku Point (see *Figure 161*). Three burials (Nos. 7-10) were discovered during archaeological monitoring in Pearl Harbor Clay east of Punahoʻolapa Marsh in Site 6423.

The SAIS subsurface testing consisted of both high density (2 trenches per acre) and low density (1 trench per acre) testing with high intensity testing for all Jaucus Sand and Pearl Harbor Clay sediments. All of the human remains identified during testing were encountered in Jaucus Sand. While traditional Hawaiian burials are potentially present in numerous soil types and topographic settings of sufficient age and integrity, there is an increased potential for such remains to be encountered in areas of intact Jaucus Sand deposits. In addition to burials there is an increased potential to encounter cultural deposits and other subsurface features such as post molds and hearths in intact Jaucus Sand deposits as well as intact Pearl Harbor Clay deposits. Based on the density of test trenches for these soil types, the areal extent of any potential additional cultural deposits would be less than one half acre, and likely much smaller, consisting of isolated remnant deposits and truncated subsurface features.

Although it was not an explicit goal of the SAIS subsurface testing, mapping and interpretation of natural, in addition to cultural stratigraphy, was facilitated by the detailed description of trench-excavated sediments. At least one and in most cases two or three composite stratigraphic profiles were presented in the subsurface findings section for each test area. These profiles summarize the subsurface stratigraphy across each test area and permit a general characterization of natural depositional processes and episodes of cultural deposition and disturbance. In addition, for all coastal test areas (Test Areas A-D) maps depicting maximum trench depths and deposit types by layer are presented. Together these two maps convey vertical and horizontal data. Both figures divide each test area into cells that average approximately one acre for low density sampled areas (Test Area A) and approximately one-half acre cells for the high density sampled areas (Test Areas B and D).

Test Area A has a low potential for encountering intact subsurface cultural deposits or human remains during future excavations based on the results of subsurface testing. Any potential cultural deposits in Area A would be confined to the alluvial sediments overlying the marine-deposited sand. The alluvial deposits are no more than 0.66 m thick and most are substantially less, but the average thickness is 0.37 m. The alluvial deposits are surficial in some places and in others are buried by fill. Testing documented that the entire area has been disturbed by historic agricultural activity that would have destroyed the physical integrity of surficial prehistoric cultural deposits. Prehistoric agricultural use of the alluvial land along Kawela Bay is probable, but evidence for agricultural use is negligible.

Test Area B was formerly used as the staging area for equipment and material during construction of the Turtle Bay hotel and is currently used for generalized recreation-related activities, including horse stables and pasture. Most of the surface is relatively flat and grass-covered, punctuated by clumps of trees around the Test Area boundary, with a perceptible but gentle rise toward the shore. The relatively flat surface lacks visual evidence of the presence of deeply buried sediments. In fact, the limestone substrate at the south end is as shallow as 16 cm below the surface and overlain by minimal alluvial deposition. Trenches across the *mauka* half of Test Area B encountered abundant evidence of fill deposits, extending 1.80 m deep in some places. It is on the *makai* side of Test Area A that aeolian sand deposits exceed 2.5 m and are capped by marine-deposited sand. This area constitutes the back slope of the coastal dune. Prior to development, alluvial sediments behind the bay front were covered by aeolian sand. Episodically deposited marine sand covered the dune and some alluvial deposits on the *mauka* side of the dune.

An intact subsurface human burial (Site 7288) was encountered in an aeolian sand deposit in Test Area B. The topographical setting of the intact burial at Site 7288 and location of sand deposits is the key to identifying areas of increased potential for encountering additional burials in Test Area B. The burial was preserved in an aeolian dune deposit 44 cm below the surface. The aeolian deposit was capped by c. 25 cm of marine deposited sand. There was no evidence of an associated cultural deposit, *per se*. That is, no dark staining, no charcoal flecks, no cultural material other than the burial exposed in the trench wall. Yet, cultural materials characteristic of habitation deposits were recovered from the screened excavation deposits containing mixed Layer I and II sand while recovering bone fragments. The cultural materials are either associated with the burial or with the marine deposited sand, possibly in secondary context, since the burial is presumably in a pit underlying a cultural surface. In either case, intact sand deposits in Test Area B exhibit increased potential for encountering additional subsurface cultural deposits and subsurface features including burials. *Figure 163* illustrates the locations exhibiting increased potential for encountering subsurface cultural remains in Test Area B. These deposits encompass an area of approximately 23,600 sq m (5.8-acres) of Test Area B.

Test Area C is a forested coastal sand dune on the west side of Kaihalulu Bay, c. 90-135 m from the shoreline. The central *makai* side of the dune contains 4.75 to 6.7 m of aeolian sand overlying the limestone substrate. The southwest side of the dune contains 1.0 to 2.60 m of aeolian sand and fill overlying limestone. The southeast side of the dune was possibly mined for sand during WW II, and the pits subsequently filled with trash of the same era. In the late 1980's and early 1990's the north side of the dune was mined for sand in connection with resort development; the pits remain as open holes to this day.

As many as 8 individual burials from the central portion of the dune (Site 4488) have been documented (Kennedy 1992, Carson *et al*. 1996) and an isolated skeletal element was recovered on the ground surface near SP-7 during fieldwork for the SAIS, presumed to be a bone displaced from one of the eight burials. The SAIS study identified relatively shallow disturbance (roads, trash pits, areas of fill) across the dune, but deep, intact aeolian and marine deposited sand deposits remain. The upper 1.5 m of these intact sand deposits exhibit an increased potential for encountering cultural deposits in future excavations and encompass approximately 22,300 sq m (5.5-acres; 68.7%) of Test Area C. The area of increased potential for cultural deposits is depicted in *Figure 164.*

Test Area D is located inland of the forested sand dunes parallel to the shoreline on the west side of Kaihalulu Bay and is undeveloped. The terrain is fairly level and varies in elevation from c. 4 ft to 16 ft. The south one-third of Test Area D contains aeolian sand deposits to a depths exceeding 2.8 m above the water table, overlying gley deposits. The northeastern two-thirds of Test Area D contain c. 0.1 to 3.8 m of tsunami deposits overlying alluvial deposition formed on tropical peat or the limestone substrate. The absence of surface sites in Test Area D can be attributed to widespread land modification associated with the Kahuku Army Airfield and the destructive effects of the 1946 tsunami. Subsurface cultural deposits were identified between 1988-1992 on the north side of Area D at Site 6411-Feature C and Site 6419.

Stratified subsurface prehistoric habitation deposits, including an adult burial, were documented in association with the aeolian deposition at the south end of Test Area D. These deposits are exposed from 0.30 to 0.80 m bgs at Site 7289. Intact stratified subsurface prehistoric habitation deposits were also documented in alluvial deposits in the center of Test Area D at Site 7290 from 0.17 to 0.85 m bgs; Kahuku Army Airfield deposits (Site 7275) seal the underlying prehistoric deposits. Similarly, widespread subsurface prehistoric habitation deposits were documented at the north end of Test Area D, where Site 7291 was documented from 0.38 to 3.53 m bgs in association with alluvial deposition and sealed by Airfield deposits or tsunami deposits. Buried alluvial A horizons that could contain subsurface cultural deposits were identified in an area between Sites 7290 and 7291. Because of the demonstrated association between prehistoric habitation deposits and burials, intact deposits around the prehistoric sites in Test Area D exhibit an increased potential to contain cultural deposits. These deposits and the areas of the three sites comprise approximately 36,500 sq m (9 acres; 56%) of Test Area D. The extent of these areas is presented in *Figure 165*.

Table 6. Summary of burials identified on TBR property

Site Number	Burial Number	Location	Number of Burials	Researchers	Description	Final Disposition of Remains
4488*	11-14, 17	West side of Kaihalala Bay - Test Area C	8	Kennedy (1992), Maly and Rosendahl (1992), Carson *et al.* (1996, 1999), Haun et al. (2012)	Burials 11-14 consist of 4 disturbed burials (3 sub-adults, 1 adult female) removed from dune south of Kulima Point (Kennedy 1992). Disturbed remains of 3+ adults and 1 bone from sub-adult noted by Carson *et al.* (1996, 1999) in same area and designated as Burial 17. Wood and nails suggesting a coffin were found in associated with one set of the Burial 17 remains. Burials 11-14 reinterred following Maly and Rosendahl (1992) BTP. Burial 17 curated with SHPD in 1996 and subsequently reinterred. Isolated metatarsal identified during SAIS	Burials 11-14, 17 Reinterred, Treatment of metatarsal to be determined by O'ahu Island Burial Council (OIBC)
6410	1	TU-20, Makai Test Area A	1	Bath et al. (1984), Walker et al. (1988a), Jensen (1989), Maly and Rosendahl (1992), Kalima (1993)	Adult female burial in wooden coffin within stone-lined cyst noted 1st by Bath et al. (1984), then Walker et al. (1988a). Burial disinterred following guidelines in (1989b) mitigation program. Osteological analysis by conducted by Kalima (1993). Burial reinterred at Reinterment Site as specified in Maly and Rosendahl (1992) Burial Treatment Plan (BTP).	Reinterred
6410	2	TU-9	1	Walker et al. (1988a), Jensen (1989), Maly and Rosendahl (1992), Kalima (1993)	Adult male burial in flexed position noted in pit feature (HF-45) by Walker *et al.* (1988a). Burial disinterred as part of Jensen (1989b) mitigation program. Osteological analysis by Kalima (1993). Burial reinterred following Maly and Rosendahl (1992) BTP.	Reinterred
6410	3, 4, 5, 6, 9	Makai Test Area A	5	Sullivan (1991), Jensen (1989), Maly and Rosendahl (1992), Kalima (1993)	Human remains noted during monitoring of grading for Hotel H-2. Two clusters of two burials found 15 m apart. Burial 3 is a juvenile, Burial 4 is a infant, Burials 5 and 6 are adults. Burials disinterred following guidelines in Jensen (1989b) mitigation plan. During osteological analysis of Burials 5 and 6 by Kalima (1993), single humerous of third individual was noted, designated as Burial 9. Burial reinterred following Maly and Rosendahl (1992) BTP.	Reinterred
6423	7	BT-1, TUs 11 and 13, East side TBR Property	1	Sullivan (1991), Jensen (1989b), Maly and Rosendahl (1992), Kalima (1993)	Human remains noted during monitoring at Site 6423 area, found within a natural sinkhole feature used as a burial pit (HF-12). Cranium and infracranial skeletal remains interpreted as those of female adult from 25 to 30 years of age. Burials disinterred following guidelines in Jensen (1989b) mitigation plan and analysis conducted by Kalima (1993). Burial reinterred following Maly and Rosendahl (1992) BTP.	Reinterred
6423	8, 10	TU-14, East side TBR Property	2	Sullivan (1991), Jensen (1989b), Maly and Rosendahl (1992), Kalima (1993)	Human remains noted during monitoring at Site 6423 area, beneath resort access road and west fork of Marconi Road. Remains were partially articulated and are those of adult female. Burials disinterred following guidelines in Jensen (1989b) mitigation plan and osteological analysis conducted by Kalima (1993). During analysis, fragmentary remains of an additonal sub-adult were found and designated as Burial 10. Both sets of remains reinterred following Maly and Rosendahl (1992) BTP.	Reinterred
6411	15, 19	East Kahuku Point Burial Area	5	Neller (1984), Walker *et al.* (1988b), Maly and Rosendahl (1992)	Burial 15 noted in dunes east of Kahuku Point was exhumed and examined by SHPD (Neller (1984) and determined to be two complete skeletons and one partial skeleton. Walker *et al.* (1988b) identified two burials (Burial 19) in pits in TU-2 in Area B. Burial 19 was re-buried in original location.	Reinterred (Burial 15), Left *in situ* (Burial 19)
6411	16, 18	West Kahuku Point Burial Area	2	Neller (1989), Walker *et al.* (1988b), Maly and Rosendahl (1992)	Burial 16 noted in dunes to west of Kahuku Point and exhumed by Honolulu Police. Remains were subsequently examined by SHPD (Neller (1989). Burial 18 identified by Walker *et al.* (1988b) in TU-24 in Area A. Burial 18 was re-buried in its original location.	Reinterred (Burial 16), Left *in situ* (Burial 18)
7288	-	Test Area B	1	Haun et al. 2012	Burial identified during trenching in Test Area B in BT-B-6-2 . Primary sub-adult burial, estimated age of 6 to 8 years, undetermined gender. Displaced remains reburied in original location	To be determined by OIBC
7289	-	Test Area D	1	Haun et al. 2012	Burial identified during trenching in Test Area D in BT-D-2-1b . Complete adult male primary burial. Displaced remains reburied in original location	To be determined by OIBC
		Total	**27**			

4488* - isolated metatarsal likely element of a previous identified burial

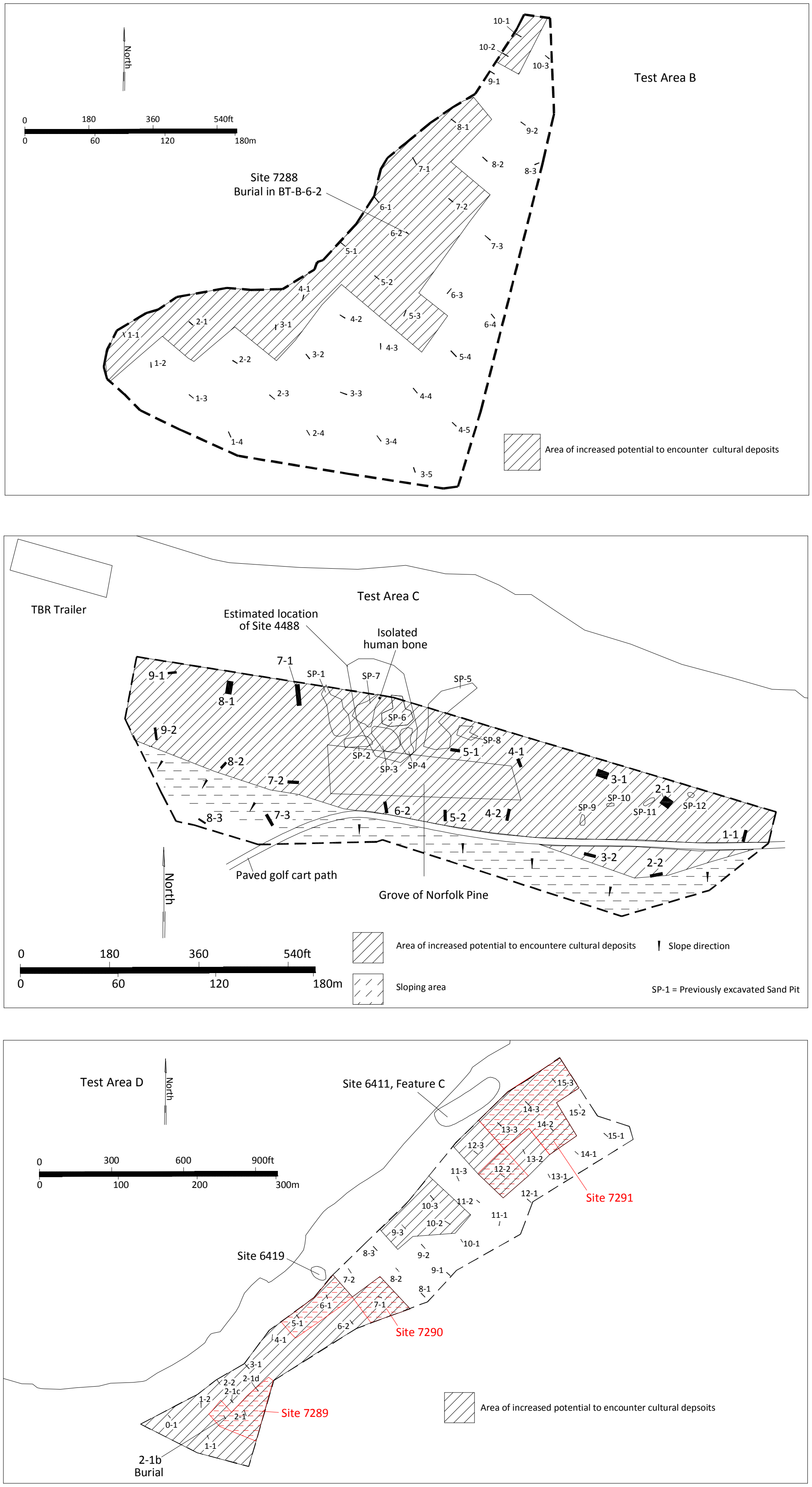


Figure 163. Areas of increased potential for encountering cultural deposits in Test Areas B-D

Test Area E is a relatively level, low lying and currently undeveloped ironwood and *haole koa* forest east of Punahoʻolapa Marsh. The ground surface of Test Area E was extensively modified during construction of the main NW-SE runway of the Kahuku Army Airfield (Site 7275) and peripheral support facilities. A sod farm and nursery formerly used by the resort occupied the south end of Test Area E in the recent past. Testing in Area E documented widespread fill deposits associated with the Airfield overlying alluvial deposits and gley developed on the limestone substrate. WW II-era fill deposits vary in depth from 0.25 to 1.38 m bgs. Where preserved, alluvial deposition was encountered 0.16 to 0.82 m bgs, overlying gley or the limestone substrate. Many fill deposits directly overlie bedrock in Test Area E, but where no fill deposits were encountered, testing documented that alluvial deposits overlying gley or limestone were at least 0.45 to 0.82 m deep. Five subsurface prehistoric habitation sites were identified as a result of testing in Area E (Sites 7292-7296). All are associated with buried alluvial deposition and overlying fill seals many of the cultural deposits. Prehistoric subsurface cultural deposits cover approximately 14,325 sq m (3.5-acres) or 5% of Test Area E.

Test Area F is characterized by widespread surface disturbance associated with 20th Century infrastructure for the OR&L railroad, the Kahuku Army Airfield barracks, the Palmer golf course and ancillary access roads. Although intact alluvial deposits are preserved across much of Test Area F, no evidence of prehistoric subsurface cultural deposits was encountered. It is possible that prehistoric cultural deposits were destroyed as a result of 20th Century land modification, but the potential to encounter intact prehistoric cultural deposits or burials in Test Area F is negligible.

Test Area G consists entirely of alluvial Waialua Silty Clay and was sampled by excavating one-trench per acre. The soil is more suitable for agricultural use rather than habitation and not surprisingly, no evidence of historic or prehistoric habitation was encountered. Test Area G exhibits very low potential for encountering subsurface cultural deposits or burials.

Historic Sites

One site that is potentially prehistoric to early historic in age, is Site 7283, a possible agricultural mound. One of the burials previously documented at Site 4488 was associated with coffin remnants including square nails that likely indicate interment in the 1800s. A section of dry-stacked limestone wall (Site 7299), which probably functioned as a livestock wall associated with Kahuku Ranch was documented and likely dates to the mid- to late 1800s. Charles Hopkins purchased 8,000 acres at Kahuku in 1850-1851 from Kamehameha III and established the Kahuku Ranch (Haun *et al.* 2011:26-27). Forests were cleared for pasture for free-ranging herds of sheep and cattle, which soon plagued the small Hawaiian farms that were scattered throughout the area, eventually displacing many of the farmers. Hopkins land subsequently passed through a series of owners and was sold to James Campbell for $63,500.00 in 1876

In 1889, Benjamin Franklin Dillingham chartered the Oʻahu Railroad and Land Company (OR&L) and leased the Kahuku lands from James Campbell for 50 years (*ibid.*). Dillingham then subleased the lands to James Castle. Castle's Kahuku Plantation Company received its charter in 1890. The company began commercial production of sugarcane using pumped spring water, streams and rain for irrigation. The first sugarcane crop from 2,800 cultivated acres was harvested in 1892. *Figure 164* is based on an 1890 map of Kahuku Plantation and shows areas in sugarcane cultivation. A series of walled enclosures correspond to LCAs surrounding Punahoʻolapa Marsh. An old school and a church are located seaward of the Old Government Road and the Kahuku Ranch buildings are located in the central portion of the TBR property, immediately west of the marsh. The Site 7299 wall (see *Figure 84*), initially identified by Bath *et al.* in 1984, that may be a remnant of a ranch wall shown on *Figure 164*, extends from the inland side of the marsh to the coast east of Kahuku Point.

Bath *et al.* (1984:33) identified another wall site (T-2) on the east side of the marsh that probably was part of the Kahuku Ranch facility (see *Figure 164*). Although not mapped, the site was described as "an L-shaped stacked coral wall. The SE leg is 30 meters long; the NE leg was not followed beyond 40 meters from the wall corner. It appears to go out into the present marsh" (*ibid.*). These walls described by Bath *et al.* are probably part of the

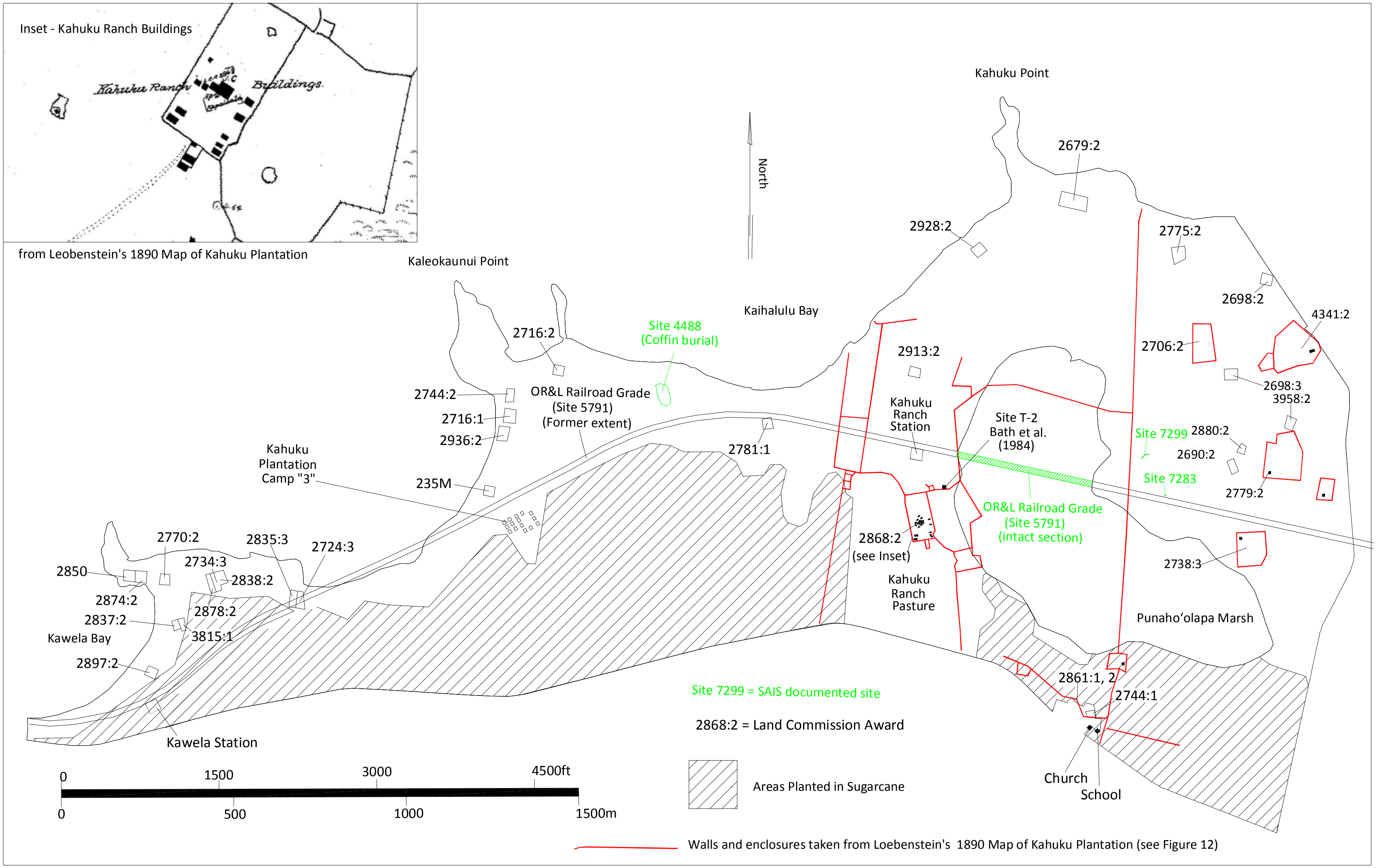


Figure 164. Mid-1800s to early 1900s Sites

complex of walls depicted on *Figure 164* on the east side of the Kahuku Ranch buildings based on Loebenstein's 1890 map of Kahuku Plantation (see inset *Figure 164*).

By 1900, the OR&L Railroad line (Site 5791) extended from Honolulu to Kahuku. Site 5791 is an intact portion of the OR&L railroad grade that consists of a 475 m long causeway extending across Punahoʻolapa Marsh (see *Figure 166*). By the early 1900s there were railroad stations at Kawela, Kahuku Ranch, and Marconi. A plantation camp was established along the railroad between Kawela and Kahuku Ranch Stations to house plantation workers by at least 1932 (see *Figure 164*, "Camp 3"). Marconi Station was located just east of the TBR property at Punamanō Marsh.

Two sites, and potentially a third, date to the early 1930s operation of Marconi Station that was situated adjacent to the TBR property near Kahuku Point (*Figure 165*). The wireless communication facility was established by the Marconi Company in 1914, and its operation was taken over by Radio Corporation of America (RCA) by the 1930s (Bennett 2011:52). The SAIS survey documented two concrete structures (Sites 7279, 7282; see *Figures 51-55*) that functioned to support the station's extensive antenna array (see *Figures 56-57*). Site 7280 is an unusual octagonal concrete structure that also potentially served to support an antenna and may also date to the station's operation in the 1930s (see *Figure 59*). A nearly identical octagonal structure was reported by Bath *et al.* (1984) in the same vicinity as 7280 (Site T-4), but differences in reported dimensions and location indicates it is not the same feature identified at Site 7280, but rather a second one.

The majority of the sites (22 of 39) documented by the SAIS work are associated with the Kahuku Army Airfield (see *Figure 165*). The SIHP Site Number 7275 is applied to the main runway in Area E, but is also used here generically to refer to the entire airfield facility. The airfield was a large military complex covering 12,000 acres, that was initially transferred by the James Campbell Estate to the US Navy for use as a bombing range and subsequently to the US Army for use as an airfield. Construction on the runway began in December 1941 and the airfield was in use until March 1946, and was not returned to the landowner until sometime between June 1947 and March 1948 (Bennett 2011: 52, 59).

David Trojan of the Hawaiian Aviation Preservation Society (Trojan, n.d.) presents a brief history of the construction and use of the airfield:

> There are references to Kahuku as an emergency field dating to the 1930's, but it was not until the United States entered World War II that the airfield was developed. Kahuku Army Airfield was classified as an auxiliary field and had a very short life span, from 1942 until it was closed in the late 1940's. Ground troops were stationed in the area to protect the airfield and man the shoreline fortifications. The northern tip of Oahu had a total of three airfields in close proximity during World War II. The Kahuku Point Airfield was located near the tip of Kahuku Point, and was evidently the most elaborate.
>
> The Kahuku Army Airfields were used for training of pilots from Wheeler AAF for instrument flying on different types of aircraft. The airfield was ideal for training because it had a good approach, runway length, and take off clearance. This field was not over populated like Hickam or Wheeler. It is documented that the 18th Air base Group, 47th Pursuit Squadron was stationed there along with B-24s and B-17s that were based at Kahuku for short periods of time during World War II.

The Airfield encompassed runways, taxiways, revetments, bunkers and artillery emplacements. A composite of three blueprint sheets of the airbase shows its various components (see *Figure 17*); note the U-shape revetments used for airplane storage located adjacent to the runways. A recent aerial photograph of the TBR property (Figure 20 in Haun *et al.* 2011:36) shows the extent of the Kahuku Army Airfield facility superimposed on it as well as a large area for barracks and other facilities inland of the Airfield (see *Figure 11*). The Airfield, revetments and barracks occupied approximately 195 acres (23%) of the TBR property.

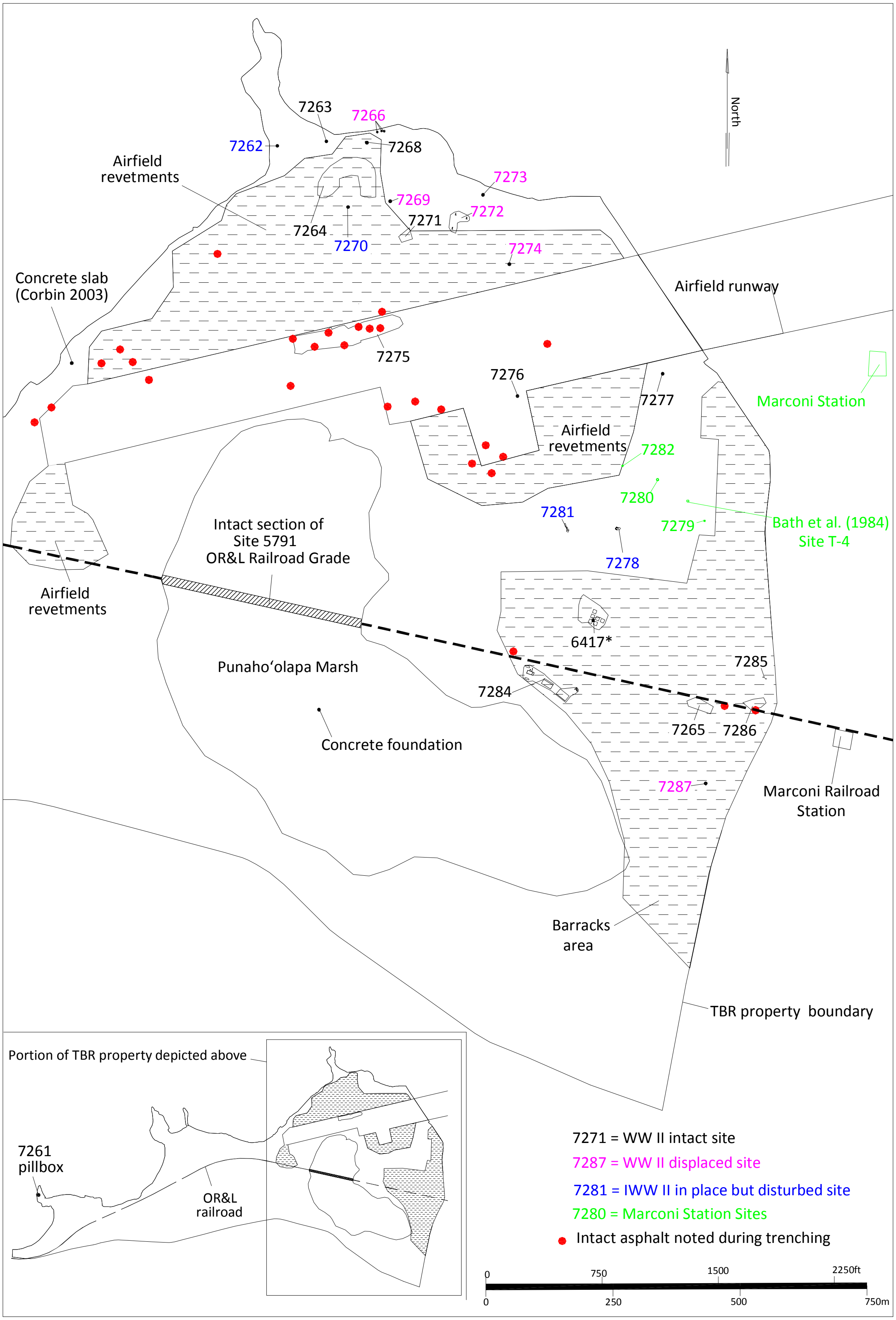


Figure 165. World War II and Marconi Station Sites

The surviving remnants of the airfield recorded during the SAIS fieldwork consist of a concrete pillbox located at Kawela Bay (Site 7261; see inset *Figure 165*), 11 sites located in the Kahuku Point Archaeological Preserve (Sites 7262-7264, 7266 and 7268-7274), six sites located in Test Area E (Sites 7275-7278 and 7280-7281) and five sites located in Test Area F (Sites 7265 and 7284-7287). Although many of the structures are displaced and badly damaged, likely by tsunami in 1946 and 1957 and during the construction of the golf course, intact remnants of the complex are present. *Figure 165* depicts the distribution of all World War II era sites documented by the SAIS and prior studies.

The central feature of the Airfield facility is Site 7275, a 717' long section of the original 6,500' long airfield runway. The NE-SW main runway served as the primary feature of the airfield and was used for pilot training. Following the war, the runway was used as a race course and as a civilian airfield. An intact earthen revetment (Site 7264) is present to the north of the runway, used for the storage and protection of the military aircraft. It is the only documented revetment of 32 or more that were situated on the north and south sides of the main runway. As is illustrated in *Figure 165*, the extant exposed portion of the runway represents a tiny portion of the overall surface. The SAIS subsurface testing encountered intact asphalt pavement in 27 locations that are depicted as red dots on *Figure 165*. The dots shown within the area of the Site 7275 portion of the runway are surface exposures of the pavement and the other red dots denote intact runway pavement in subsurface contexts in test trench walls. The dots within the runway foot-print shown on *Figure 165* were part of the main runway and the ones situated elsewhere represent remnants of taxiways, service aprons, roads, and other paved areas; however, no attempt was made to correlate these with specific features.

Figure 165 color codes the Airfield SIHP site numbers with degraded physical integrity, in which pink indicates displaced remains, and blue indicating in place, but damaged features. All except for one of the displaced sites are situated adjacent to the shoreline and probably represent structural remnants that were displaced by the 1946 and/or 1957 tsunamis. The one displaced structure situated inland is Site 7287, located in the airfield barracks area (see *Figure 83*). The structure is situated upside down on a mechanically-piled berm of boulders and other debris. Site 7287 appears to be identical to a relatively intact concrete structure, Site 7278 (based on dimensions and other construction attributes), situated in the central portion of the airfield facility in between the main runway and the inland barracks area (see *Figures 48-50*). Two other sites consist of concrete structural remnants that probably are from the same type of structure (Sites 7272 and 7281). The structures all are interpreted as possible gun positions, potentially open revetments for anti-aircraft guns, based on their morphology and locations around the periphery of the main runway facility.

Figures 166 and *167* show the locations of several sites associated with the Airfield. *Figure 166* is a 1942 aerial photograph showing the Airfield facility as originally constructed. It shows the OR&L Railroad line (Site 5791) extending through the facility and the probable locations of several sites along the rail line. The railroad was used to transport troops to base (Bennett 2011). A group of faintly visible structures potentially includes a cluster of six concrete pads recorded as Site 6417 by Corbin (2003; see Haun *et al.* 2011:63, Figure 32). *Figure 167* is a 1943 map of the main cantonment, or barracks area from Bennett (2011:54). It shows the same area depicted in the *Figure 166* aerial.

The map (see *Figure 167*) also shows the location of the most intact group of Airfield structures on the TBR property. These are the foundations of three buildings at Site 7284 (Features A, B and D) that were apparently constructed in 1943 based on their absence in the aerial photograph from the previous year. Also shown are the locations of the Site 7265 concrete slab and Site 7286 pavement. The concrete slab apparently was the foundation for a large building, probably a warehouse situated on the inland side of the OR&L railroad. The Site 7286 asphalt pavement is correlated with an expanse of pavement at a road intersection on the seaward side of the railroad grade. Trench F-3-9 was excavated on the inland side of the pavement and encountered an asphalt pavement overlying probable railroad grade fill indicating the Site 7286 pavement also served as a railroad crossing. The gate posts recorded as Site 7285 probably were positioned on either side of a main road leading from this paved intersection seaward toward the main runway. The estimated locations of the slab, pavement, and gate posts are also shown on the *Figure 166* aerial photograph.

The remaining site identified during the SAIS fieldwork is an abandoned 1950s era bus in Test Area A (see *Figures 31-34*). The Site 7267 bus was operated by the Honolulu Rapid Transit Company for the City and County of Honolulu until at least 1973. Sugarcane cultivation continued until 1971 when the Turtle Bay Resort and golf course were constructed. Some inland portions of the property continued to be used for vegetable farming until the 1980s.

Consultation

This SAIS Plan was prepared in consultation with DLNR-SHPD, the Office of Hawaiian Affairs (OHA), and the O'ahu Island Burial Council (OIBC). The consultation ensures that the work complies with applicable laws, regulations and rules. This consultation also ensures that the Plan reflects a mutually acceptable scope of work for the SAIS fieldwork prior to implementation. Consultation with the OIBC included an informational briefing regarding the SAIS work to solicit input regarding the study, and to identify any additional interested parties.

The consultation process sought input from interested organizations and individuals, including the local community, Hawaiian cultural organizations, potential lineal and cultural descendants and individuals knowledgeable about the TBR property cultural resources and land use history. SAIS consultation included TBR management meetings with the Kahuku Burial Committee (KBC), composed of families who have a connection to TBR lands and who have expressed a desire to take an active role in caring for ancestral remains on the property. Consultation also included TBR management meetings with the Ko'olauloa and Ko'olaupoko Hawaiian Civic Clubs. TBR management has invited cultural practitioners, *kūpuna* and knowledgeable individuals to be part of a cultural advisory council to share their *mana'o* on the cultural issues associated with TBR.

Public notices seeking to identify interested parties, including potential lineal and cultural descendants, were published in Honolulu Star-Advertiser (May 5, 2011) and the monthly OHA newsletter Ka Wai Ola (June 2011). Two responses to the notices were received, including one individual who owns a *kuleana* parcel surrounded by the TBR property.

Consultation is also part of the Cultural Impact Assessment (CIA) prepared by Pacific Legacy, Inc. for the TBR property and was conducted in accordance with HAR §13-13-284-(c)-(3) and §13-13-276-5-(g). The CIA study concluded:

> In summary, the Turtle Bay Resort property contains an array of cultural resources that are currently being used for traditional cultural practices, including marine food sources, medicinal plants, plants used in crafts, wood for woodcarving, and salt for various uses. The presence of human burials on the property has also been established. Furthermore, supernatural and/or divine phenomenon in the project area experienced by a few informants and acknowledged by others, suggests that there is still cultural significance and spiritual connection for those who have ancestral ties to the land (Mooney and Cleghorn 2012:75).

The DLNR-SHPD and KBC were consulted concerning SAIS identification of all human remains. KBC members conducted a site visit following the identifications and provided cultural protocols for the isolated bone at Site 4488 in Test Area C and the burials in Test Area B (Site 7288) and Test Area D (Site 7289). According to a memorandum dated March 12, 2012, from the KBC to TBR and Haun & Associates, at a Committee meeting on March 8, 2012, the Committee members recommended:

1. Reburial of the isolated element in Area C at a reinterment site on TBR property where the previously discovered remains of eight individuals from the same location were reburied;
2. Preservation in place for the burial in Test Area D because it is situated in area that the TRB Revised Master Plan designates for park use; and

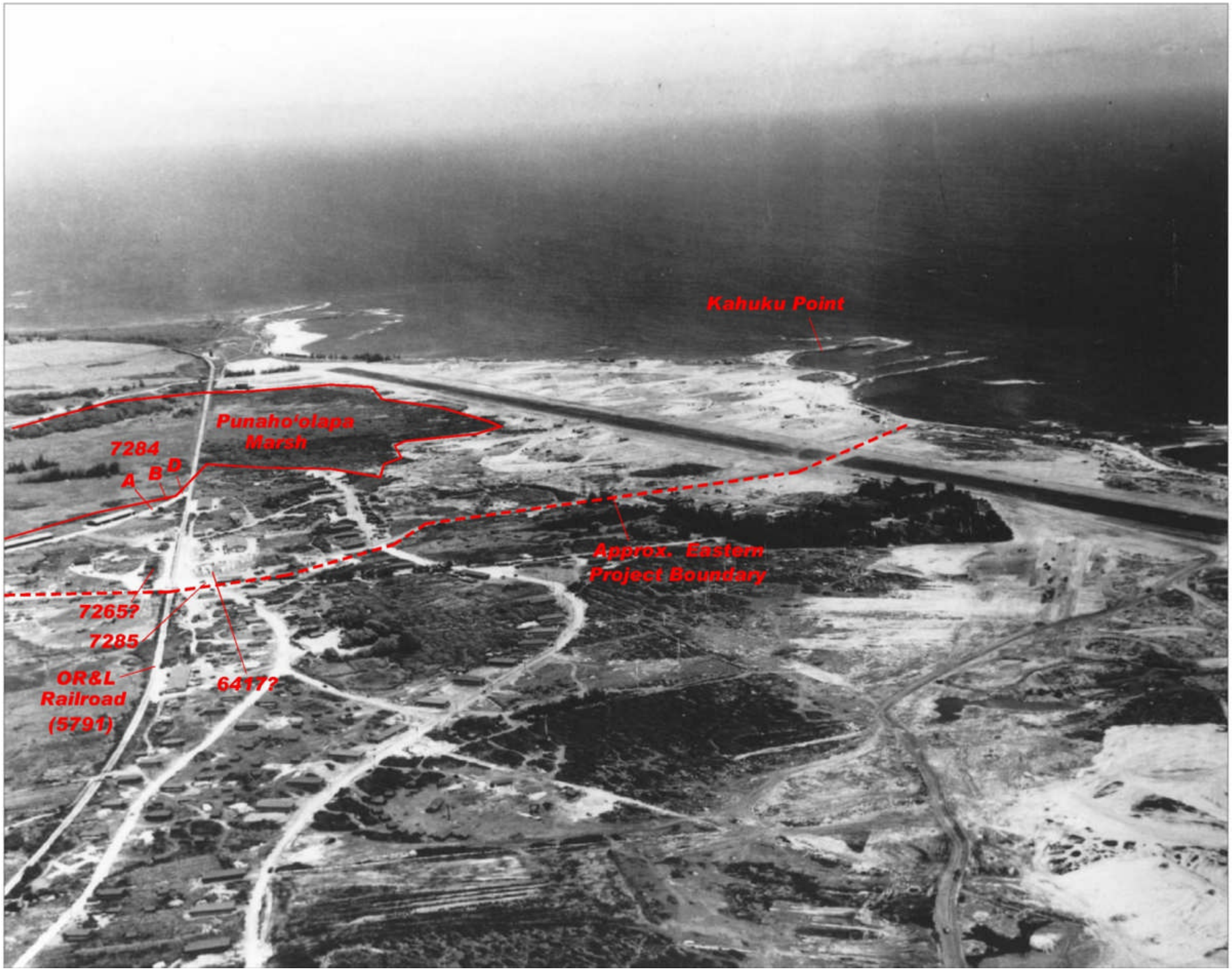


Figure 166. August 20, 1942 photograph of Kahuku Army Airfield

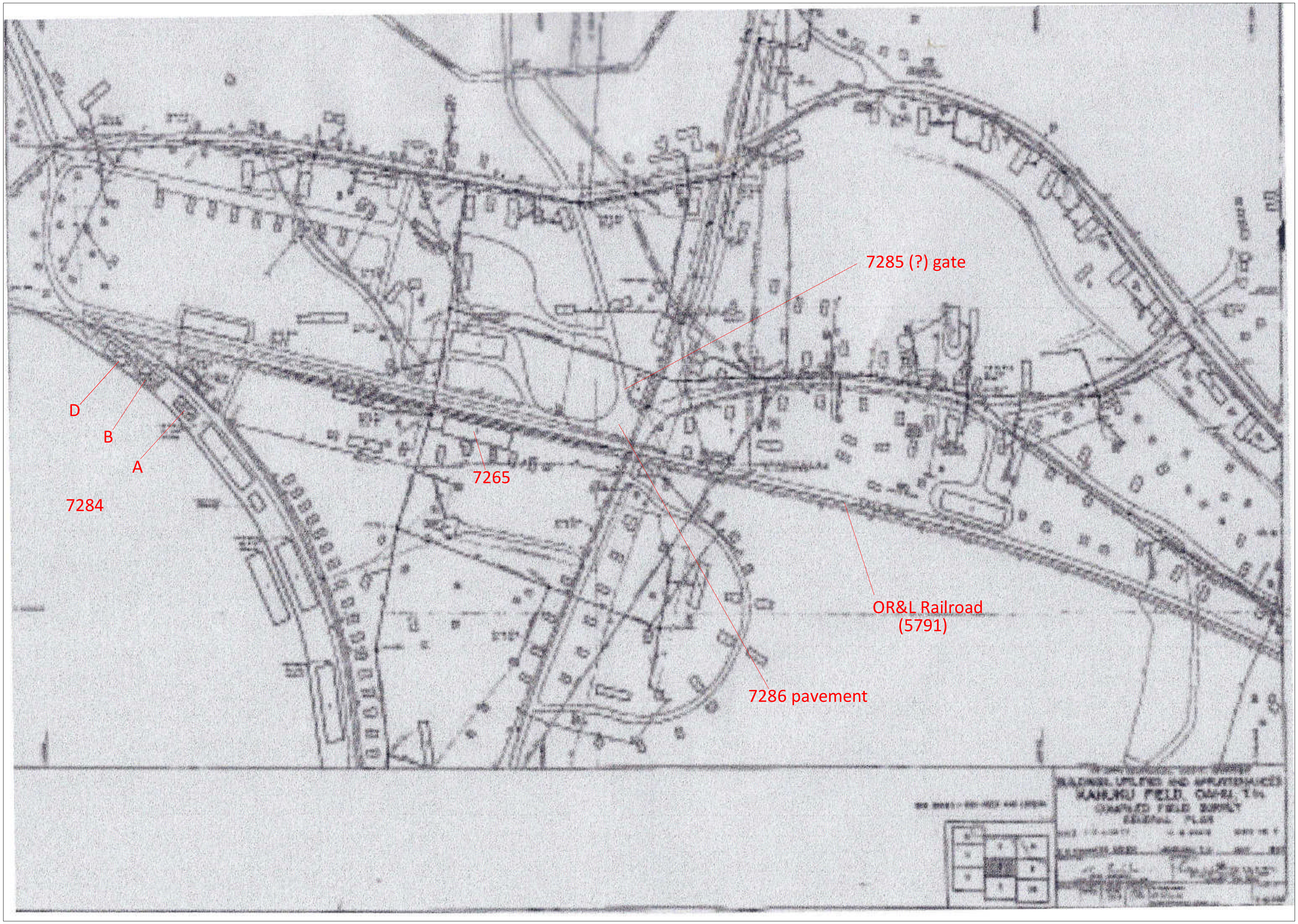


Figure 167. Main cantonment of Kahuku Army Airfield (from Bennett 2011:54)

3. Relocation of the Test Area B burial to a permanent preservation site within a Revised Master Plan-proposed park in Hanakaʻoe Ahupuaʻa.

The Committee further recommended that planned park areas be used for reburial of any future inadvertently discovered burials from the same *ahupuaʻa*. TBR concurs with the KBC's recommendations on disposition of the three previously identified human remains.

Significance Assessments

Pursuant to DLNR (2003) Chapter 275-6 (d), the initial significance assessments provided herein are not final until concurrence from the DLNR has been obtained. The sites documented during the survey are assessed for significance based on the criteria outlined in the Rules Governing Procedures for Historic Preservation Review (DLNR 2003: Chapter 275). According to these rules, a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criteria:

1. Criterion "a". Be associated with events that have made an important contribution to the broad patterns of our history;

2. Criterion "b". Be associated with the lives of persons important in our past;

3. Criterion "c". Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

4. Criterion "d". Have yielded, or is likely to yield, information important for research on prehistory or history; and

5. Criterion "e". Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts--these associations being important to the group's history and cultural identity.

Table 7 lists the significance assessments and recommended treatments for the 39 sites documented by the SAIS project. Two other sites the Kahuku Point Archaeological Preserve (Site 6411) and Punaho'olapa Marsh (Site 6412) are also included in the table for a comprehensive list of extant sites on TBR property. These two sites were previously assessed as significant for their research value and approved for data recovery (Walker *et al.* 1987); however, the landowner subsequently elected to preserve both sites. The remaining 39 sites are all assessed as significant under Criterion "d". The sites have yielded information important for understanding prehistoric and historic land use in project area. Two sites (7261 and Features A, C and D of 7284) are assessed as significant under Criterion "c" as good site type examples because they are the most intact remaining structures on TBR property that are associated with Kahuku Army Airfield. Three sites are additionally assessed as significant under Criterion "e" because human burials of probable Hawaiian ancestry are present (Sites 4488, 7288 and 7289).

Recommended Treatments

The mapping, written descriptions and photography at 16 sites adequately document them and no further work or preservation is recommended (see *Table 7*). These sites consist of World War II era features (Sites 7265, 7275-7278, 7281 and 7284-7287), three sites that date to the early 1930s used in conjunction with Marconi Station (Sites 7279, 7280 and 7282), a stone wall (Site 7299), a stone mound (7283) and an abandoned 1950s era bus (Site 7267).

Treatment of the human remains identified at Sites 4488, 7288 and 7289 will be determined by the O‘ahu Island Burial Council (OIBC) in consultation with the Kahuku Burial Committee, other SHPD-recognized lineal or cultural descendants, and TBR. The determination process will require preparation of a Burial Treatment Plan.

Fourteen sites and two features of an additional site are recommended for preservation. These sites consist of the Kahuku Point Archaeological Preserve (Site 6411) and Punaho‘olapa Marsh (Site 6412), the extant section of the Site 5791 railroad grade across the marsh, the Site 7261 military pillbox and 11 WWII-era sites situated within the boundaries of the Kahuku Point Archaeological Preserve (Sites 7262-7264, 7266 and 7268-7274).
The eight remaining sites (Sites 7283 and 7290-7296) and the non-burial portion of Site 7289 retain the potential to yield information important for understanding prehistoric and early historic land use. These sites are recommended for data recovery, which would entail excavation to obtain a larger sample of portable remains and dating samples. The plans for data recovery would be detailed in a Data Recovery Plan prepared for DLNR-SHPD review and approval.

Specific plans for treatment of the burial features would be detailed in a Burial Treatment Plan prepared for DLNR-SHPD and the O‘ahu Island Burial Council (OIBC) review and approval. Measures to protect the non-burial sites recommended for preservation would be described in an Archaeological Site Preservation Plan prepared for DLNR-SHPD review and approval.

It is also recommended that all ground disturbing activities within the project area be monitored by an archaeologist. The extent and nature of this monitoring activity would be described in an Archaeological Monitoring Plan prepared for DLNR-SHPD review and approval. The monitoring plan should have provisions for variable intensity monitoring. The highest intensity would be for areas determined to have an increased potential for encountering cultural deposits (see *Figure 163*). At a minimum, construction excavation work in these areas should be done in a manner that maximizes archaeological monitoring effectiveness. The excavation of sand should be done by excavators and not with bulldozers or graders. Each excavating machine should have at least two monitors; one observing the excavation equipment as it digs and the other scanning the excavated material.

Table 7. Site Significance and Recommended Treatments

SIHP Site No.	Formal type	Function	Area	Significance Criteria	Recommended Treatment
4488	Human remains	Burial	C	D, E	OIBC*
5791	Railroad grade	Transportation	Punahoʻolapa Marsh	D	PR
6411	Cultural deposit with burials	Habitation/Burial	Kahuku Point	D, E	PR
6412	Punahoʻolapa Marsh	Agriculture/Resource Area	Punahoʻolapa Marsh	D	PR
7261	Concrete structure	Gun position	Kawela Bay	C, D	PR
7262	Concrete slab	Indeterminate	Kahuku Point	D	PR**
7263	Concrete pier block	Antenna support?	Kahuku Point	D	PR**
7264	Revetment	Storage	Kahuku Point	D	PR**
7265	Concrete slab	Foundation	F	D	NFW
7266	Concrete pier blocks	Antenna support?	Kahuku Point	D	PR**
7267	Transit bus	Transportation	A	D	NFW
7268	Concrete structure	Indeterminate	Kahuku Point	D	PR**
7269	Concrete structure remnant	Indeterminate	Kahuku Point	D	PR**
7270	Metal tank	Storage	Kahuku Point	D	PR**
7271	Asphalt area	Transportation	Kahuku Point	D	PR**
7272	Concrete structure	Gun position?	Kahuku Point	D	PR**
7273	Concrete block	Indeterminate	Kahuku Point	D	PR**
7274	Concrete cylinder	Possible light fixture base	Kahuku Point	D	PR**
7275	Asphalt area	Runway remnant	E	D	NFW
7276	Concrete block	Anchor base	E	D	NFW
7277	Concrete slab	Foundation	E	D	NFW
7278	Concrete structure	Gun position?	E	D	NFW
7279	Concrete block	Antenna support?	E	D	NFW
7280	Concrete structure	Antenna support?	E	D	NFW
7281	Concrete structure	Gun position?	E	D	NFW
7282	Concrete block	Antenna support?	E	D	NFW
7283	Stone mound	Possible agricultural	F	D	NFW
7284	Foundation Complex	Military Support	F	D	NFW
7285	Metal posts	Gate	F	D	NFW
7286	Asphalt area	Pavement	F	D	NFW
7287	Concrete structures	Gun position?	F	D	NFW
7288	Human remains	Burial	B	D, E	OIBC*
7289	Cultural deposit with burial	Habitation/Burial	D	D, E	DR/OIBC*
7290	Cultural deposit	Habitation	D	D	DR
7291	Cultural deposit	Habitation	D	D	DR
7292	Cultural deposit	Habitation	E	D	DR
7293	Cultural deposit	Habitation	E	D	DR
7294	Cultural deposit	Habitation	E	D	DR
7295	Cultural deposit	Habitation	E	D	DR
7296	Cultural deposit	Habitation	E	D	DR
7299	Wall	Livestock control	Punahoʻolapa Marsh	D	NFW

Signficance Criteria - C = Good site type example, D = Important for information content, E = Cultural Value

Treatments - DR = Data Recovery, PR = Preservation, NFW = No further Work

OIBC = Treatment of human remains to be determined by Oʻahu Island Burial Council*

*PR** = Sites within the Kahuku Point Archaeological Preserve*

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APPENDIX A- SHPD Acceptance Letter for SAIS Plan

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
KAHUHIHEWA BUILDING
601 KAMOKILA BLVD, KAPOLEI HI 96706

December 12, 2011

Alan E. Haun, Ph.D
Principal Investigator
73-1168 Kahuna A'o road a
Kailua, Kona Hi 96740

Log# 2011.3197
Doc # 1112PA02

Dear Dr. Haun:

Re: Revised Plan for Supplemental Archaeological Inventory Survey
Lands of Kahuku, Punalau, Ulupehupehu, 'Oio, Hanaka'oe, Kawela, and 'Opana
Koolauloa District, Island of Oahu
TMK (1) 5-6-003:040-042, 044; 5-7-001:001, 013, 016, 017, 020, 022, 028, 030, 031, 033; 5-7-006:001-017, 019, 020

Thank you for the above referenced document entitled, *Plan for Supplemental Archaeological Inventory Survey, Lands of Kahuku, Punalau, Ulupehupehu, 'Oio, Hanakaoe, Kawela and 'Opana, Koolauloa District, Island of Oahu, TMK (1) 5-6-003:040-042, 044; 5-7-001:001, 013, 016, 017, 020, 022, 028, 030, 031, 033; 5-7-006:001-017, 019, 020 (*Haun, A.E, Berrigan, D.M, & Henry, D. Revised November 2011*)*. We received your report on December 1.

The plan proposes to supplement earlier archaeological inventories done of the project area, and focuses mainly on untested areas of jaucus sand and Pearl Harbor Clay deposits, and expanding study areas where burial, or significant cultural layers were found that are being proposed for development. We had asked for three corrections and all have been addressed in the revised document.

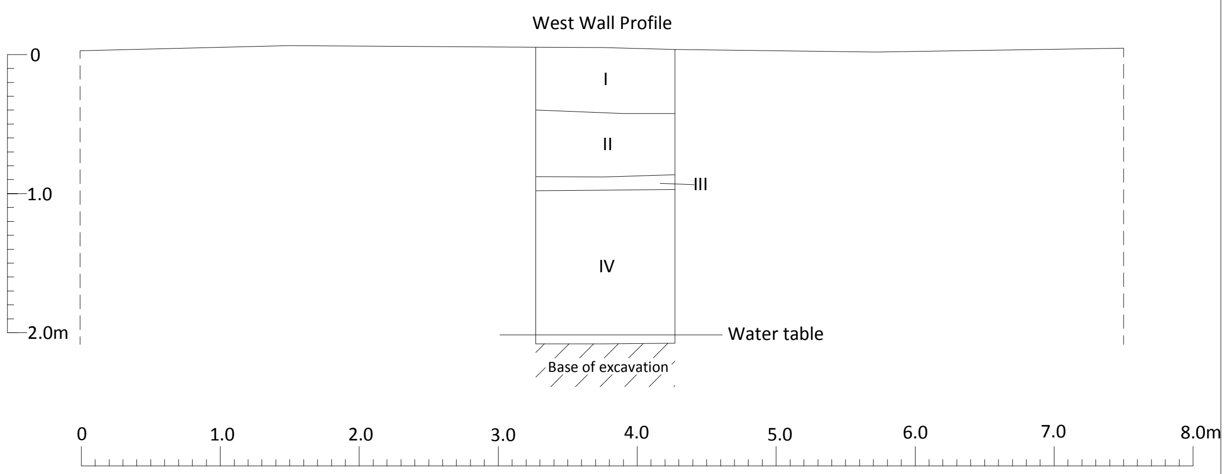
Based on the information provided in the report, we believe that an adequate study area is being proposed, and that your research question regarding site types, site density and where feasible, dates or occupation are all appropriate. This plan meets the requirements of HAR 13-284 (c). Please provide a copy of this letter, and one copy of the report, clearly marked FINAL to the Kapolei office, as well as an electronic version on CD.

Sincerely,

Pua Aiu
Administrator

APPENDIX B- Trench Profiles

Area A Trenches



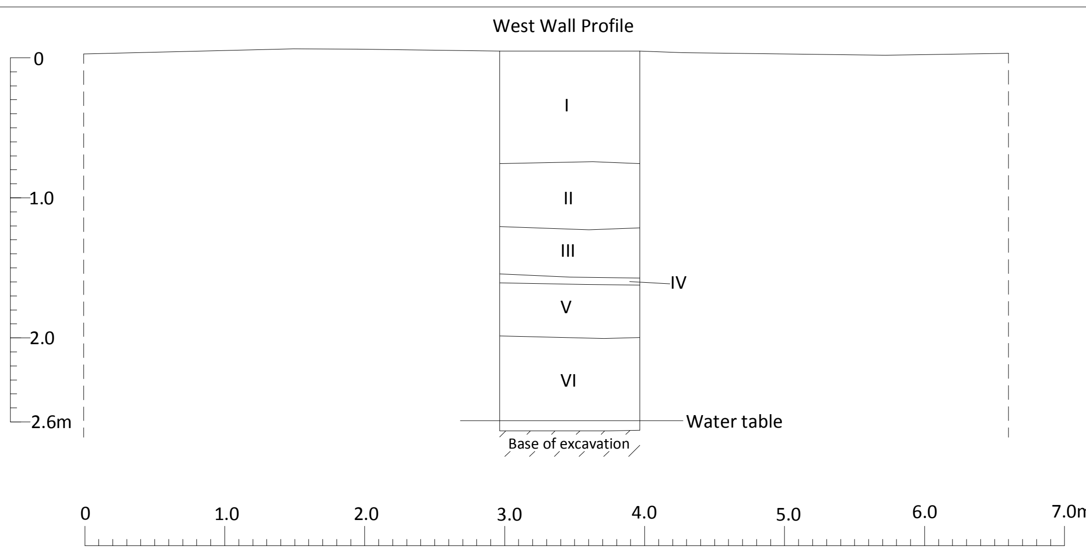
Layer I - Very dark brown (7.5YR 2.5/3) friable sandy clay loam; plow zone; Aggregate present

Layer II - Yellowish red (5YR 5/8) coarse marine sand; No cultural remains

Layer III - Very pale brown (10YR 8/4) coarse marine sand; No cultural remains

Layer IV - White (10YR 8/1) to very pale brown (10YR 8/2) very coarse sand; No cultural remains

Figure B-1. Profile of BT-A-1-1



Layer I - Very dark brown (10YR 2/2) friable sandy clay loam; Plastic hose and crushed rock present

Layer II - Dark brown (7.5YR 3/3) friable sandy clay loam; plow zone; Volcanic glass core present

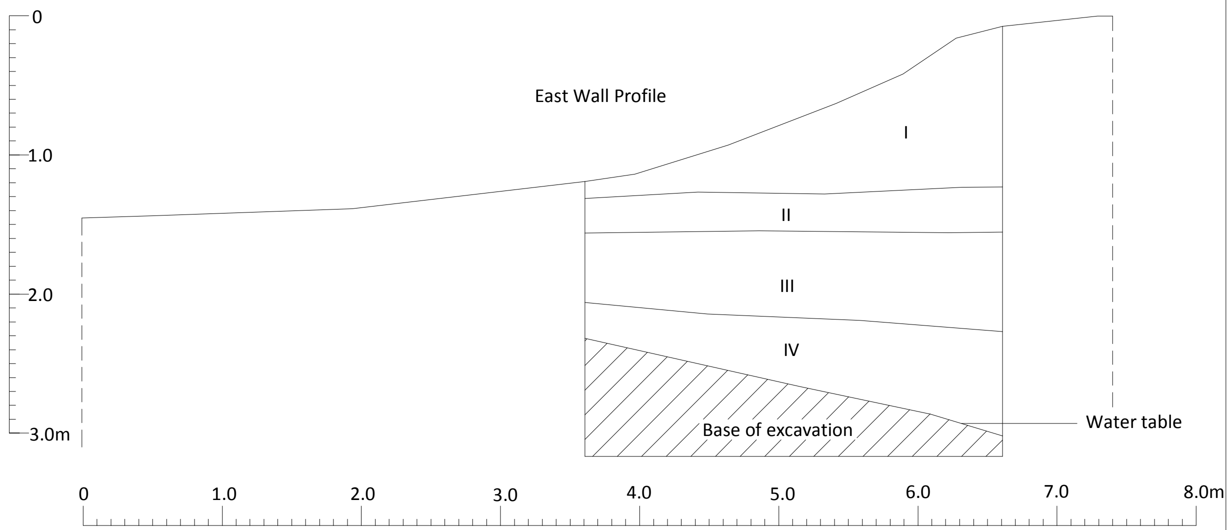
Layer III - Strong brown (7.5YR 5/6) coarse marine sand; No cultural remains

Layer IV - Brown (7.5YR 5/2) calcium carbonate precipiate; No cultural remains

Layer V - Very pale brown (10YR 8/3 to 10YR 8/4) coarse marine sand; No cultural remains

Layer VI - Very pale brown (10YR 8/1) compact weathered limestone; No cultural remains

Figure B-2. Profile of BT-A-1-2



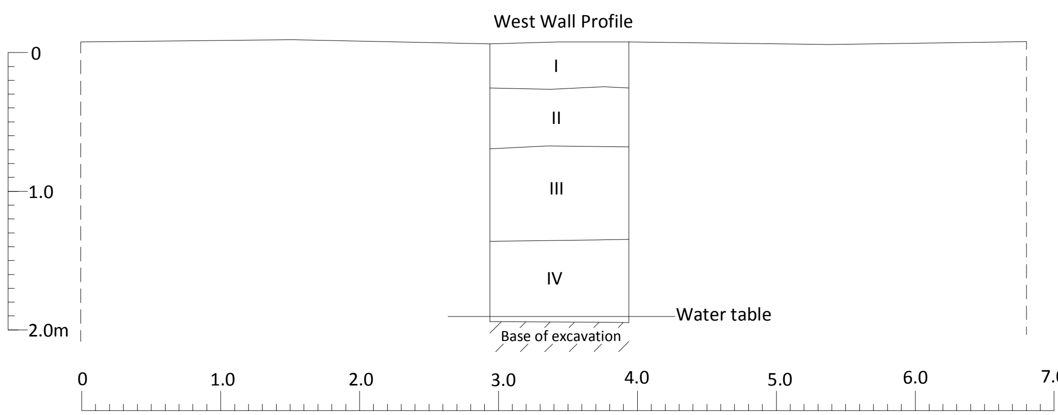
Layer I - Dark brown (10YR 3/3) friable sandy clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/3) friable sandy clay loam; plow zone; No cultural remains

Layer III - Reddish yellow (7.5YR 6/6) coarse marine sand; No cultural remains

Layer IV - Very pale brown (10YR 8/2) to light gray (10YR 7/2) limestone sand; No cultural remains

Figure B-3. Profile of BT-A-1-3



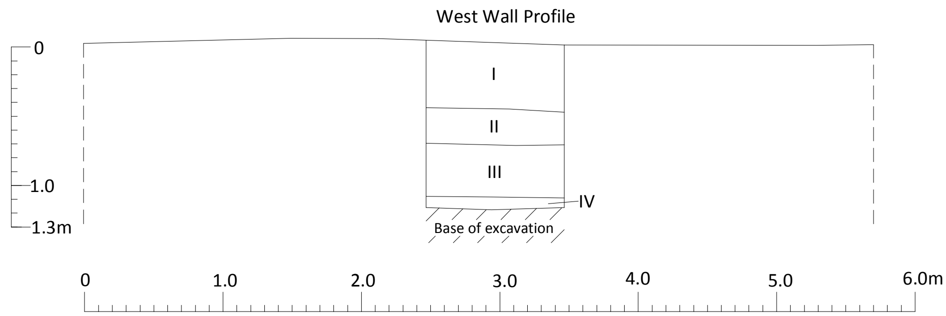
Layer I - Very dark brown (10YR 2/2) friable sandy clay loam; plow zone; No cultural remains

Layer II - Very dark brown (7.5YR 2.5/3) friable sandy clay loam; plow zone; No cultural remains

Layer III - Pink (7.5YR 8/3 to 7.5YR 8/4) coarse marine sand; No cultural remains

Layer IV - White (10YR 8/1) limestone sand; No cultural remains

Figure B-4. Profile of BT-A-2-1



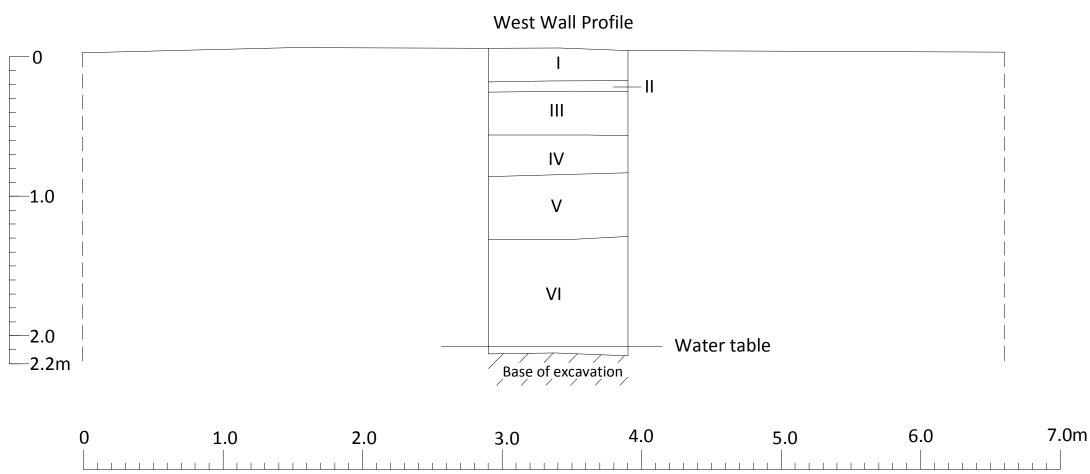
Layer I - Dark brown (7.5YR 3/2) friable sandy clay loam; plow zone; No cultural remains

Layer II - Reddish yellow (7.5YR 6/6) coarse marine sand; No cultural remains

Layer III - Very pale brown (10YR 7/3) loose aeolian sand; No cultural remains

Layer IV - Very pale brown (10YR 7/3) limestone sand; No cultural remains

Figure B-5. Profile of BT-A-2-2



Layer I - Dark brown (7.5YR 3/3) friable sandy loam; plow zone; No cultural remains

Layer II - Light yellowish brown (10YR 6/4) loose sand; No cultural remains

Layer III - Dark brown (7.5YR 3/3) friable sandy loam; plow zone; No cultural remains

Layer IV - Reddish yellow (7.5YR 6/6) fine marine sand ; No cultural remains

Layer V - Very pale brown (10YR 8/2) coarse marine sand; No cultural remains

Layer VI - White (10YR 8/1) limestone sand; No cultural remains

Figure B-6. Profile of BT-A-2-3

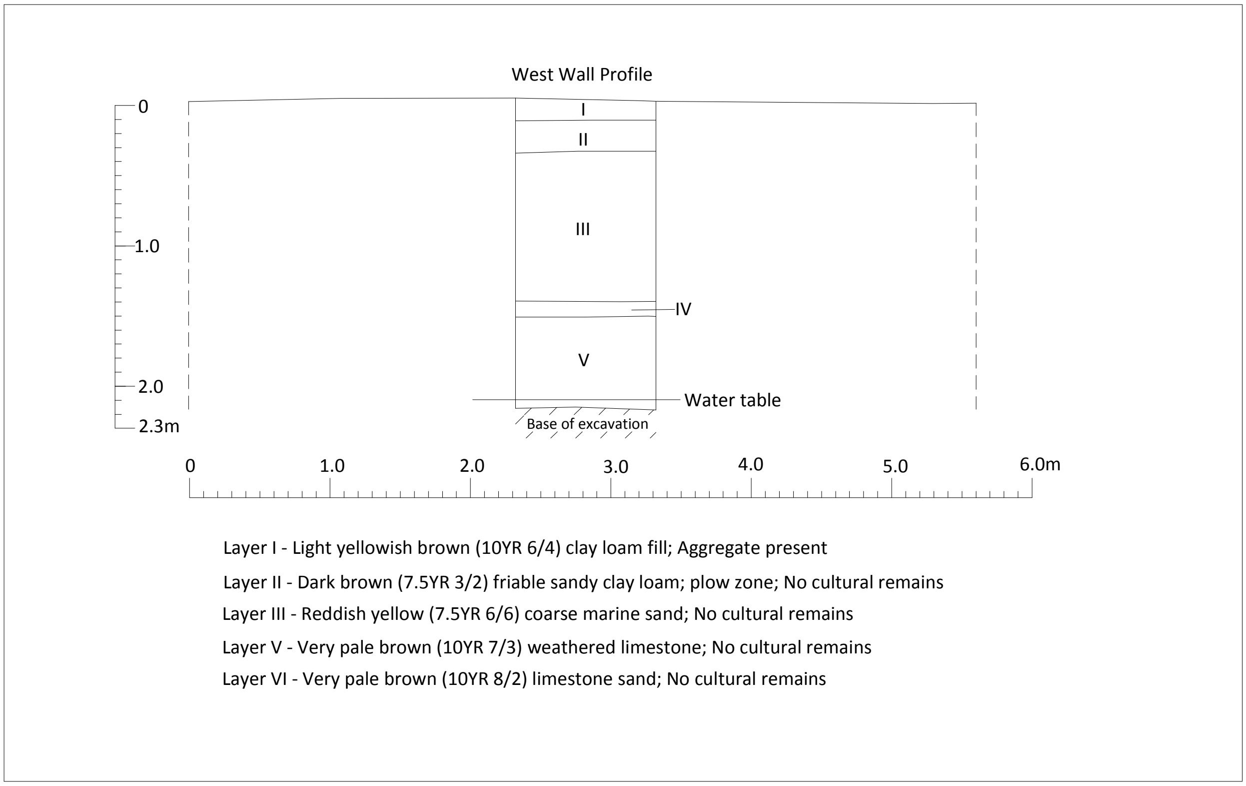


Figure B-7. Profile of BT-A-3-1

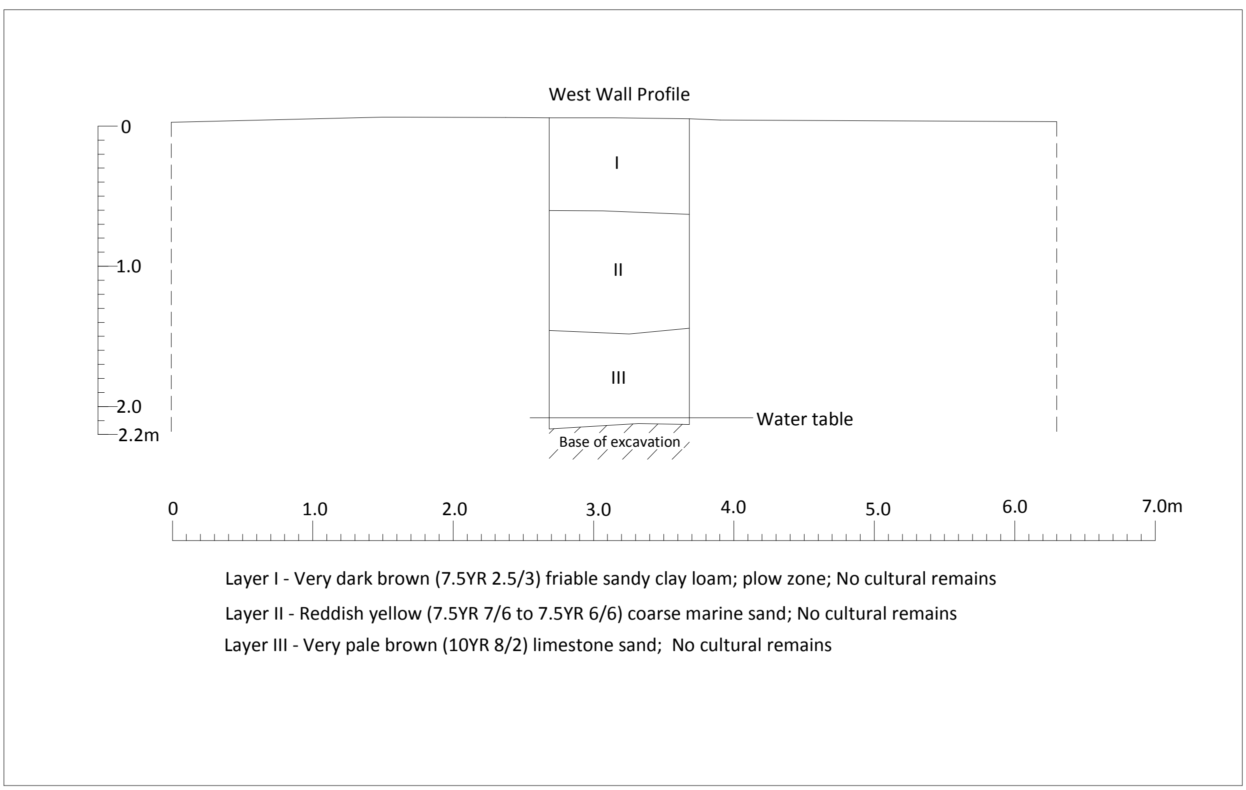
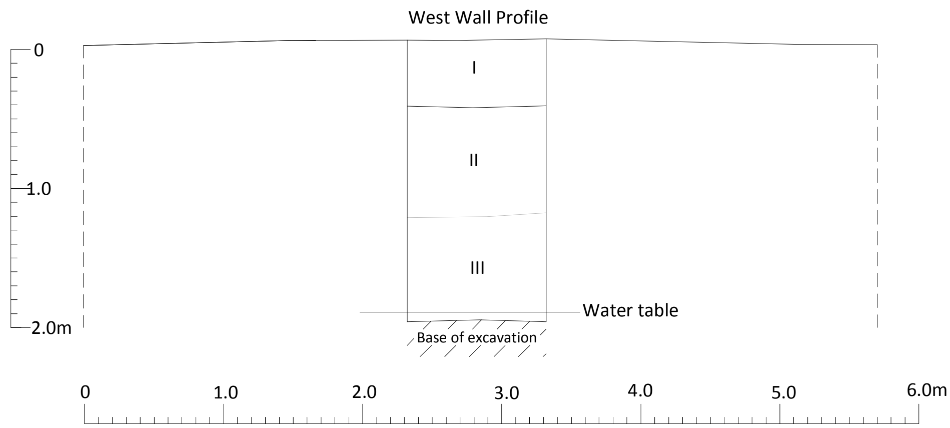


Figure B-8. Profile of BT-A-3-2

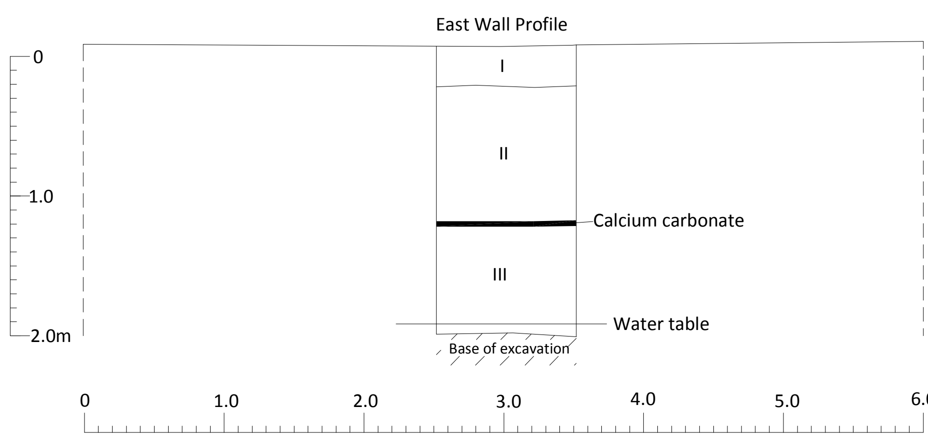


Layer I - Very dark brown (7.5YR 2.5/3) friable sandy clay loam; plow zone; No cultural remains

Layer II - Strong brown (7.5YR 5/8) coarse marine sand; No cultural remains

Layer II - White (10YR 8/1) to very pale brown (10YR 8/2) limestone sand; No cultural remains

Figure B-9. Profile of BT-A-3-3



Layer I - Very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) friable sandy loam; plow zone; No cultural remains

Layer II - Very pale brown (10YR 7/4 to 10YR 8/2) coarse marine sand; No cultural remains

Calcium carbonate = Brown (7.5YR 5/2) precipitate; No cultural remains

Layer IIII - White (10YR 8/1) to very pale brown (10YR 8/2) limestone sand; No cultural remains

Figure B-10. Profile of BT-A-4-1

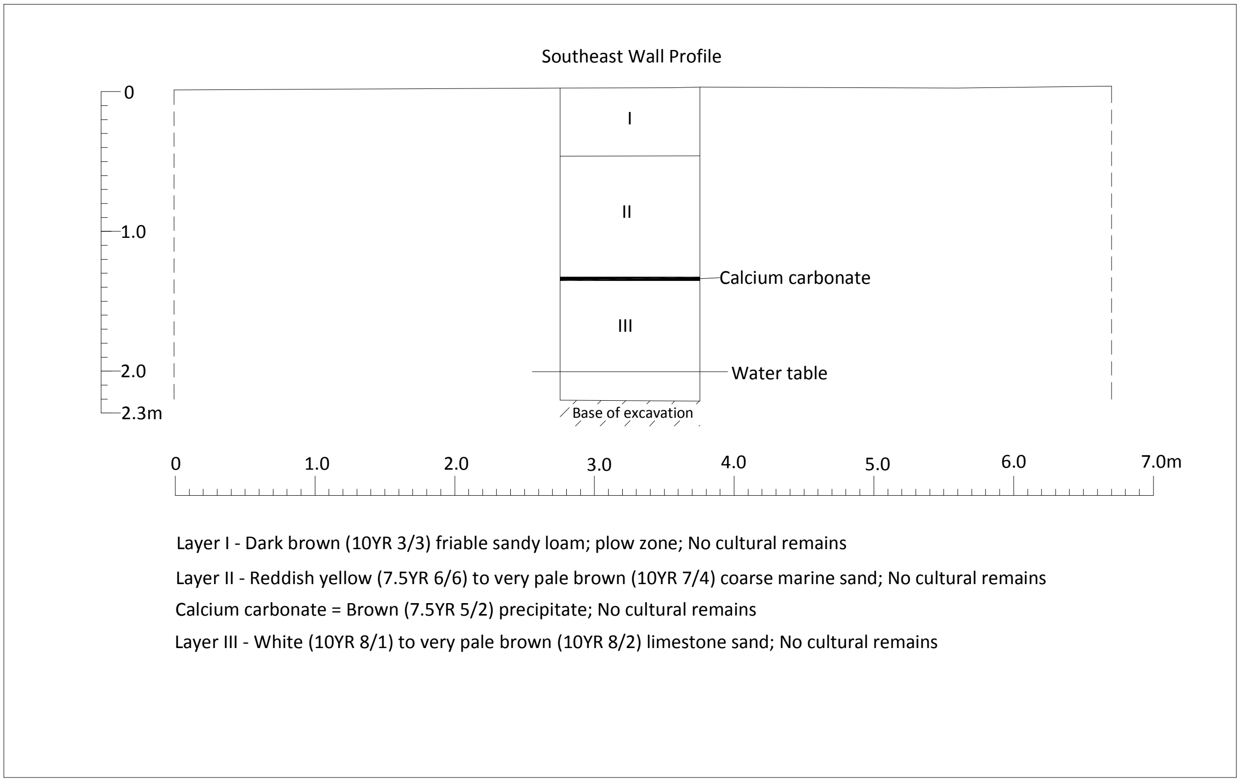


Figure B-11. Profile of BT-A-4-2

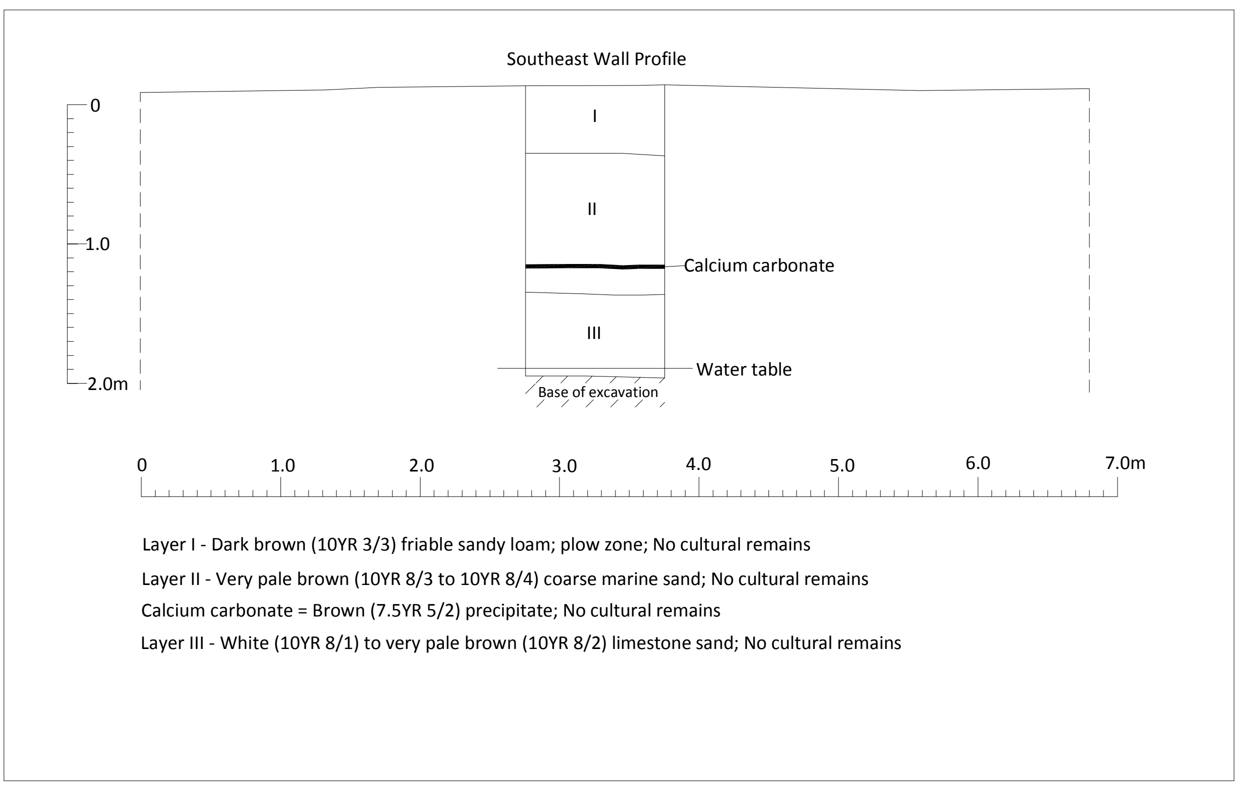
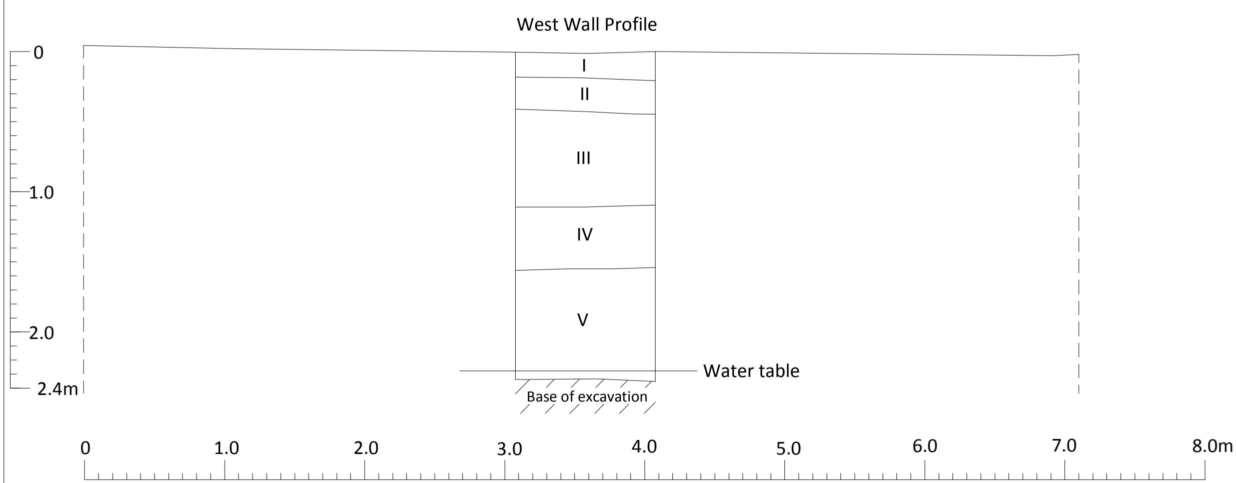
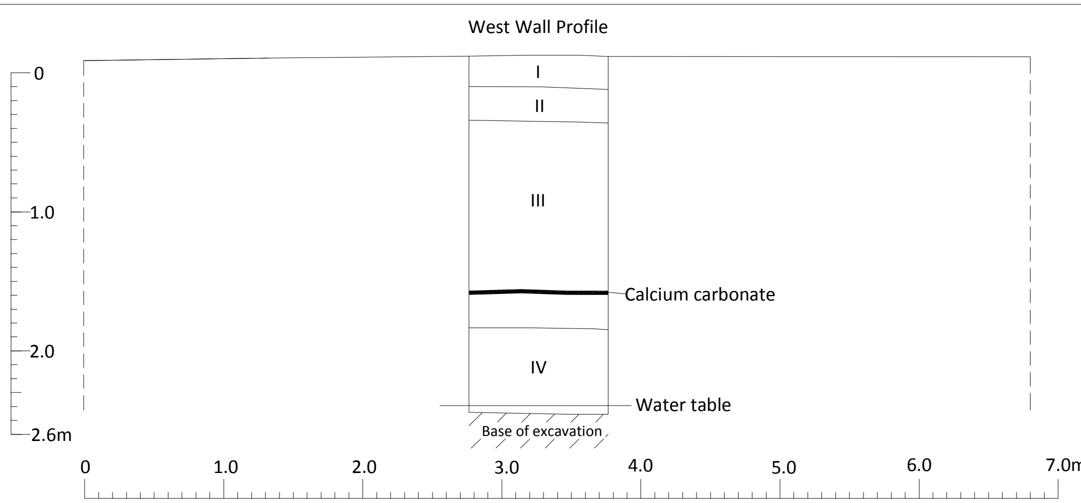


Figure B-12. Profile of BT-A-4-3



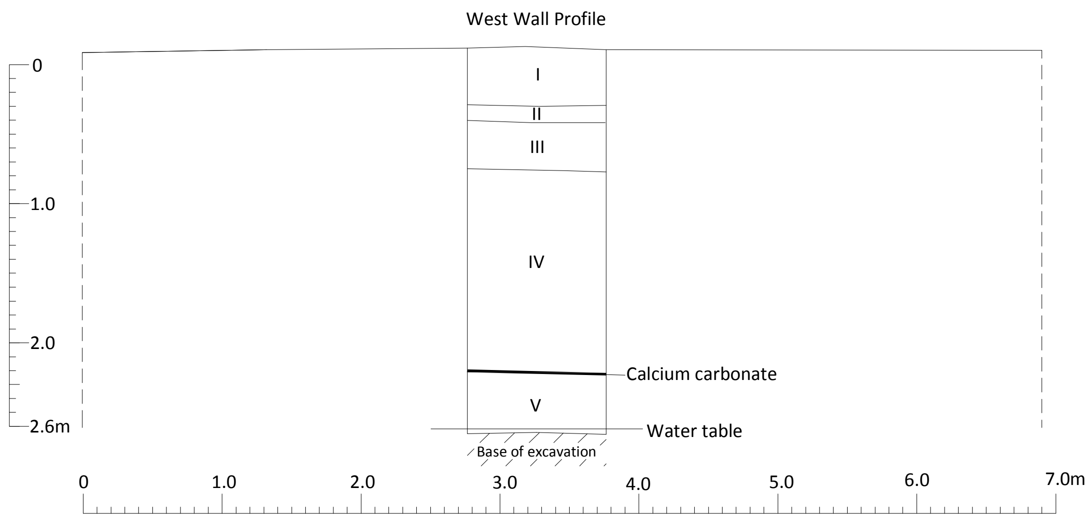
Layer I - Very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) loose silty loam fill; No cultural remains
Layer II - Pale brown (10YR 6/3) compact crushed limestone fill; Aggregate present
Layer III - Dark brown (7.5YR 3/4) to brown (7.5YR 5/3) friable bedded clay loam fill; No cultural remains
Layer IV - Brown (10YR 3/3) friable clay loam; Asphalt and metal fragments present
Layer V - White (10YR 8/1) to very pale brown (10YR 8/2) coarse marine sand; No cultural remains

Figure B-13. Profile of BT-A-5-1



Layer I - Dark reddish brown (5YR 3/3) friable clay loam fill; No cultural remains
Layer II - Dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) loose loamy sand; plow zone; No cultural remains
Layer III - White (10YR 8/1) to very pale brown (10YR 8/2) coarse marine sand; No cultural remains
Calcium carbonate = Brown (7.5YR 5/2) precipitate; No cultural remains
Layer IV - White (10YR 8/1) limestone sand; No cultural remains

Figure B-14. Profile of BT-A-5-2



Layer I - Brown (10YR 5/3) friable clay loam fill; No cultural remains

Layer II - Dusky red (2.5YR 3/4) blocky clay fill; No cultural remains

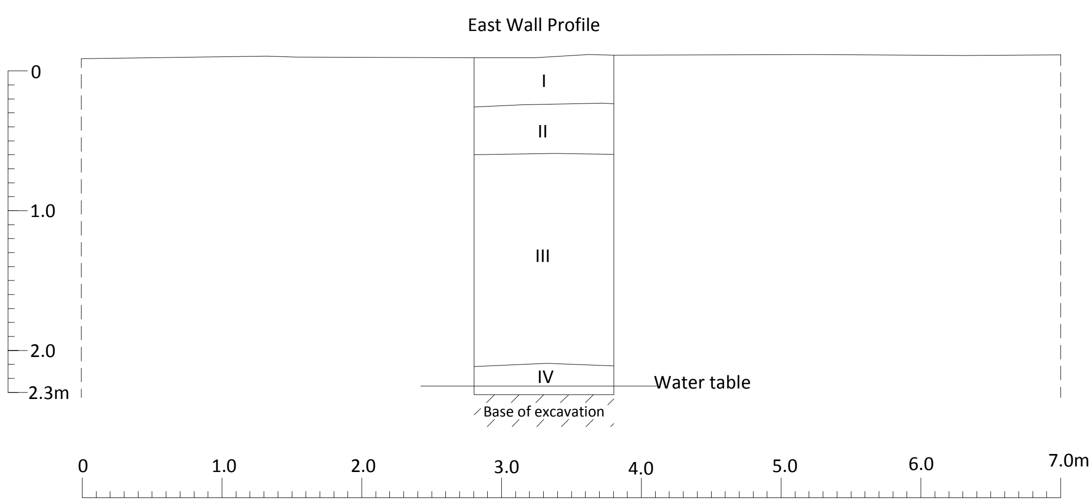
Layer III - Very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) loose silty sand; plow zone; Charcoal flecks and plastic

Layer IV - Very pale brown (10YR 8/3 to 10YR 8/4) coarse marine sand; No cultural remains

Calcium carbonate = Brown (7.5YR 5/2) precipitate; No cultural remains

Layer V - White (10YR 8/1) limestone sand; No cultural remains

Figure B-15. Profile of BT-A-5-3



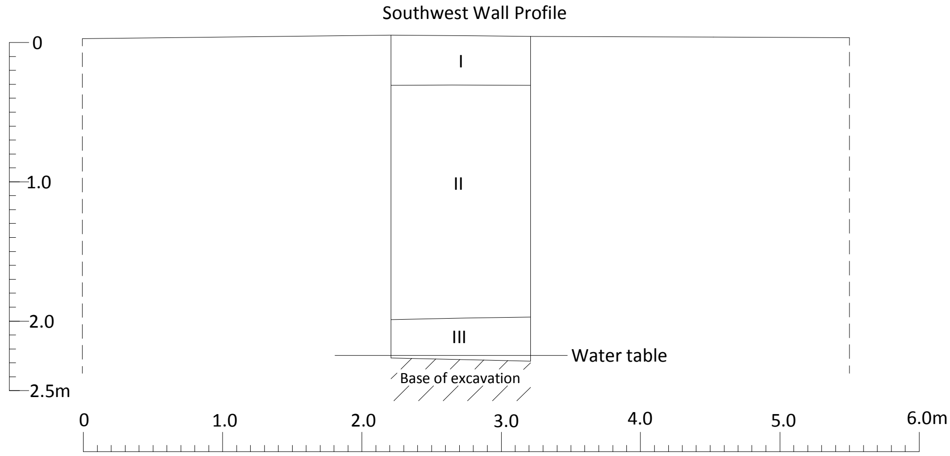
Layer I - Dusky red (2.5YR 3/4) blocky clay fill; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) loose silty sand; plow zone; Conus sp. shell

Layer III - Very pale brown (10YR 8/3 to 10YR 7/3) coarse marine sand; No cultural remains

Layer IV - White (10YR 8/1) compact sand; No cultural remains

Figure B-16. Profile of BT-A-5-4

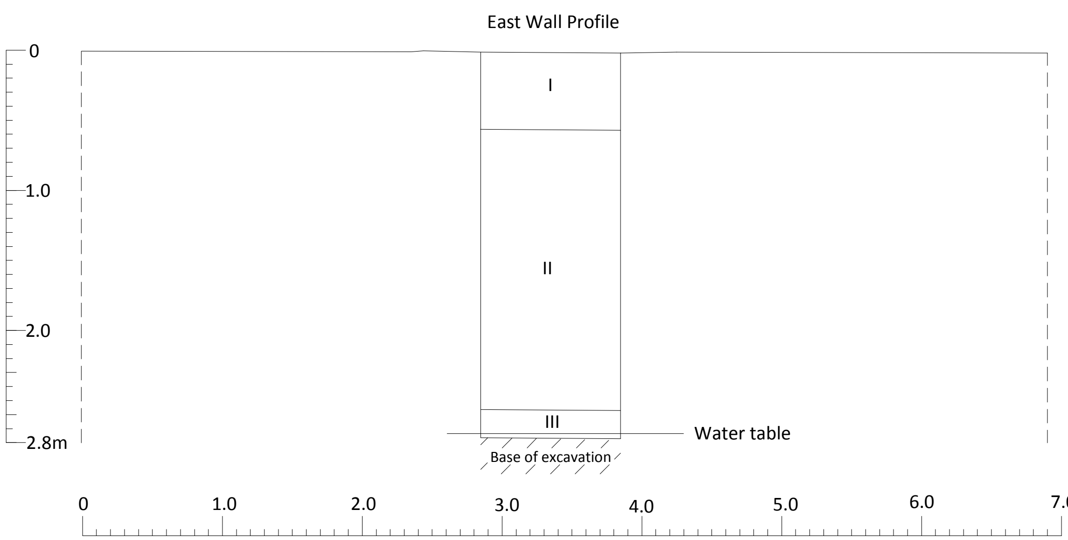


Layer I - Dark brown (10YR 3/3) friable silt loam; plow zone; No cultural remains

Layer II - Reddish yellow (7.5YR 6/6) loose marine sand; No cultural remains

Layer III - White (10YR 8/1) coarse marine sand; No cultural remains

Figure B-17. Profile of BT-A-6-1



Layer I - Very dark gray (3/1) to very dark grayish brown (10YR 3/2) loose silty sand; plow zone; No cultural remains

Layer II - Very pale brown (10YR 8/3 to 10YR 7/3) coarse marine sand; No cultural remains

Layer III - White (10YR 8/1) compact sand; No cultural remains

Figure B-18. Profile of BT-A-6-2

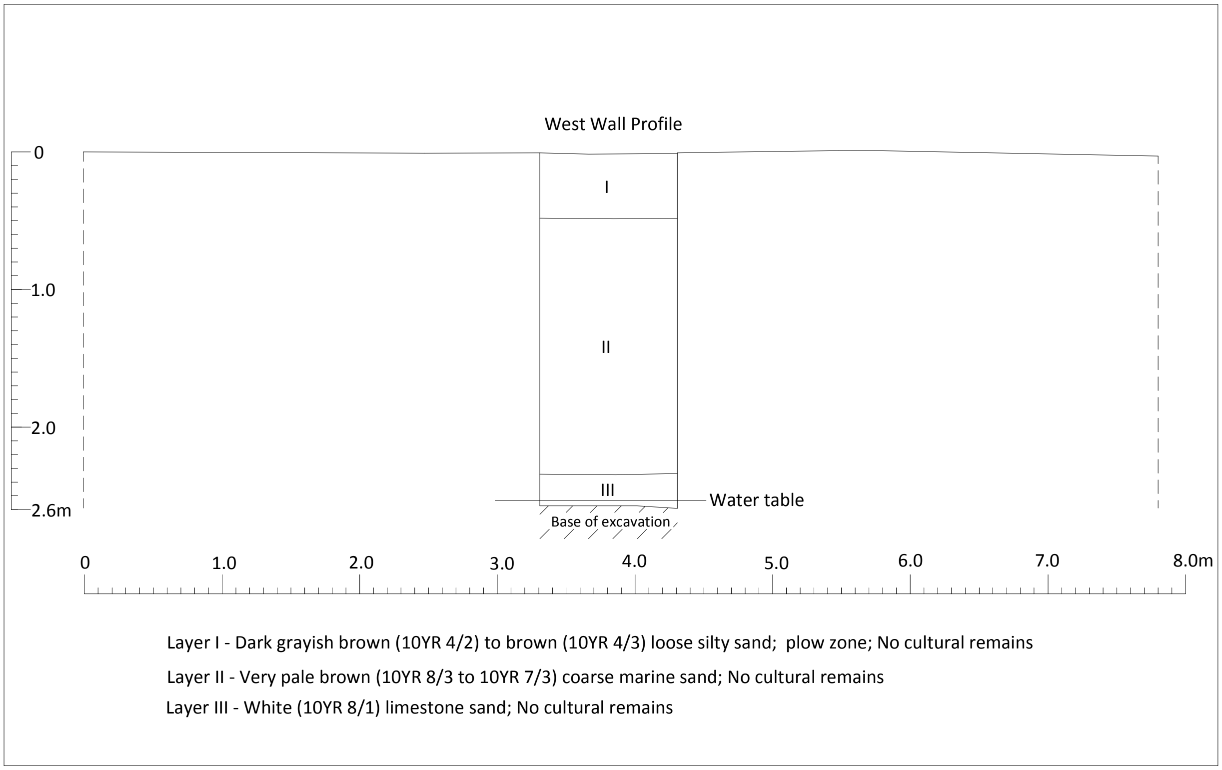


Figure B-19. Profile of BT-A-6-3

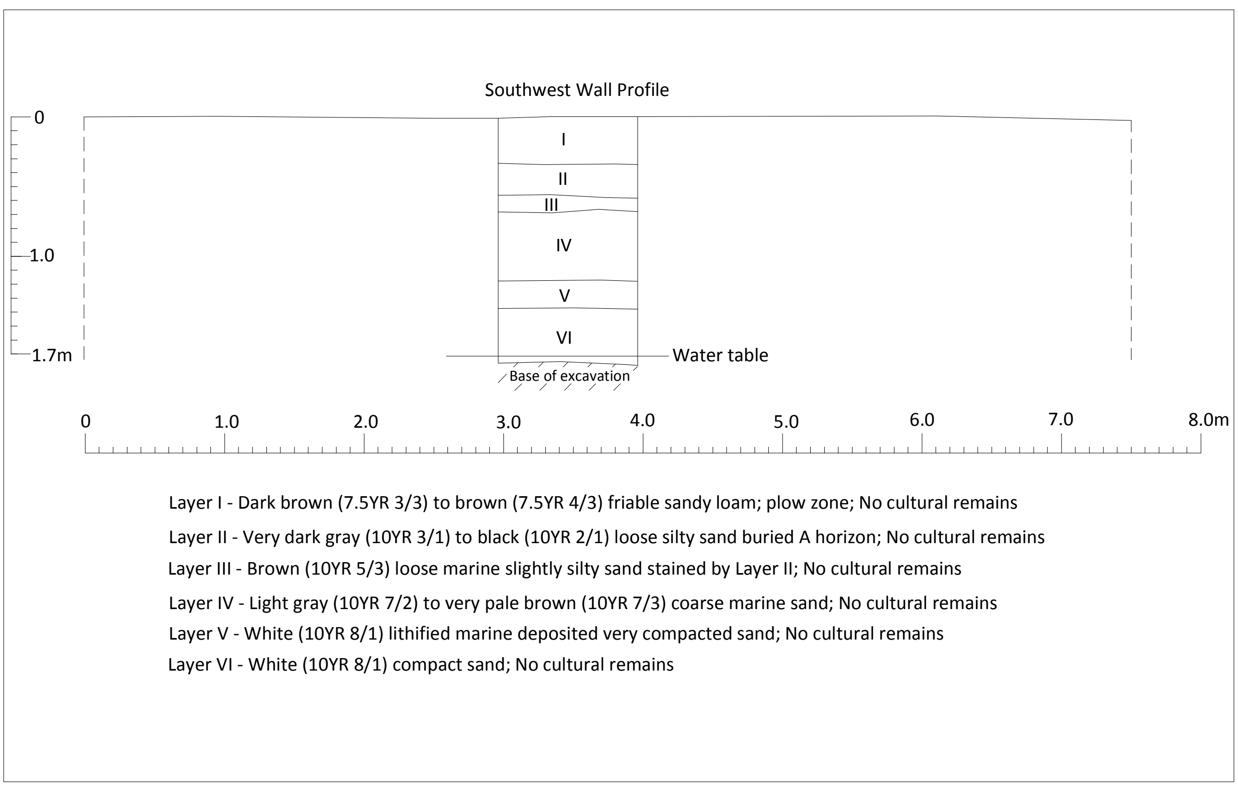
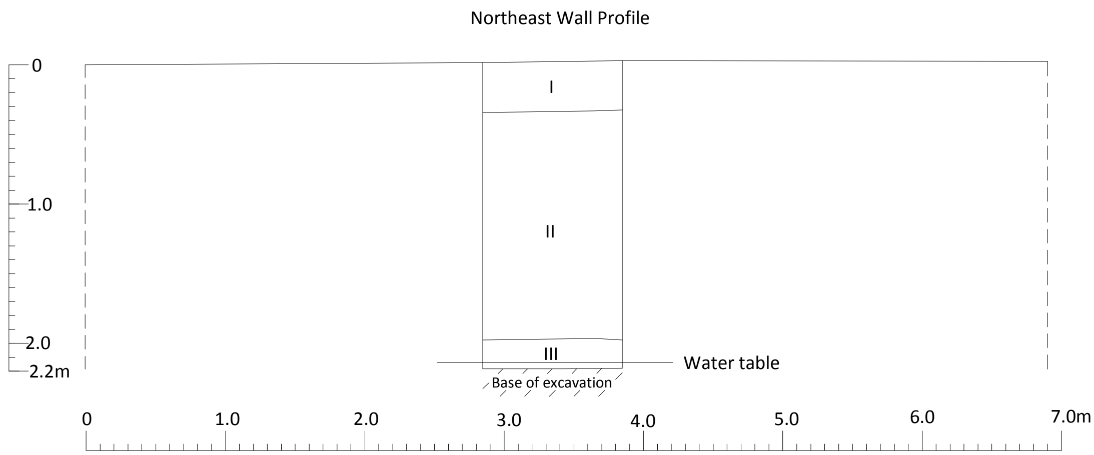


Figure B-20. Profile of BT-A-7-1

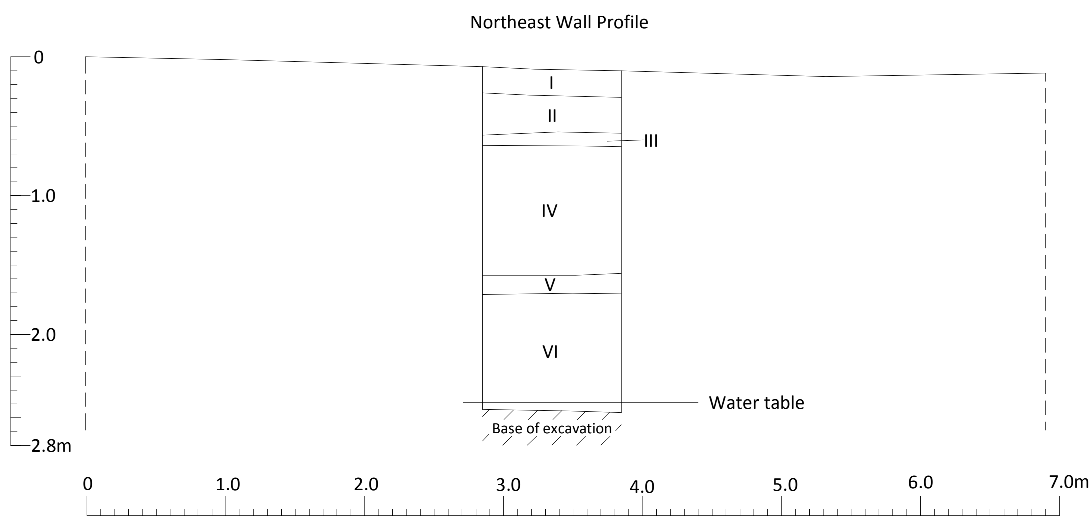


Layer I - Dark brown (10YR 3/3) friable silty loam; plow zone; No cultural remains

Layer II - Reddish yellow (7.5YR 6/6) coarse marine sand; No cultural remains

Layer III - White (10YR 8/1) limestone sand; No cultural remains

Figure B-21. Profile of BT-A-7-2



Layer I - Very dark brown (10YR 2/2) loose loamy sand fill; Plastic fragments

Layer II - Very dark grayish brown (10YR 3/2) compact loamy sand plow zone; No cultural remains

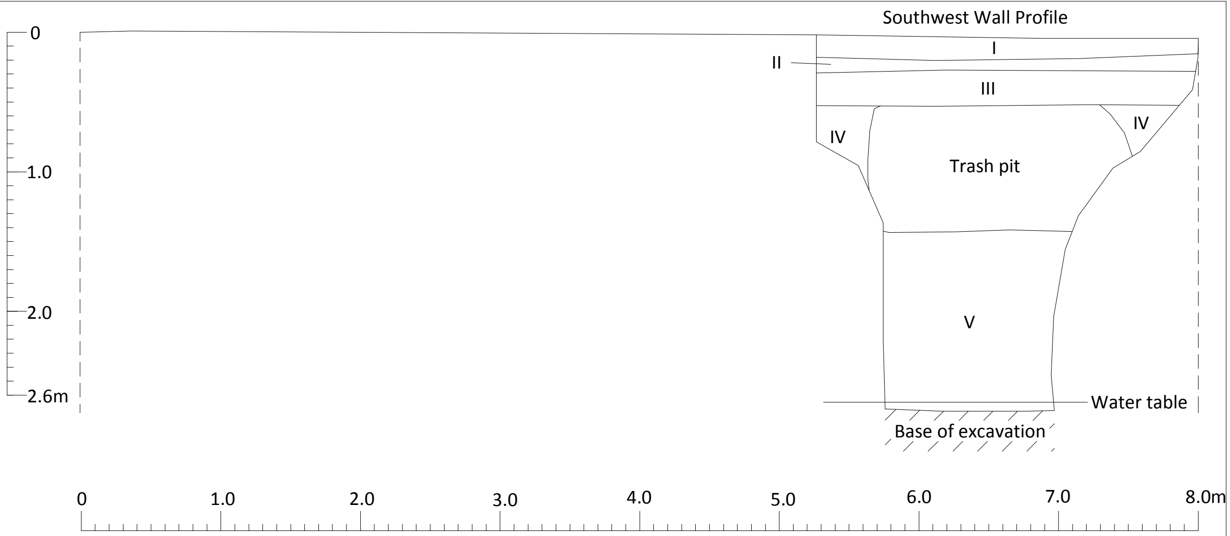
Layer III - Strong brown (7.5YR 4/6) coarse marine slightly silty sand; No cultural remains

Layer IV - Very pale brown (10YR 8/2 to 10YR 8/4) coarse marine sand; No cultural remains

Layer V - Reddish yellow (7.5YR 7/6) compact marine sand; No cultural remains

Layer VI - White (10YR 8/1) to very pale brown (10YR 8/2) compact sand; No cultural remains

Figure B-22. Profile of BT-A-8-1



Layer I - Dark reddish brown (5YR 3/3) blocky clay fill; No cultural remains

Layer II - Pale brown (10YR 6/3) to dark grayish brown (10YR 4/2) loose sand; No cultural remains

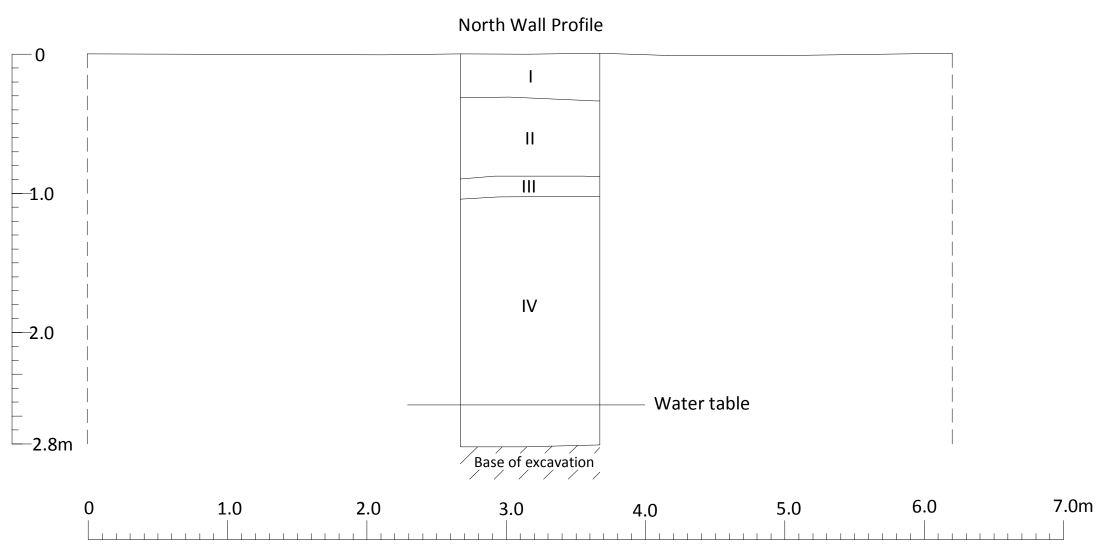
Layer III - Black (10YR 2/1) loose loamy sand; plow zone; No cultural remains

Trash pit in very pale brown (10YR7/3) loamy sand; Historic materials present

Layer IV - Very pale brown (10YR 8/3 to 10YR 7/4) coarse marine sand; No cultural remains

Layer V - Brownish yellow (10YR 6/6) weathered limestone and clay; No cultural remains

Figure B-23. Profile of BT-A-9-1



Layer I - Dark brown (10YR 3/3) loose silty sand; plow zone; No cultural remains

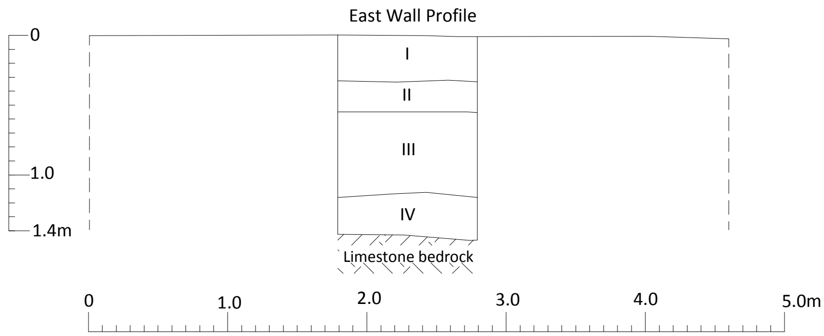
Layer II - Light gray (10YR 7/2) to very pale brown (10YR 7/4) coarse marine sand; No cultural remains

Layer III - Strong brown (7.5YR 4/6) coarse marine sand; No cultural remains

Layer IV - Brown (7.5YR 4/4) massive clay; No cultural remains

Figure B-24. Profile of BT-A-10-1

Area B Trenches



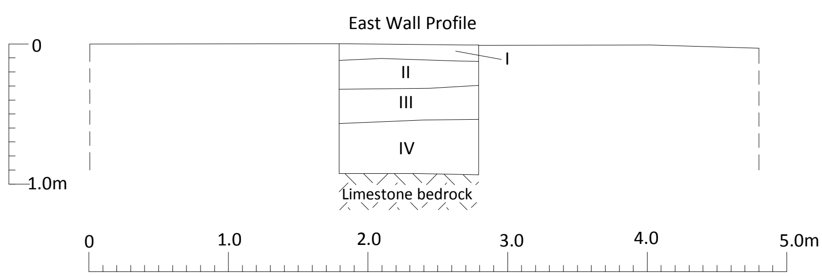
Layer I - Dark brown (7.5YR 3/3) friable sandy clay loam; Rubber hose and aluminum cans

Layer II - Brown (10YR 4/3) to very pale brown (10YR 7/3) loose silty sand; Sparce charcoal

Layer III - White (10YR 8/1) to very pale brown (10YR 7/4) loose marine sand; No cultural remains

Layer IV - Brown (7.5YR 4/4) compact clay; No cultural remains

Figure B-25. Profile of BT-B-1-1



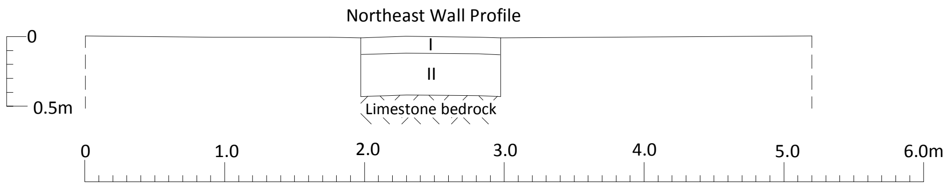
Layer I - Very pale brown (10YR 7/4) to White (10YR 8/1) coarse sand; No cultural remains

Layer II - Brown (10YR 5/3) friable sandy loam alluvium; No cultural remains

Layer III - Very pale brown (10YR 7/4) to light yellowish brown (10YR 6/4) compact marine sand; No cultural remains

Layer IV - Brown (7.5YR 4/4) massive clay; No cultural remains

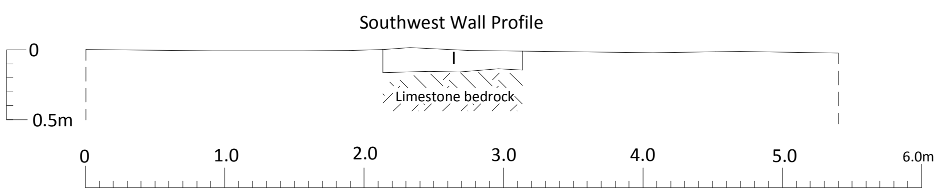
Figure B-26. Profile of BT-B-1-2



Layer I - Dark brown (10YR 3/3) friable sandy clay loam alluvium; No cultural remains

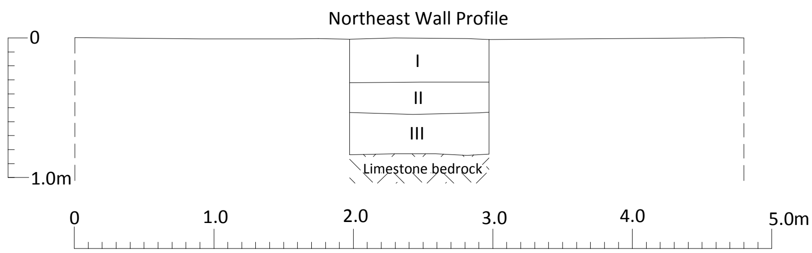
Layer II - Brown (10YR 4/3) friable clay; No cultrual remains

Figure B-27. Profile of BT-B-1-3



Layer I - Dark brown (7.5YR 3/3) friable clay loam alluvium; No cultural remains

Figure B-28. Profile of BT-B-1-4

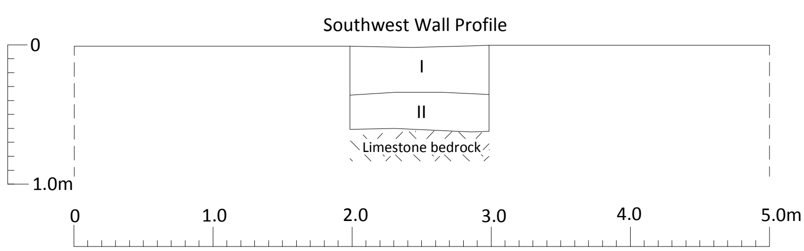


Layer I - Brown (10YR 5/3) loose slightly silty sand; No cultural remains

Layer II - Very pale brown (10YR 7/4) fine aeolian sand; No cultural remains

Layer III - Strong brown (7.5YR 4/6) single grain sandy clay; No cultural remains

Figure B-29. Profile of BT-B-2-1



Layer I - Dark brown (10YR 3/3) friable sandy clay loam alluvium; No cultural remains

Layer II - Brown (7.5YR 4/4) massive clay; No cultural remains

Figure B-30. Profile of BT-B-2-2

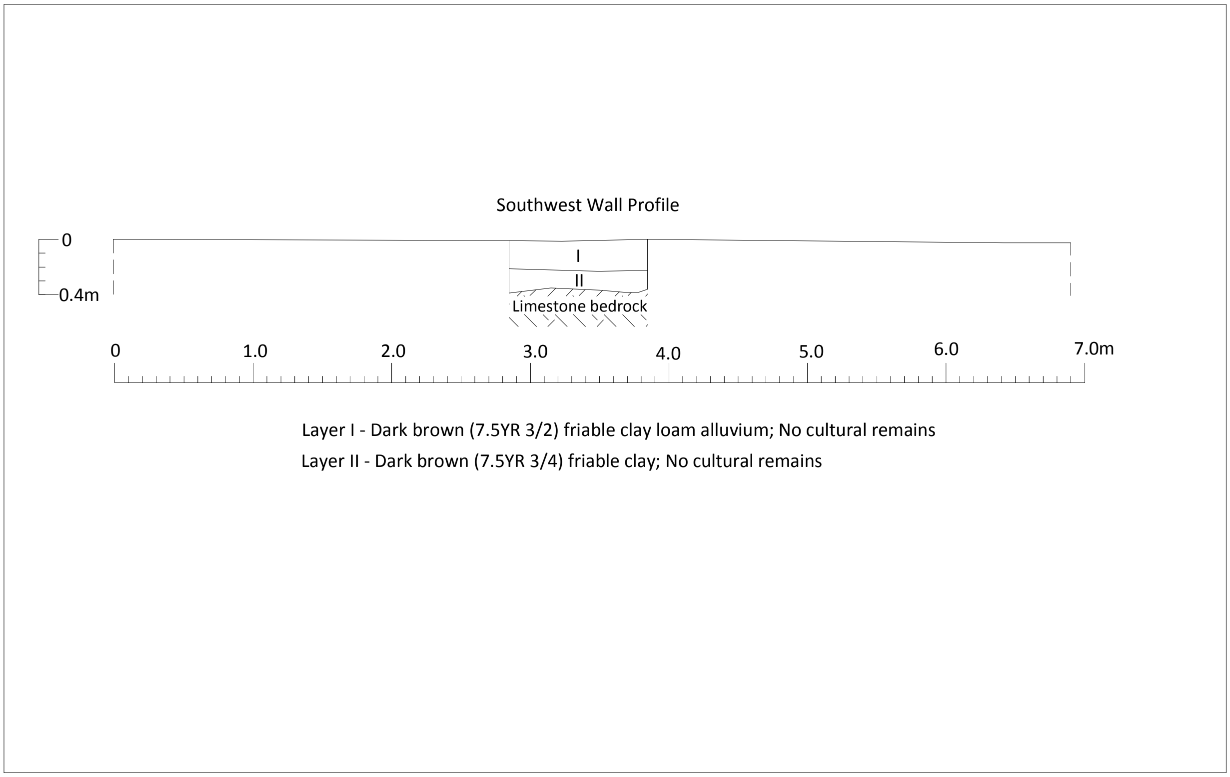


Figure B-31. Profile of BT-B-2-3

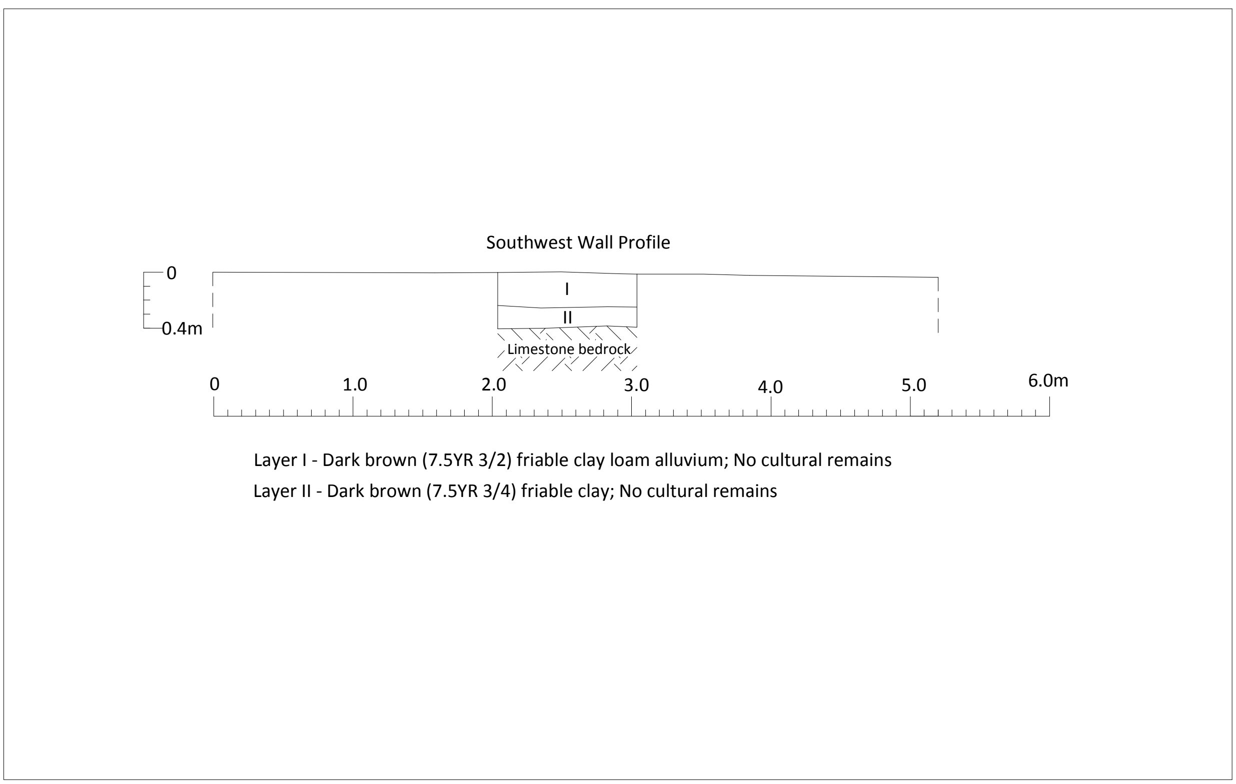
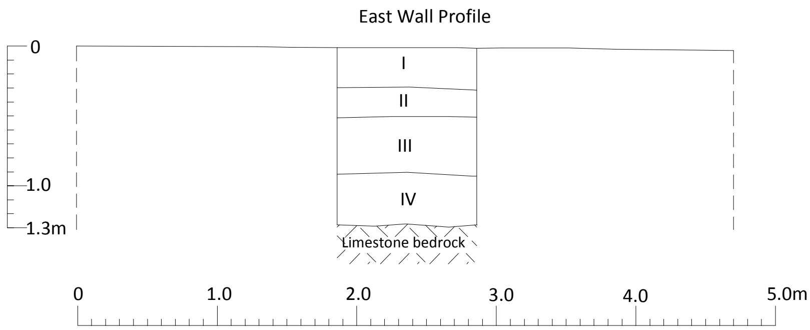


Figure B-32. Profile of BT-B-2-4



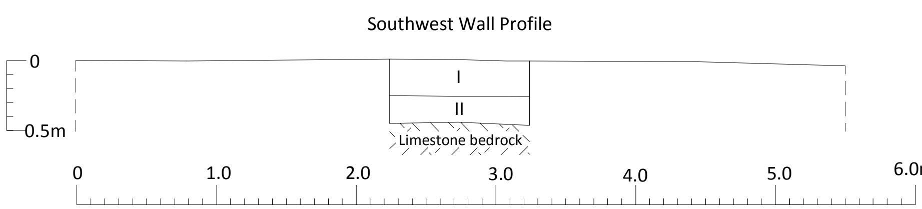
Layer I - Dark brown (10YR 3/3) loose loamy sand; No cultural remains

Layer II - Dark brown (7.5YR 3/4) friable sandy loam alluvium; No cultural remains

Layer III - Very pale brown (10YR 7/4) loose marine sand; No cultural remains

Layer IV - Dark brown (7.5YR 3/4) massive clay; No cultural remains

Figure B-33. Profile of BT-B-3-1



Layer I - Dark brown (7.5YR 3/3) friable sandy clay loam alluvium; No cultural remains

Layer II - Brown (7.5YR 4/4) massive clay; Bottle glass present

Figure B-34. Profile of BT-B-3-2

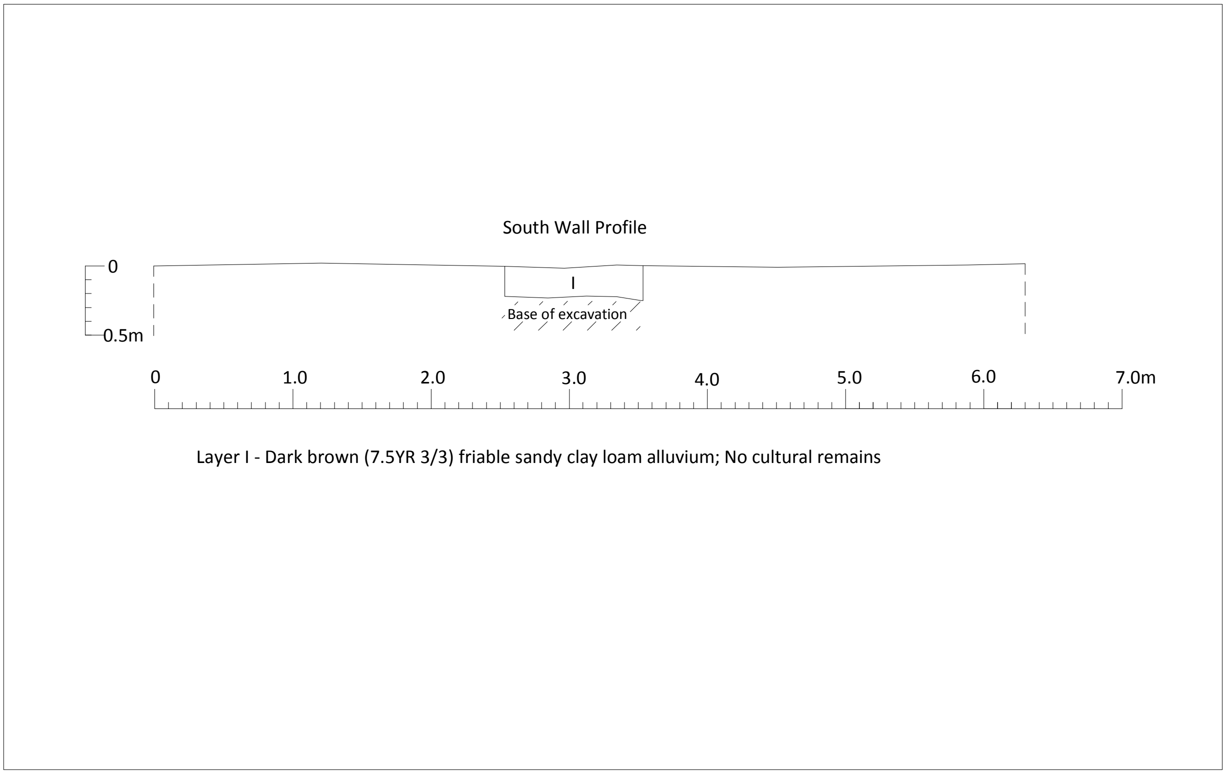


Figure B-35. Profile of BT-B-3-3

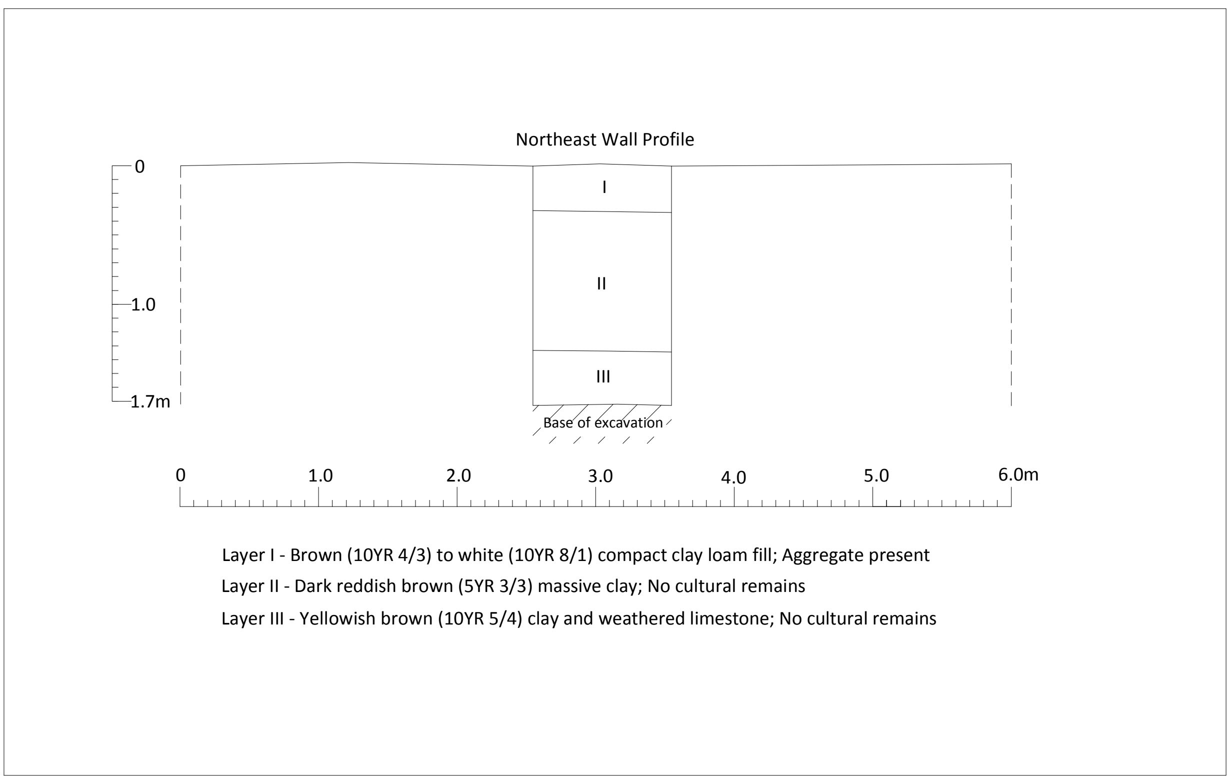
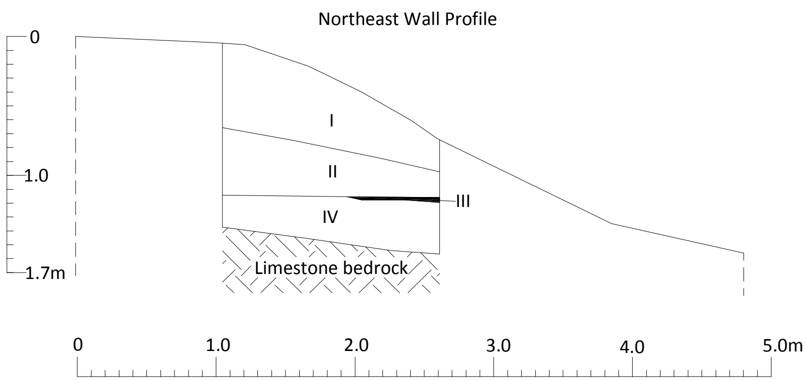


Figure B-36. Profile of BT-B-3-4



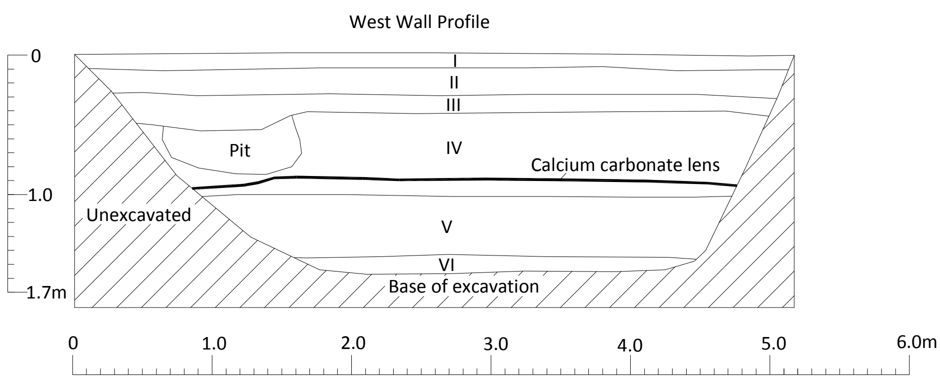
Layer I - Dark brown (7.5YR 3/2) friable clay loam fill; Basalt aggregate, asphalt and plastic fragments, ceramic tile

Layer II - Brown (10YR 4/3) friable sandy clay loam fill; Basalt aggregate

Layer III - Light gray (10YR 7/2) to light brownish gray (10YR 6/2) loose marine sand; No cultural remains

Layer IV - Dark reddish brown (5YR 3/2) massive clay; No cultural remains

Figure B-37. Profile of BT-B-3-5



Layer I - Brown (10YR 5/3) compact silty sand; No cultural remains

Layer II - Very pale brown (10YR 7/3) to pale brown (10YR 6/3) loose slightly silty sand; Bottle glass present

Layer III - Brown (10YR 4/3) to very dark grayish brown (10YR 3/2) moderately compact silty sand; No cultural remains

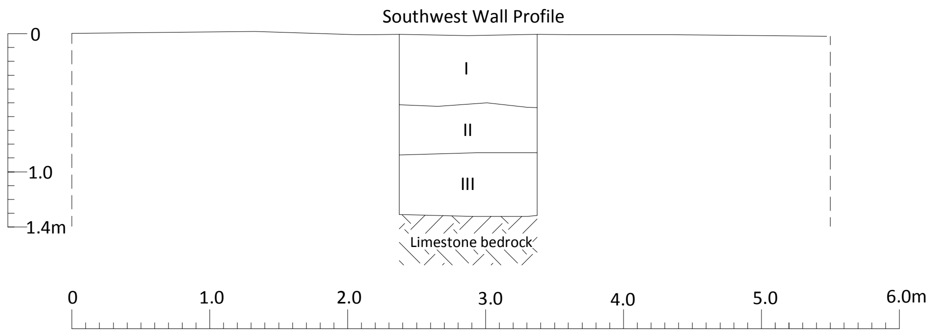
Layer IV - White (10YR 8/1) loose aeolian sand; No cultural remains

Pit - Pale brown (10YR 6/3) to brown (10YR 5/3) compact banded silty sand pit; No cultural remains

Layer V - Very pale brown (10YR 8/2 to 10YR 8/3) coarse marine sand; No cultural remains

Layer VI - Yellowish red (5YR 5/8) to reddish yellow (5YR 6/8) limestone sand; No cultural remains

Figure B-38. Profile of BT-B-4-1

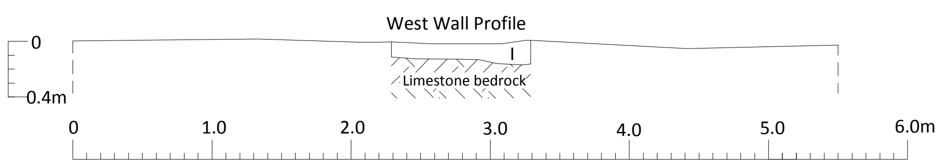


Layer I - Very dark grayish brown (10YR 3/2) friable sandy clay loam alluvium; No cultural remains

Layer II - Reddish yellow (7.5YR 6/6) single grain marine sand; No cultural remains

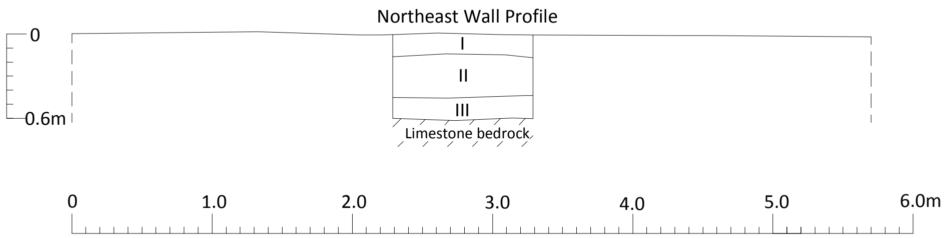
Layer III - Brown (7.5YR 5/4) massive clay; No cultural remains

Figure B-39. Profile of BT-B-4-2



Layer I - Dark brown (7.5YR 3/3) friable clay; Basalt aggregate

Figure B-40. Profile of BT-B-4-3

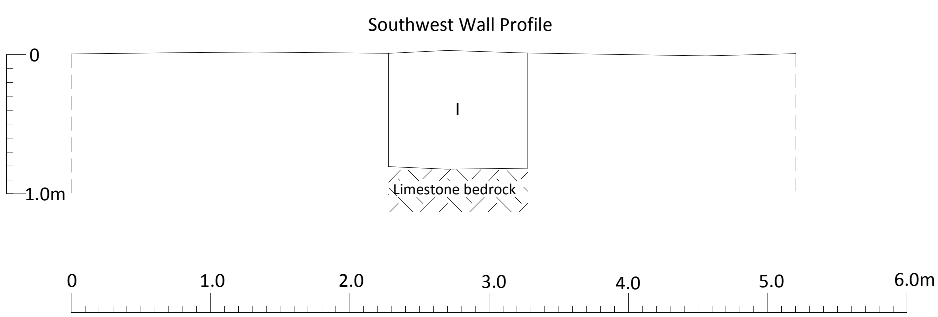


Layer I - Dark brown (10YR 3/3) friable clay loam fill; No cultural remains

Layer II - Brown (10YR 5/3) to very dark grayish brown (10YR 3/2) single grain silty sand; No cultural remains

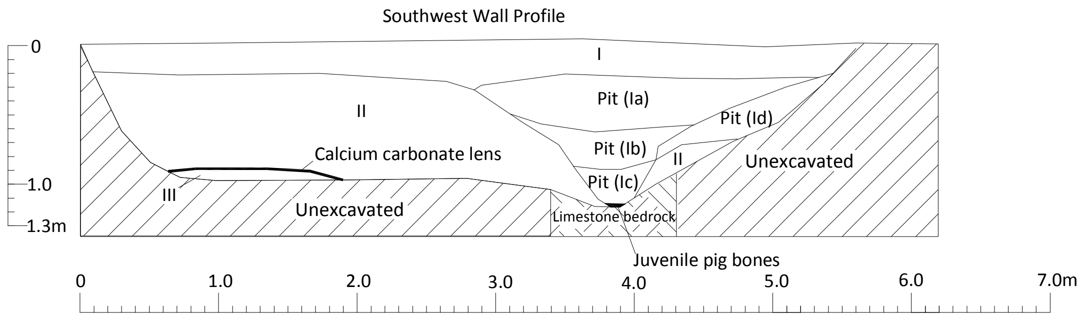
Layer III - Dark brown (7.5YR 3/2) massive clay; No cultural remains

Figure B-41. Profile of BT-B-4-4



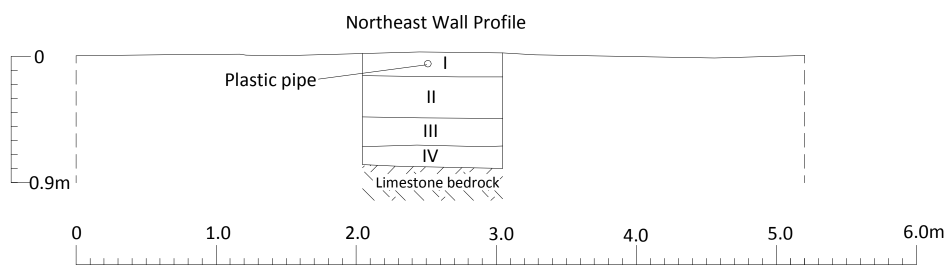
Layer I - Very dark brown (7.5YR 2.5/3) to dark grayish brown (10YR 4/2) friable sandy clay fill; Asphalt fragments present

Figure B-42. Profile of BT-B-4-5



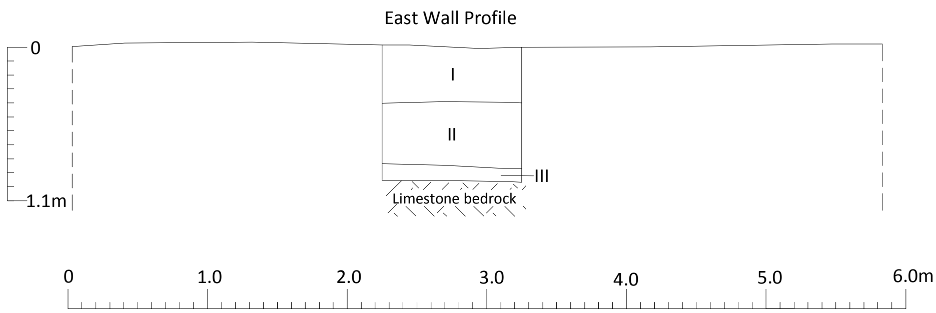
Layer I - Pale brown (10YR 6/3) single grained slightly silty sand; Electrical wires and plastic fragments
Pit (Layer Ia) - Dark gray (10YR 4/1) compact slightly silty sand pit fill; Conus sp. shell
Pit (Layer Ib) - Grayish brown (10YR 5/2) to very dark grayish brown (10YR 3/2) loose sand pit fill; Ash
Pit (Layer Ic) - Grayish brown (10YR 5/2) to white (10YR 8/1) loose slightly silty sand pit fill; Pig bones
Pit (Layer Id) - Gray (10YR 6/1) to light gray (10YR 7/2) loose sand fill; No cultural remains
Layer II - White (10YR 8/1) loose aeolian sand; No cultural remains
Layer III - Very pale brown (10YR 8/4) coarse marine sand; No cultural remains

Figure B-43. Profile of BT-B-5-1



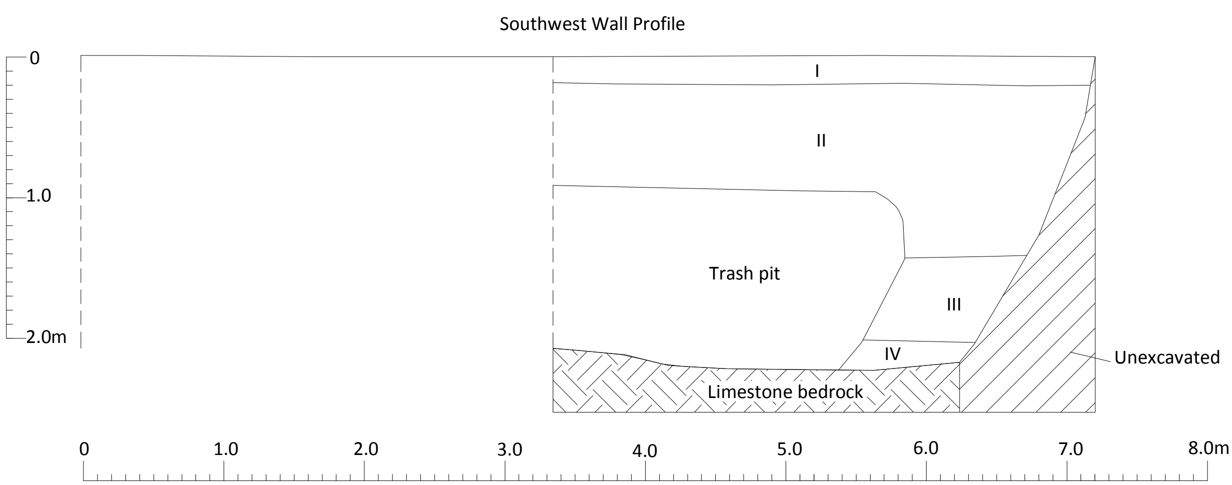
Layer I - Dusky red (2.5YR 3/4) friable clay fill; Plastic pipe present
Layer II - Brown (10YR 4/3) friable sandy clay loam fill; Plastic fragments present
Layer III - Pale brown (10YR 6/3) loose silty marine sand; No cultural remains
Layer IV - Dark brown (7.5YR 3/3) massive clay; No cultural remains

Figure B-44. Profile of BT-B-5-2



Layer I - Dark brown (10YR 3/3) friable sandy clay loam fill; No cultural remains
Layer II - Dark brown (7.5YR 3/4) friable clay loam fill; Asphalt fragments present
Layer III - Very pale brown (10YR 8/2 to 10YR 7/3) loose marine sand; No cultural remains

Figure B-45. Profile of BT-B-5-3



Layer I - Dark reddish brown (5YR 3/4) friable clay fill; No cultural remains
Layer II - Dark brown (7.5YR 3/2 and 7.5YR 3/3) friable clay fill; No cultural remains
Trash pit - Brown (10YR 4/3) to dark brown (10YR 3/3) friable clay pit fill; Milled lumber, plastic hose, plastic fragments
Layer III - Dark brown (7.5YR 3/3) massive clay; No cultural remains
Layer IV - Brown (10YR 5/3) massive clay; No cultural remains

Figure B-46. Profile of BT-B-5-4

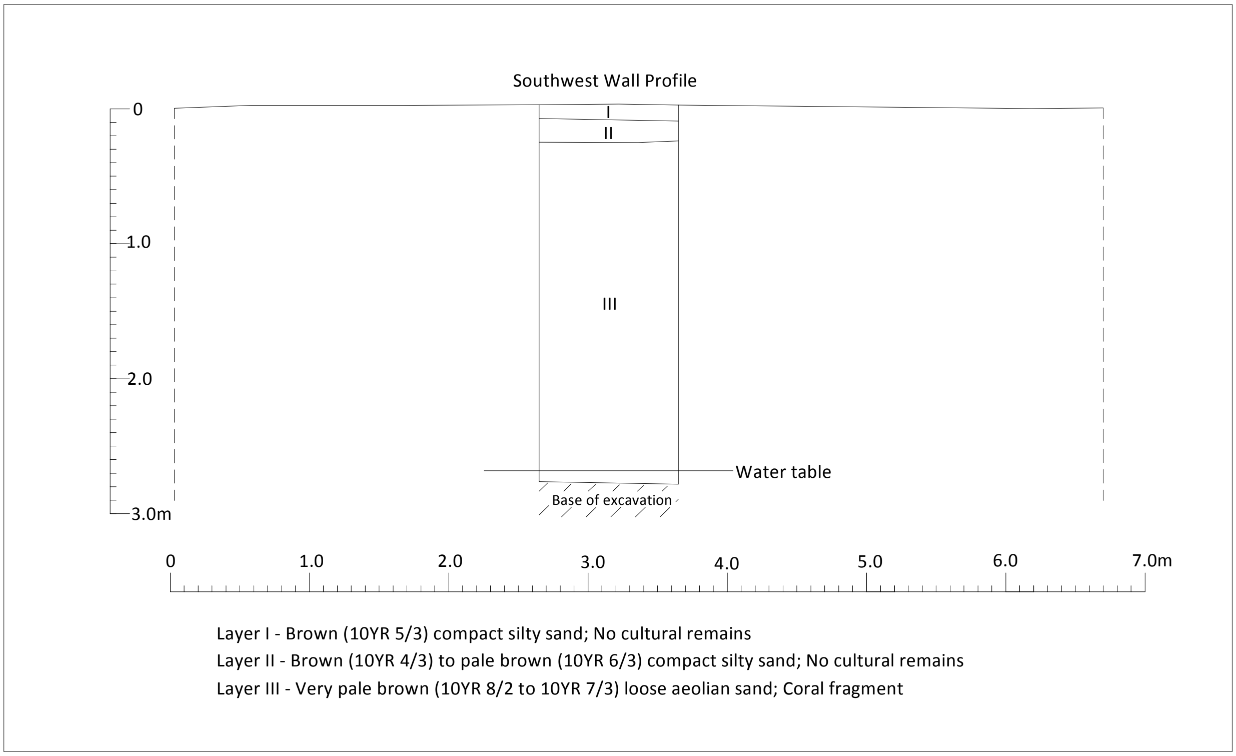


Figure B-47. Profile of BT-B-6-1

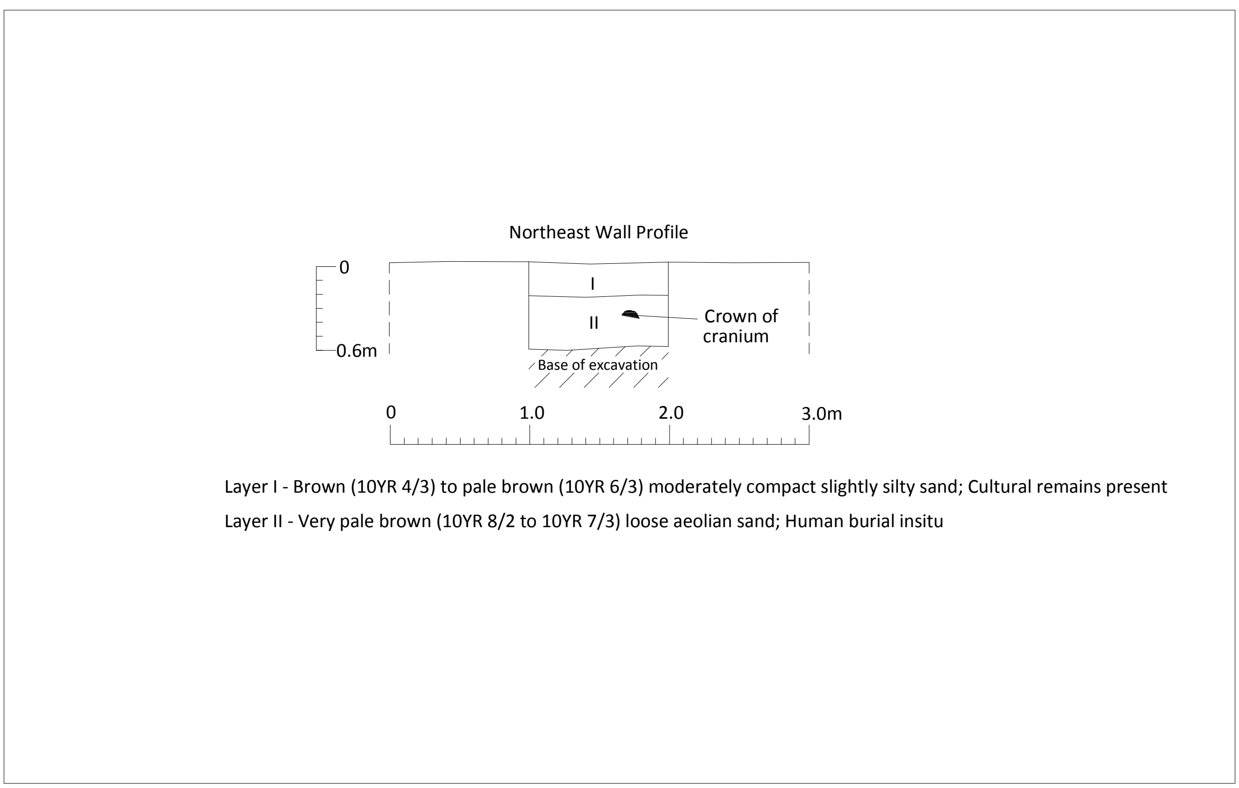
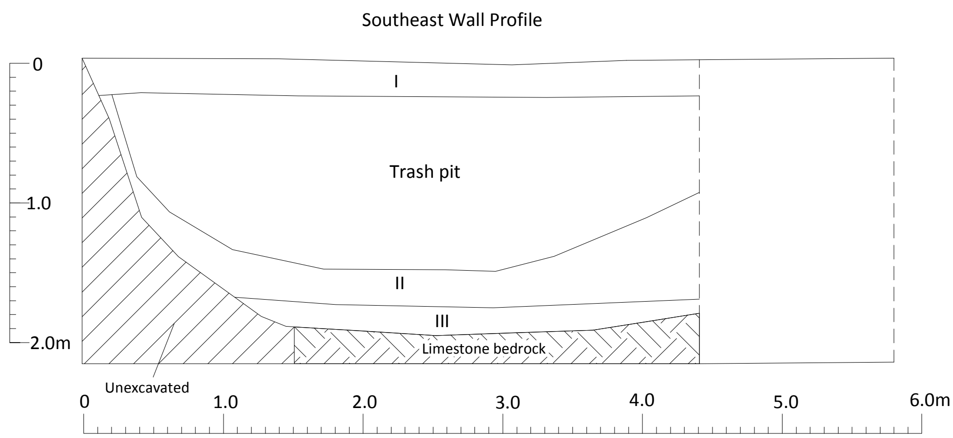


Figure B-48. Profile of BT-B-6-2



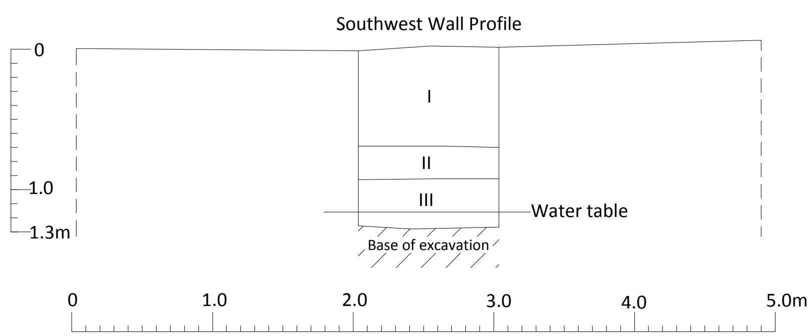
Layer I - Dark reddish brown (5YR 3/4) friable clay fill; No cultural remains

Trash pit - Black (10YR 2/1) to very dark grayish brown (10YR 3/2) friable clay pit fill; Modern trash present

Layer II - Dark brown (7.5YR 3/2) massive clay; No cultural remains

Layer III - Brown (10YR 4/3) massive clay; No cultural remains

Figure B-49. Profile of BT-B-6-3



Layer I - Dusky red (2.5YR 3/2) friable clay fill; No cultural remains

Layer II - Pale brown (10YR 6/3) friable clay; No cultural remains

Layer III - Brown (10YR 4/2) massive clay; No cultural remains

Figure B-50. Profile of BT-B-6-4

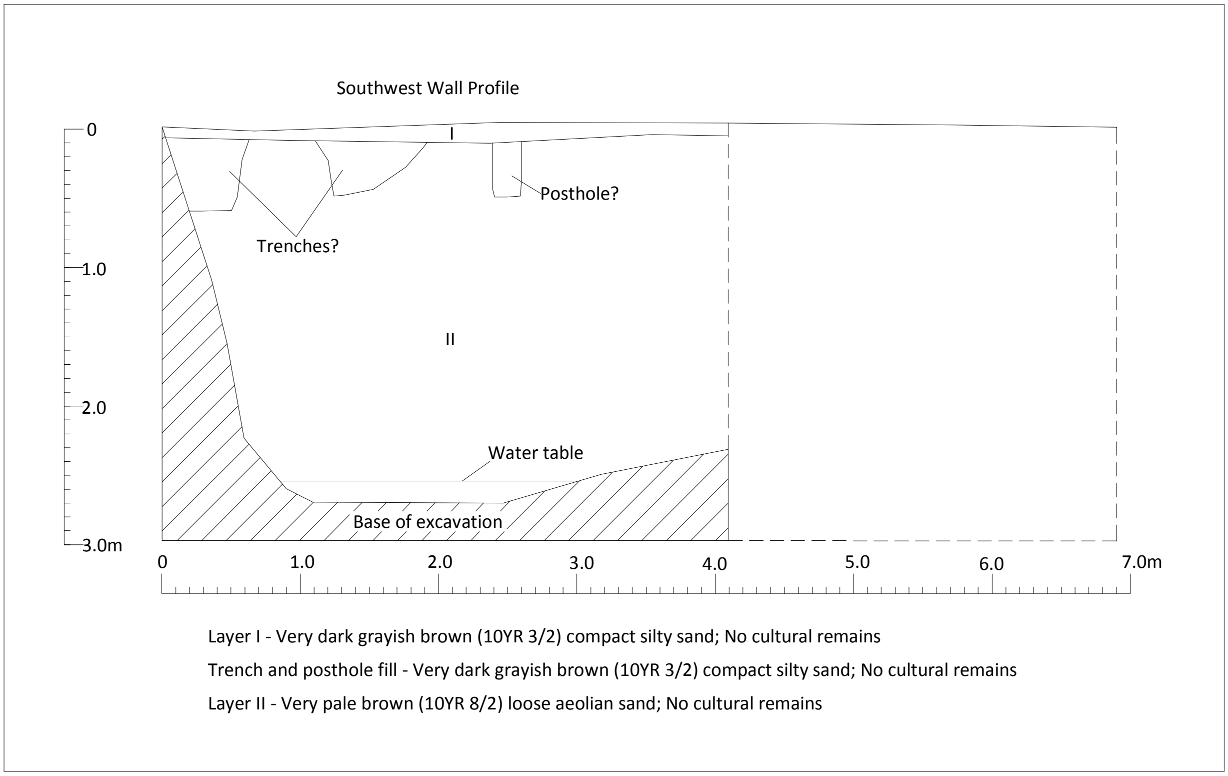


Figure B-51. Profile of BT-B-7-1

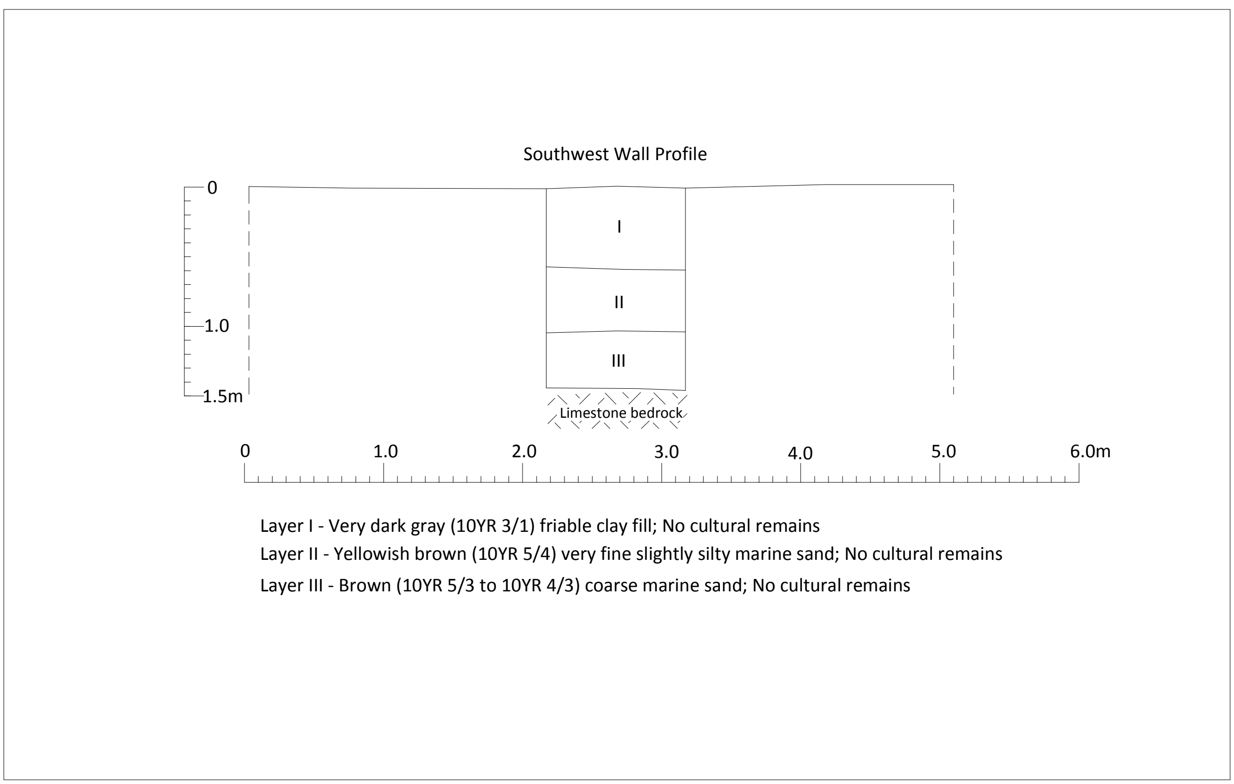


Figure B-52. Profile of BT-B-7-2

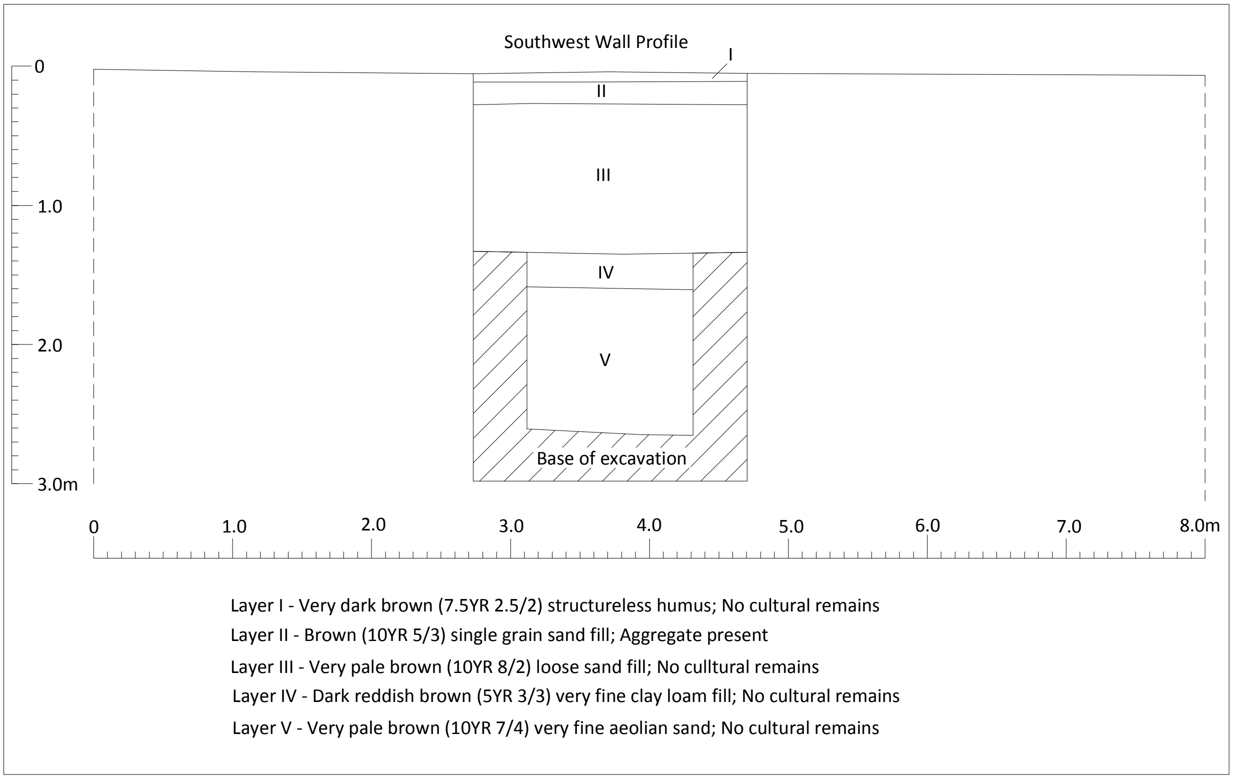


Figure B-53. Profile of BT-B-7-3

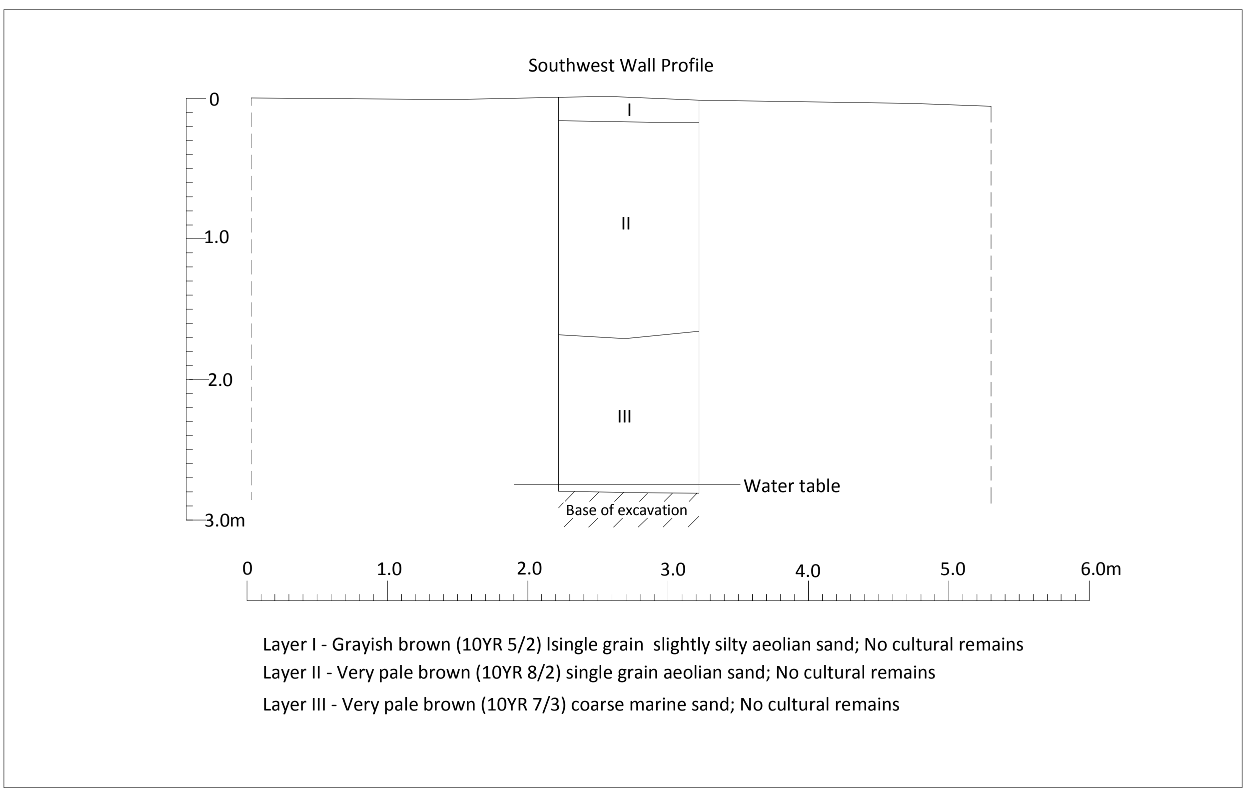
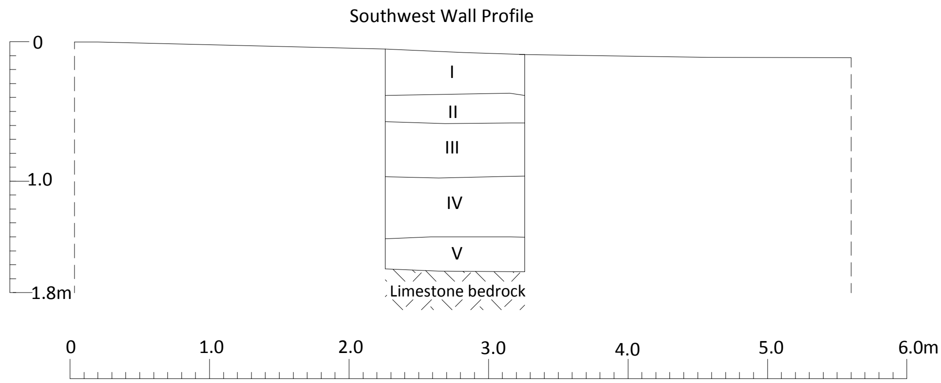


Figure B-54. Profile of BT-B-8-1



Layer I - Brown (7.5YR 4/4) to grayish brown (10YR 5/2) compact clay and silty sand fill; Plastic bag present

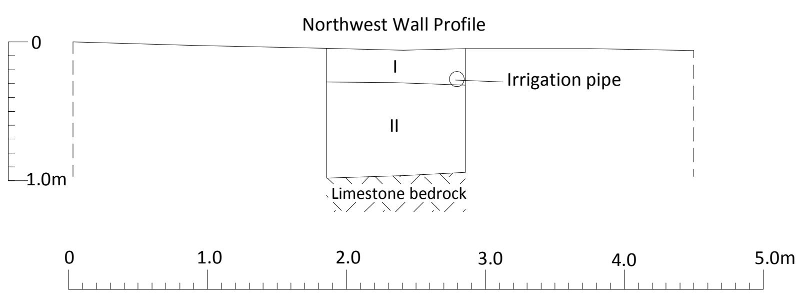
Layer II - Very pale brown (10YR 8/2) loose sand; No cultural remains

Layer III - Dark brown (7.5YR 3/3) compact silty sand alluvium; No cultural remains

Layer IV - Strong brown (7.5YR 5/6) compact silty marine sand; No cultural remains

Layer V - Brown (10YR 5/3) loose marine sand; No cultural remains

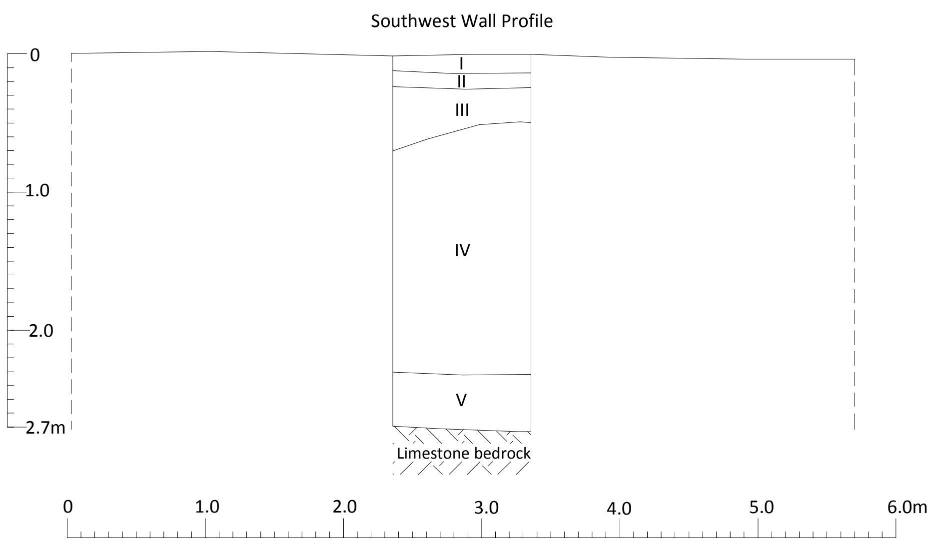
Figure B-55. Profile of BT-B-8-2



Layer I - Dark brown (7.5YR 3/3) compact clay fill; Irrigation pipe present

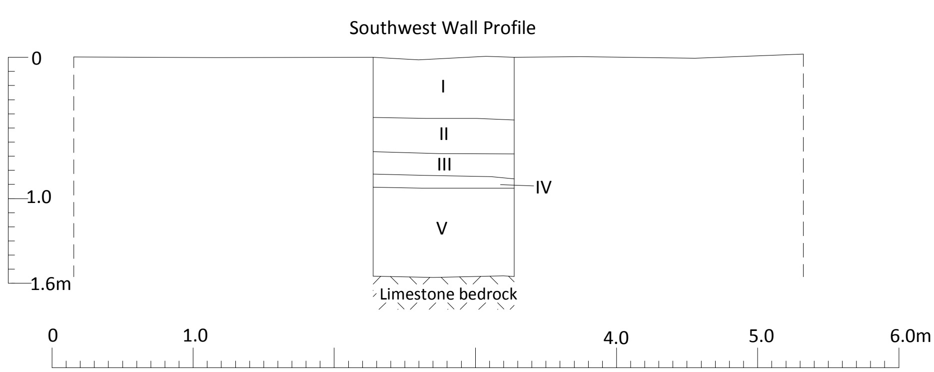
Layer II - Dark yellowish brown (10YR 4/4) single grain loamy sand alluvium; No cultural remains

Figure B-56. Profile of BT-B-8-3



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Light gray (10YR 7/2) to very pale brown (10YR 7/3) compact sand fill; No cultural remains
Layer III - Dark grayish brown (10YR 4/2) to very pale brown (10YR 7/3) compact silty sand fill; No cultural remains
Layer IV - Dark brown (7.5YR 3/3) to brown (10YR 4/3) massive sandy clay fill; No cultural remains
Layer V - Light brownish gray (10YR 6/2) coarse sand deposit; No cultural remains

Figure B-57. Profile of BT-B-9-1



Layer I - Brown (10YR 4/3) friable sandy clay loam fill; No cultural remains
Layer II - Pale brown (10YR 6/3) friable silty sand fill; Aggregate present
Layer III - Very pale brown (10YR 7/3) compact silty sand fill; Aggregate present
Layer IV - Brown (10YR 4/3) compact sandy clay loam alluvium; No cultural remains
Layer V - Strong brown (7.5YR 4/6) compact silty marine sand; No cultural remains

Figure B-58. Profile of BT-B-9-2

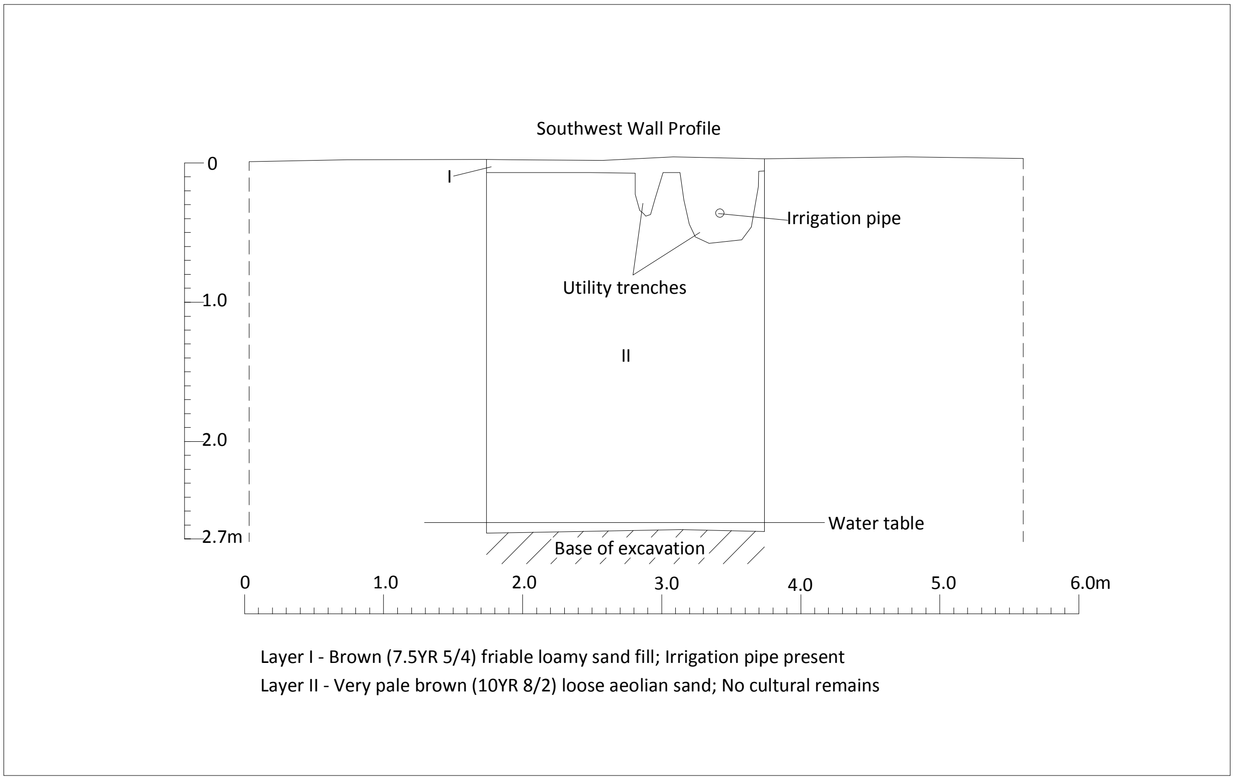


Figure B-59. Profile of BT-B-10-1

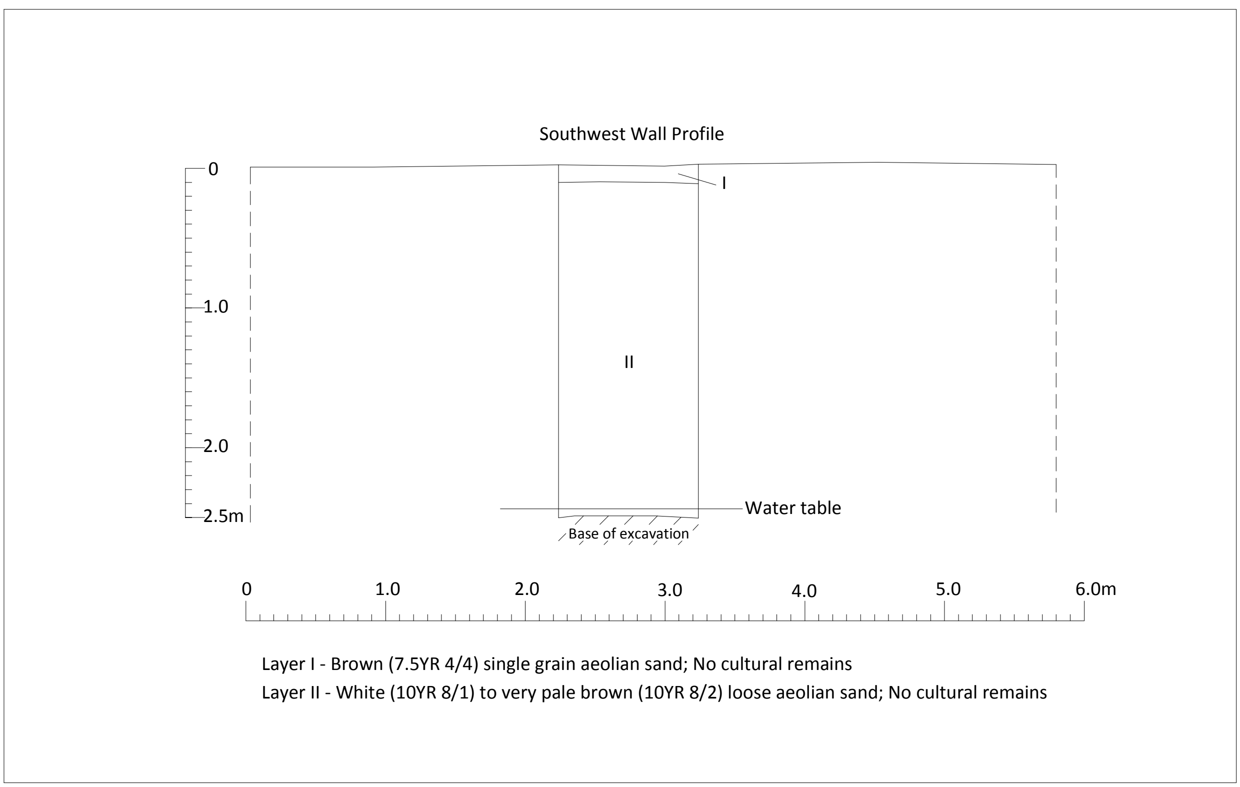
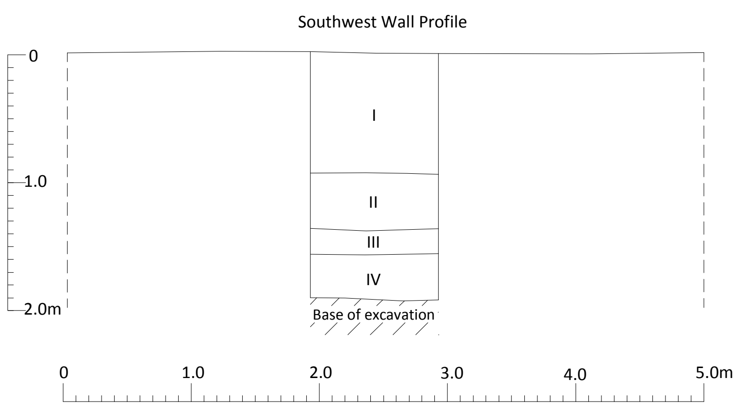


Figure B-60. Profile of BT-B-10-2



Layer I - Dark reddish brown (5YR 3/4) to very dark brown (7.5YR 2.5/3) sandy clay fill; Basalt aggregate present

Layer II - Dark reddish brown (5YR 4/4) to dark gray (10YR 4/1) compact clay fill; No cultural remains

Layer III - Very dark gray (7.5YR 3/1) coarse marine sand; No cultural remains

Layer IV - Brownsih yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-61. Profile of BT-B-10-3

Area C Trenches

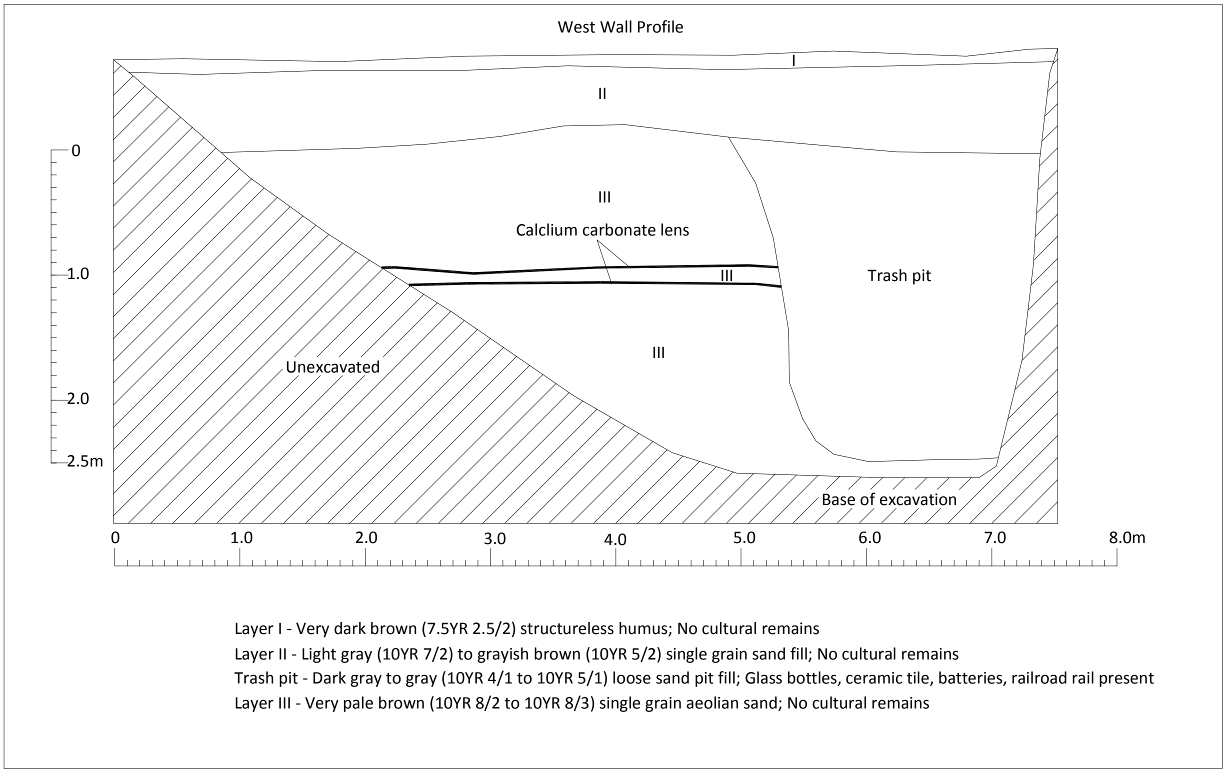


Figure B-62. Profile of BT-C-1-1

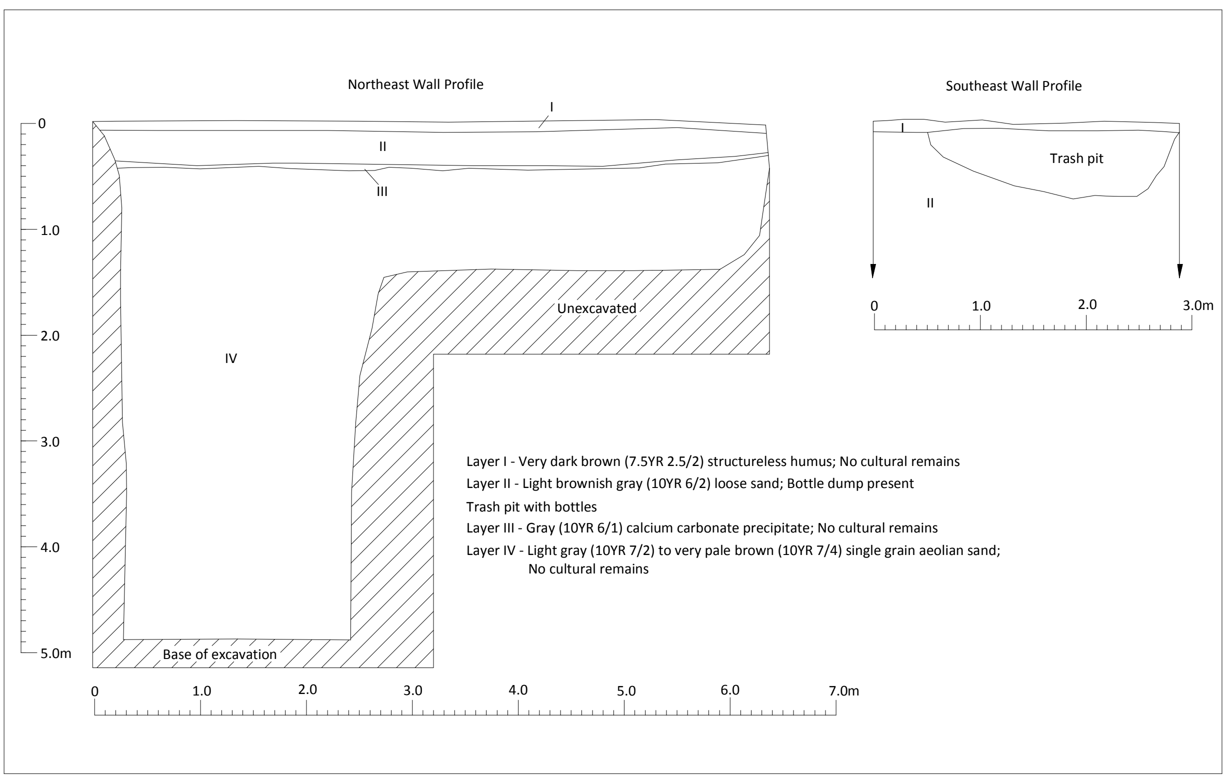
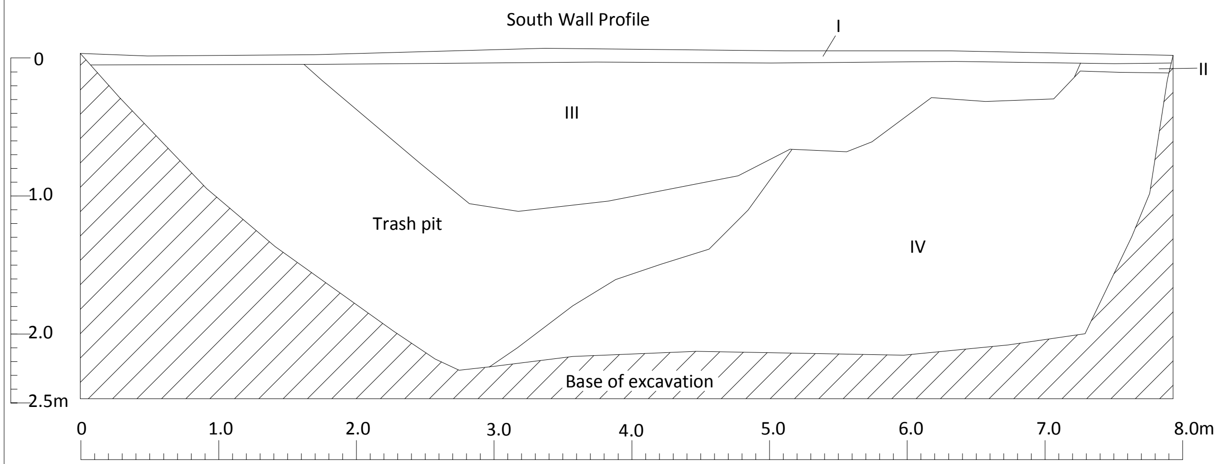


Figure B-63. Profile of BT-C-2-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

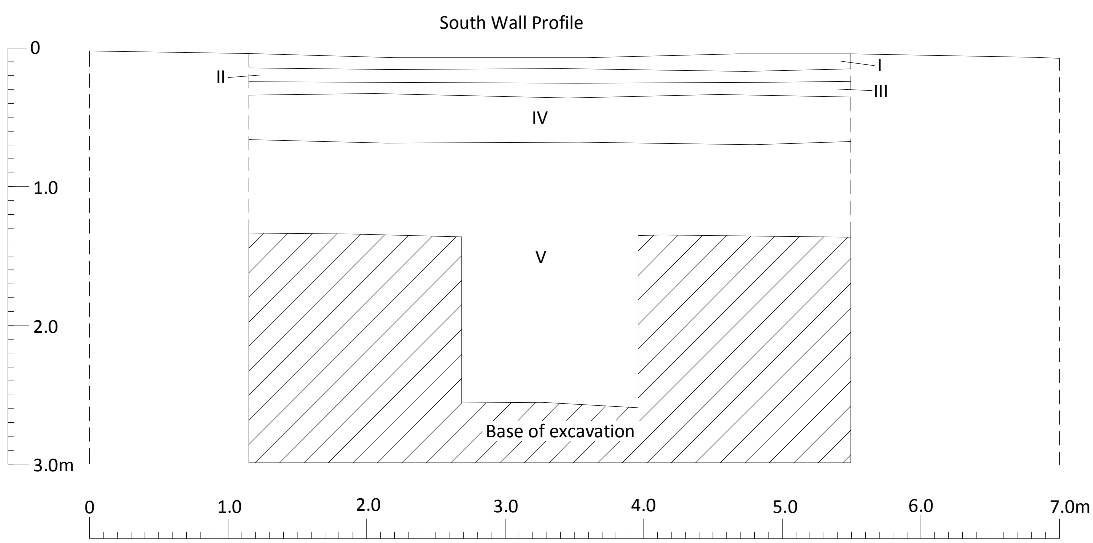
Layer II - Pale brown (10YR 6/3) single grain slightly loam sand; No cultural remains

Trash pit - Grayish brown to light gray (10YR 5/2 with pocktes of 10YR 7/2) single grain slightly loamy sand pit fill; Glazed ceramics, glass bottles

Layer III - Light brownish gray (10YR 6/2) single grain sand; No cultural remains

Layer IV - Very pale brown (10YR 8/2) moderately compact aeolian sand; No cultural remains

Figure B-64. Profile of BT-C-2-2



Layer I - Dark brown (7.5YR 3/2 structureless humus; No cultural remains

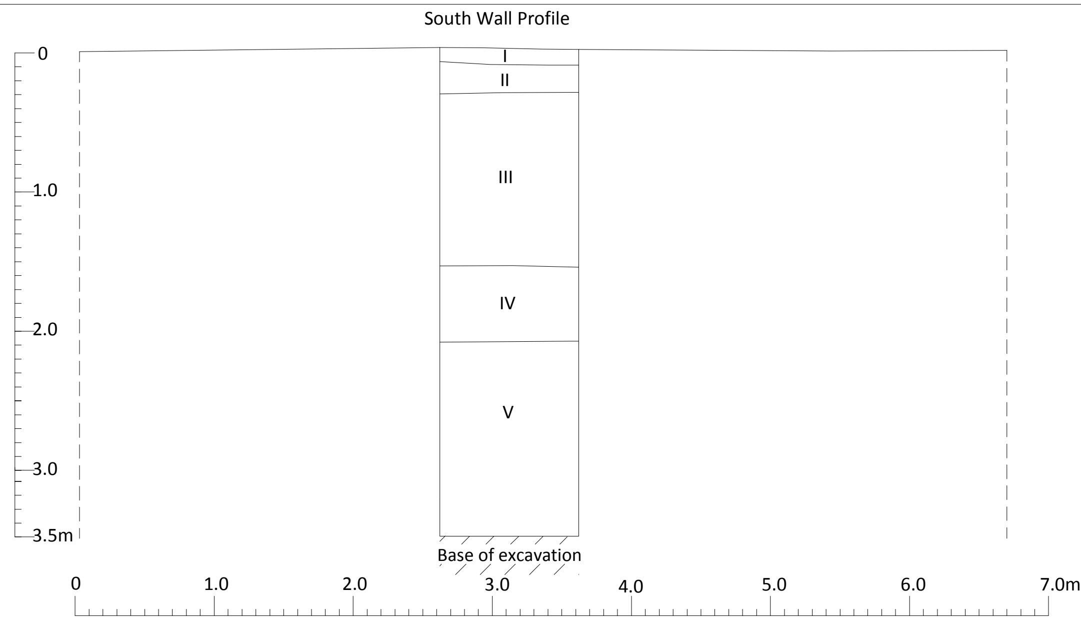
Layer II - Very pale brown (10YR 8/3) loose aeolian sand; No cultural remains

Layer III - Light brownish gray (10YR 6/2) to very pale brown (10YR 7/3) loose banded sand; No cultural remains

Layer IV - Pale brown (10YR 6/3) massive cemented very compact aeolian sand; No cultural remains

Layer V - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Figure B-65. Profile of BT-C-3-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

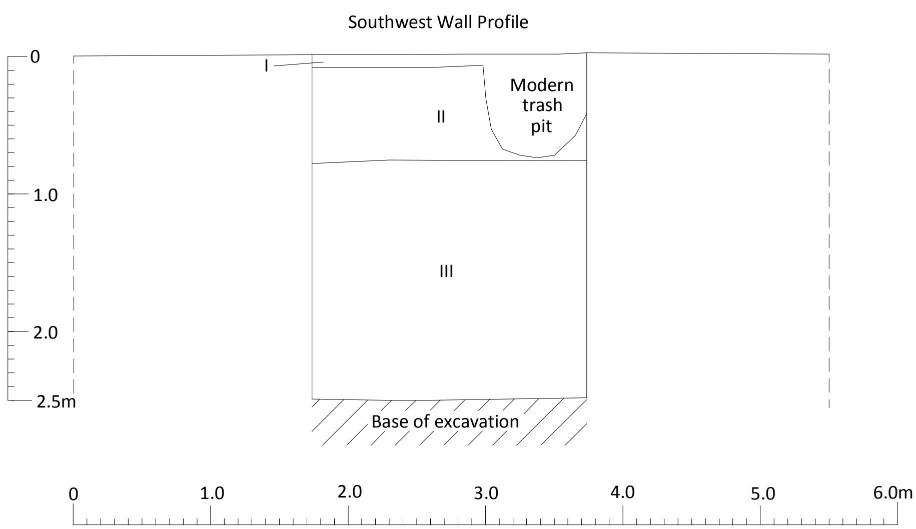
Layer II - Light brownish gray (10YR 6/2) single grain sand; No cultural remains

Layer III - Very pale brown (10YR 8/2) and light brownish gray (10YR 6/2) banded single grain sand; Broken glass throughout

Layer IV - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer V - Very pale brown (10YR 8/2) and light gray (10YR 7/2) compacted banded sand; No cultural remains

Figure B-66. Profile of BT-C-3-2

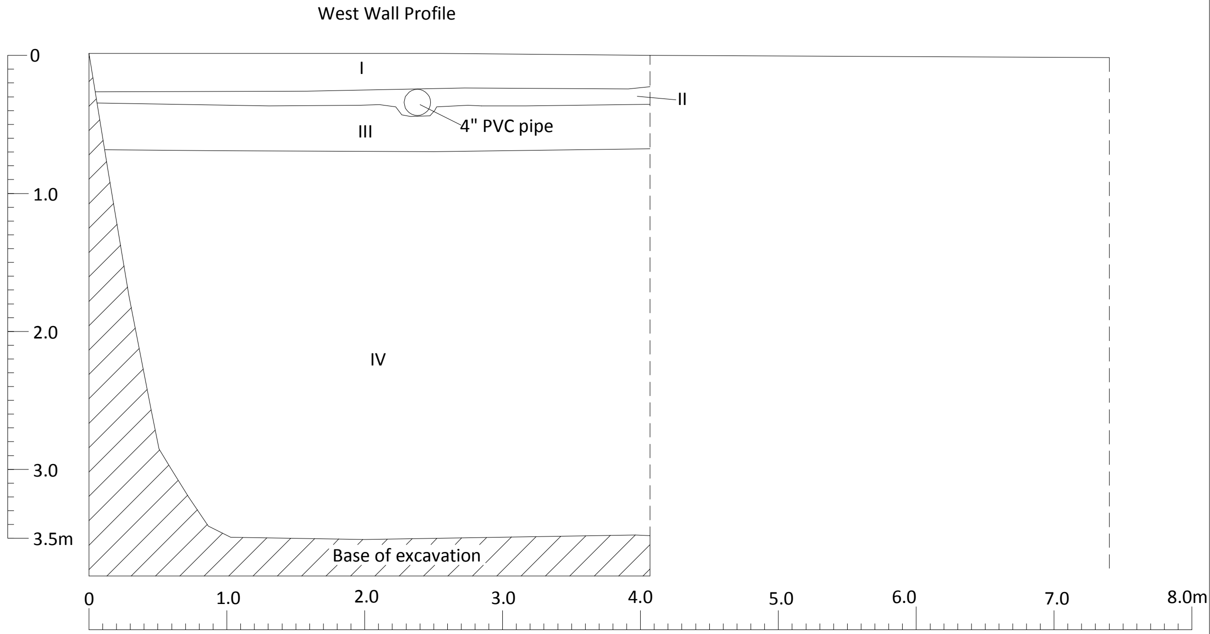


Layer I - Dark brown (7.5YR 3/3) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) to white (10YR 8/1) loose aeolian sand; Modern trash pit present

Layer III - White (10YR 8/1) to very pale brown (10YR 8/2) semi-lithified aeolian sand; No cultural remains

Figure B-67. Profile of BT-C-4-1



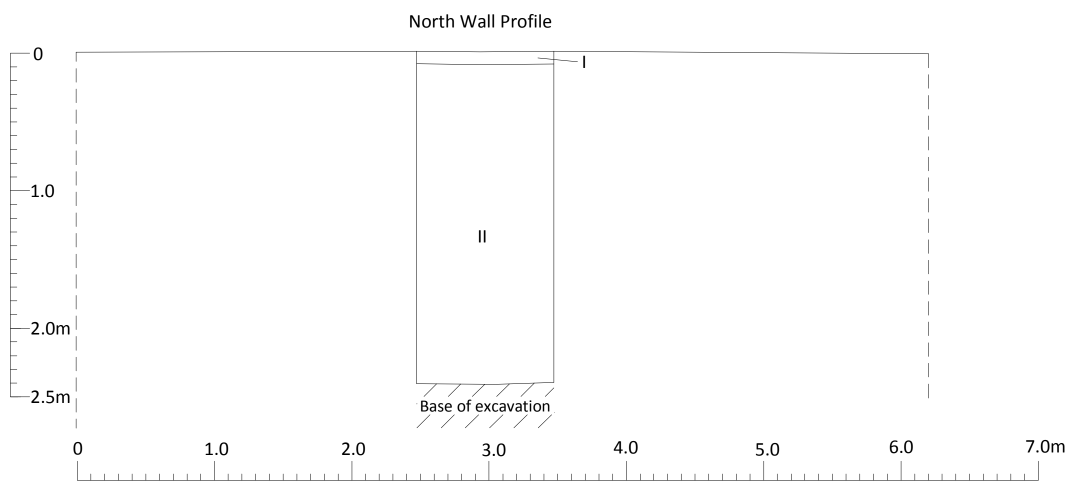
Layer I - Dark brown (7.5YR 3/3) very fine friable clay fill; No cultural remains

Layer II - Gray (10YR 6/10 to light gray (10YR 7/1) loose sand; PVC pipe, electrical wire

Layer III - White (10YR 8/1) to very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Layer IV - White (10YR 8/1) to very pale brown (10YR 8/2) lithified aeolian sand; No cultural remains

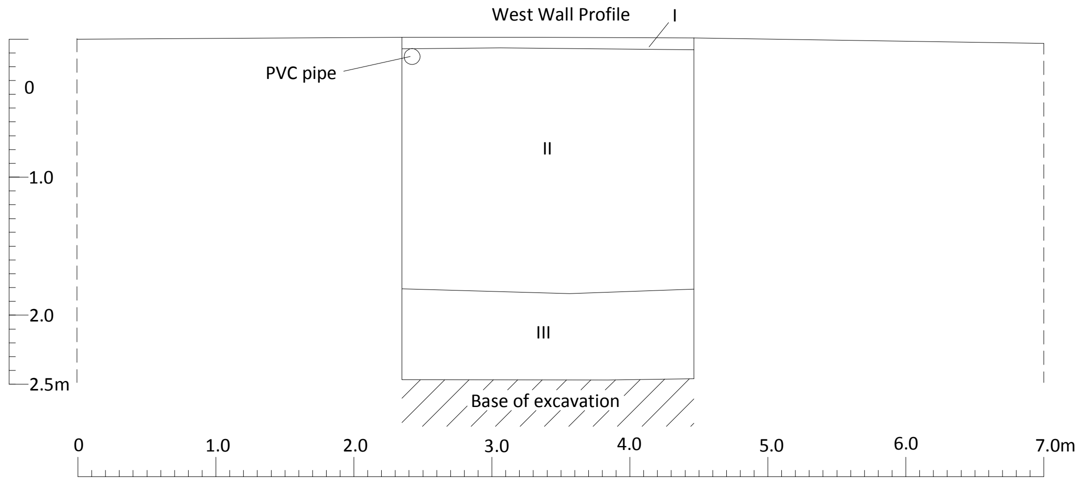
Figure B-68. Profile of BT-C-4-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Figure B-69. Profile of BT-C-5-1

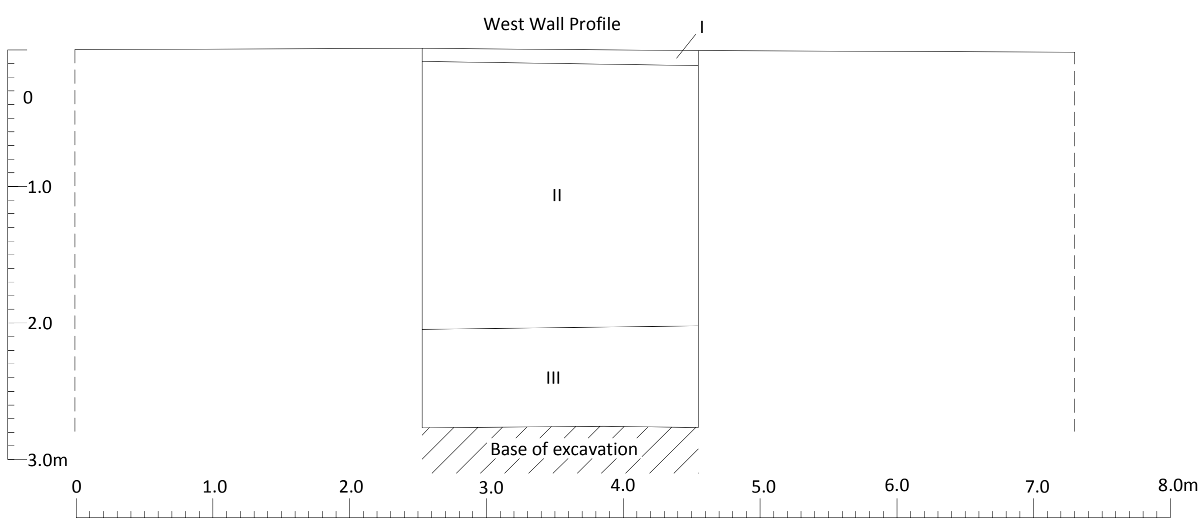


Layer I - Brown (10YR 4/3) loose sand and humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) semi-lithified aeolian sand; PVC pipe and electrical wires present

Layer III - Very pale brown (10YR 8/2) lithified aeolian sand; No cultural remains

Figure B-70. Profile of BT-C-5-2

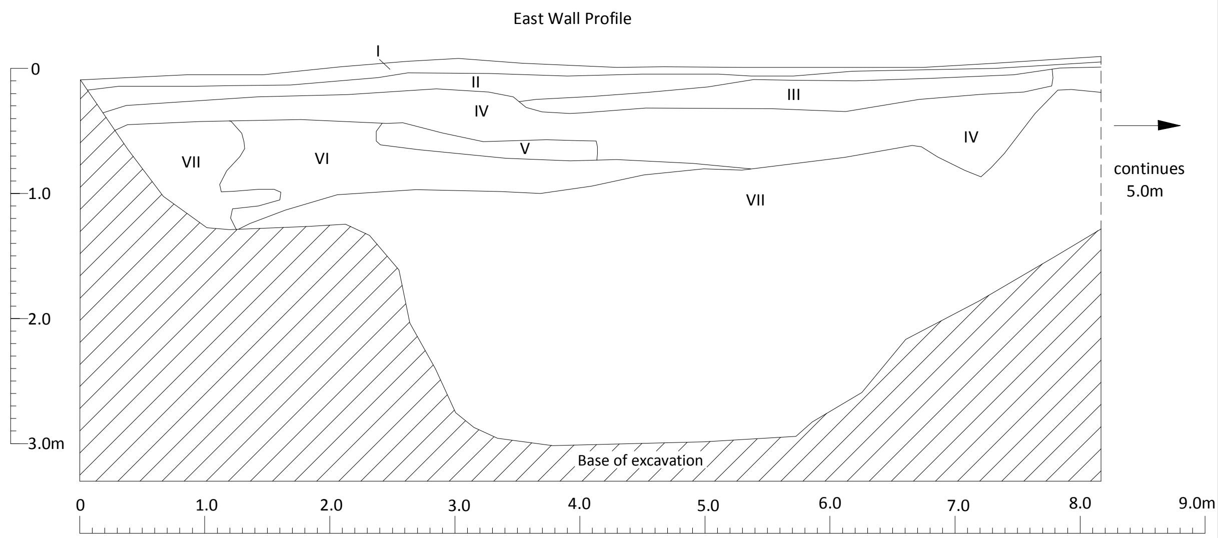


Layer I - Brown (10YR 4/3) loose sand and humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) semi-lithified aeolian sand; No cultural remains

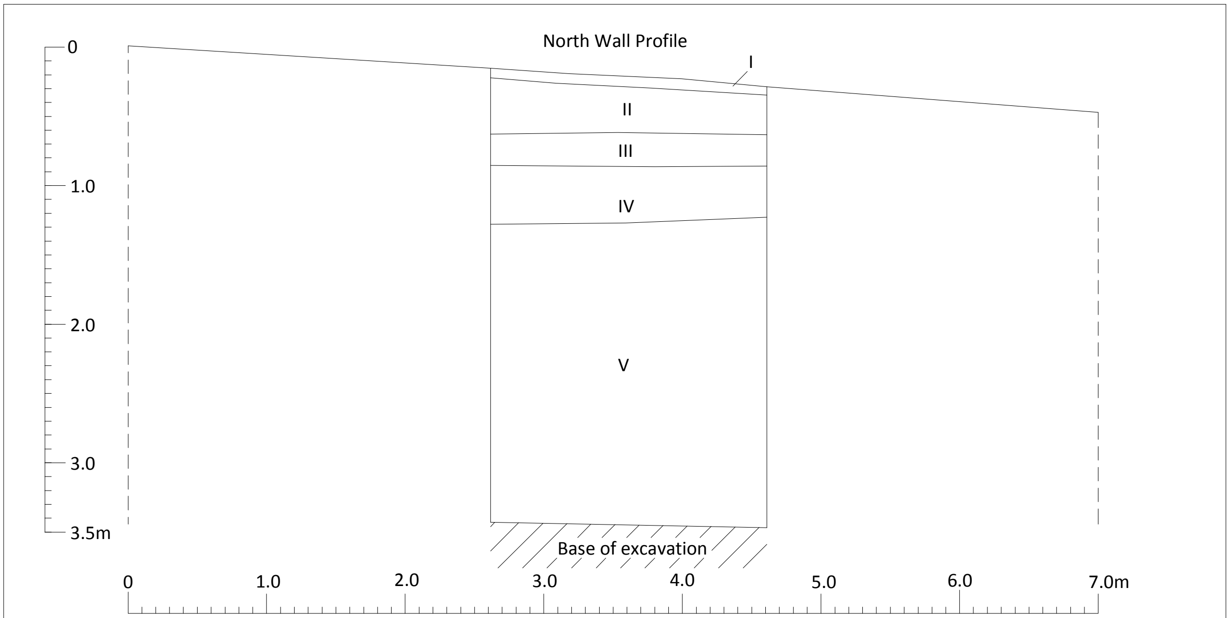
Layer III - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Figure B-71. Profile of BT-C-6-2



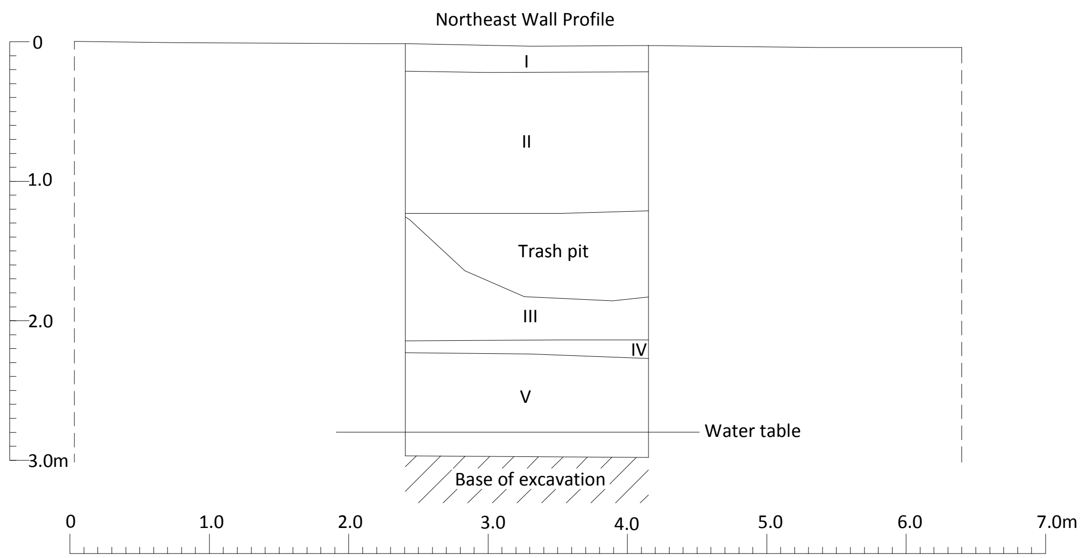
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Pale brown (10YR 6/3) loose aeolian sand; No cultural remains
Layer III - Gray (10YR 5/1) to black (7.5YR 2.5/1) compact sand; Pig bone and coral pebble present
Layer IV - Light brownish gray (10YR 6/2) to pale brown (10YR 6/3) moderately compact sand; No cultural remains
Layer V - Very pale brown (10YR 8/2 to 10YR 8/3) loose sand; No cultural remains
Layer VI - Pale brown (10YR 6/3) to brown (10YR 5/3) moderately compact sand; No cultural remains
Layer VII - Very pale brown (10YR 8/3) single grain aeolian sand; No cultural remains

Figure B-72. Profile of BT-C-7-1



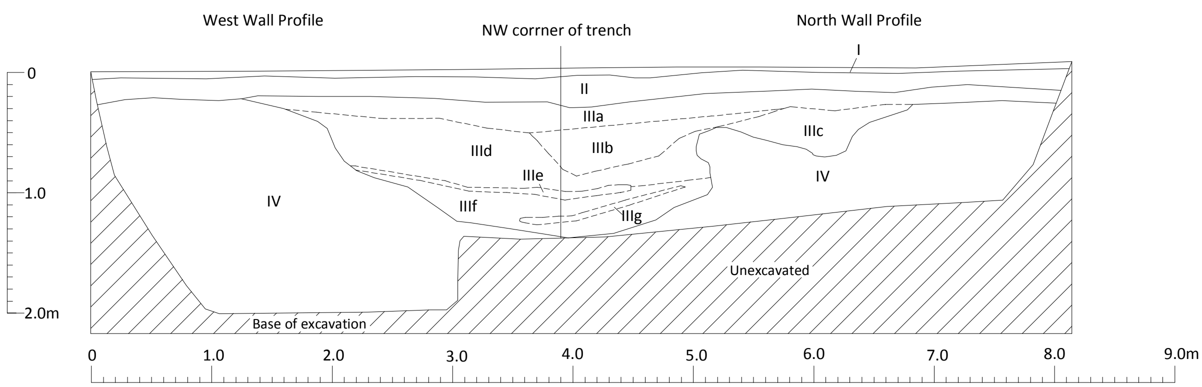
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Very pale brown (10YR 8/2 to 10YR 7/4) loose sand; No cultural remains
Layer III - Pale brown (10YR 6/3) to brown (10YR 5/3) moderately compact aeolian sand; No cultural remains
Layer IV - Very pale brown (10YR 8/2) moderately compact aeolian sand; No cultural remains
Layer V - Very pale brown (10YR 8/2 to 10YR 8/3) single grain aeolian sand; No cultural remains

Figure B-73. Profile of BT-C-7-2



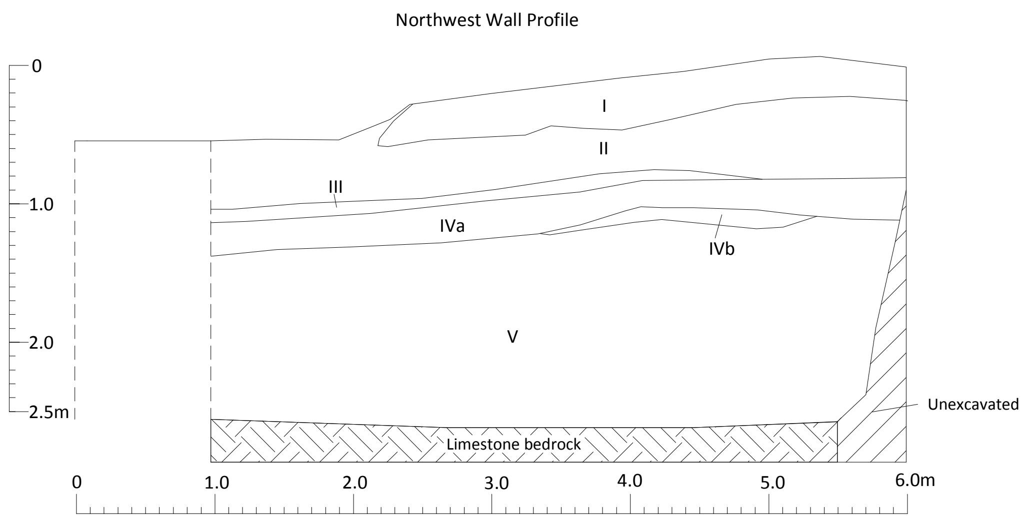
Layer I - Dark brown (7.5YR 3/3) friable clay fill; No cultural remains
Layer II - Dark yellowish brown (10YR 3/4) friable sandy clay loam fill; No cultural remains
Trash pit - Light gray (10YR 7/2) to dark brown (7.5YR 3/4) friable clay loam pit fill; Modern trash present
Layer III - Yellowish brown (10YR 5/4) single grain loamy marine sand; No cultural remains
Layer IV - White (10YR 8/1) weathered limestone; No cultural remains
Layer V - Brown (10YR 4/3) massive clay residual deposit; No cultural remains

Figure B-74. Profile of BT-C-7-3



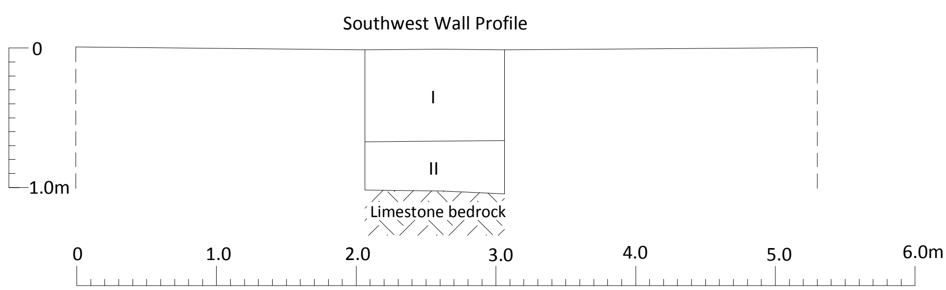
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Very pale brown (10YR 7/3) to pale brown (10YR 6/3) loose aeolian sand; No cultural remains
Layer IIIa - Dark gray (10YR 4/1) to very dark grayish brown (10YR 3/2) sand; Charcoal flecks present
Layer IIIb - Dark gray (10YR 4/1) sand; No cultural remains
Layer IIIc - Grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2) sand; No cultural remains
Layer IIId - Pale brown (10YR 6/3) sand; No cultural remains
Layer IIIe - Dark gray (10YR 4/1) sand; No cultural remains
Layer IIIf - Brown (10YR 5/3) sand; No cultural remains
Layer IIIg - Very dark gray (10YR 3/1) sand; No cultural remains
Layer V - Very pale brown (10YR 8/3) moderately compact aeolian sand; No cultural remains

Figure B-75. Profile of BT-C-8-1



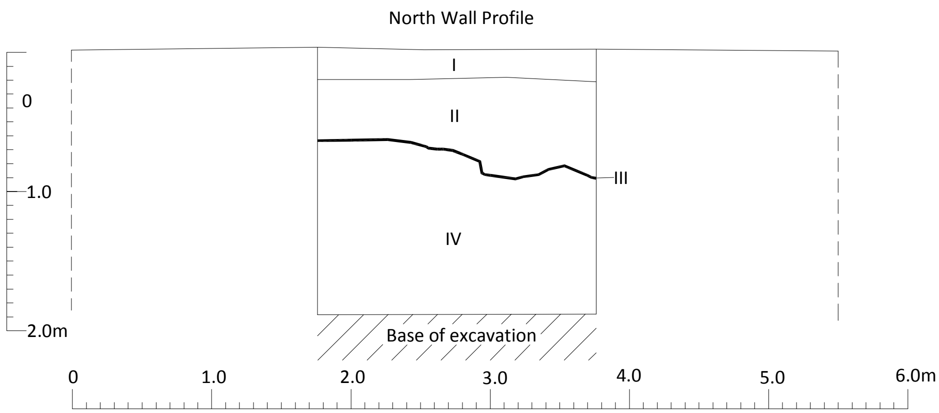
Layer I - Brown (7.5YR 4/3) loose loamy sand; No cultural remains
Layer II - White (10YR 8/1) to light brownish gray (10YR 6/2) single grain sand; No cultural remains
Layer III - White (10YR 8/1) loose sand; No cultural remains
Layer IVa - Gray (10YR 5/1) compact slightly loamy sand; Sparse charcoal and waterworn marine shells
Layer IVb - Dark gray (10YR 4/1) compact sand; No cultural remains
Layer V - Very pale brown (10YR 8/2 to 10YR 8/3) moderately compact aeolian sand; No cultural remains

Figure B-76. Profile of BT-C-8-2



Layer I - Dusky red (2.5YR 4/4) compact clay fill; Asphalt and gravel present
Layer II - Dark grayish brown (10YR 4/2) compact clay fill; Aggregate present

Figure B-77. Profile of BT-C-8-3



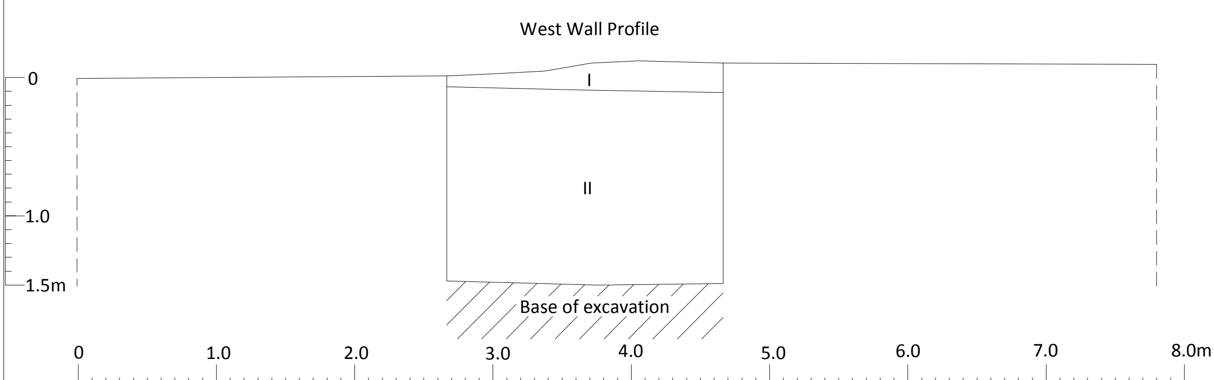
Layer I - Dark grayish brown (10YR 4/2) loose sand; PVC pipe and electrical wires present

Layer II - Very pale brown (10YR 8/2) to light brownish gray (10YR 6/2) moderately compact aeolian sand; No cultural remains

Layer III - Grayish brown (10YR 5/2) calcium carbonate precipitate; No cultural remains

Layer IV - Very pale brown (10YR 8/2 to 10YR 8/3) moderately compact aeolian sand; No cultural remains

Figure B-78. Profile of BT-C-9-1

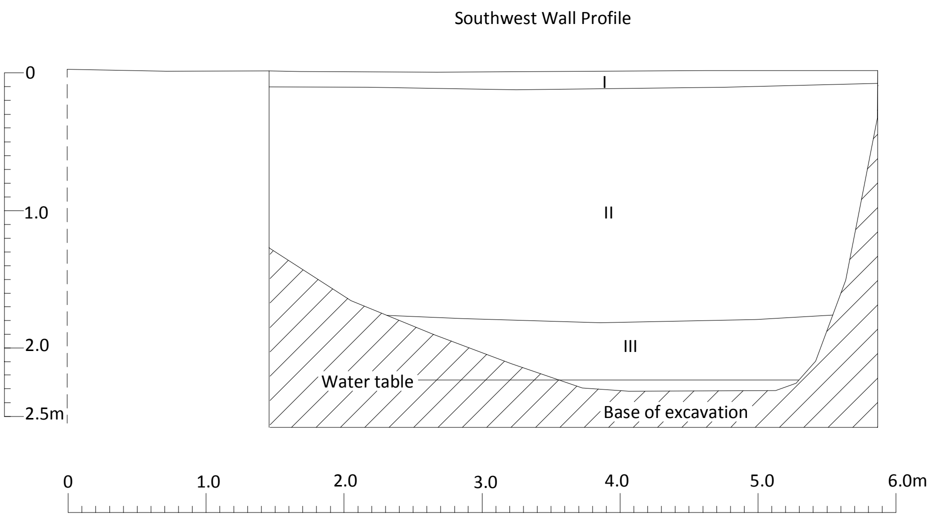


Layer I - Dark brown (10YR 3/3) to dark yellowish brown (10YR 3/4) friable sandy clay loam fill; Plastic and glass fragments and milled lumber

Layer II - Light gray (10YR 7/2) to very pale brown (10YR 8/2) compact aeolian sand; No cultural remains

Figure B-79. Profile of BT-C-9-2

Area D Trenches

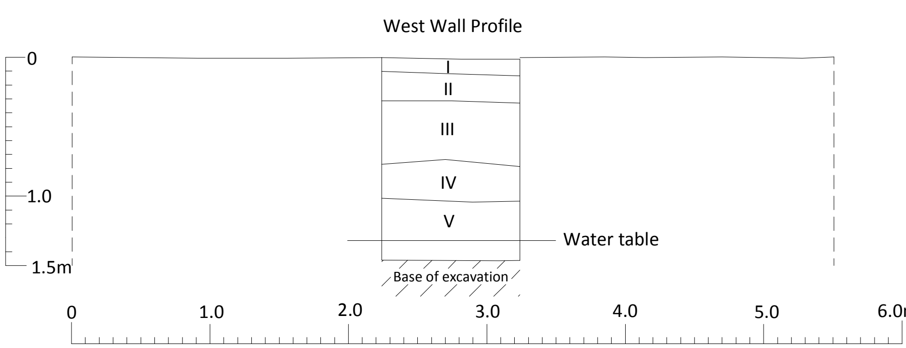


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2 and 10YR 8/3) fine aeolian sand; No cultural remains

Layer III - Light gray (Gley 7/N) fine saturated gley and sand; No cultural remains

Figure B-80. Profile of BT-D-0-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

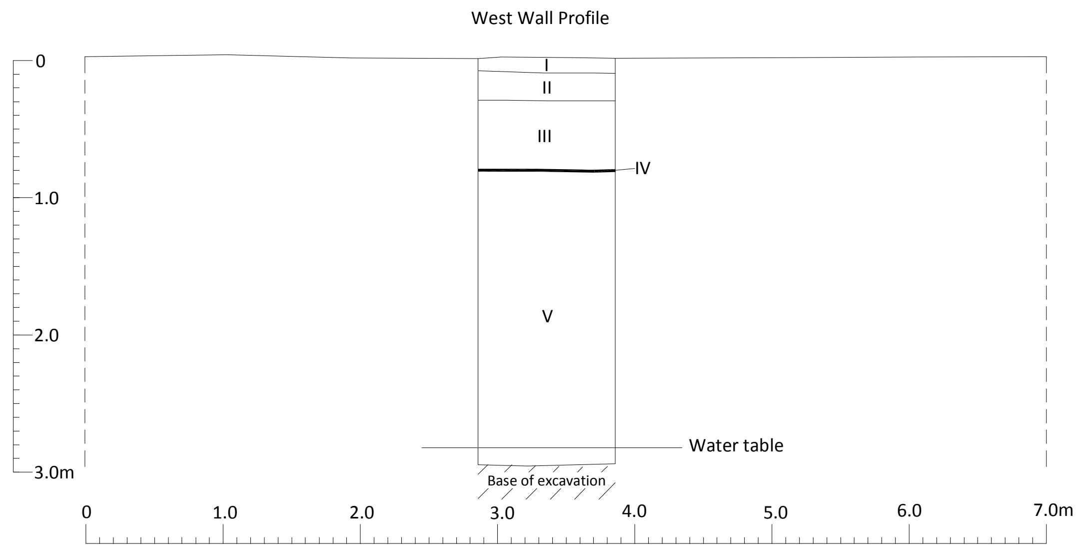
Layer II - Yellowish brown (10YR 5/4) loose aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 7/3) to pale brown (10YR 6/3) single grain aeolian sand; No cultural remains

Layer IV- Pink (7.5YR 8/3 to 7.5YR 8/4) single grain aeolian sand; No cultural remains

Layer V - Light gray (10YR 7/1) single grain aeolian silty sand; No cultural remains

Figure B-81. Profile of BT-D-1-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

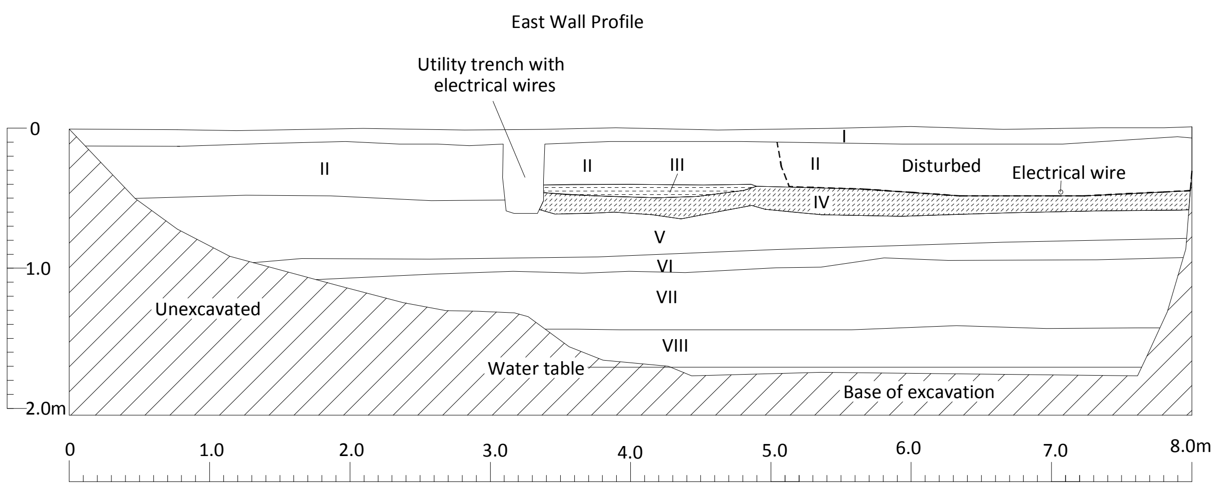
Layer II - Light brownish gray (10YR 6/2) loose aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 8/3) compact aeolian sand; No cultural remains

Layer IV - Gray (10YR 6/1) calcium carbonate precipitate; No cultural remains

Layer V - Very pale brown (10YR 8/3 to 10YR 8/4) moderately compact aeolian sand; No cultural remains

Figure B-82. Profile of BT-D-1-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) compacted aeolian loamy sand; Electrical wires and utility trench present

Layer III - Black (7.5YR 2.5/1) very fine friable loamy sand; Site 7289 cultural deposit

Layer IV - Brown (10YR 4/3 to 7.5YR 5/4) single grain aeolian slightly loamy sand; Site 7289 cultural deposit

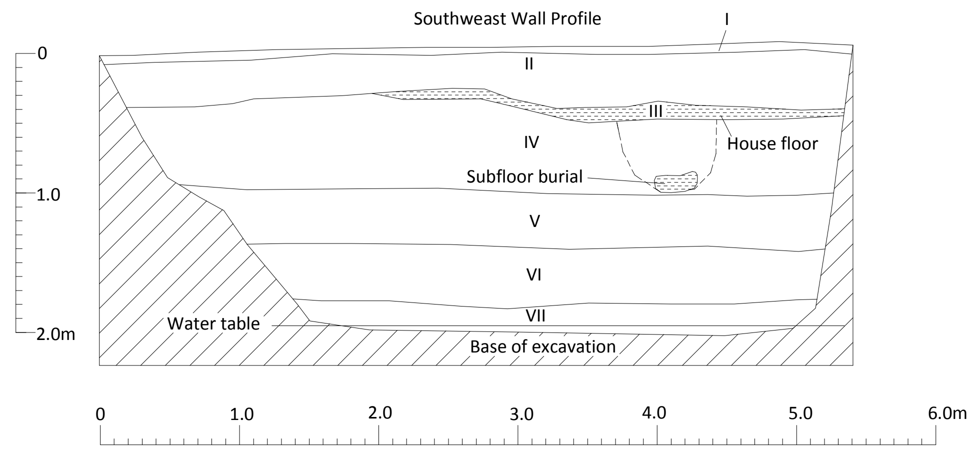
Layer V - Very pale brown (10YR 8/2) compacted aeolian sand; No cultural remains

Layer VI - Light gray (10YR 7/2) compacted semi-lithified aeolian sand; No cultural remains

Layer VII - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer VIII - White (10YR 8/1) very fine single grain aeolian sand; No cultural remains

Figure B-83. Profile of BT-D-2-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Grayish brown (10YR 5/2) and brown (7.5YR 4/3) loose slightly loamy sand; No cultural remains

Layer III - Grayish brown (10YR 5/2) and Dark grayish brown (10YR 4/2) and brown (10YR 5/3) moderatelysit compacted loamy sand; Site 7289 cultural deposit

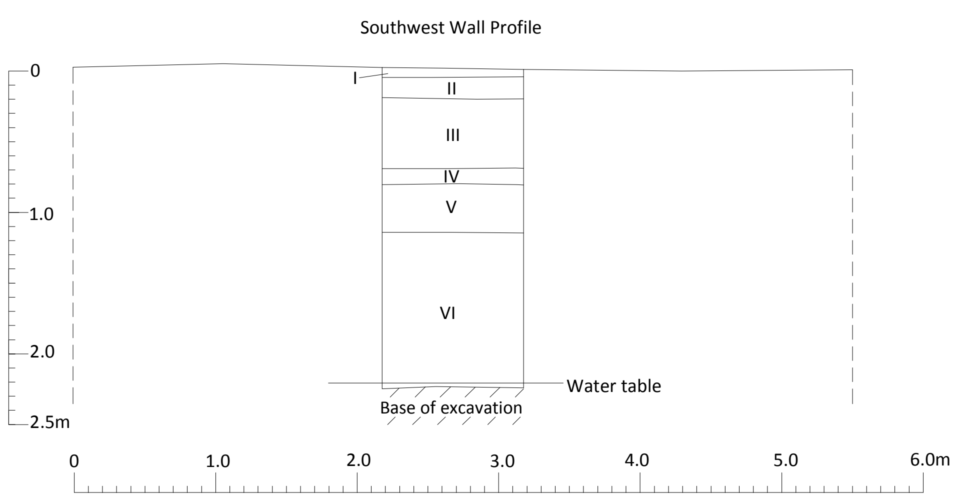
Layer IV - Very pale brown (10YR 8/2) loose aeolian sand; Human remainsin sub-floor burial pit

Layer V - Very pale brown (10YR 8/2) semi-lithified aeolian sand; No cultural remains

Layer VI - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Layer VII - White (Gley 1 8/N) single grain aeolian sand; No cultural remains

Figure B-84. Profile of BT-D-2-1b



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Pale brown (10YR 6/3) single grain sand; No cultural remains

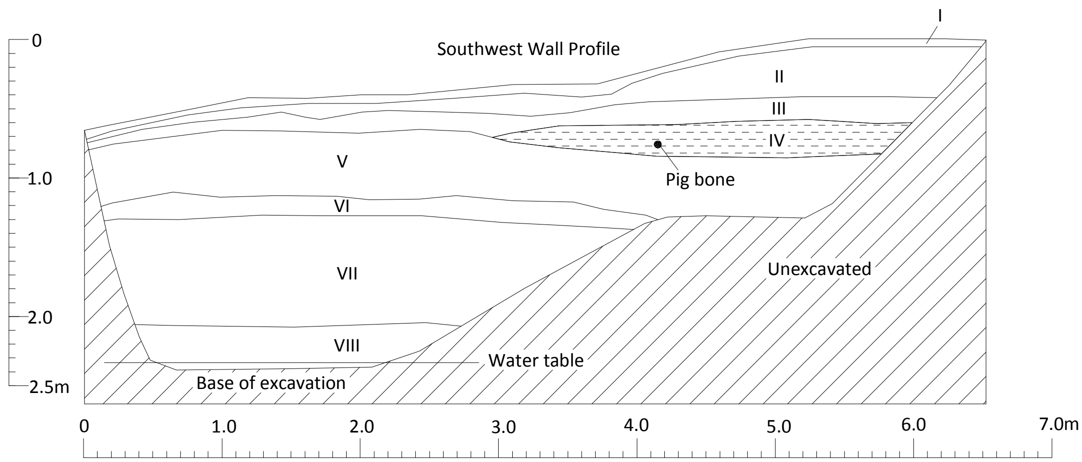
Layer III - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer IV - Pale brown (10YR 6/1) calcium carbonate precipitate; No cultural remains

Layer V - Very pale brown (10YR 8/3) semi-lithified aeolian sand; No cultural remains

Layer VI - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Figure B-85. Profile of BT-D-2-1c



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) loose sand; No cultural remains

Layer III - Gray (10YR 5/1) compacted loamy sand; 50% basalt aggregate

Layer IV - Grayish brown (10YR 5/2) compacted loamy sand; Site 7289 cultural deposit (pig bones and charcoal)

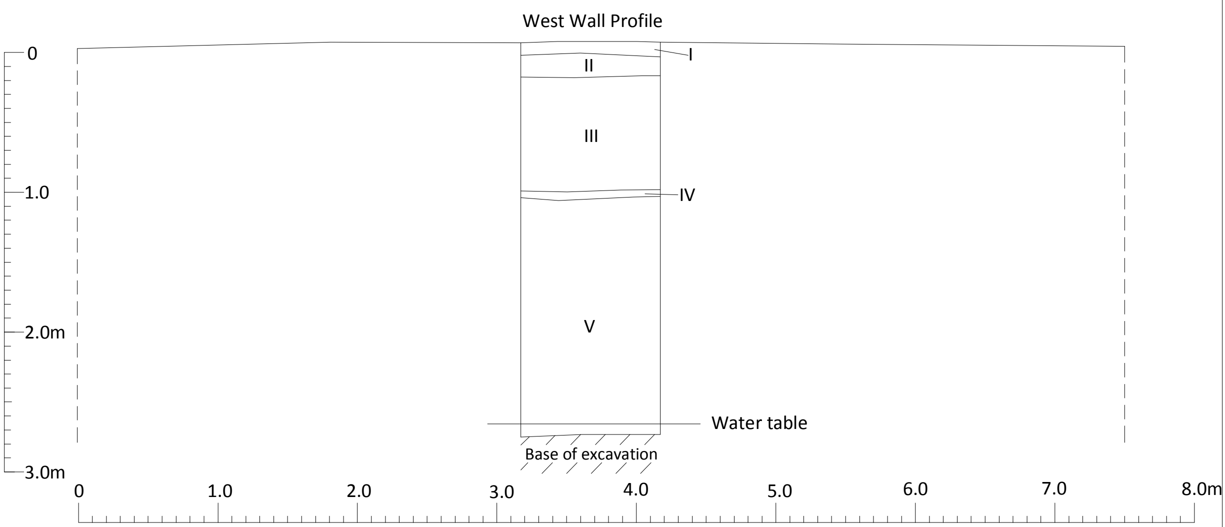
Layer V - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer VI - Grayish brown (10YR 5/2) calcium carbonate precipitate - cemented aeolian sand; No cultural remains

Layer VII - Very pale brown (10YR 8/3) loose aeolian sand; No cultural remains

Layer VIII - Light gray (10YR 7/1) loose aeolian sand; No cultural remains

Figure B-86. Profile of BT-D-2-1d



Layer I - Very dark brown (7.5YR 2.5/3) structureless humus; No cultural remains

Layer II - Light yellowish brown (10YR 6/4) loose aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 8/3) to gray (10YR 6/1) single grain aeolian sand; No cultural remains

Layer IV - Gray (10YR 6/1) compact calcium carbonate precipitate lenses; No cultural remains

Layer V - Very pale brown (10YR 8/2) loose aeolian sand; No cultural remains

Figure B-87. Profile of BT-D-2-2

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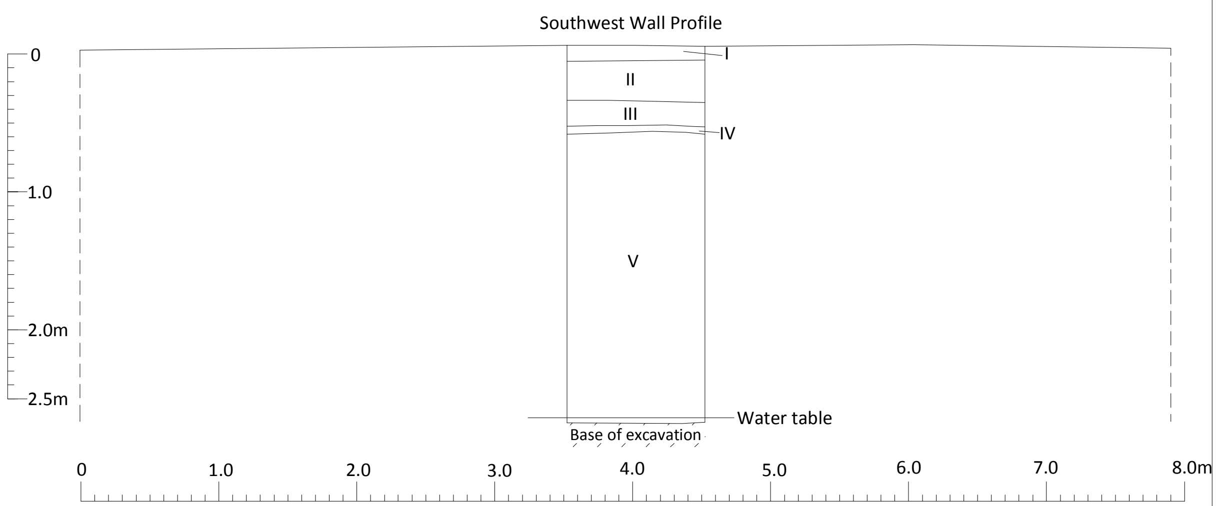


Layer I - Very dark brown (7.5YR 2.5/3) structureless humus; No cultural remains

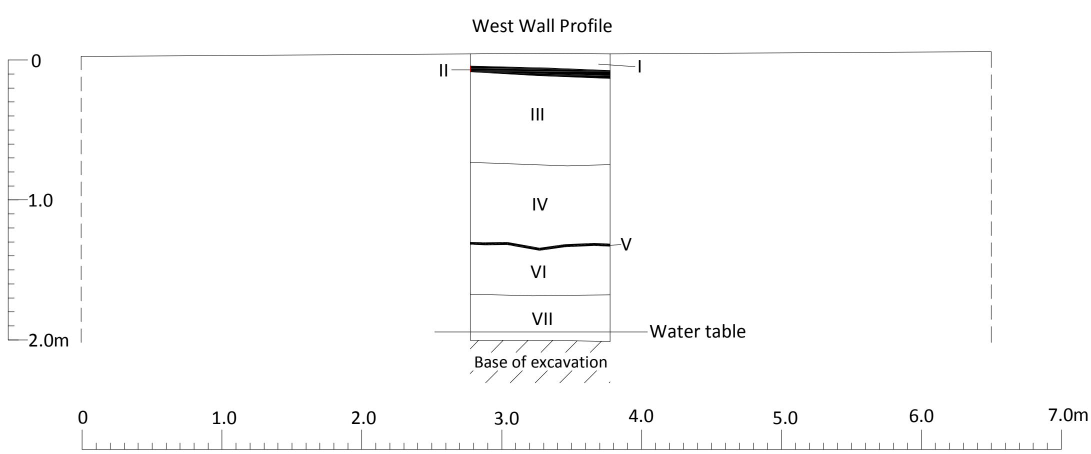
Layer II - Light yellowish gray (10YR 6/2) to pale brown (10YR 6/3) loose aeolian sand; No cultural remains

Layer III - Very pale brown (10YR 8/3) to gray (10YR 6/1) calcium caronate precipiate lenses; No cultural remains

Layer IV - Gray (10YR 6/1) compact sand; No cultural remains

Layer V - Very pale brown (10YR 8/3) loose aeolian sand; No cultural remains

Figure B-88. Profile of BT-D-3-1



Layer I - Very dark grayish brown (10YR 3/2) friable sandy loam fill; Aggregate present

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Light brownish gray (10YR 6/2) to yellowish brown (10YR 5/4) fine friable sandy loam fill; Aggregate present

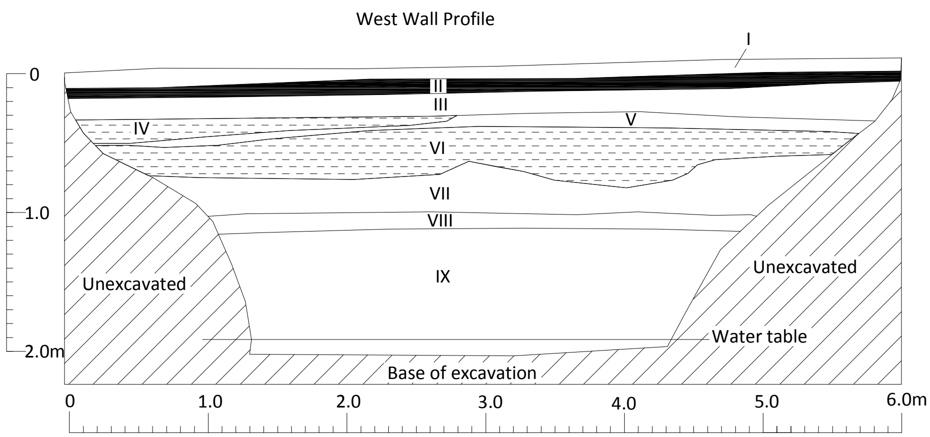
Layer IV - Very pale brown (10YR 8/3 to 10YR 8/4) single grain aeolian sand; No cultural remains

Layer V - Gray (10YR 6/1) to light brownish gray (10YR 6/2) calcium carbonate precipitate; No cultural remains

Layer VI - Very pale brown (10YR 8/3) loose aeolian sand; No cultural remains

Layer VII - White (7.5YR 8/1) single grain aeolian silty sand; No cultural remains

Figure B-89. Profile of BT-D-4-1



Layer I - Dark grayish brown (10YR 4/2) to light brownish gray (10YR 6/2) single grain loamy sand fill; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer; WWII airfield pavement

Layer III - Very dark grayish brown (10YR 3/2) to yellowish brown (10YR 5/4) very fine friable clay loam fill; Aggregate for Airfield pavement bedding

Layer IV - Very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2) single grain loamy sand; Site 7290 cultural deposit

Layer V - Pale brown (10YR 6/3) single grain sand; No cultural remains

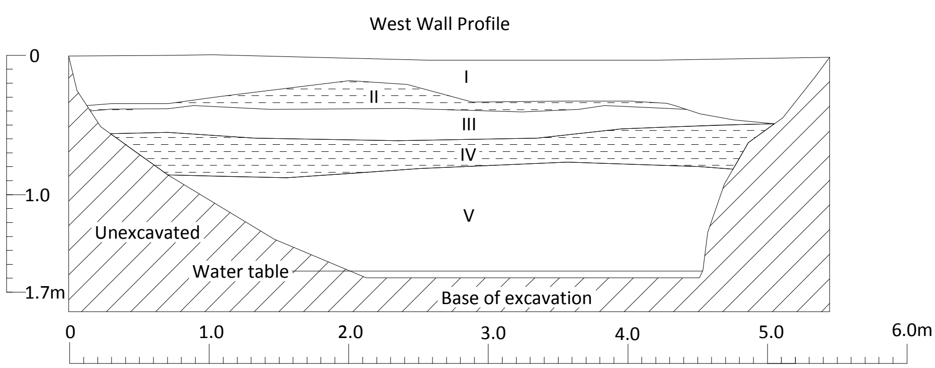
Layer VI - Very dark gray (10YR 3/1) to grayish brown (10YR 5/2) mottled single grain carbon stained slightly loamy sand; Site 7290 cultural deposit

Layer VII - Very pale brown (10YR 8/2) single grain aeolian sand; No cultural remains

Layer VIII - White (10YR 8/1) calcium carbonate precipitate; No cultural remains

Layer IX - Very pale brown (10YR 8/3) single grain aeolian sand; No cultural remains

Figure B-90. Profile of BT-D-5-1



Layer I - Brown (10YR 5/3) compacted sandy clay loam; Aggregate for Airfield pavement bedding

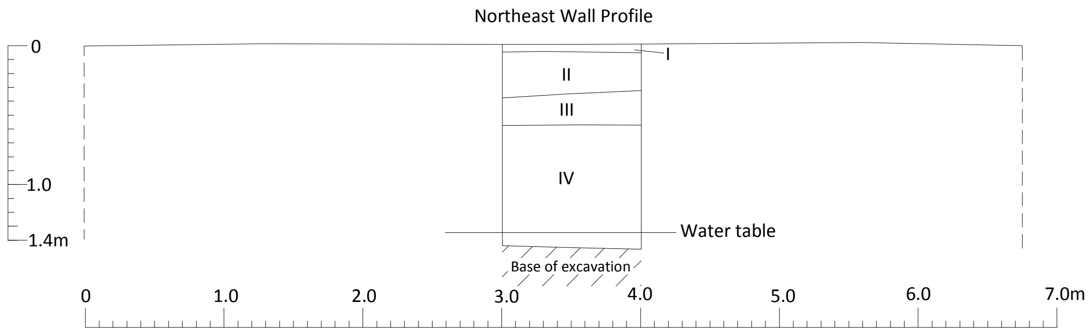
Layer II - Black (7.5YR 2.5/1) and very dark brown (10YR 2/2) single grain banded loamy sand; Site 7290 cultural deposit (Marine shells and charcoal)

Layer III - Grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) and pale brown (10YR 6/3) single grain sand; No cultural remains

Layer IV - Very dark grayish brown (10YR 3/2) very fine friable sandy loam; Site 7290 cultural deposit (Marine shells and charcoal)

Layer V - Very pale brown (10YR 7/3) very fine single grain aeolian slightly silty sand; No cultural remains

Figure B-91. Profile of BT-D-6-1



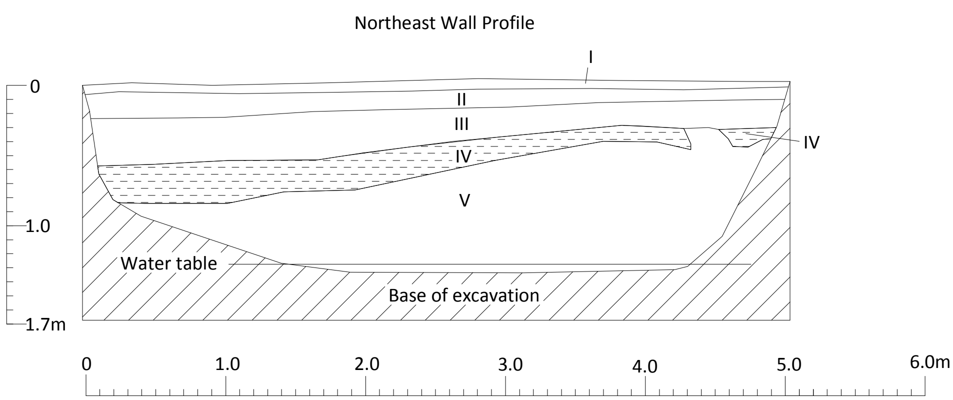
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) compact sandy clay loam; Aggregate present

Layer III - White (10YR 8/1) compacted sand; No cultural remains

Layer IV - Light gray (10YR 7/2) very fine silty sand; No cultural remains

Figure B-92. Profile of BT-D-6-2



Layer I - Dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Light gray (10YR 7/2) and light brownish gray (10YR 6/2) compacted crushed limestone fill; Aggregate for Airfield runway shoulder

Layer III - Very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) fine friable sandy clay loam; No cultural remains

Layer IV - Very dark gray (7.5YR 3/1)fine friable carbon flecked sandy clay loam; Site 7290 cultural deposit (Marine shells and probable avian bones)

Layer V - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

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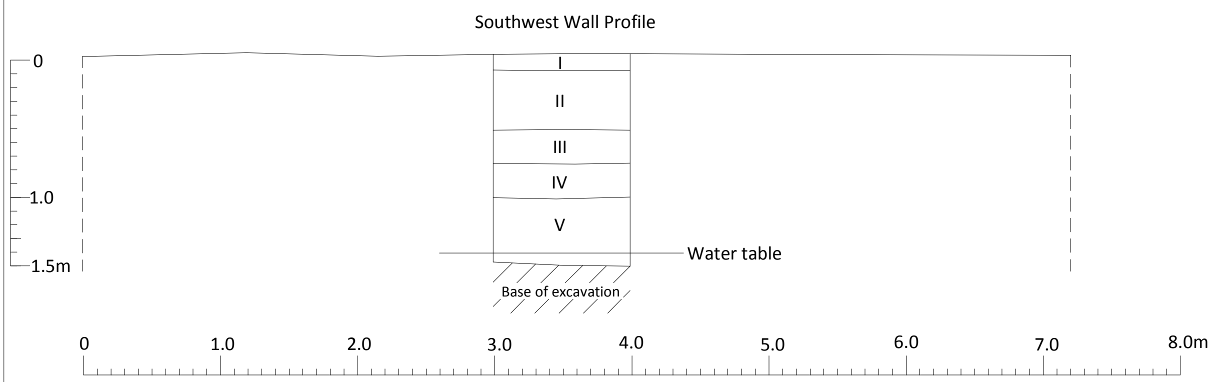
Figure B-93. Profile of BT-D-7-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus ; No cultural remains

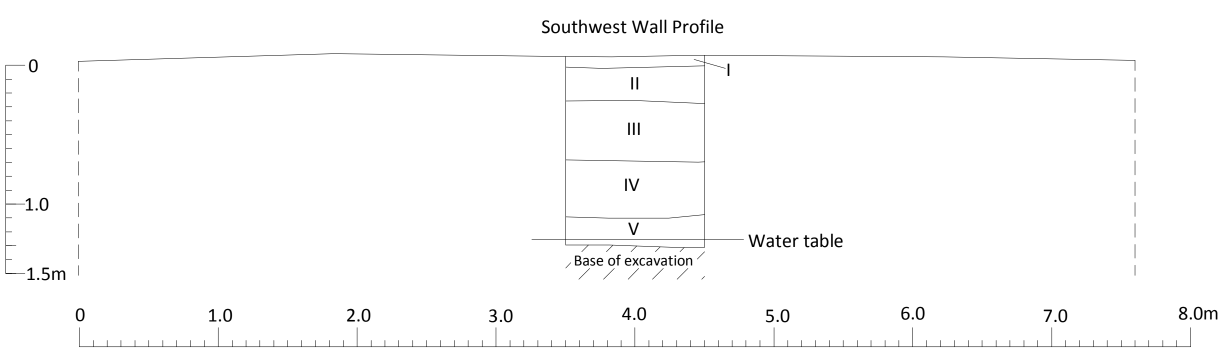
Layer II - Light brownish gray (10YR 6/2) to light gray (10YR 7/2) compact crushed limestone fill; Aggregate present

Layer III - Very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) very fine friable sandy clay loam buried A horizon; No cultural remains

Layer IV - Dark yellowish brown (10YR 4/4) very fine friable sandy clay loam; No cultural remains

Layer V - Very pale brown (10YR 7/3) compact weathered limestone; No cultural remains

Figure B-94. Profile of BT-D-7-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

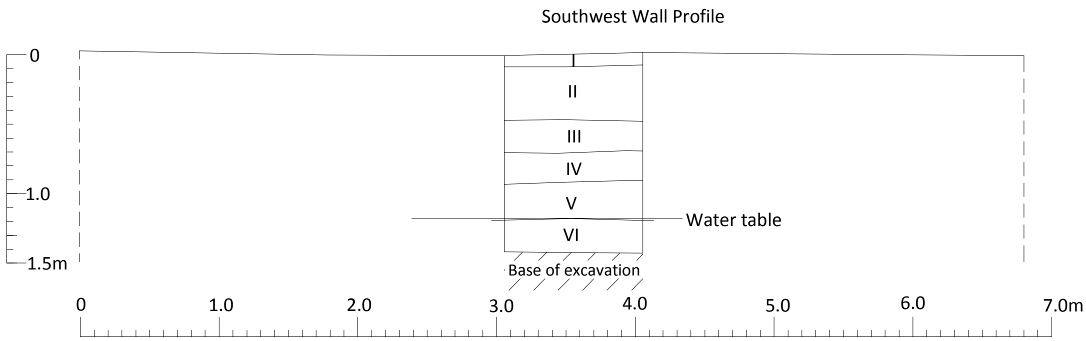
Layer II - Dark grayish brown (10YR 4/2) compact clay loam; Metal pipe and aggregate present

Layer III - Brown (10YR 4/3) to dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Layer IV - Dark grayish brown (10YR 4/2) very fine friable clay No cultural remains

Layer V - Very dark gray (7.5YR 3/1) massive clay; No cultural remains

Figure B-95. Profile of BT-D-8-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) compact sandy loam; Aggregate present

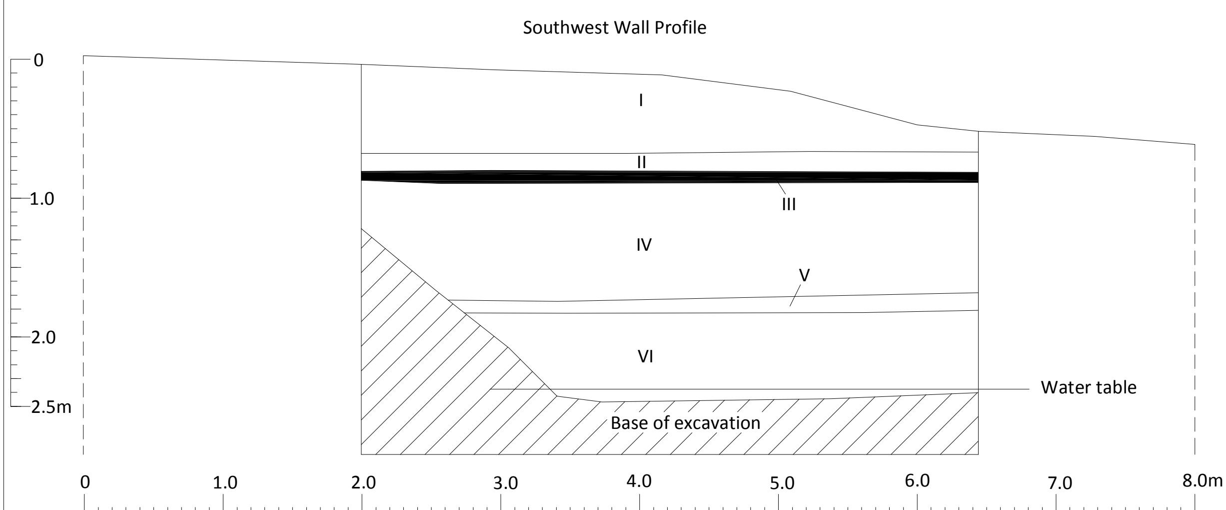
Layer III - Brown (10YR 4/3) to pale brown (10YR 6/3) single graiin slighlty silty sand; No cultural remains

Layer IV - Very pale brown (10YR 8/2) lsingle grain sand; No cultural remains

Layer V - Very dark grayish brown (10YR 3/2) very fine friable clay loam buried A horizon; No cultural remains

Layer VI- Black (7.5YR 2.5/1) to very dark grayish brown (10YR 3/2) decomposing organics (peat); No cultural remains

Figure B-96. Profile of BT-D-8-2



Layer I - Grayish brown (10YR 5/2) compact sandy loam; Marine shell, urchin, crab claw

Layer II - Light gray (10YR 7/2) coarse sand; Metal cable present

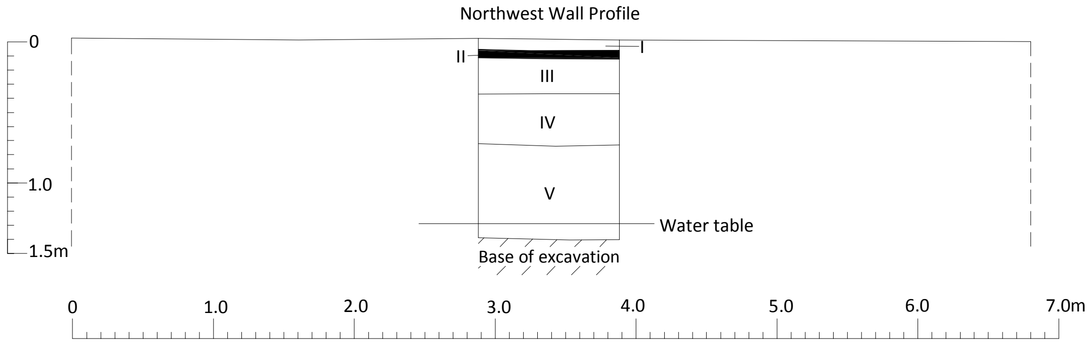
Layer III - Black (10YR 2/1) intact asphalt layer

Layer IV - Yellowish brown (10YR 5/4) very fine friable silty sand; Aggregate present

Layer V - Very dark gray (10YR 3/1) very fine friable sandy clay loam buried A horizon; No cultural remains

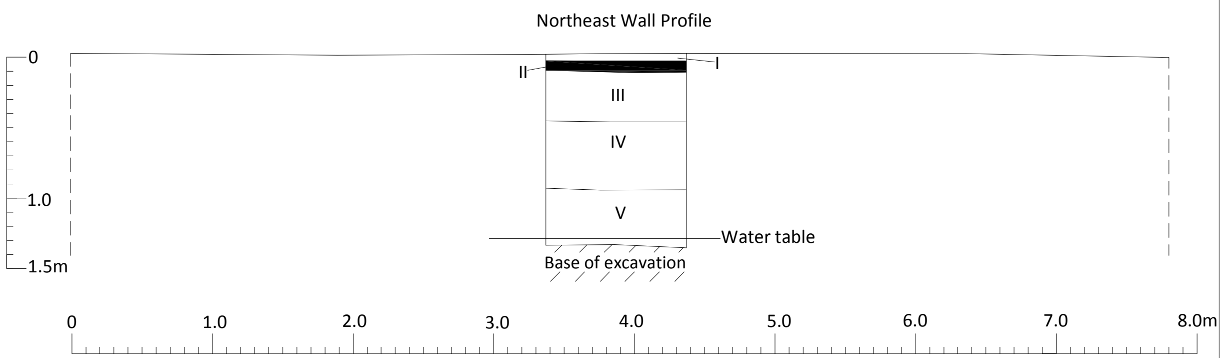
Layer VI - Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-97. Profile of BT-D-8-3



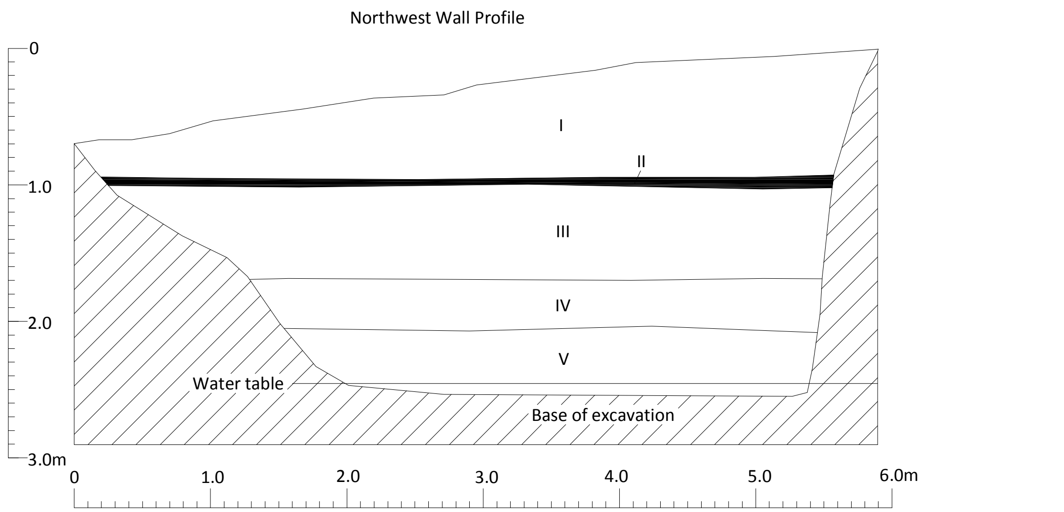
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Black (10YR 2/1) intact asphalt layer
Layer III - Light brownish gray (10YR 6/2) compact crushed limestone fill; Aggregate present
Layer IV - Brown (10YR 4/3) compact sandy clay loam fill; No cultural remains
Layer V - Very dark brown (10YR 8/2) compact crushed limestone fill; Aggregate present

Figure B-98. Profile of BT-D-9-1



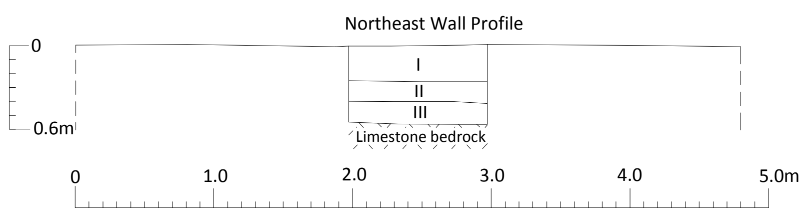
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains
Layer II - Black (10YR 2/1) intact asphalt layer
Layer III - Light gray (10YR 7/2) compact crushed limestone fill; Aggregate present
Layer IV - Brown (10YR 4/2 and 7.5YR 4/3) very fine friable sandy clay loam; No cultural remains
Layer V - Dark yellowish brown (10YR 4/4) massive clay; No cultural remains

Figure B-99. Profile of BT-D-9-2



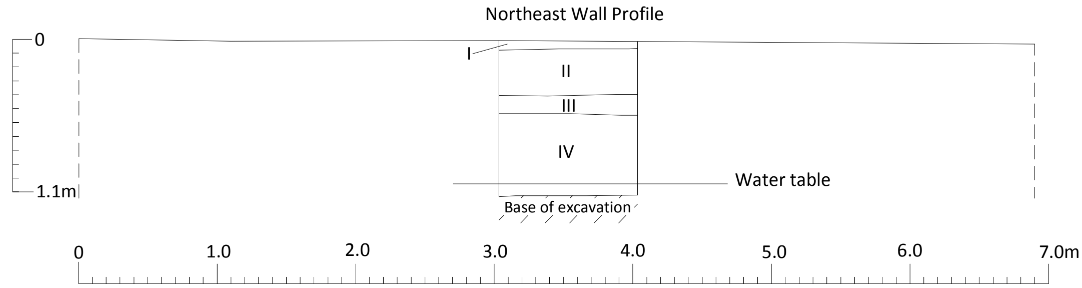
Layer I - Brown (10YR 4/3) unconsoliodated sandy loam; Sheet metal fragments present
Layer II - Black (10YR 2/1) intact asphalt layer
Layer III - Light gray (10YR 7/2) compact sandy clay loam fill; Aggregate present
Layer IV - Very dark grayish brown (10YR 3/2)very fine friable clay loam buried A horizon; Marine shell, crab claw, charcoal flecks
Layer V - Very pale brown (10YR 8/2) massive clay; No cultural remains

Figure B-100. Profile of BT-D-9-3



Layer I - Brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains
Layer II - Yellowish brown (10YR 5/4) very fine friable sandy clay loam fill; No cultural remains
Layer III - Dark gray (10YR 4/1) massive clay; No cultural remains

Figure B-101. Profile of BT-D-10-1



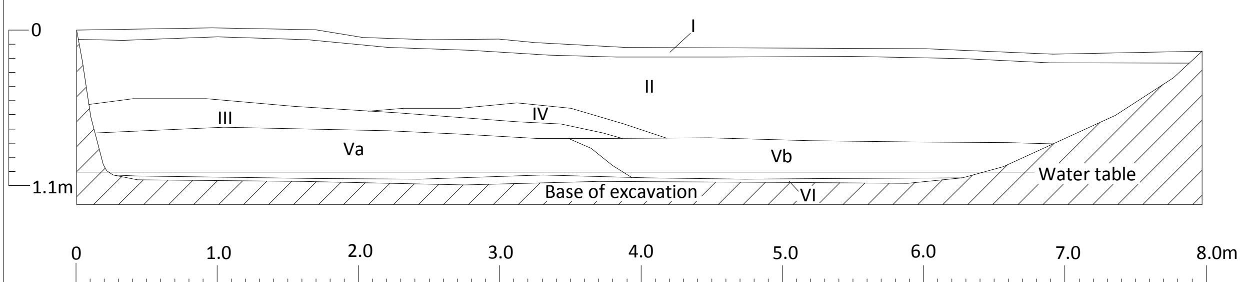
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (7.5YR 5/4) to very pale brown (10YR 8/2) unconsolidated sandy clay loam; Aggregate present

Layer III - Very dark grayish brown (10YR 3/2) very fine friable clay loam buried A horizon; No cultural remains

Layer IV - Grayish brown (10YR 5/2) massive clay; No cultural remains

Figure B-102. Profile of BT-D-10-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Pinkish gray (7.5YR 7/2) coarse sand; No cultural remains

Layer III - Very dark gray (10YR 3/1) to dark gray (10YR 4/1) very fine friable sandy clay loam buried A horizon; No cultural remains

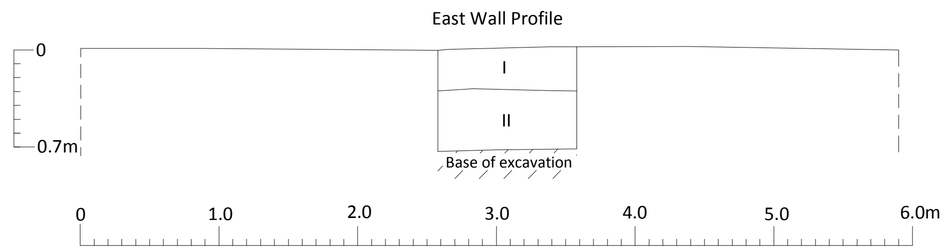
Layer IV - Dark brown (10YR 3/3) very fine friable clay loam alluvium; No cultural remains

Layer Va - Light brownish gray (10YR 6/2) massive clay; No cultural remains

Layer Vb - Black (2.5/N) to very dark grayish brown (10YR 3/2) massive clay; No cultural remains

Layer VI - Black (7.5YR 2.5/1) vegetal mat (peat); No cultural remains

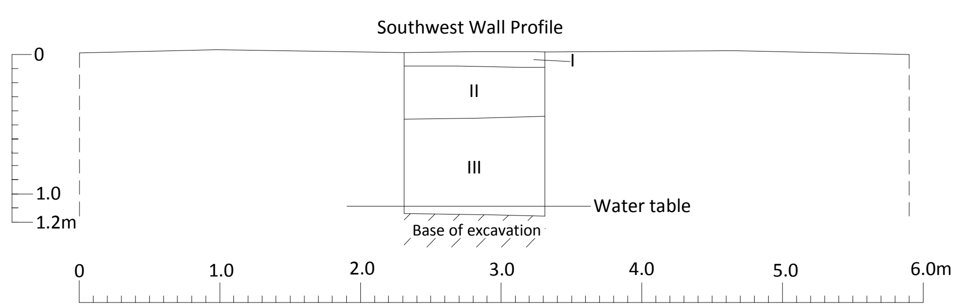
Figure B-103. Profile of BT-D-10-3



Layer I - Very pale brown (10YR 8/3) compact crushed limestone gravel fill; Aggregate present

Layer II - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-104. Profile of BT-D-11-1

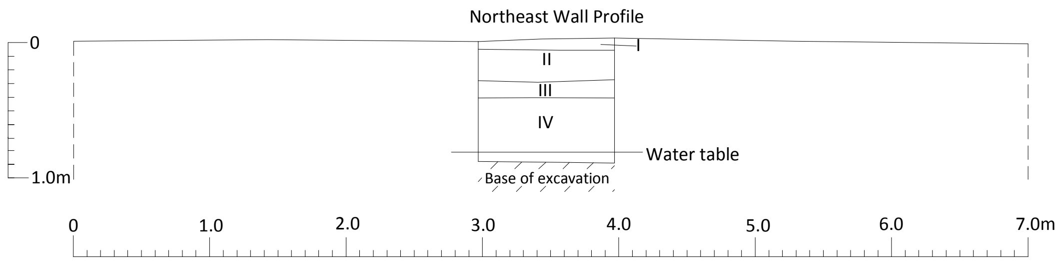


Layer I - Pale brown (10YR 6/2) to grayish brown (10YR 5/2) loose silty sand with humus; No cultural remains

Layer II - Yellowish brown (10YR 5/4) very fine friable sandy clay loam; Crushed limestone present

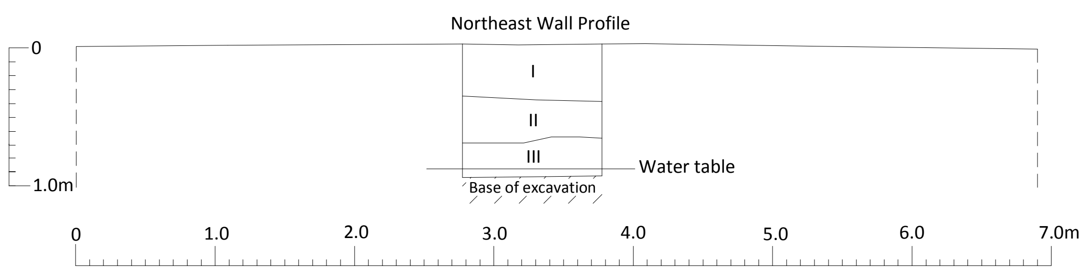
Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-105. Profile of BT-D-11-2



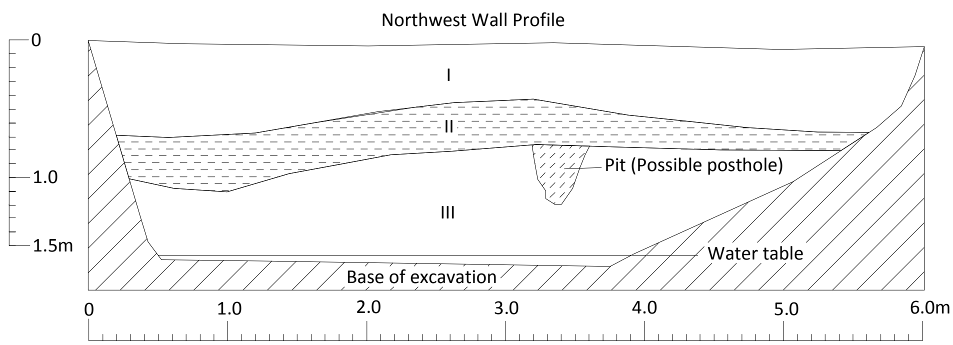
Layer I - Pale brown (10YR 6/2) unconsolidated silty sand with humus; No cultural remains
Layer II - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains
Layer III - Very dark grayish brown (10YR 3/2) to black (10YR 2/1) massive clay; No cultural remains
Layer IV - Pink (10YR 8/3) weathered limestone; No cultural remains

Figure B-106. Profile of BT-D-11-3



Layer I - Yellowish brown (10YR 5/4) unconsolidated sandy clay loam fill; Crushed limestone present
Layer II - Dark grayish brown (10YR 4/2) to very dark grayish brown very fine friable clay; No cultural remains
Layer III - Gray (10YR 6/1) massive clay; No cultural remains

Figure B-107. Profile of BT-D-12-1



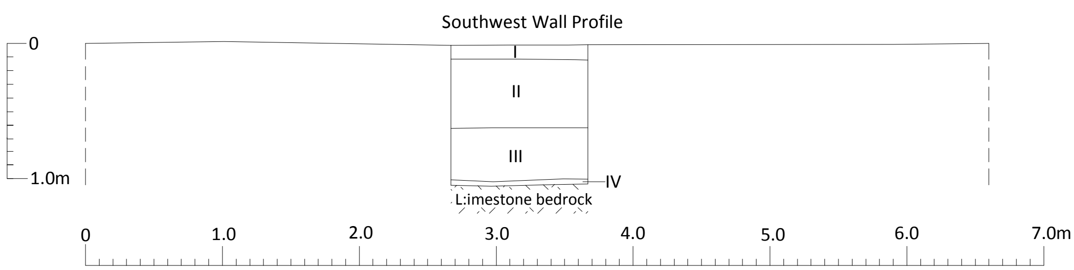
Layer I - Dark yellowish brown (10YR 3/4) loose sandy clay loam fill; 80-90% limestone aggregate

Layer II - Very dark gray (10YR 3/1) to black (10YR 2/1) very fine friable silt loam; Site 7291 cultural deposit (Marine shells, charcoal, kukui nutshells, coral)

Pit (Possible posthole) - Same soil matrix as Layer II (Marine shelsl and charcoal)

Layer III - Very pale brown (10YR 8/2) coarse limestone sand; No cultural remains

Figure B-108. Profile of BT-D-12-2



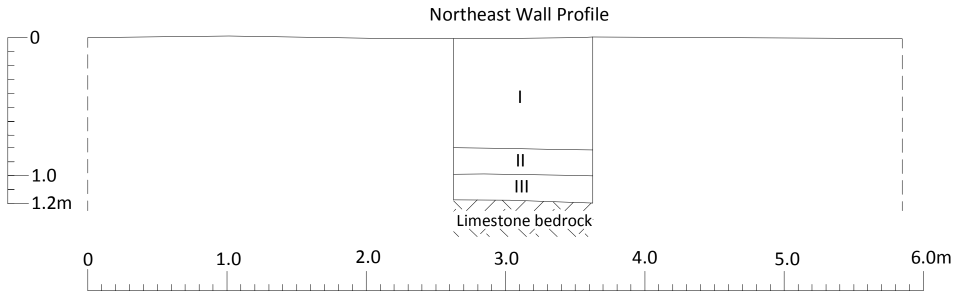
Layer I - Very dark brown (7.5YR 2.5/2) loose sandy loam with humus; No cultural remains

Layer II - Pale brown (10YR 6/3) to yellowish red (5YR 4/6) very fine friable sandy clay loam and clay clumps; No cultural remains

Layer III - Brown (7.5YR 3/4) very fine friable clay loam; No cultural remains

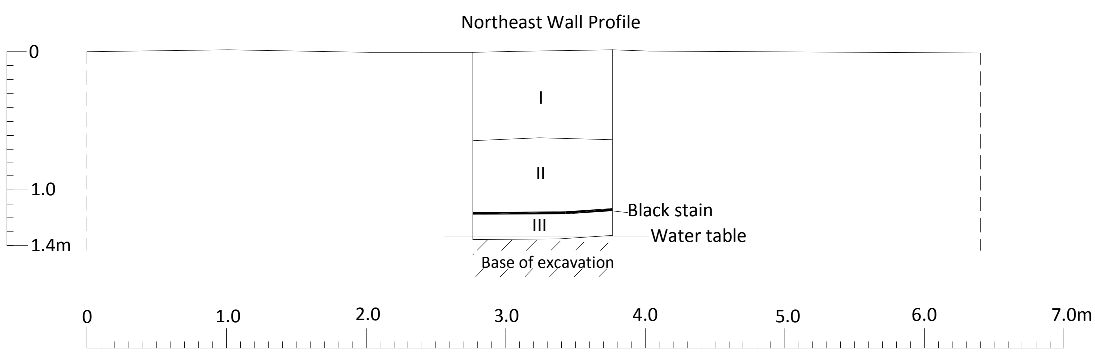
Layer IV - Brown (7.5YR 4/4) very fine friable clay; No cultural remains

Figure B-109. Profile of BT-D-12-3



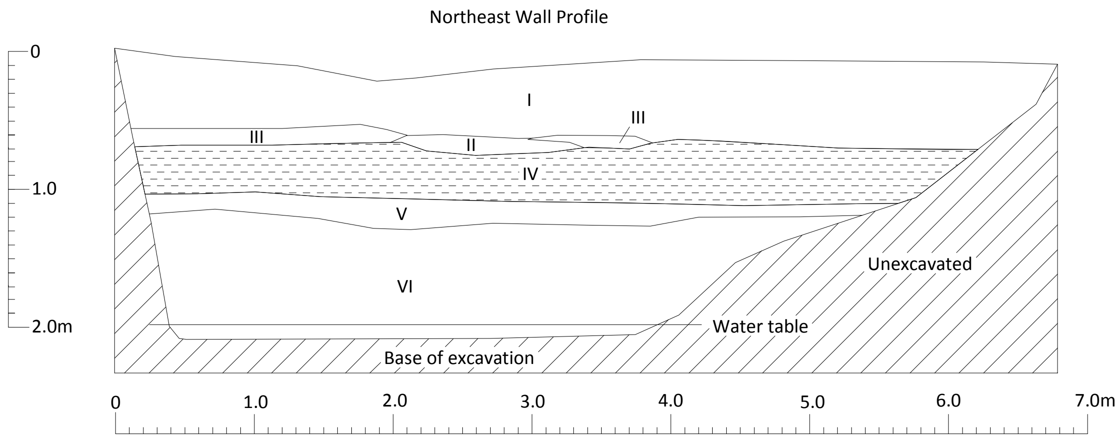
Layer I - Dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2) moderately compact sandy clay loam fill; No cultural remains
Layer II - Dark grayish brown (10YR 4/2) very fine friable slightly sandy clay loam; No cultural remains
Layer III - Very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1)very fine friable clay; No cultural remains

Figure B-110. Profile of BT-D-13-1



Layer I - Very pale brown (10YR 8/2) compact crushed limestone fill; Aggregate present
Layer II - Reddish brown (5YR 4/3) very fine friable clay fill; No cultural remains
Layer III - Weathered limestone; No cultural remains

Figure B-111. Profile of BT-D-13-2



Layer I - Dark grayish brown (10YR 4/2) loose very sandy loam; Marston matting from runway

Layer II - Light gray (10YR 7/2) unconsolidated clean beach sand; No cultural remains

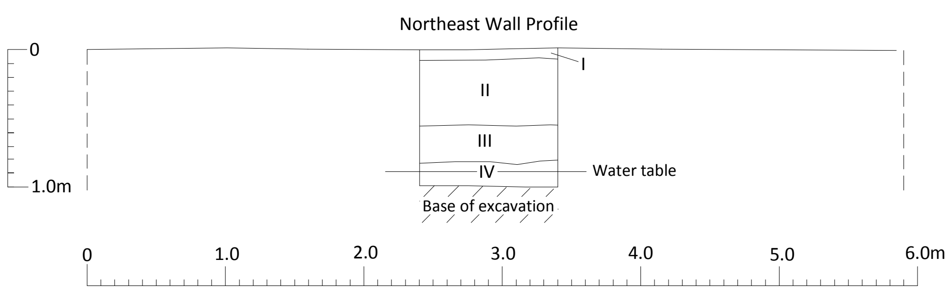
Layer III - Very pale brown (10YR 7/3) to pale brown (10YR 6/3) compact crushed limestone fill; 100% aggregate

Layer IV - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; Site 7291 cultural deposit (Marine shells, urchin, crab, Canis bone, kukui nutshell, charcoal)

Layer V - Pinkish gray (7.5YR 6/2) very compacted alluvial silty clay; No cultural remains

Layer VI - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-112. Profile of BT-D-13-3



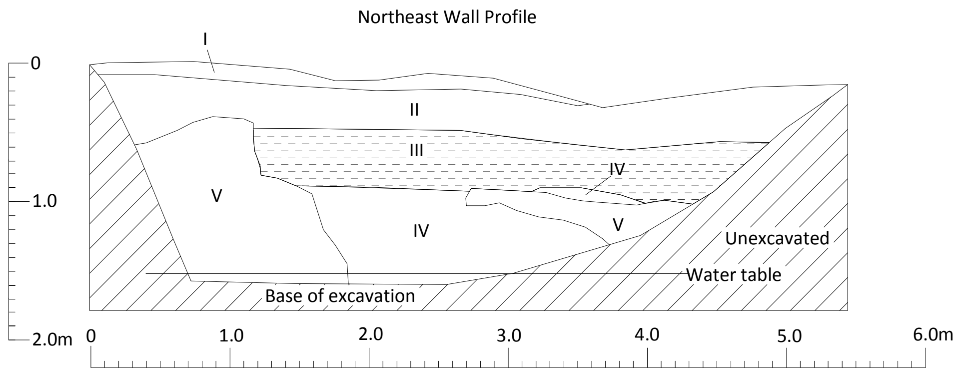
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) fine friable sandy clay loam; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) fine friable sandy clay loam; No cultural remains

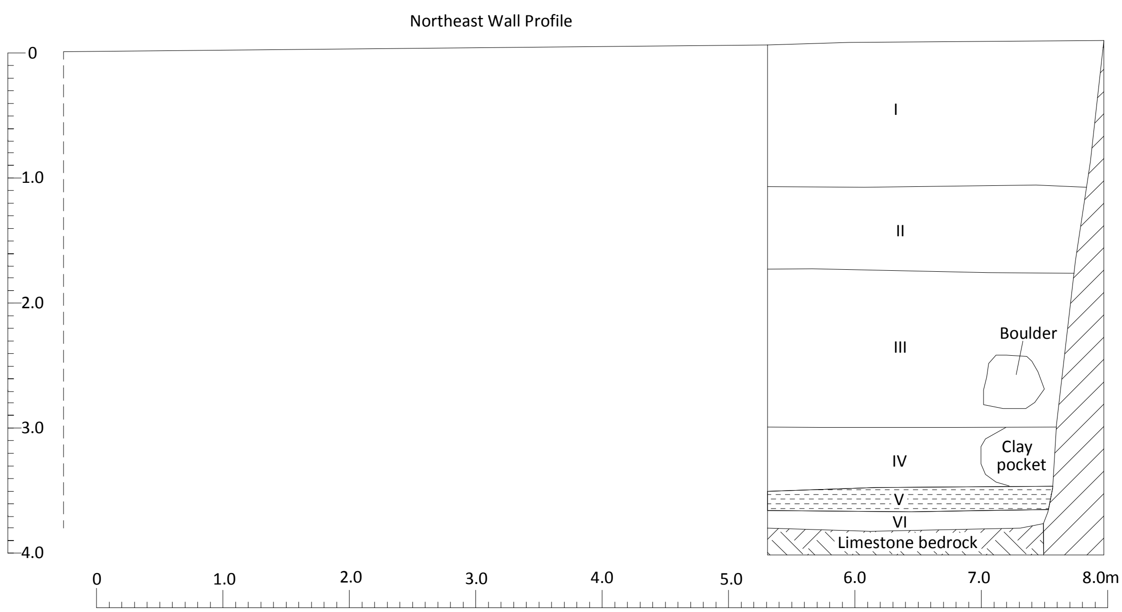
Layer IV - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-113. Profile of BT-D-14-1



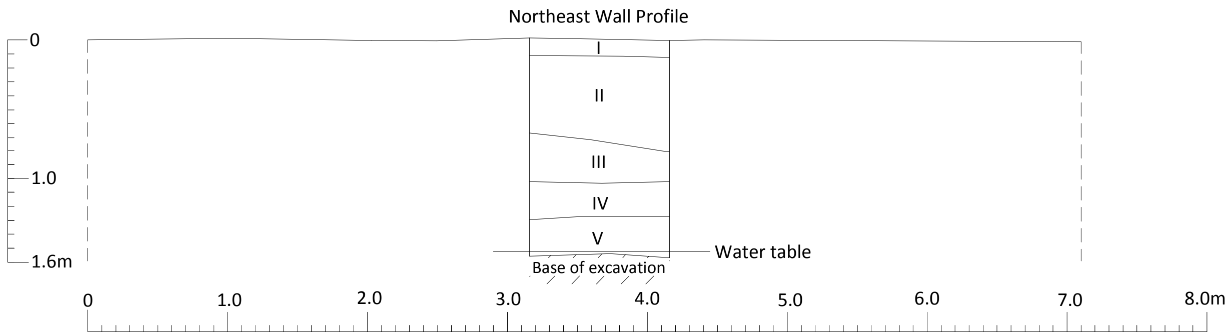
Layer I - Brown (10YR 5/3) loose sandy clay loam with humus; No cultural remains
Layer II - Strong brown (7.5YR 4/6) compacted clay fill; Limestone aggregate
Layer III - Black (7.5YR 2.5/1)very fine friable clay loam; Site 7291 cultural deposit (Marine shells, fishbone and charcoal)
Layer IV - Light brown (7.5YR 6/3) and grayish brown (10YR 5/2) massive clay; No cultural remains
Layer V - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-114. Profile of BT-D-14-2



Layer I - Pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) coarse loamy sand; No cultural remains
Layer II - Pale brown (10YR 6/3) and dark grayish brown (10YR 4/2) coarse banded, wavy interbedded loamy sand; No cultural remains
Layer III - Grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains
Layer IV - Very pale brown (10YR 7/3) unconsolidated beach sand and dark grayish brown (10YR 4/2) clay pockets; No cultural remains
Layer V - Black (7.5YR 2.5/1) compacted carbon rich loam; Site 7291 cultural deposit (Marine shells, urchin, crab, charcoal, coral)
Layer VI - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Figure B-115. Profile of BT-D-14-3



Layer I - Grayish brown (10YR 5/2) to brown (10YR 5/3) single grain loamy sand; No cultural remains

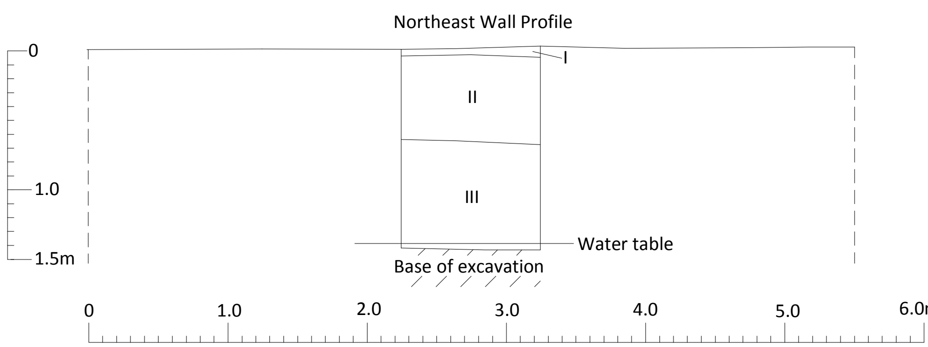
Layer II - Dark grayish brown (10YR 4/2) fine friable sandy clay loam; No cultural remains

Layer III - Very dark gray (10YR 3/1) massive clay loam buried A; No cultural remains

Layer IV - Yellowish brown (10YR 5/4) massive clay ; No cultural remains

Layer V - Light gray (10YR 7/2) to very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-116. Profile of BT-D-15-1

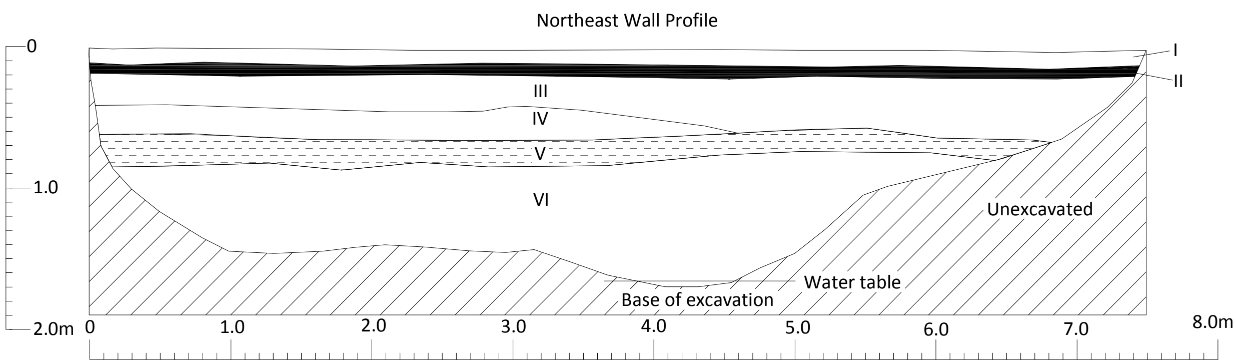


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Yellowish brown (10YR 5/4) to very pale brown (10YR 8/2) loose silty sand fill; Crushed limestone present

Layer III - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-117. Profile of BT-D-15-2



Layer I - Dark reddish brown (5YR 3/3) compacted clay fill; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer; Intact pavement in Site 7275 revetment area

Layer III - Very pale brown (10YR 7/3) compacted crushed limestone fill; 100% aggregate

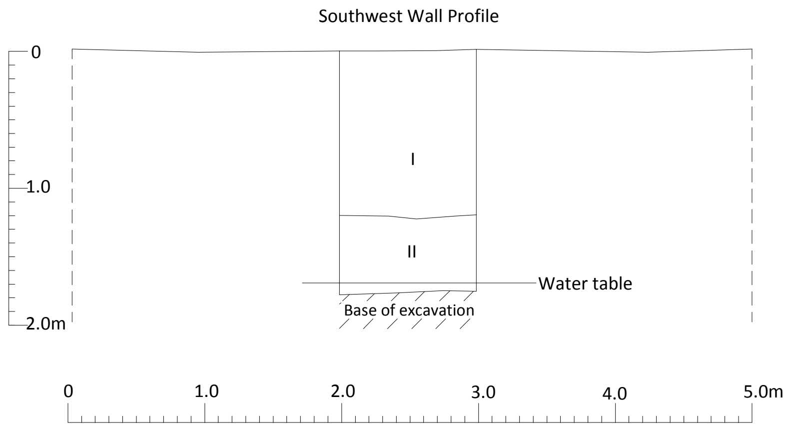
Layer IV - Brown (10YR 4/3 to 10YR 5/3) compacted silty sand; No cultural remains

Layer V - Black (7.5YR 2.5/1) compacted sandy clay loam; Site 7291 cultural deposit (Marine shells and urchin)

Layer VI - Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-118. Profile of BT-D-15-3

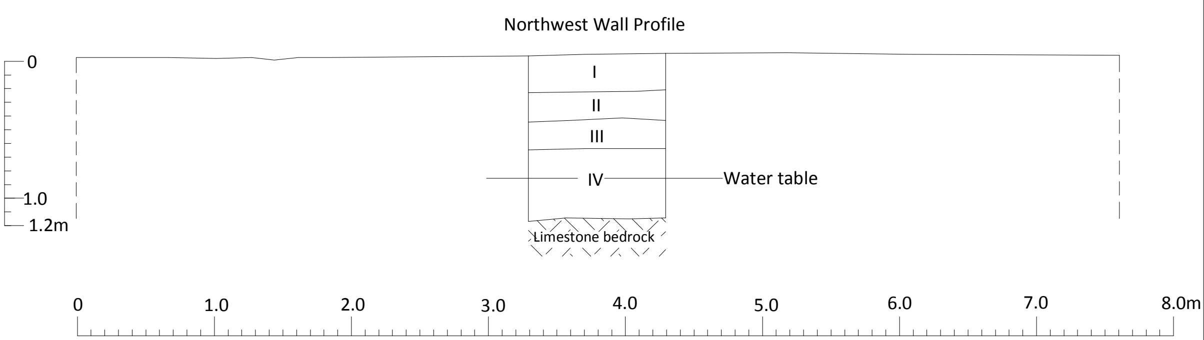
Area E Trenches



Layer I - Dark grayish brown (10YR 4/2) to brown (10YR 4/3) very fine friable sandy clay loam fill; Glass bottle and mesh cloth present

Layer II - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-119. Profile of BT-E-1-1



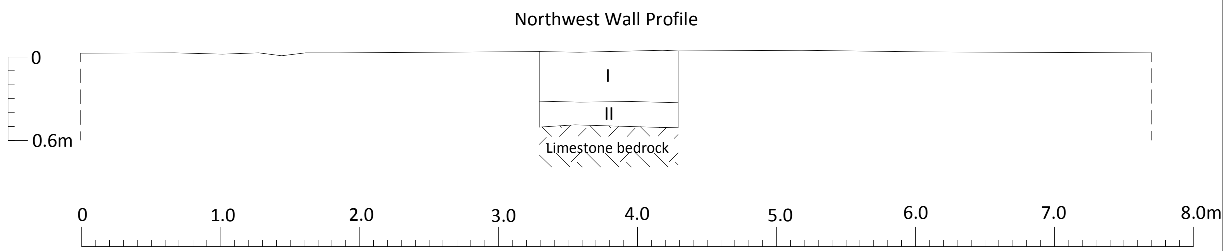
Layer I - Grayish brown (10YR 5/2) moderately compact sandy clay loam; Aggregate present

Layer II - Very dark gray (10YR 3/1) blocky friable clay loam; No cultural remains

Layer III - Yellowish brown (10YR 5/4) massive clay; No cultural remains

Layer IV - Very pale brown (10YR 7/3) massive sandy clay; No cultural remains

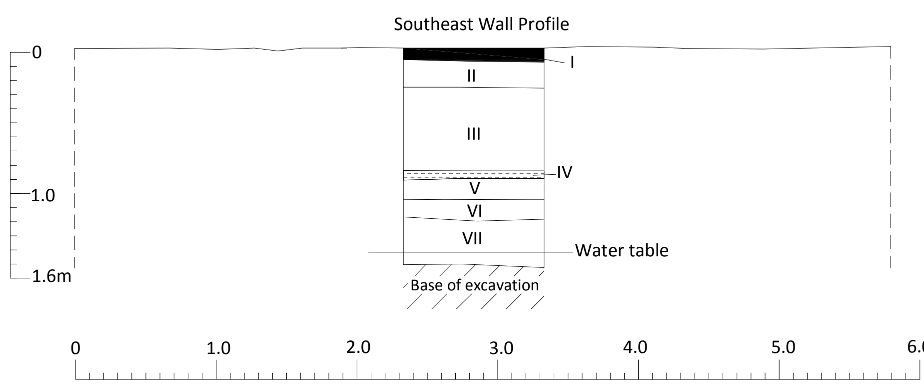
Figure B-120. Profile of BT-E-2-1



Layer I - Dark grayish brown (10YR 4/2) very fine friable sandy loam; 40% limestone aggregate

Layer II - Dark grayish brown (10YR 4/2) to brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains

Figure B-121. Profile of BT-E-2-2



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Brown (10YR 5/3) compact clay loam fill; 95% limestone aggregate

Layer III - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; Asphalt fragments, 60% limestone aggregate

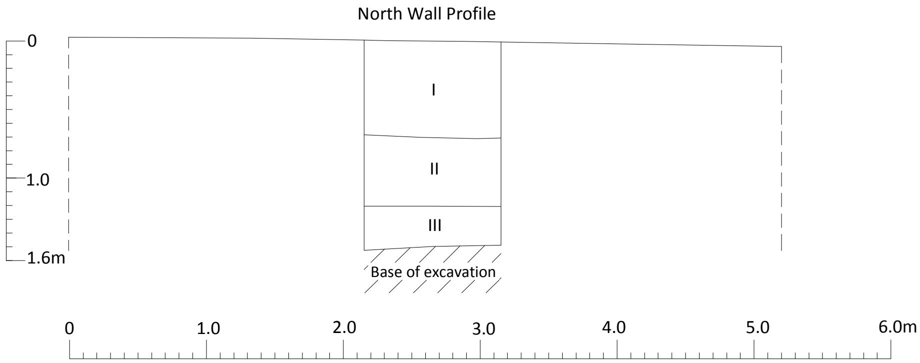
Layer IV - Very dark gray (10YR 3/1) to black (10YR 2/1) massive clay; Site 7292 cultural layer

Layer V - Dark gray (10YR 4/1) massive clay; No cultural remains

Layer VI - Gray (10YR 6/1) massive clay; No cultural remains

Layer VII - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-122. Profile of BT-E-2-3

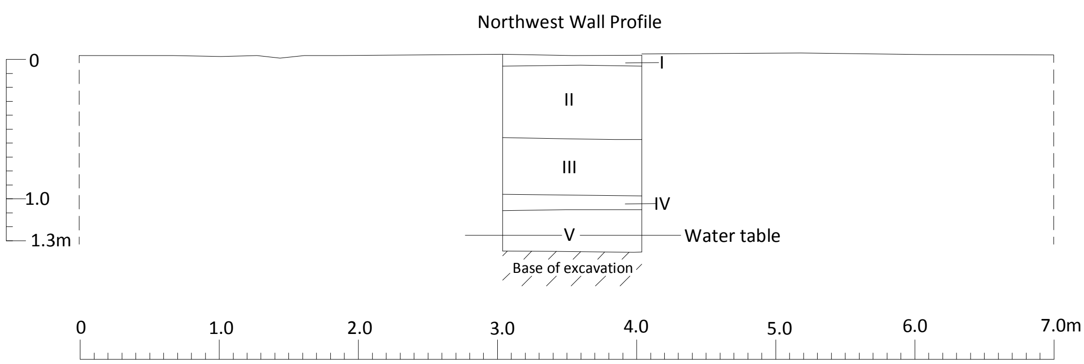


Layer I - Dusky red (2.5YR 3/3) compact clay fill; No cultural remains

Layer II - Brown (7.5YR 5/4) compact clay fill; No cultural remains

Layer III - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-123. Profile of BT-E-2-3b



Layer I - Very dark brown (7.5YR 2.5/3) structureless organics (Humus); No cultural remains

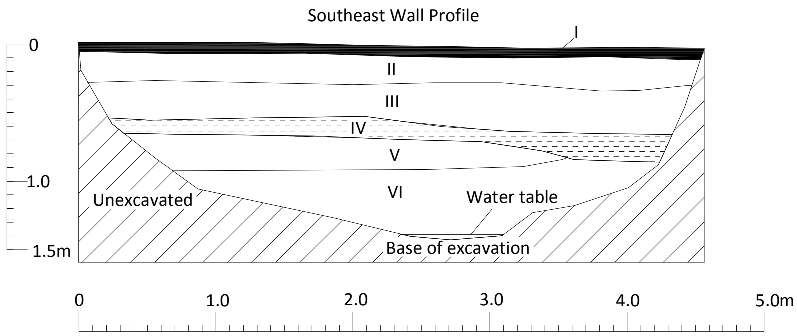
Layer II - Pale brown (10YR 6/3) very fine friable sandy clay loam; Aggregate present

Layer III - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Layer IV - Dark yellowish brown (10YR 4/4) massive clay; No cultural remainsd

Layer V - Bluish gray (G2 5/1) massive gley; No cultural remains

Figure B-124. Profile of BT-E-3-1



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Brown (7.5YR 4/4) to light yellowish brown (10YR 6/4) compact sandy clay loam; 60% limestone aggregate

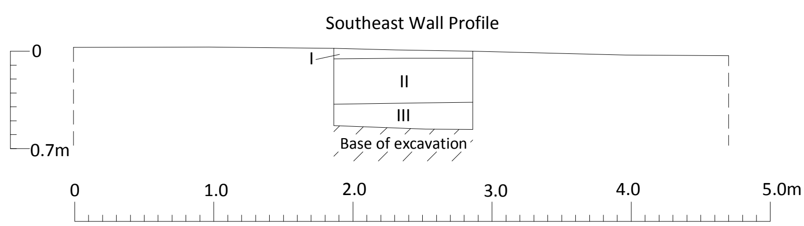
Layer III - Pale brown (10YR 6/3) compact silty sand; 90% limestone aggregate

Layer IV - Black (7.5YR 2.5/1) very fine friable sandy clay loam; Site 7292 cultural layer (Marine shells and basalt debitage)

Layer V - Light brownish gray (10YR 6/2) single grain sand; No cultural remains

Layer VI - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-125. Profile of BT-E-3-2

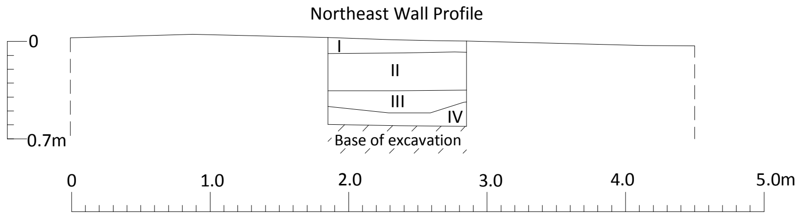


Layer I - Very dark brown (7.5YR 2.5/2) structureless organics (Humus); No cultural remains

Layer II - Very dark grayish brown (10YR 3/2)loose, fine friable silty loam; Basalt aggregate present

Layer III - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-126. Profile of BT-E-3-2b



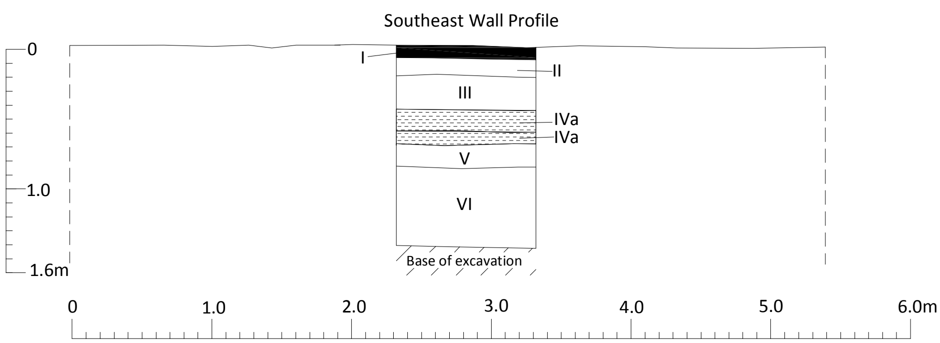
Layer I - Very dark brown (7.5YR 2.5/2) structureless organics (Humus); No cultural remains

Layer II - Pale brown (10YR 6/3) fine friable clay loam; 80% limestone aggregate

Layer III - Brown (10YR 4/3) fine friable clay loam; No cultural remains

Layer IV - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-127. Profile of BT-E-3-2c



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Brown (7.5YR 5/4) compact clay loam; 70% limestone aggregate

Layer III - Gray (10YR 6/1) to light brownish gray (10YR 6/2) compact limestone fill; 100% limestone aggregate

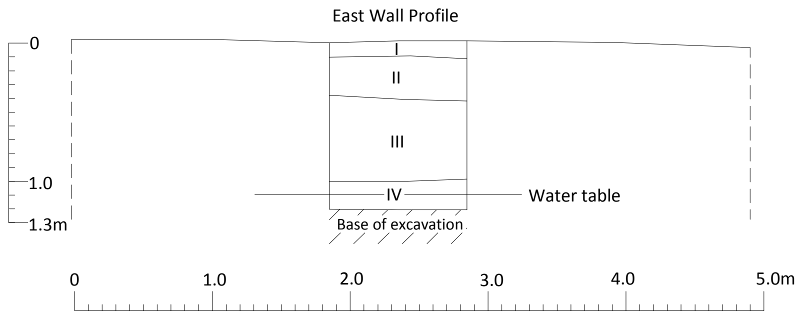
Layer IVa - Dark gray (7.5YR 4/1) to very dark gray (7.5R 3/1) moderately compact clay loam; Site 7292 cultural layer (Charcoal)

Layer IVb - Black (7.5YR 2.5/1) very compact carbon-rich clay; Site 7292 cultural layer

Layer V - Brown (10YR 4/3) massive clay; No cultural remains

Layer VI - Brownish yellow (10YR 6/6) weathered limestone; No cultural remains

Figure B-128. Profile of BT-E-3-3



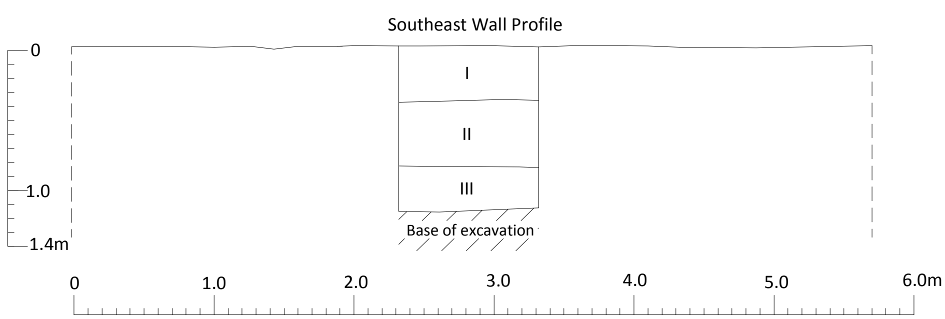
Layer I - Dark brown (10YR 3/3) fine friable clay loam; No cultural remains

Layer II - White (10YR 8/1) compact limestone; Aggregate present

Layer III - Brown (10YR 4/3) to dark yellowish brown (10YR 4/4) fine friable clay loam; No cultural remains

Layer IV - Dark gray (10YR 4/1) massive clay; No cultural remains

Figure B-129. Profile of BT-E-3-3b

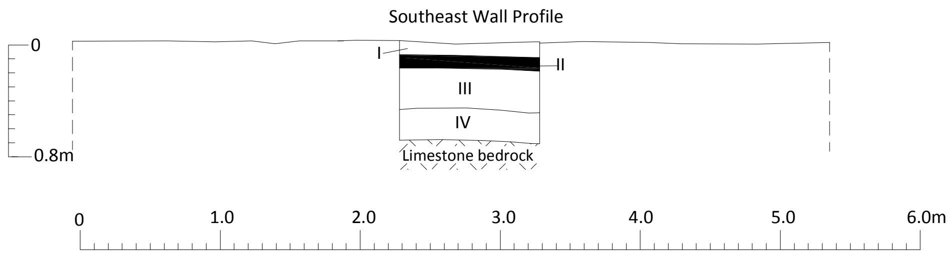


Layer I - Dark brown (7.5YR 3/3) very fine friable clay loam; No cultural remains

Layer II - Light brownish gray (10YR 6/2) compact clay loam; Aggregate present

Layer III - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-130. Profile of BT-E-3-4



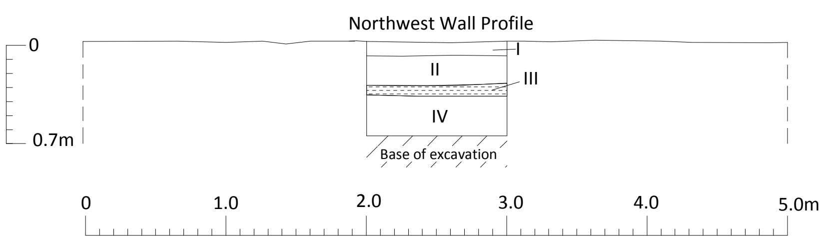
Layer I - Brown (7.5YR 4/3) very fine friable clay loam; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer III - Gray (10YR 5/1) very fine friable sandy clay loam; 85% limestone aggregate

Layer IV - Grayish brown (10YR 5/2) massive clay; No cultural remians

Figure B-131. Profile of BT-E-3-5



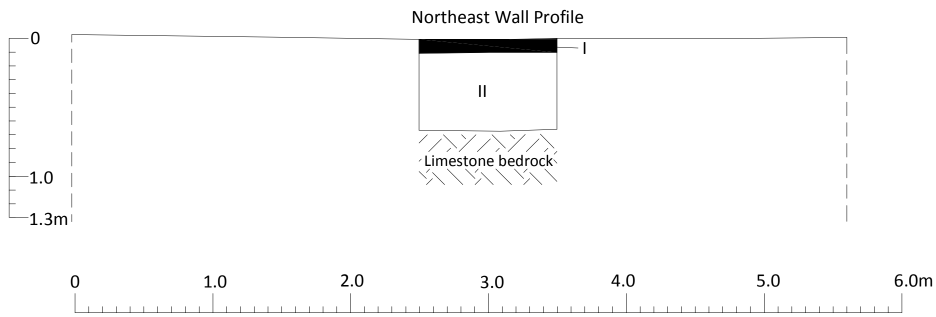
Layer I - Black (10YR 2/1) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) loose sandy clay loam; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) and dark brown (7.5YR 3/4) compacted clay loam; Site 7292 cultural layer (charcoal flecks)

Layer IV - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

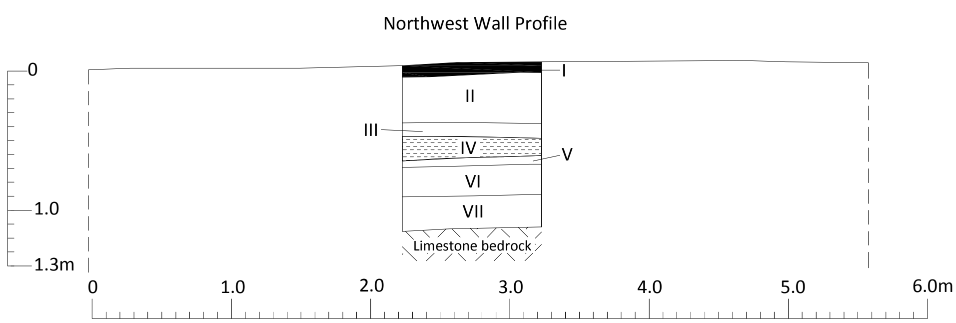
Figure B-132. Profile of BT-E-4-1



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Pale brown (10YR 6/3) compact sandy clay loam; Bottle glass, 70% limestone aggregate

Figure B-133. Profile of BT-E-4-1b



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Brown (10YR 5/3) very fine friable sandy clay loam; 60% limestone aggregate

Layer III - Brown (7.5YR 4/4) very fine friable sandy clay loam; 60% limestone aggregate

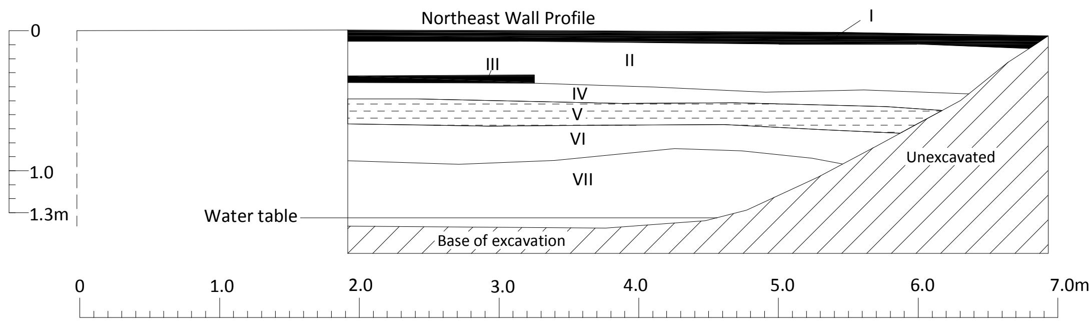
Layer IV - Very dark gray (7.5YR 3/1) very fine friable sandy clay loam; Site 7292 cultural deposit(Marine shell, charcoal)

Layer V - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Layer VI - Very pale brown (10YR 8/4) weathered limestone; No cultural remains

Layer VII - Yellowish brown (10YR 5/4) massive clay; No cultural remains

Figure B-134. Profile of BT-E-4-2



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

Layer II - Dark yellowish brown (10YR 4/4) fine friable clay; 90% limestone aggregate

Layer III - Black (10YR 2/1) intact asphalt layer (Site 7275 runway)

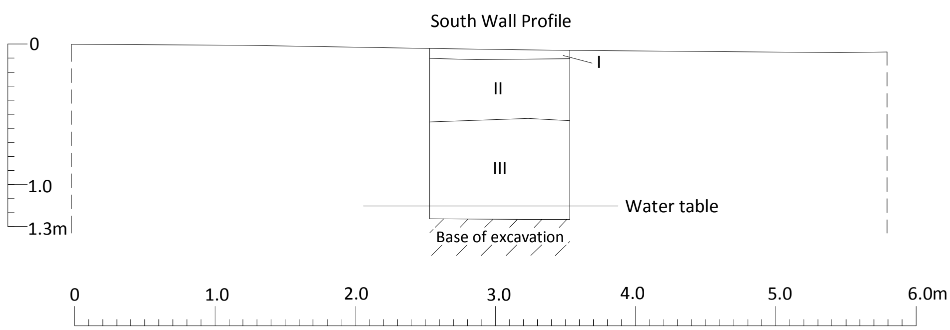
Layer IV - White (10YR 8/1) compacted limestone fill; 100% limestone aggregate

Layer V - Very dark gray (10YR 3/1) and black (10YR 2/1) fine friable clay loam; Site 7292 cultural deposit (charcoal)

Layer VI - White (10YR 8/1) weathered limestone; No cultural remains

Layer VII - Brown (10YR 4/3) massive clay; No cultural remains

Figure B-135. Profile of BT-E-4-2b

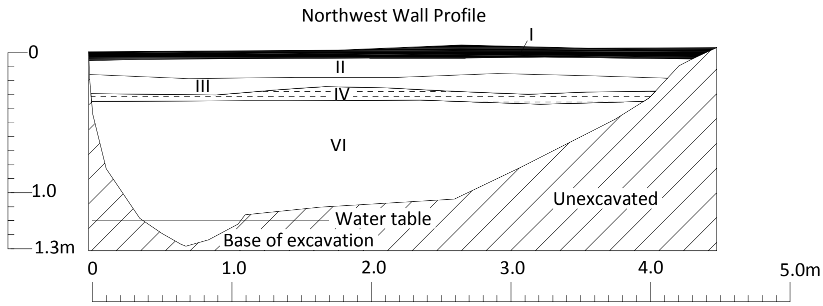


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) fine friable sandy clay loam; Asphalt fragments and limestone aggregate present

Layer III - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-136. Profile of BT-E-4-2c



Layer I - Black (10YR 2/1) intact asphalt layer (Site 7275 runway pavement)

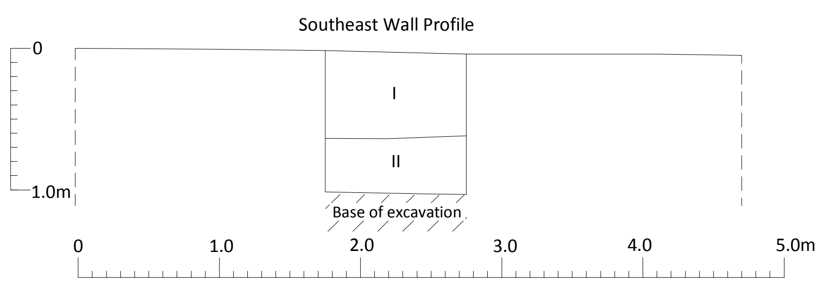
Layer II - Very pale brown (10YR 7/3) compact imestone fill; 10% limestone aggregate

Layer III - Brown (7.5YR 4/4) very fine friable sandy clay loam; 70% limestone aggregate

Layer IV - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; Site 7292 cultural deposit (Marine shells and charcoal)

Layer V - Dark brown (7.5YR 3/4) very fine friable sandy clay loam; No cultural remains

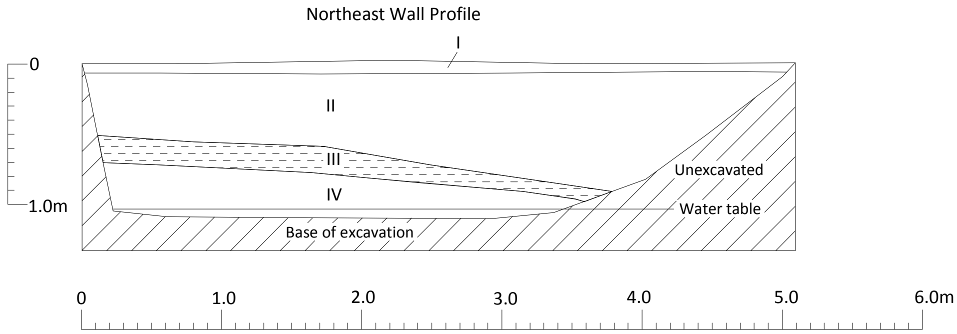
Figure B-137. Profile of BT-E-4-3



Layer I - Pale brown (10YR 6/3) compact sandy clay loam; No cultural remains

Layer II - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-138. Profile of BT-E-4-3b



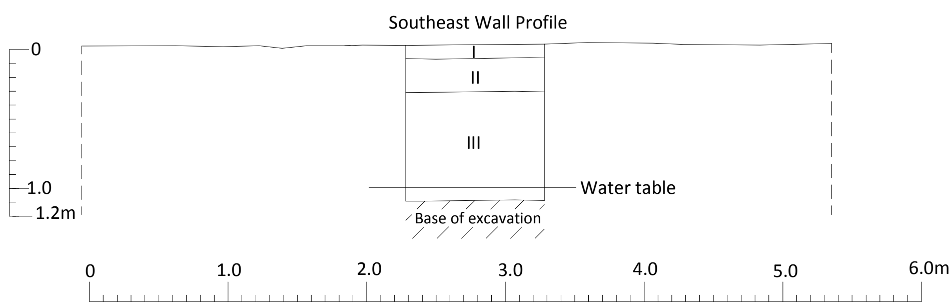
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2 to 10YR 7/3) compact limestone fill; Aggregate fill of Site 7275

Layer III - Very dark gray (10YR 3/1) to dark gray (10YR 4/1) fine friable clay loam; Site 7292 cultural deposit

Layer IV - Dark yellowish brown (10YR 4/4) to gray (10YR 5/1) massive clay; No cultural remains

Figure B-139. Profile of BT-E-4-3c

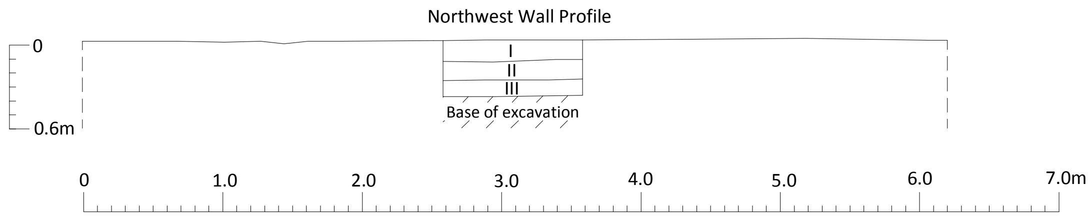


Layer I - Very dark brown (10YR 2/2) fine friable clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) compact sandy clay loam; No cultural remains

Layer III - Gray (7.5YR 5/1) to dark gray (7.5YR 4/1) compact sandy clay loam; No cultural remains

Figure B-140. Profile of BT-E-4-4

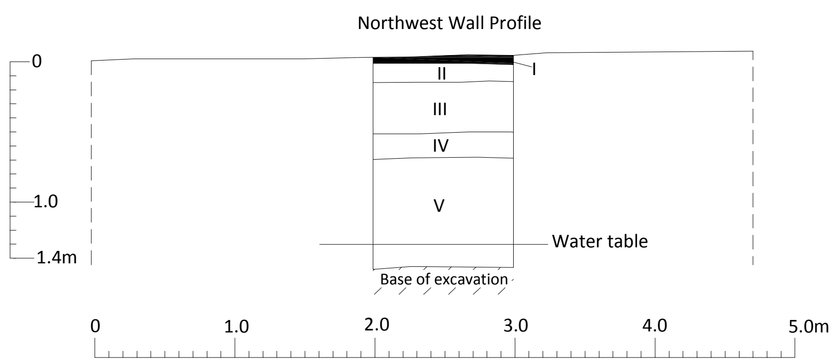


Layer I - Very dark brown (7.5YR 2.5/2) very fine friable clay loam with humus; No cultural remains

Layer II - Yellowish brown (10YR 5/4) compact clayey sand; No cultural remains

Layer III - Very pale brown (10YR 7/3) weathered bedrock; No cultural remains

Figure B-141. Profile of BT-E-5-1



Layer I - Black (10YR 2/1) intact asphalt layer; No cultural remains

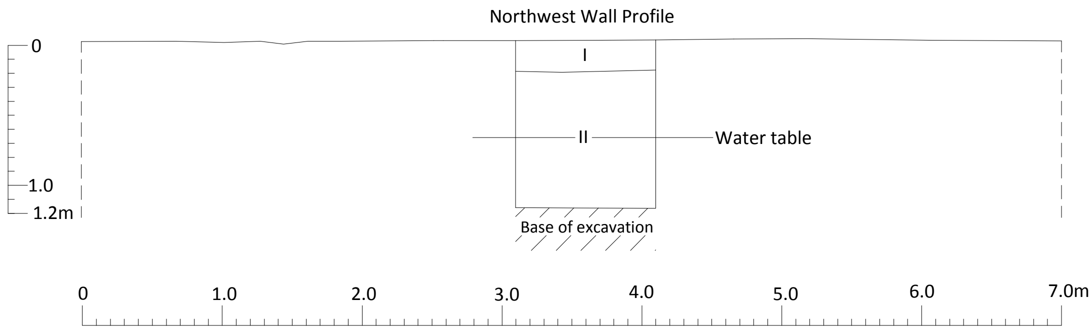
Layer II - Light gray (10YR 7/1) compact limestone fill; Aggregate present

Layer III - Dark gray (10YR 4/1) compact sandy clay loam; No cultural remains

Layer IV - White (10YR 8/1) weathered limestone; No cultural remains

Layer V - Yellowish brown (10YR 5/4) massive clay; No cultural remains

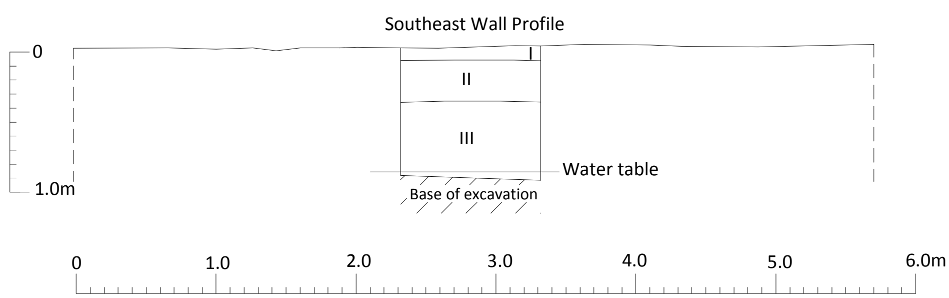
Figure B-142. Profile of BT-E-5-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-143. Profile of BT-E-5-3

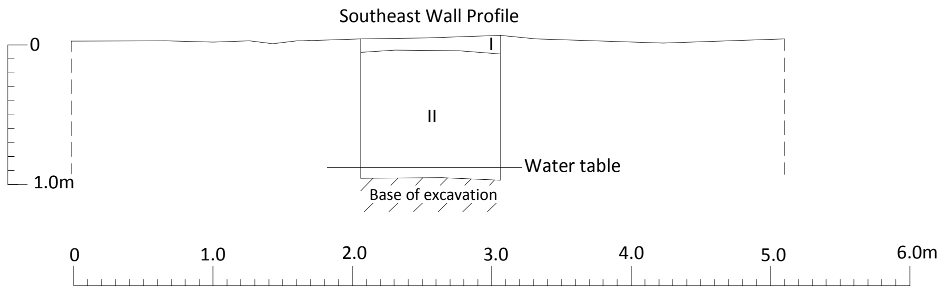


Layer I - Very dark grayish brown (10YR 3/2) fine fraible clay with humus; No cultural remains

Layer II - Light yellowish brown (10YR 6/4) to yellowish brown (10YR 5/4)) unconsolidated sandy loam; Aggregate present

Layer III - Grayish brown (10YR 5/2) fine friable sandy clay loam; Fire brick and metal pipe present

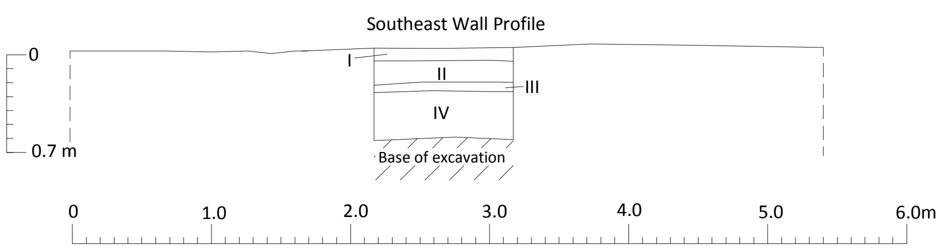
Figure B-144. Profile of BT-E-5-4



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (7.5YR 2.5/2) compact sandy clay loam; No cultural remains

Figure B-145. Profile of BT-E-5-5



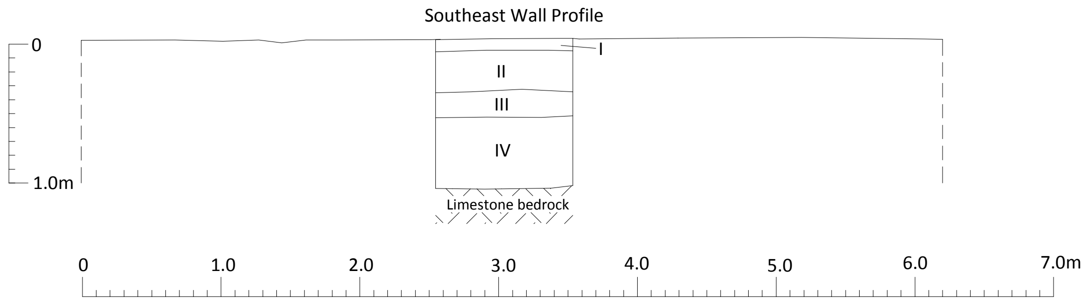
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) compact limestone fill; Aggregate present

Layer III - Yellowish brown (10YR 5/4) very fine friable sandy clay loam; No cultural remains

Layer IV - Very pale brown (10YR 7/3 and 8/2) weathered limestone; No cultural remains

Figure B-146. Profile of BT-E-6-1



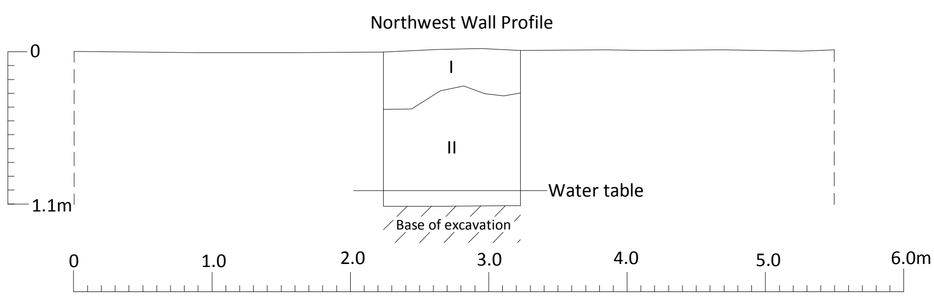
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2)very fine friable sandy clay loam; No cultural remains

Layer III - Dark yellowish brown (10YR 4/4) massive clay; No cultural remains

Layer IV - Very pale brown (10YR 7/3) massive sandy clay; No cultural remains

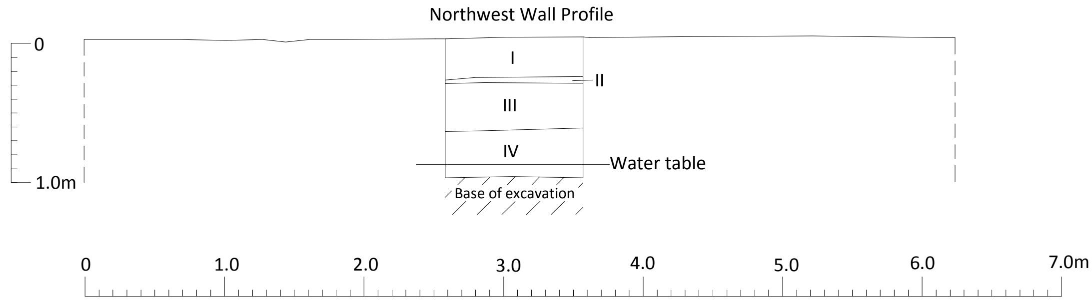
Figure B-147. Profile of BT-E-6-2



Layer I - Very dark brown (10YR 2/2) very fine friable clay loam; No cultural remains

Layer II - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-148. Profile of BT-E-6-3



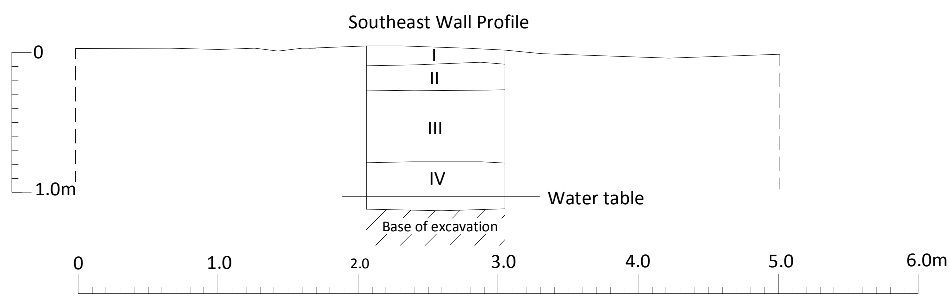
Layer I - Dark brown (10YR 3/3) very fine friable clay loam; Plastic fragment present

Layer II - Very dark brown (10YR 2/2) very fine friable sandy clay loam; No cultural remains

Layer III - Brown (10YR 5/3) very fine friable sandy clay loam; No cultural remains

Layer IV - Very pale brown (10YR 7/3) weathered limestone sand; No cultural remains

Figure B-149. Profile of BT-6-4



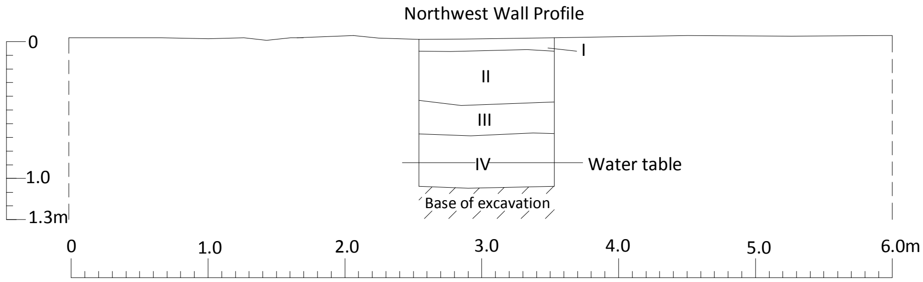
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) compact limestone fill; Aggregate present

Layer III - Brown (7.5YR 4/3) very fine friable clay; No cultural remains

Layer IV - Brown (10YR 4/3) massive clay; No cultural remains

Figure B-150. Profile of BT-E-6-5



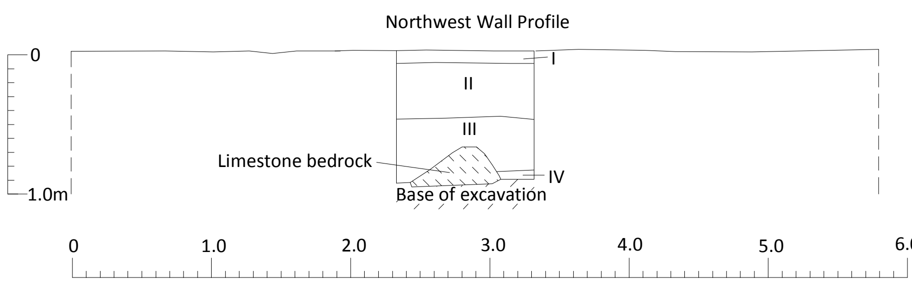
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable sandy clay loam; No cultural remains

Layer III - Pale brown (10YR 6/3) very fine friable sandy clay loam; No cultural remains

Layer IV - Dark yellowish brown (10YR 4/4) massive clay; No cultural remains

Figure B-151. Profile of BT-E-7-1



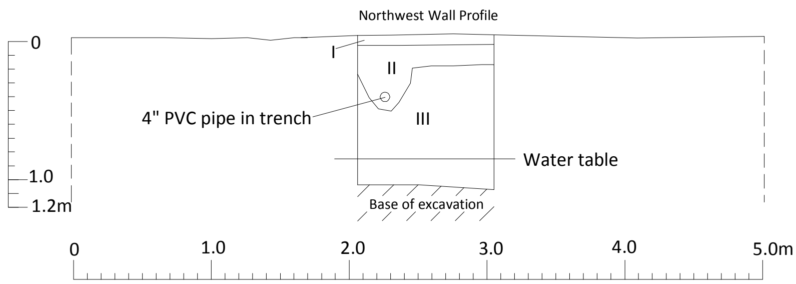
Layer I - Very dark brown (7.5YR 2.5/2) very fine friable clay loam with humus; No cultural remains

Layer II - Pale brown (10YR 6/3) very fine friable sandy clay loam; No cultural remains

Layer III - Yellowish brown (10YR 5/4) massive clay; No cultural remains

Layer IV - Very pale brown (10YR 7/3) sticky, plastic sandy clay/gley; No cultural remains

Figure B-152. Profile of BT-E-7-2

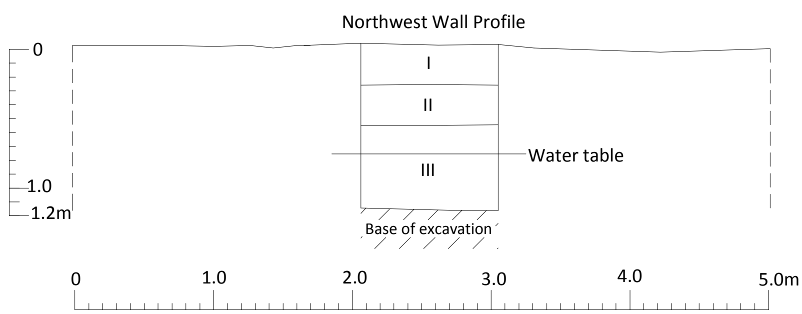


Layer I - Dark brown (7.5YR 3/2) very fine friable sandy clay loam with humus; No cultural remains

Layer II - Dark brown (7.5YR 3/3) to brown (7.5YR 4/3) very fine friable sandy clay loam fill; PVC pipe present

Layer III - Very pale brown (10YR 7/3 to 10YR 8/2) weathered limestone; No cultural remains

Figure B-153. Profile of BT-E-7-3

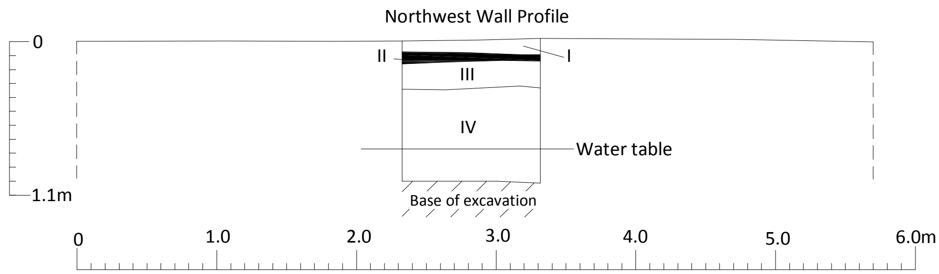


Layer I - Dark brown (10YR 3/3) very fine friable sandy clay loam; No cultural remains

Layer II - Pale brown (10YR 6/3) very fine friable sandy clay loam alluvium; No cultural remains

Layer III - Very pale brown (10YR 8/2) very fine friable sandy clay loam; No cultural remains

Figure B-154. Profile of BT-E-7-4



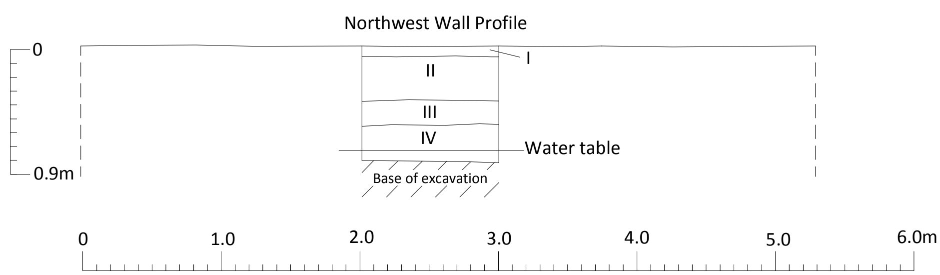
Layer I - Dark brown (7.5YR 3/4) structureless humus; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains

Layer IV - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-155. Profile of BT-E-7-5



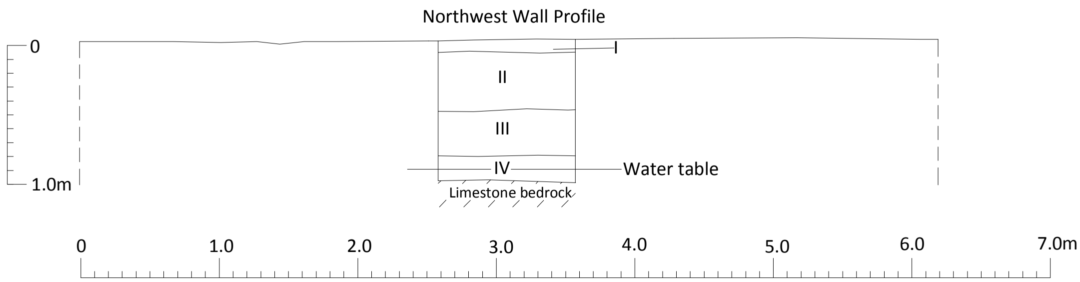
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) weathered limestone ; No cultural remains

Layer III - Yellowish brown (10YR 5/4) massive clay; No cultural remains

Layer IV - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-156. Profile of BT-E-8-1



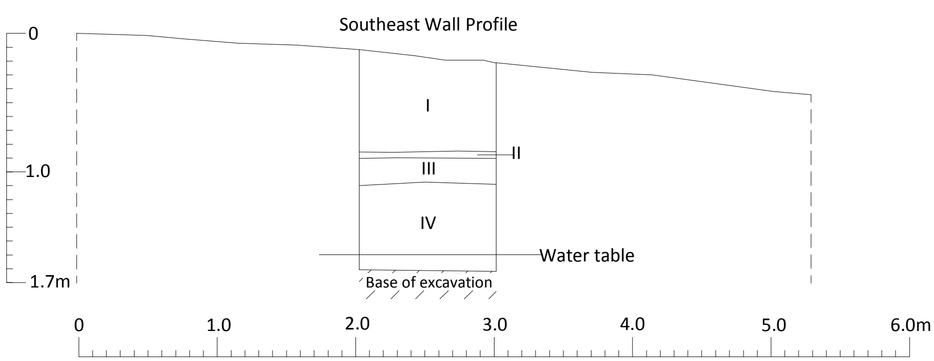
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Layer III - Yellowish brown (10YR 5/4) massive clay; No cultural remains

Layer IV - White (10YR 8/1) massive clay; No cultural remains

Figure B-157. Profile of BT-E-8-2



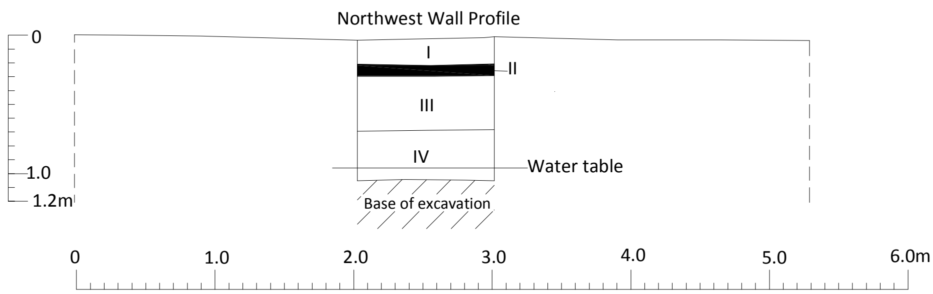
Layer I - Dark brown (7.5YR 3/3) very fine friable sandy clay loam; Asphalt fragments present

Layer II - Very dark gray (10YR 3/1) very fine friable sandy clay loam alluvium; No cultural remains

Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Layer IV - Pale brown (10YR 6/3) to dark yellowish brown (10YR 4/4) massive clay; No cultural remains

Figure B-158. Profile of BT-E-8-3



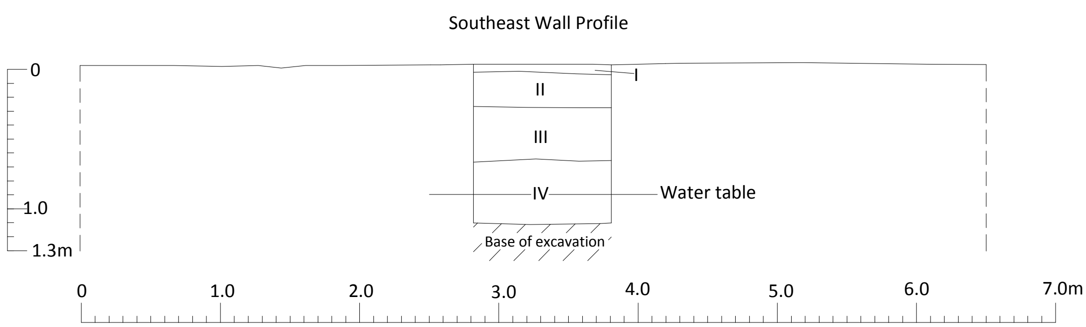
Layer I - Dark brown (7.5YR 3/3) very fine friable sandy clay loam; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Dark yellowish brown (10YR 4/4) loose sandy clay loam; No cultural remains

Layer IV - Brown (10YR 5/2 to 7.5YR 5/4) weathered limestone; No cultural remains

Figure B-159. Profile of BT-E-8-4



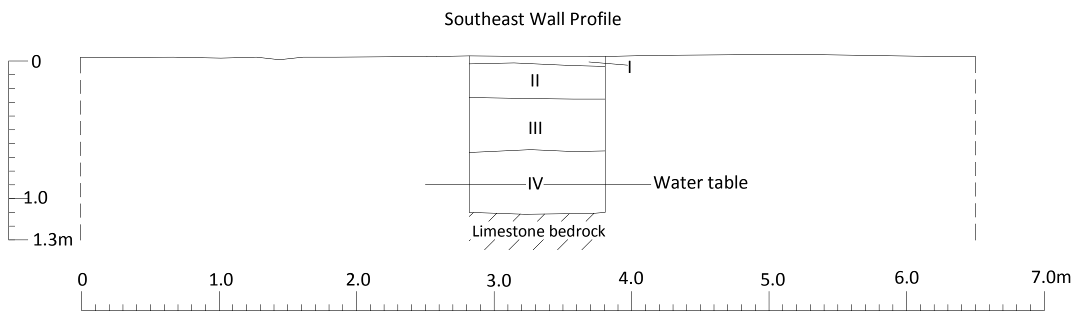
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) very fine friable clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Layer IV - Grayish brown (10YR 5/2) weathered limestone sand; No cultural remains

Figure B-160. Profile of BT-E-9-1



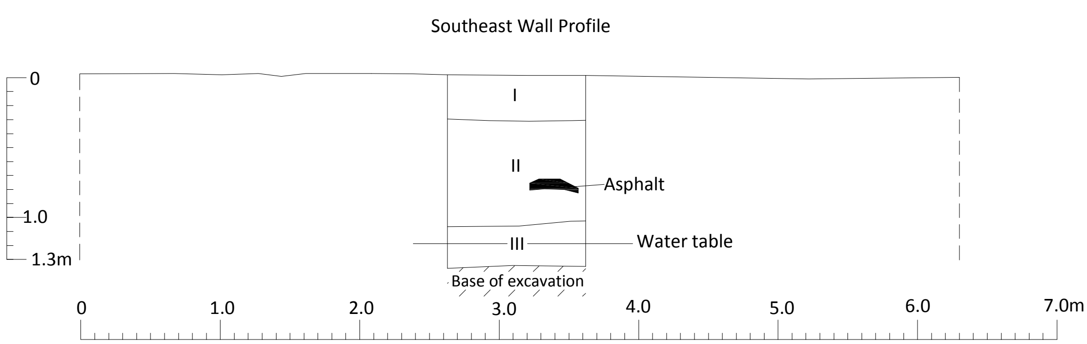
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) loose sandy clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) very compact sandy clay loam; No cultural remains

Layer IV - Grayish brown (10YR 5/2) massive clay clay; No cultural remains

Figure B-161. Profile of BT-E-9-2

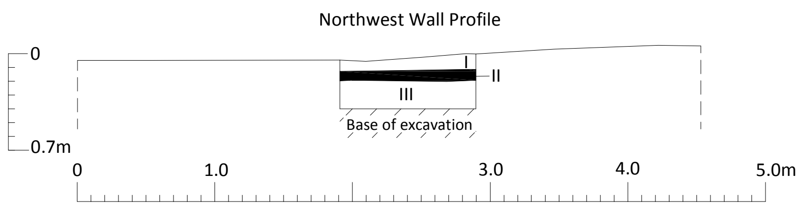


Layer I - Very dark brown (7.5YR 2.5/2) structureless greenwaste; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable sandy clay loam; Asphalt present

Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-162. Profile of BT-E-9-3

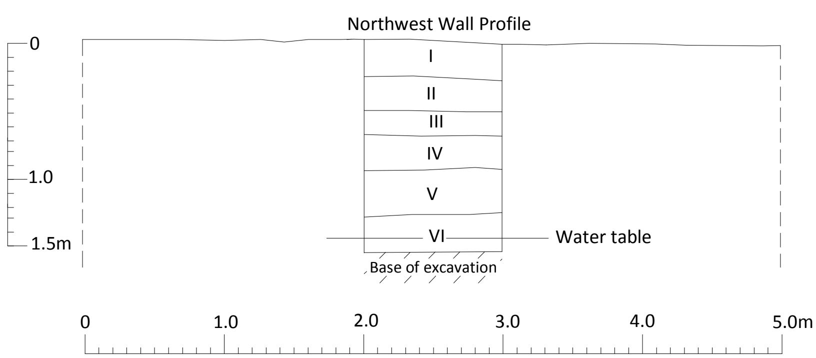


Layer I - Very dark brown (7.5YR 2.5/2) structureless organics (Humus); No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-163. Profile of BT-E-9-4



Layer I - Dusky red (2.5YR 3/2) very fine friable clay loam; No cultural remains

Layer II - Grayish brown (10YR 5/2) compact clay loam; No cultural remains

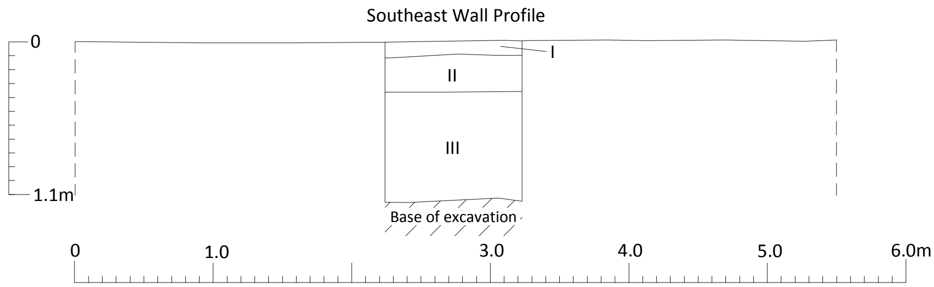
Layer III - Pale brown (10YR 6/3) very fine friable sandy clay loam; No cultural remains

Layer IV - Dark grayish brown (10YR 4/2) very fine crumb sandy clay; No cultural remains

Layer V - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Layer VI - Dark gray (10YR 4/1) massive clay; No cultural remains

Figure B-164. Profile of BT-E-9-5

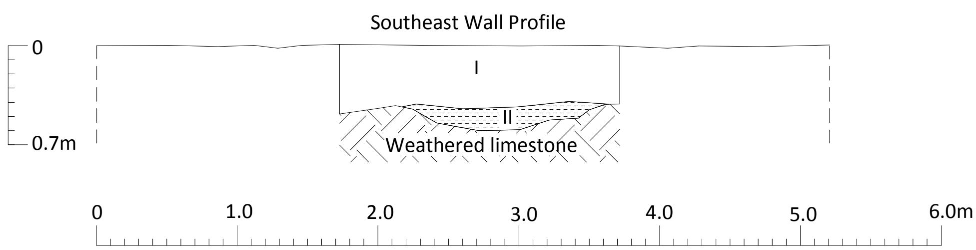


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 4/2) very fine friable clay loam; No cultural remains

Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

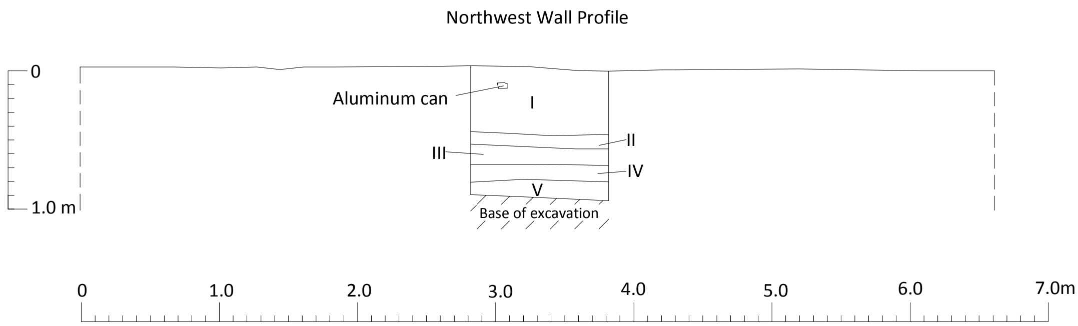
Figure B-165. Profile of BT-E-10-1



Layer I - Brown (10YR 4/3) loose, very fine friable clay loam; Plastic sheeting present

Layer II -Black (7.5YR 2.5/1) to brown (10YR 5/3) very fine friable clay loam and clayey sand;
Site 7293 cultural deposit (urchin, charcoal, fire-altered rock)

Figure B-166. Profile of BT-E-10-2



Layer I - Very dark brown (10YR 2/2) loose, very fine fraiable loam; Aluminum can present

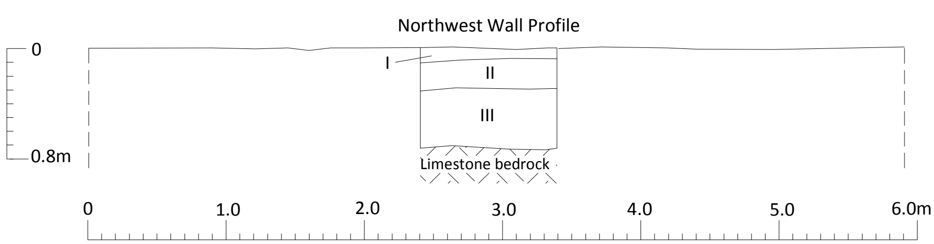
Layer II - Dark yellowish brown (10YR 4/4) very fine friable sandy clay loam; No cultural remains

Layer III - Pale brown (10YR 6/3) loose sand; No cultural remains

Layer IV - Dark gray (10YR 4/1) massive clay; No cultural remains

Layer V - White (10YR 8/1) weathered limestone; No cultural remains

Figure B-167. Profile of BT-E-10-3

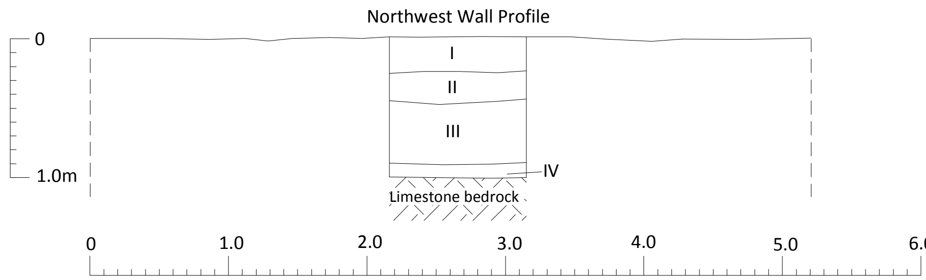


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) compact clay loam; Aggregate present

Layer II - Grayish brown (10YR 5/2) compact clay loam; Asphalt fragments and aggregate present

Figure B-168. Profile of BT-E-10-4



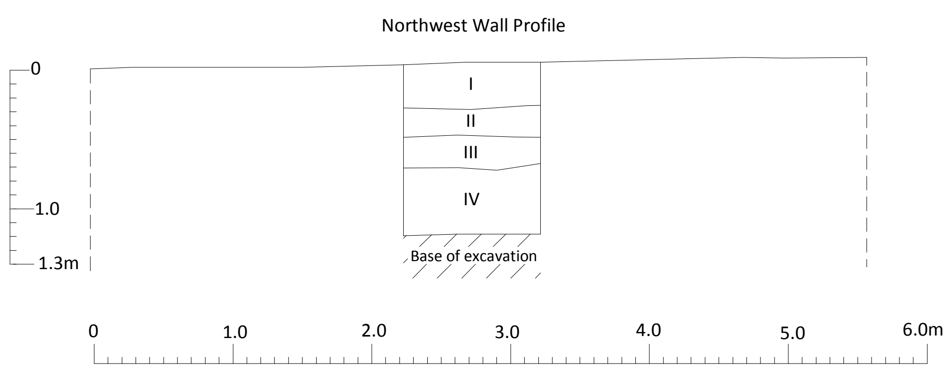
Layer I - Very dusky red (2.5YR 2.5/2) very fine friable clay loam; No cultural remains

Layer II - Pale brown (10YR 6/3) very fine friable sandy clay loam; No cultural remains

Layer III - Very pale brown (10YR 8/2) coarse sand; No cultural remains

Layer IV - Yellowish brown (10YR 5/4) sticky, plastic clay; No cultural remains

Figure B-169. Profile of BT-E-10-5



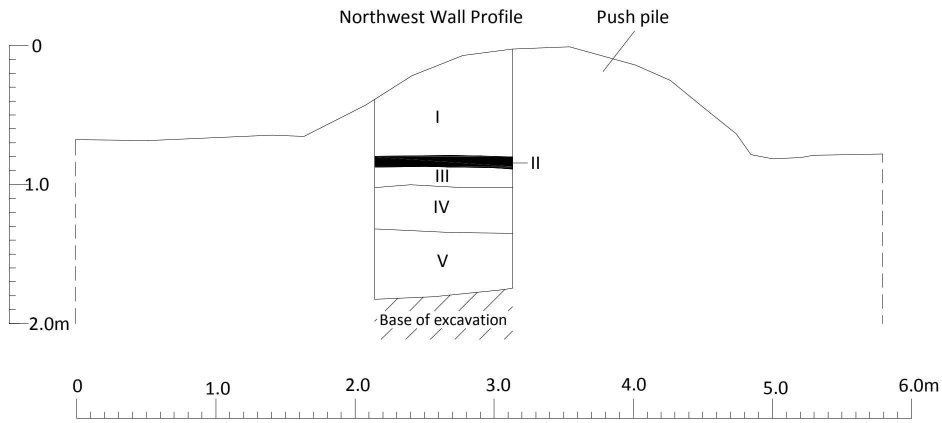
Layer I - Very dusky red (2.5YR 2.5/2) coarse clay loam; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; Asphalt fragments present

Layer III - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; No cultural remains

Layer IV -Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-170. Profile of BT-E-10-6



Layer I - Dark reddish brown (5YR 3/3) very fine friable sandy clay loam bulldozer push; Glass and plastic present

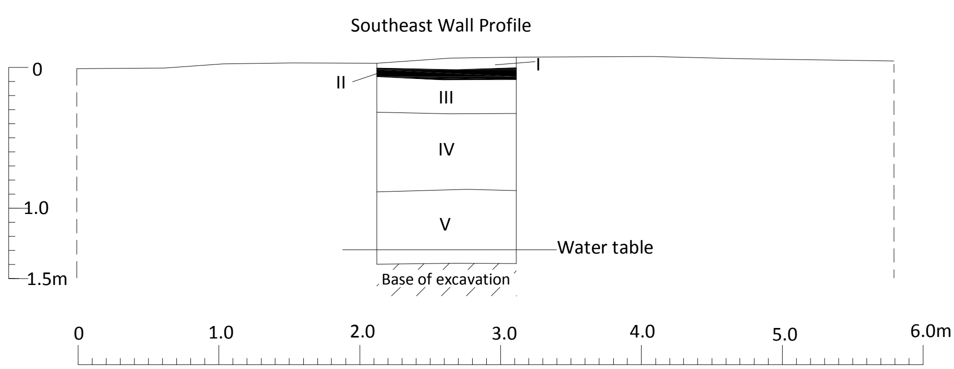
Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Light gray (10YR 7/2) compact limestone fill; Aggregate present

Layer IV - Yellowish brown (10YR 5/4) very fine friable sandy clay loam; No cultural remains

Layer V- Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-171. Profile of BT-E-11-1



Layer I - Black (7.5YR 2.5/1) structureless clay loam with humus; Asphalt fragments present

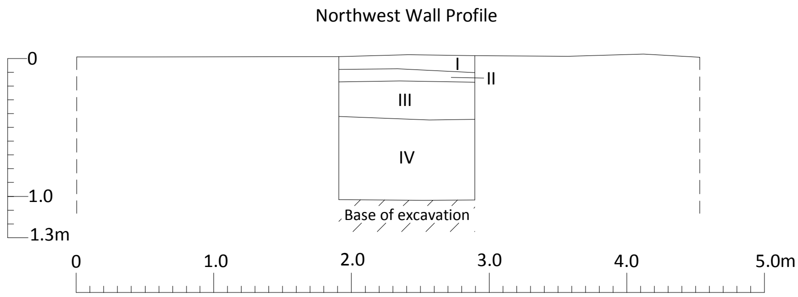
Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Light gray (10YR 7/2) compact limestone fill; Aggregate present

Layer IV - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Layer V- Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-172. Profile of BT-E-11-2



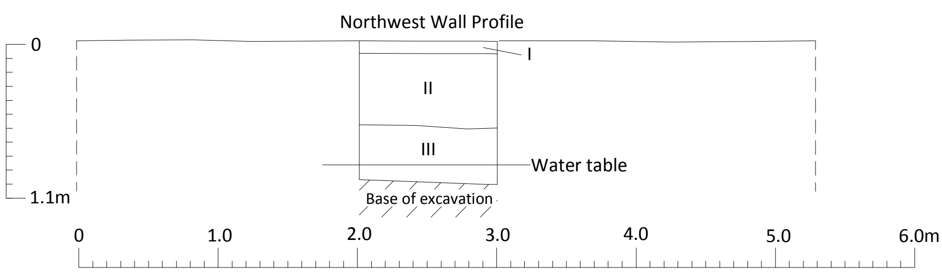
Layer I - Black (7.5YR 2.5/1) structureless clay loam with humus; Asphalt fragments present

Layer II - Brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains

Layer III - Brown (10YR 4/3) friable sandy clay loam alluvium; No cultural remains

Layer III - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-173. Profile of BT-E-11-3

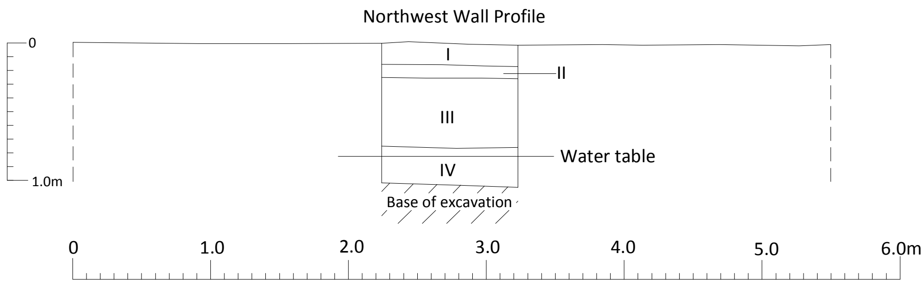


Layer I - Black (7.5YR 2.5/1) structureless clay loam with humus; Asphalt fragments present

Layer II - Brown (10YR 5/3) very fine friable loamy sand; No cultural remains

Layer III - Light brownish gray (10YR 6/2) single grain sand; No cultural remains

Figure B-174. Profile of BT-E-11-4



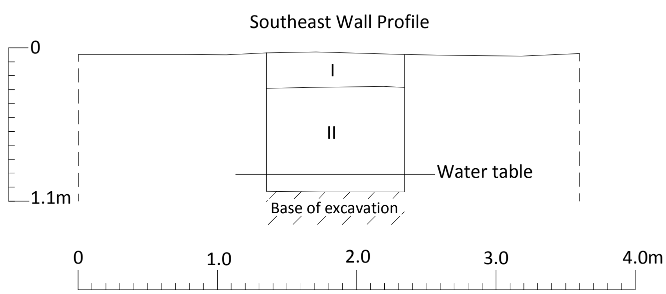
Layer I - Black (7.5YR 2.5/1) structureless clay loam with humus; Asphalt fragments present

Layer II - Very pale brown (10YR 7/4) compact limestone fill; Aggregate present

Layer III - Brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains

Layer IV - White (10YR 8/1) weathered limestone; No cultural remains

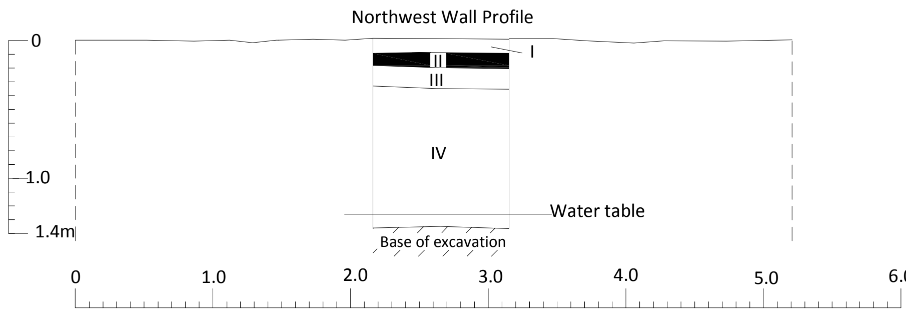
Figure B-175. Profile of BT-E-11-5



Layer I - Dark brown (10YR 3/3) structureless humus; No cultural remains

Layer II - Brown (7.5YR 4/4) to pinkish white (7.5YR 8/2) weathered limestone sand; No cultural remains

Figure B-176. Profile of BT-E-11-6



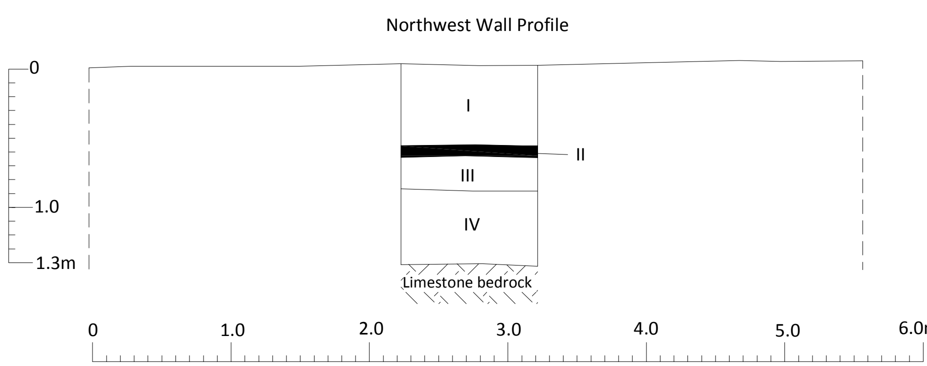
Layer I - Very dusky red (2.5YR 2.5/2) very fine friable clay loam; No cultural remains

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Brown (10YR 5/3) compact sandy clay loam; No cultural remains

Layer IV - Very pale brown (10YR 8/2) weathered limestone sand; No cultural remains

Figure B-177. Profile of BT-E-11-7



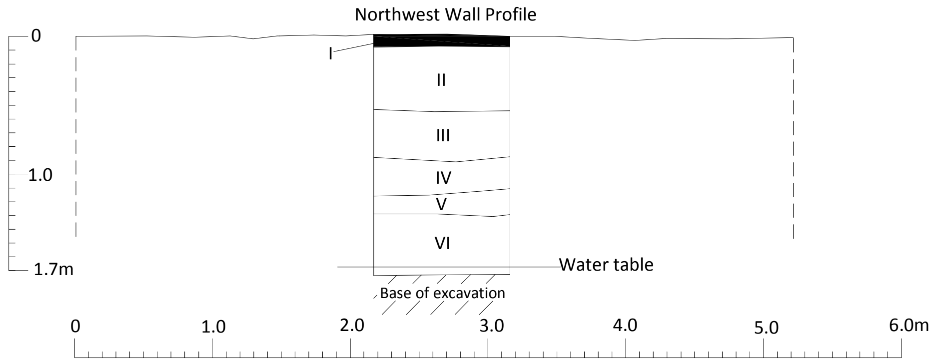
Layer I - Brown (10YR 4/3) fine friable sandy clay loam; Glazed ceramic fragment present

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Brown (10YR 5/3) to light gray (10YR 7/2) fine friable clay loam; No cultural remains

Layer IV -Brown (10YR 4/3) fine friable clay loam; No cultural remains

Figure B-178. Profile of BT-E-12-1



Layer I - Black (10YR 2/1) intact asphalt layer

Layer II - Dark grayish brown (10YR 4/2) fine friable sandy clay loam; No cultural remains

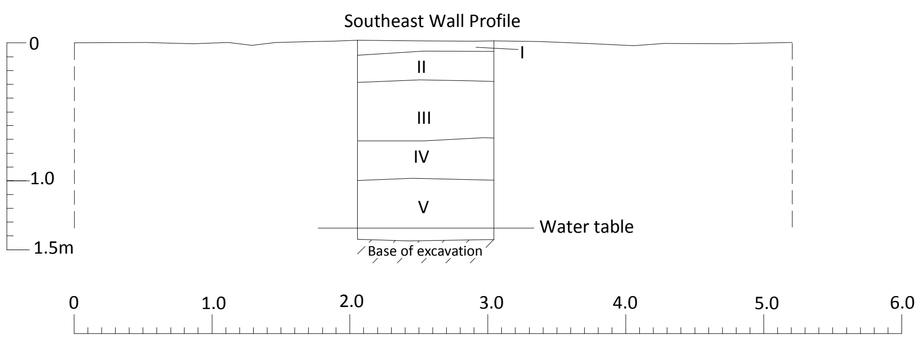
Layer III - Dark brown (10YR 3/3) to brown (10YR 4/3) compact clay loam; No cultural remains

Layer IV - Light brownish gray (10YR 6/2) weathered limestone; No cultural remains

Layer V - Brown (10YR 4/2) to dark reddish brown (5YR 3/4) massive clay; No cultural remains

Layer VI - Gray (10YR 5/1) massive clay; No cultural remains

Figure B-179. Profile of BT-E-12-2



Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

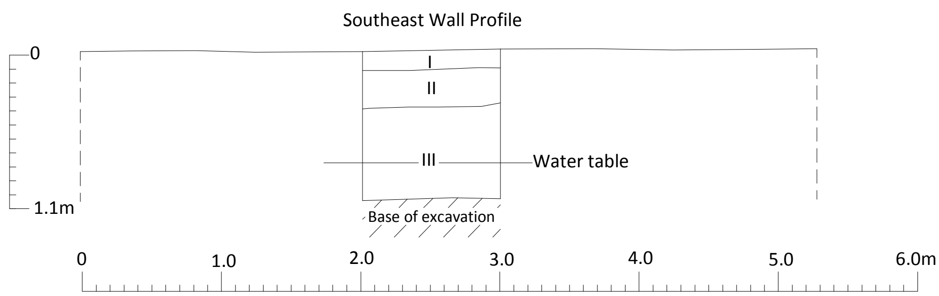
Layer II -Dark yellowish brown (10YR 4/4) fine friable sandy clay loam; No cultural remains

Layer III - Brown (10YR 5/3) fine friable sandy clay loam; No cultural remains

Layer IV -Dark grayish brown (10YR 4/2) massive clay; No cultural remains

Layer V - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-180. Profile of BT-E-12-3

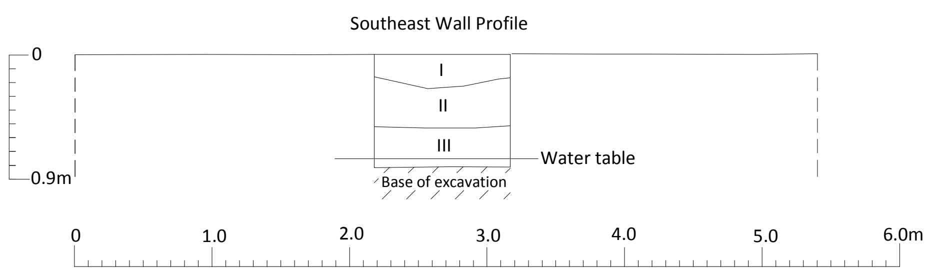


Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

Layer II - Yellowish brown (10YR 5/4) fine friable sandy clay loam; No cultural remains

Layer III - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-181 Profile of BT-E-12-4

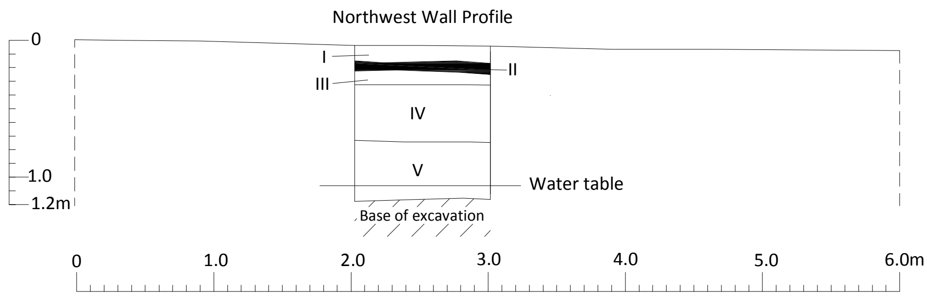


Layer I - Dark brown (7.5YR 3/2) structureless clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Light greenish gray (G 7/10GY)non-sticky, slightly plastic gley; No cultural remains

Figure B-182. Profile of BT-E-12-5



Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

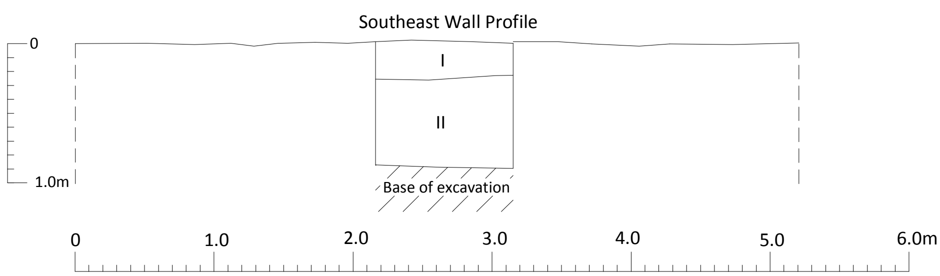
Layer II - Black (10YR 2/1) intact asphalt deposit

Layer III - Very pale brown (10YR 7/4) compact limestone fill; Aggregate present

Layer IV - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer V - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-183. Profile of BT-E-12-6



Layer I - Dark reddish brown (5YR 3/4) sticky, fine friable clay fill; No cultural remains

Layer II - Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-184. Profile of BT-E-12-7

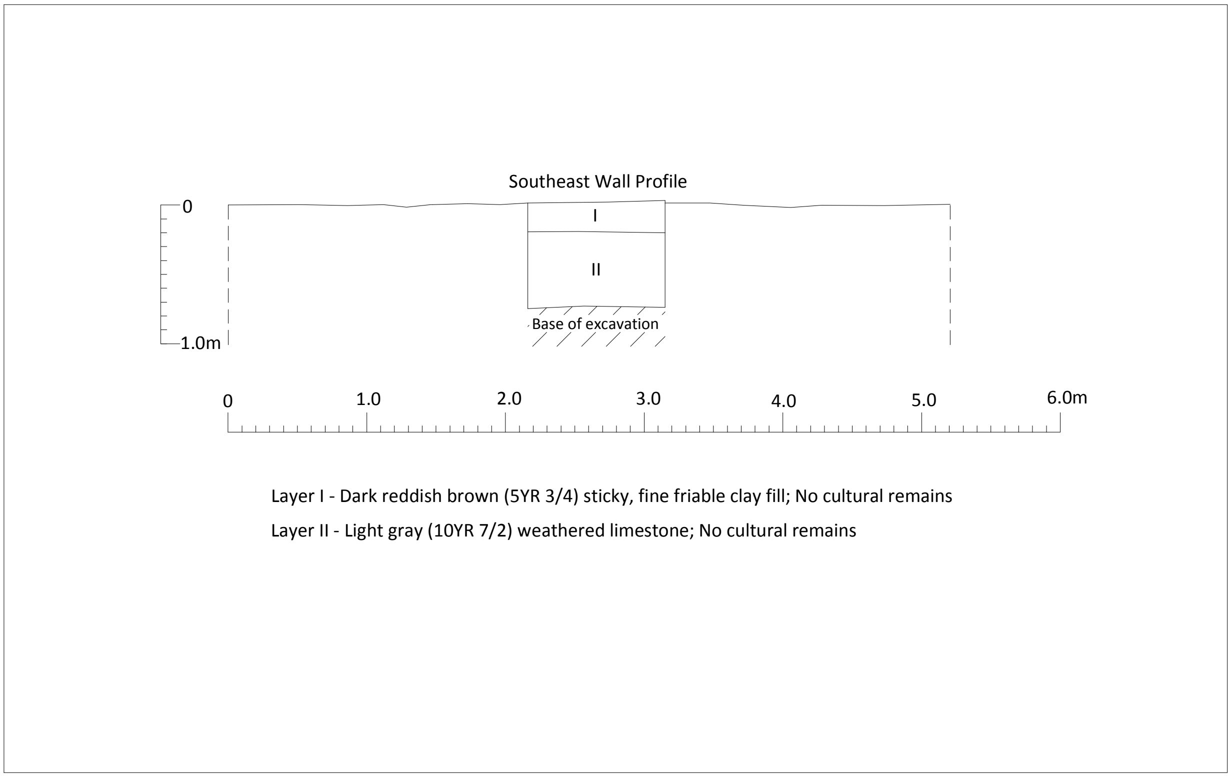


Figure B-185. Profile of BT-E-12-8

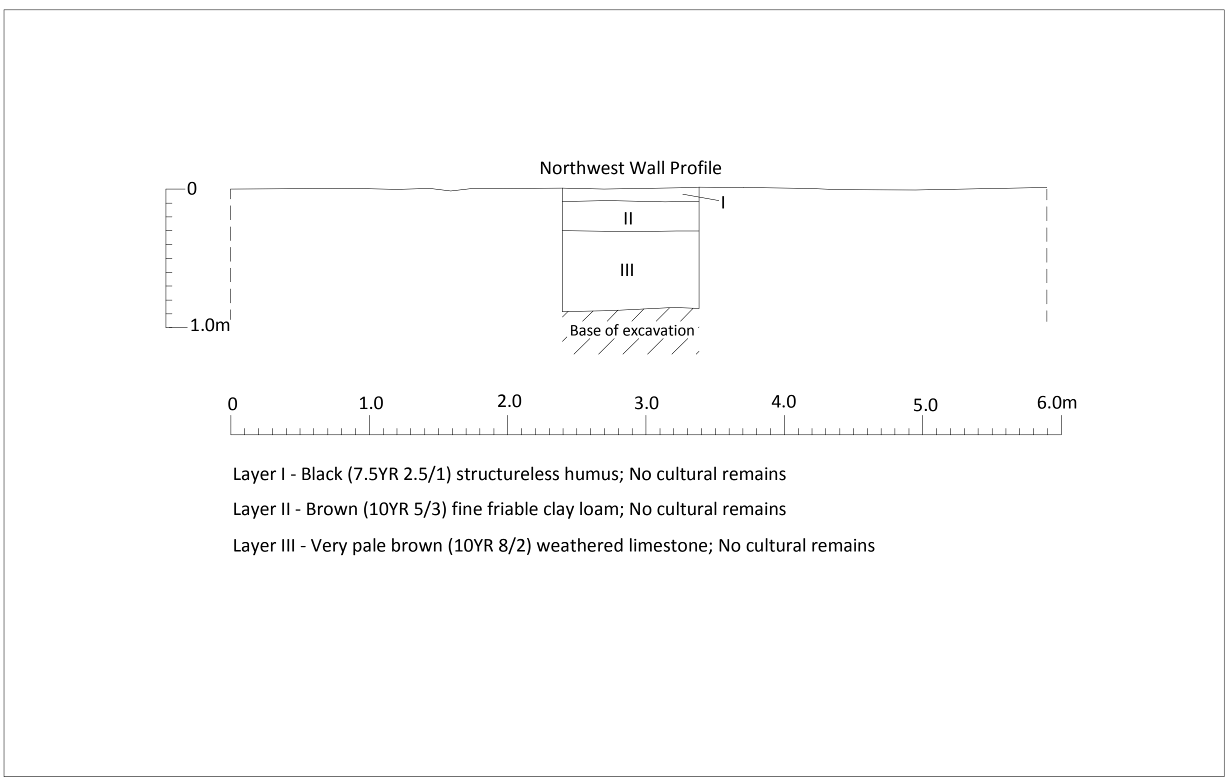
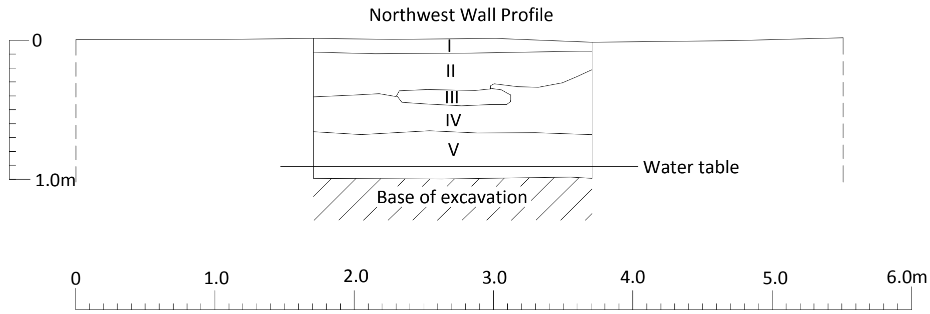


Figure B-186. Profile of BT-E-13-1



Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

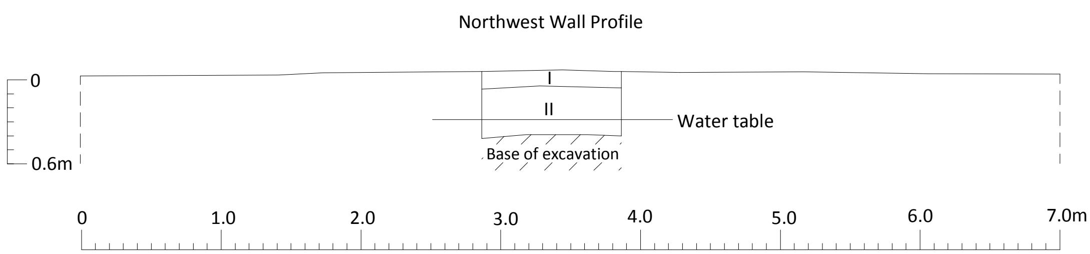
Layer II - Dark grayish brown (10YR 4/2) very fine friable clay loam; Asphalt fragments present

Layer III - Black (10YR 2/1) very fine friable clay loam buried A horizon; Charcoal flecks present

Layer IV - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Layer V - Dark yellowish brown (10YR 4/4) massive clay; No cultural remains

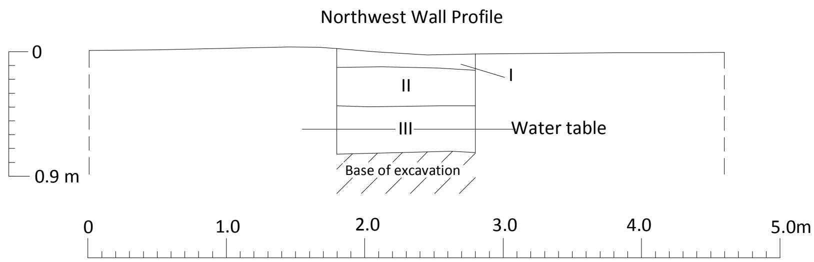
Figure B-187. Profile of BT-E-13-2



Layer I - Black (10YR 2/1) very fine friable clay loam with humus; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable clay; No cultural remains

Figure B-188. Profile of BT-E-13-3

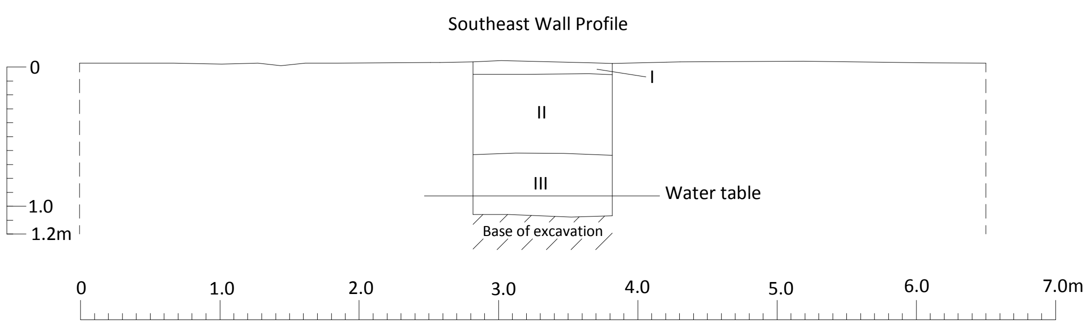


Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable sandy clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) very fine friable clay; No cultural remains

Figure B-189. Profile of BT-E-13-4

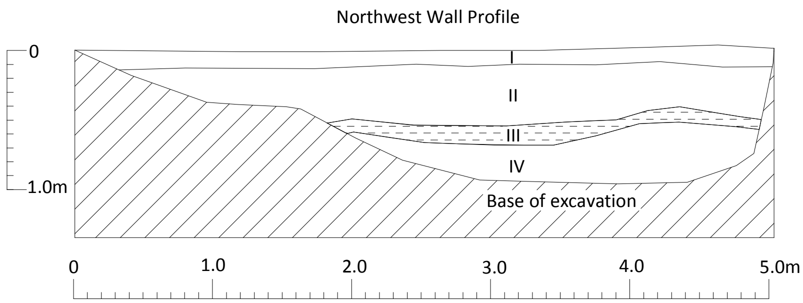


Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) fine friable sandy clay loam alluvium; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) fine friable clay; No cultural remains

Figure B-190. Profile of BT-E-13-5



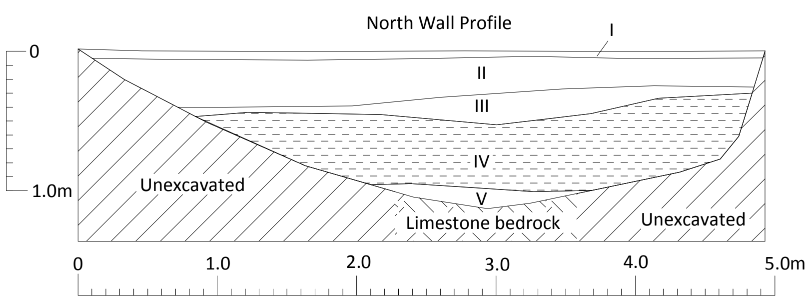
Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humic duff; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Black (10YR 2/1) fine friable loam; 7294 cultural deposit (Basalt flake, crustacean, charcoal, fire-altered rock)

Layer IV - Dark gray (10YR 4/1) to light gray (10YR 7/2) weathered limestone with clay pockets; No cultural remains

Figure B-191. Profile of BT-E-13-6



Layer I - Very dark brown (7.5YR 2.5/2) structureless humic duff; No cultural remains

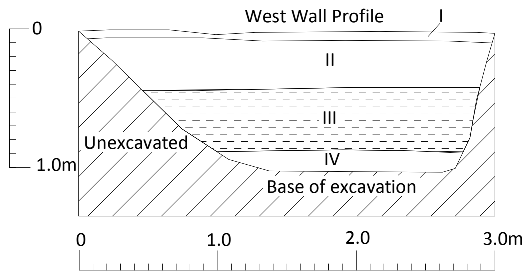
Layer II - Brown (10YR 4/3) very fine friable clay loam; 50% limestone aggregate fill for Site 7275

Layer III - Yellowish brown (10YR 5/4) very fine friable clay loam; 60% limestone aggregate fill for Site 7275

Layer IV - Brown (10YR 4/3)very fine friable clay loam; Site 7294 cultural deposit (Marine shell and charcoal)

Layer V - Dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) very fine friable clay; No cultural remains

Figure B-192. Profile of BT-E-13-6b



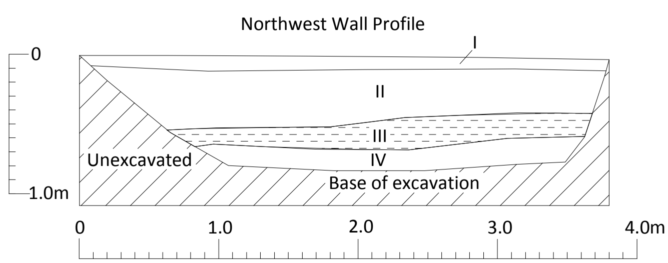
Layer I - Very dark brown (7.5YR 2.5/2) structureles humus; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) very fine friable clay loam; Site 7294 cultural deposit (Charcoal)

Layer IV - Light gray (10YR 7/2) to very pale brown (10YR 7/3) weathered limestone; No cultural remains

Figure B-193. Profile of BT-E-13-6c



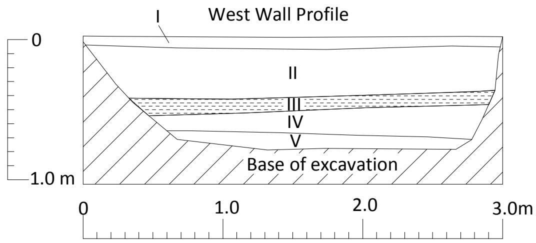
Layer I - Very dark brown (7.5YR 2.5/2) structureless organics (Humus); No cultural remains

Layer II - Brown (10YR 4/3) very fine friable clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) very fine friable clay loam; Site 7294 cultural deposit (Marine shell and charocal)

Layer IV - Very pale brown (10YR 7/2) weathered limestone; No cultrual remains

Figure B-194. Profile of BT-E-13-6d



Layer I - Very dark brown (7.5YR 2.5/2) structureless humic duff; No cultural remains

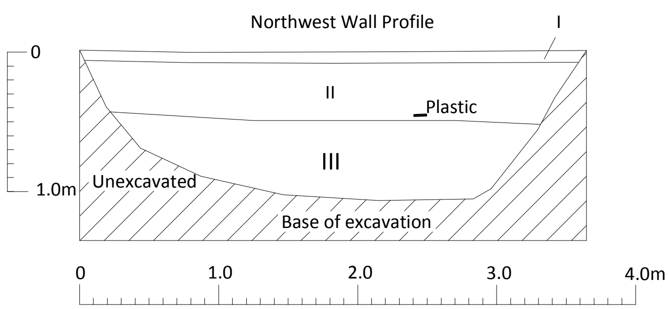
Layer II - Brown (10YR 4/3) very fine friable clay loam alluvium; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) very fine friable clay loam;Site 7294 cultural deposit (Charcoal flecks)

Layer IV - Brown (10YR 5/3) very fine friable clay; No cultural remains

Layer V - Weathered limestone; No cultural remains

Figure B-195. Profile of BT-E-13-6e

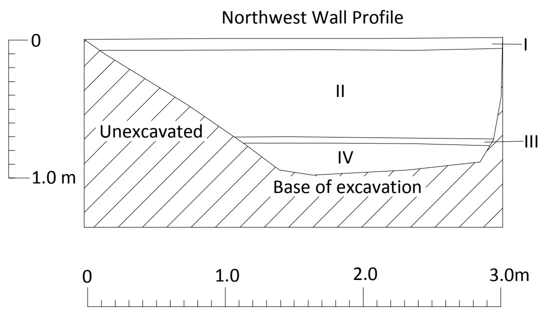


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) very fine friable clay loam; Plastic fragment present

Layer III - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Figure B-196. Profile of BT-E-13-6f



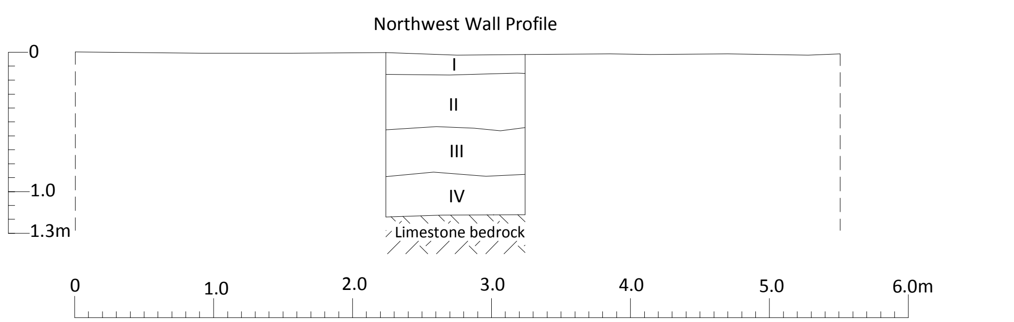
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Dark yellowish brown (10YR 4/4) to light yellowish brown (10YR 6/4) very fine friable clay loam; No cultural remains

Layer III - Pale brown (10YR 6/3) fine, single grain sand; No cultural remains

Layer IV - Very pale brown (10YR 7/4) weathered limestone; No cultural remains

Figure B-197. Profile of BT-E-13-6g



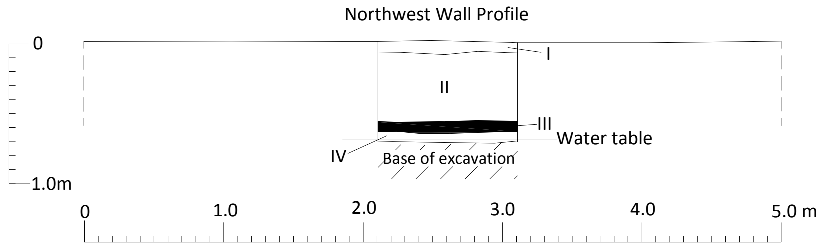
Layer I - Very dark grayish brown (10YR 3/2) fine friable clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) unconsolidated loamy sand; No cultural remains

Layer III - Pale brown (10YR 6/3) to light brownish gray (10YR 6/2)coarse, single grain sand; Asphalt fragment present

Layer IV - Dark grayish brown (10YR 4/2) fine friable sandy clay; No cultural remains

Figure B-198. Profile of BT-E-13-7



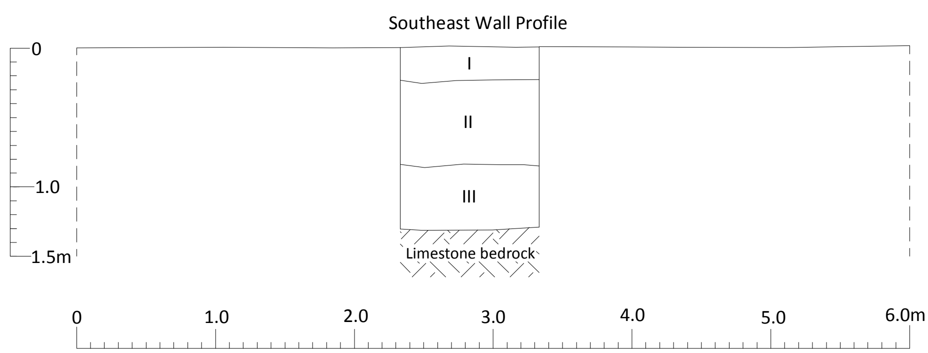
Layer I - Very dark brown (7.5YR 2.5/2) friable clay loam with humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) friable clay loam; Asphalt and plastic present

Layer III - Black (10YR 2/1) intact asphalt layer

Layer IV - Very pale brown (10YR 7/4) structreless, pulverized limestone; No cultural remains

Figure B-199. Profile of BT-E-13-8

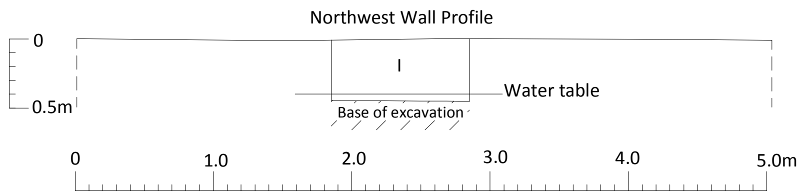


Layer I - Dark reddish brown (5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) fine crumb sandy clay loam; Asphalt present

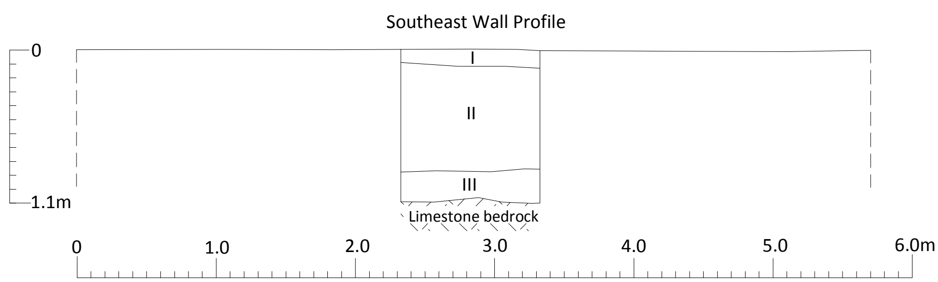
Layer III - Dark grayish brown (10YR 4/2) very fine friable clay; No cultural remains

Figure B-200. Profile of BT-E-13-9



Layer I - Very dark gray (10YR 3/1) very fine friable clay loam muck; No cultural remains

Figure B-201. Profile of BT-E-14-1

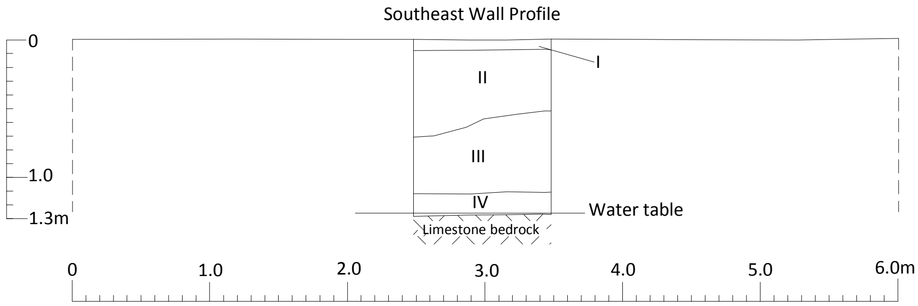


Layer I - Dark brown (7.5YR 3/2) structureless clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; Asphalt and glass bottle present

Layer III - Gray (10YR 5/1)non-sticky, super plastic clay; No cultural remains

Figure B-202. Profile of BT-E-14-2



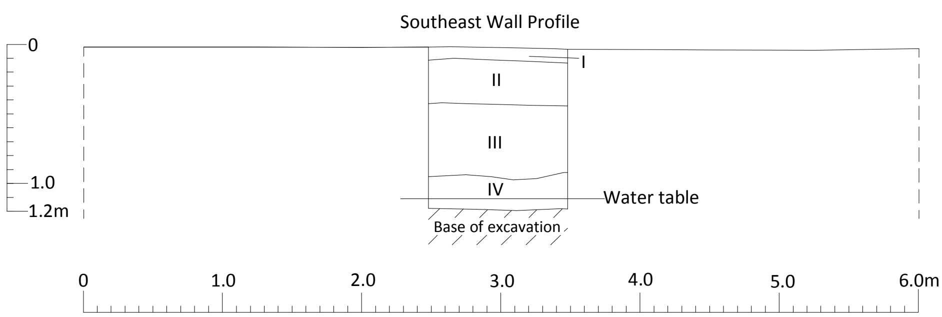
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Yellowish brown (10YR 5/4) to dark reddish brown (5YR 3/3) fine friable sandy clay; No cultural remains

Layer IV - Dark gray (10YR 4/1) sticky, plastic clay; No cultural remains

Figure B-203. Profile of BT-E-14-3



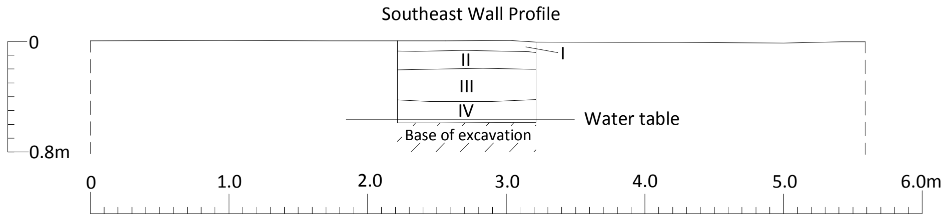
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) fine friable sandy clay loam; Asphalt fragments present

Layer IV - Dark gray (10YR 4/1) sticky, plastic compact clay; No cultural remains

Figure B-204. Profile of BT-E-14-4



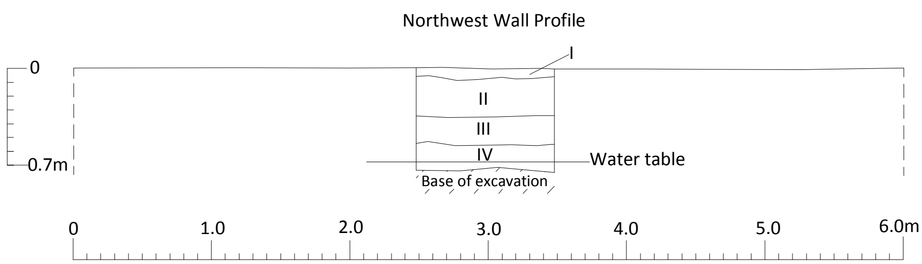
Layer I - Dark brown (7.5YR 3/2) very fine firable clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) non-sticky, plastic clay; No cultural remains

Layer IV - Light yellowish brown (10YR 6/4) to light gray (10YR 7/1) weathered limestone; No cultural remains

Figure B-205. Profile of BT-E-14-5



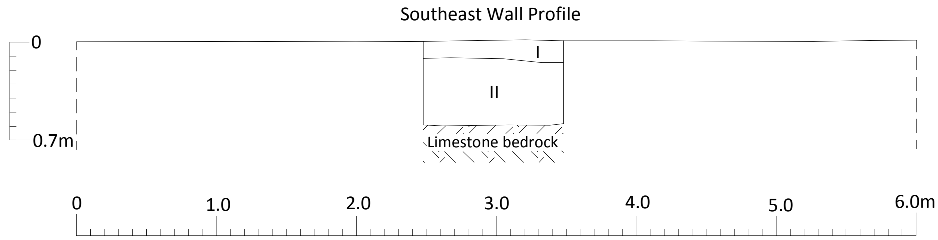
Layer I - Very dark brown (7.5YR 2.5/2) structureless clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; No cultural remains

Layer III - Pale brown (10YR 6/3) fine friable clay; No cultural remains

Layer IV - Dark gray (10YR 4/1) non-sticky, plastic clay; No cultural remains

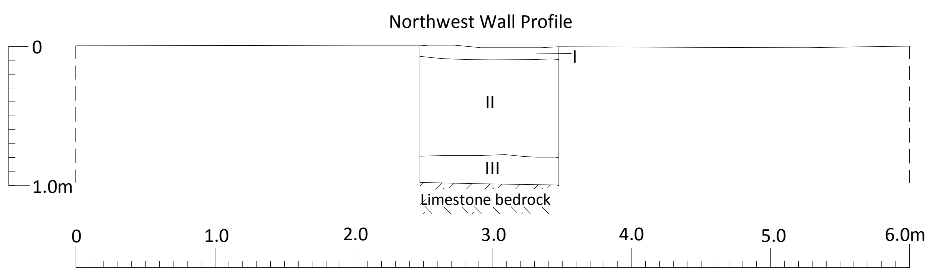
Figure B-206. Profile of BT-E-14-6



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) fine friable sandy clay loam; No cultural remains

Figure B-207. Profile of BT-E-14-7

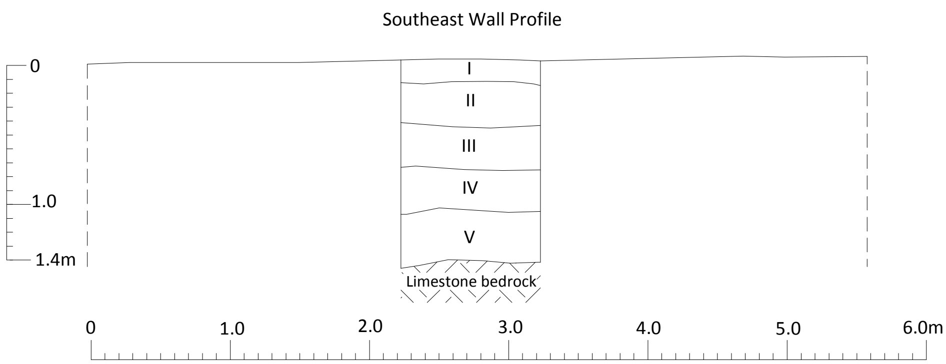


Layer I - Very dark grayish brown (10YR 3/2) fine friable clay loam with organics (Humus); No cultural remains

Layer II - Brown (10YR 4/3) fine friable sandy clay loam; Asphalt fragments present

Layer III - Brown (10YR 5/3) non-sticky, plastic clay; No cultural remains

Figure B-208. Profile of BT-E-15-1



Layer I - Dark grayish brown (10YR 4/2) loose clay loam; No cultural remains

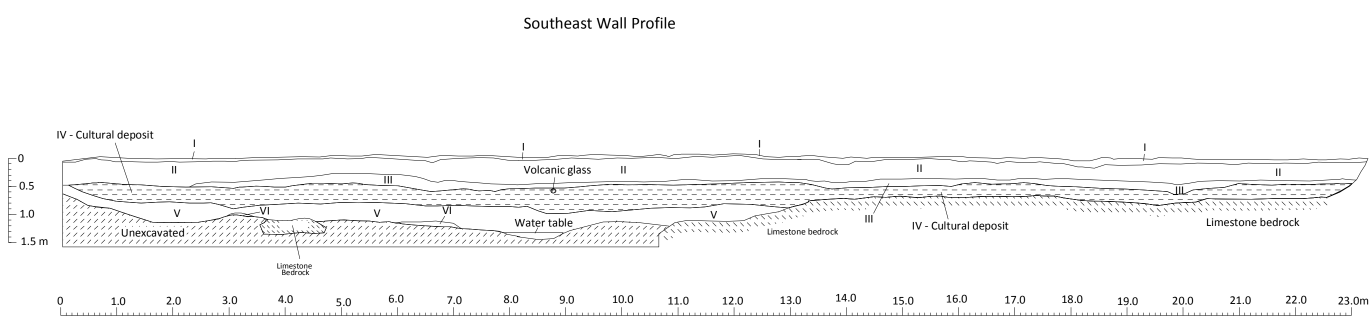
Layer II - Brown (10YR 4/3) moderately compact clay loam; No cultural remains

Layer III - Dark grayish brown (10YR 4/2) compact clay loam; 20% limestone aggregate

Layer IV -Very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) compact clay loam; 25% limestone aggregate

Layer V - Brown (10YR 4/3) massive clay; No cultural remains

Figure B-209. Profile of BT-E-15-2



Layer I - Very dark brown (10YR 2/2) structureless humic duff; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable sandy clay loam; 20% limestone aggregate for Site 7275

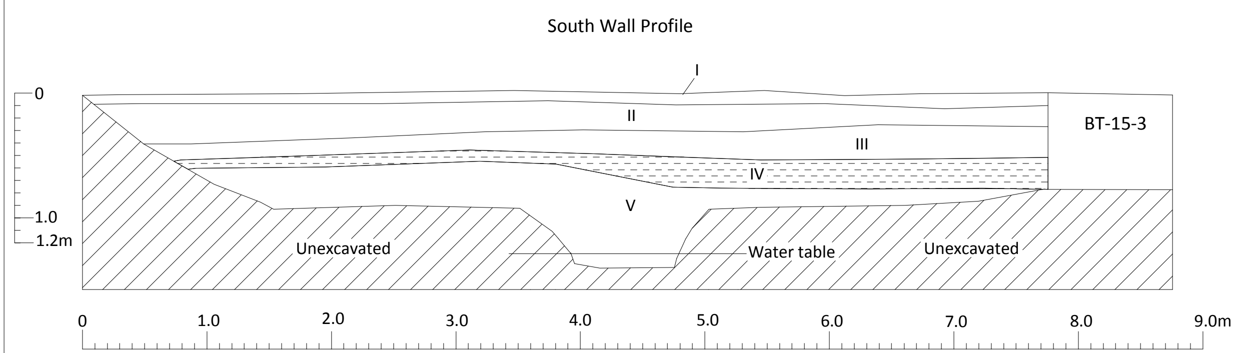
Layer III - Yellowish brown (10YR 5/4) moderately compacted silty sand; 75% limestone aggregate for Site 7275

Layer IV - Very dark grayish brown (10YR 3/2) fine friable slightly sandy clay loam; Site 7295 cultural deposit (Marine shell, volcanic glass core and charcoal)

Layer V - Brown (10YR 4/3) massive clay; No cultural remains

Layer VI - Dark grayish brown (10YR 4/2) and black (10YR 2/1) compacted saturated clay/gley; No cultural remains

Figure B-210. Profile of BT-E-15-3



Layer I - Very dark brown (7.5YR 2.5/2) structureless humic duff; No cultural remains

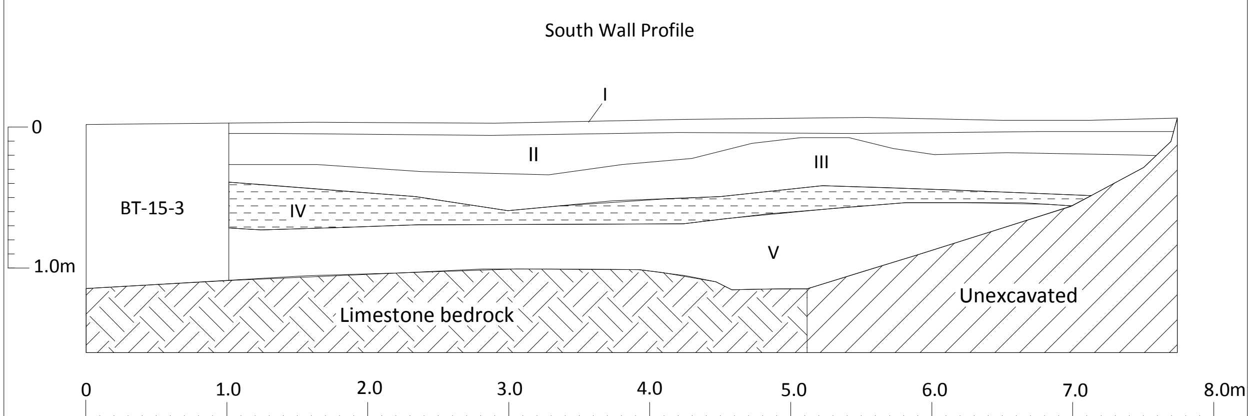
Layer II - Brown (10YR 5/3) very fine friable clay loam; 30% limestone aggregate for Site 7275

Layer III - Brown (10YR 5/3) to yellowish brown (10YR 5/4) very fine friable clay loam alluvium; 50% limestone aggregate for Site 7275

Layer IV - Dark gray (7.5YR 4/1) to very dark gray (7.5YR 3/1) very fine friable clay loam; Site 72945 cultural deposit

Layer V - Dark yellowish brown (10YR 3/4) massive clay; No cultural remains

Figure B-211. Profile of BT-E-15-3a



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

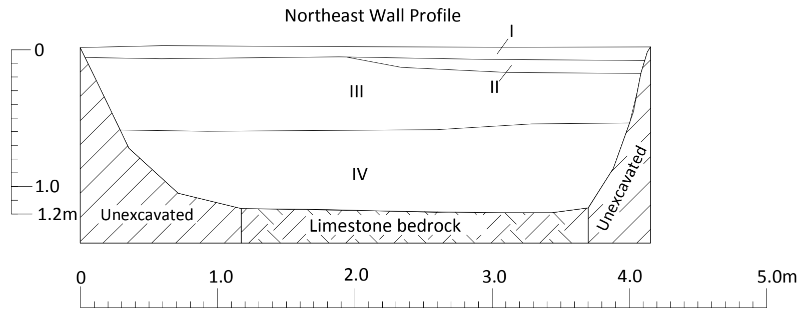
Layer II - Brown (10YR 5/3) very fine friable clay loam; 30% limestone aggregate for Site 7275

Layer III - Brown (10YR 5/3) to yellowish brown (10YR 5/4) very fine friable clay loam alluvium; 50% limestone aggregate for Site 7275

Layer IV - Dark gray (7.5YR 4/1) to very dark gray (7.5YR 3/1) very fine friable clay loam;Site 7295 cultural deposit (Charcoal flecks)

Layer V - Dark yellowish brown (10YR 3/4) massive clay; No cultural remains

Figure B-212. Profile of BT-E-15-3b



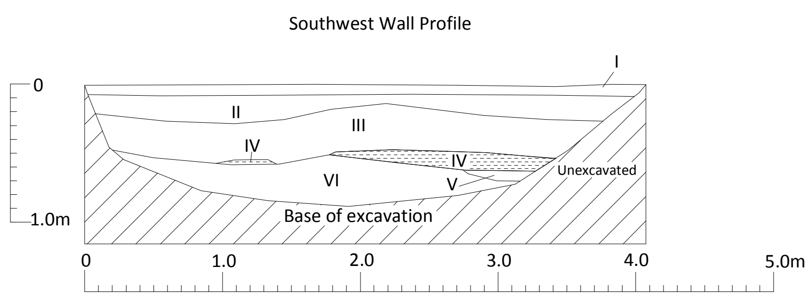
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable clay loam; 30% limestone aggregate

Layer III - Brown (10YR 5/3) to yellowish brown (10YR 5/4) very fine friable clay loam; 50% limestone aggregate

Layer IV - Very dark grayish brown (10YR 3/2) massive clay; No cultural remains

Figure B-213. Profile of BT-E-15-3c



Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable clay loam; 30% limestone aggregate for Site 7275

Layer III - Brown (10YR 5/3) to yellowish brown (10YR 5/4) very fine friable clay loam; 50% limestone aggregate for Site 7275

Layer IV - Dark gray (7.5YR 4/1) to very dark gray (7.5YR 3/1) very fine friable clay loam; Site 7295 cultural deposit

Layer V - Dark yellowish brown (10YR 3/4) massive clay; No cultural remains

Layer VI - Very pale brown (10YR 7/2) weathered limestone; No cultural remains

Figure B-214. Profile of BT-E-15-3d

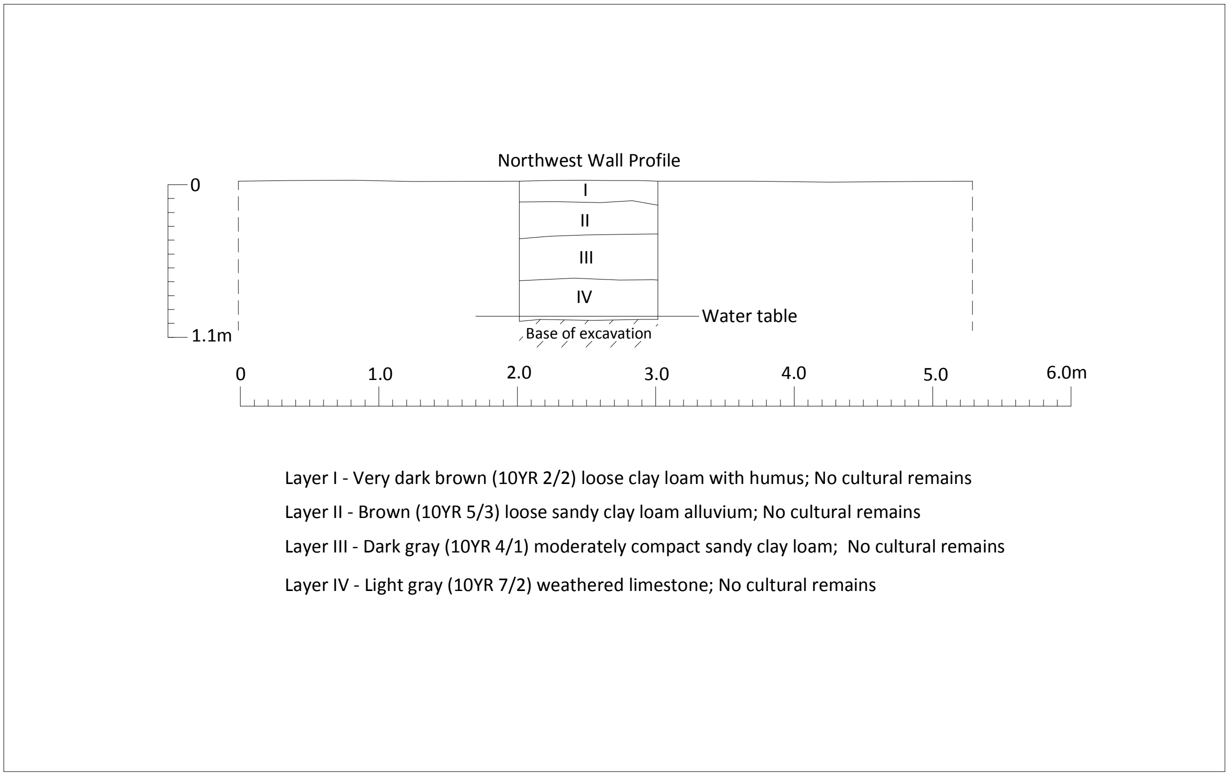


Figure B-215. Profile of BT-E-15-4

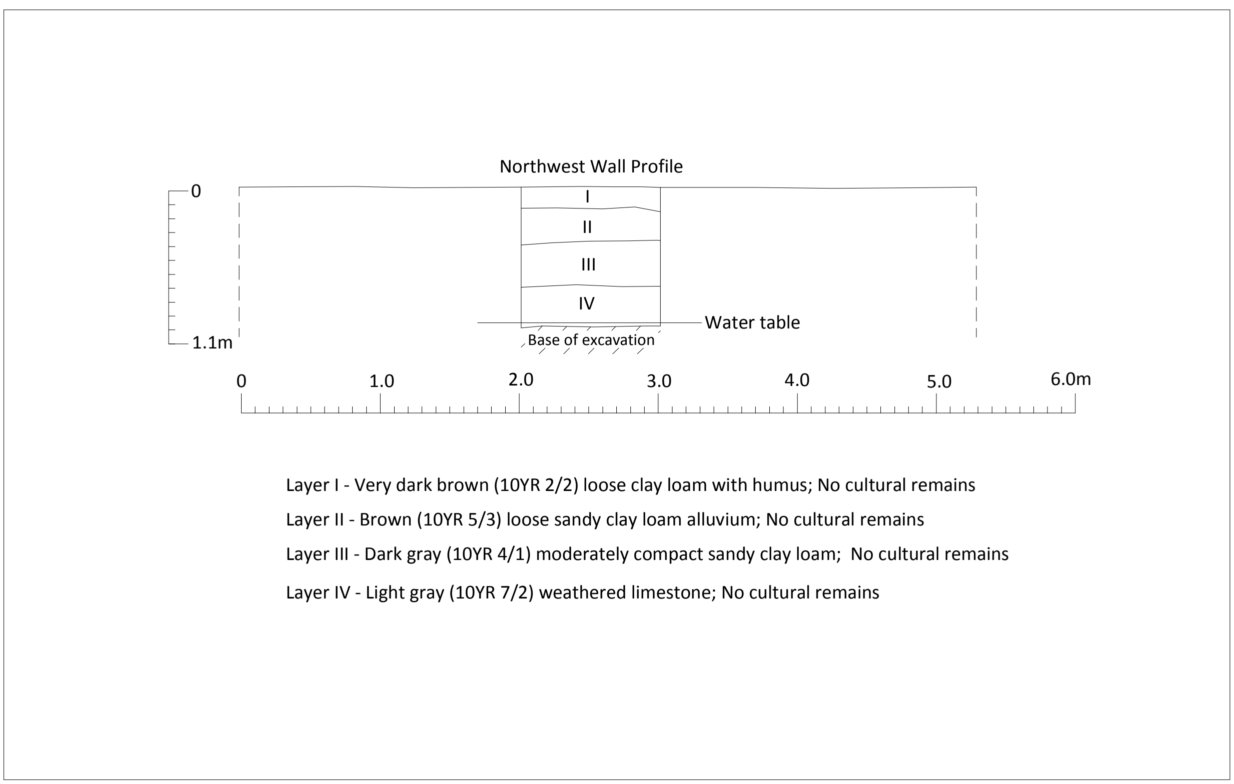
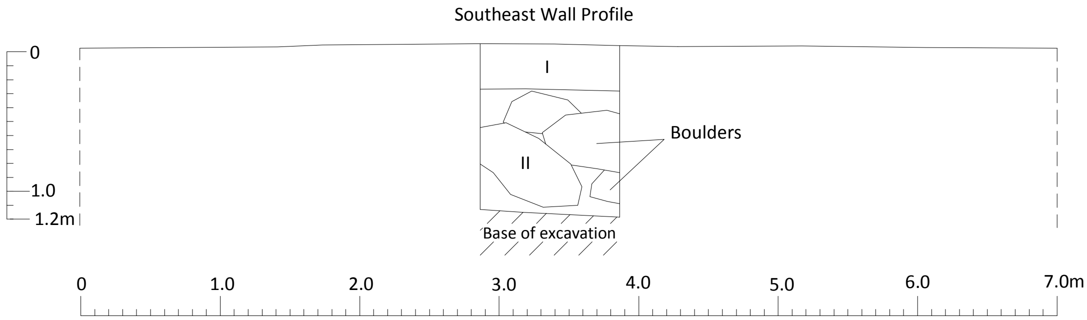


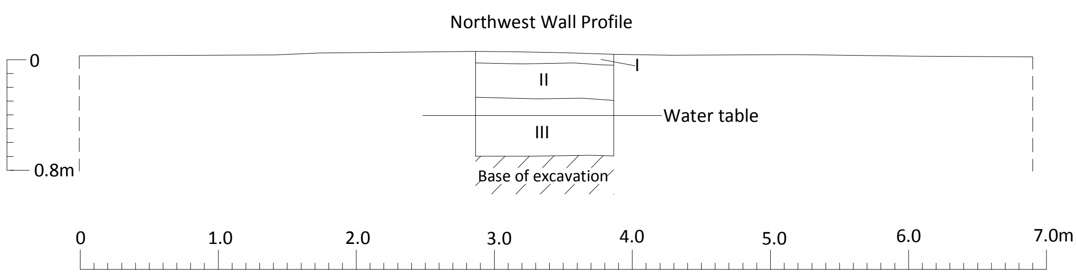
Figure B-216. Profile of BT-E-15-5



Layer I - Dark brown (7.5YR 3/3) fine friable clay loam; Electrical wires and pvc pipe present

Layer II - Brown (10YR 5/3) fine friable sandy clay loam and boulders; No cultural remains

Figure B-217. Profile of BT-E-15-6



Layer I - Very dark grayish brown (10YR 3/2) loose clay loam with humus ; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable clay residual deposit; No cultural remains

Layer III - Weathered limestone; No cultural remains

Figure B-218. Profile of BT-E-15-7

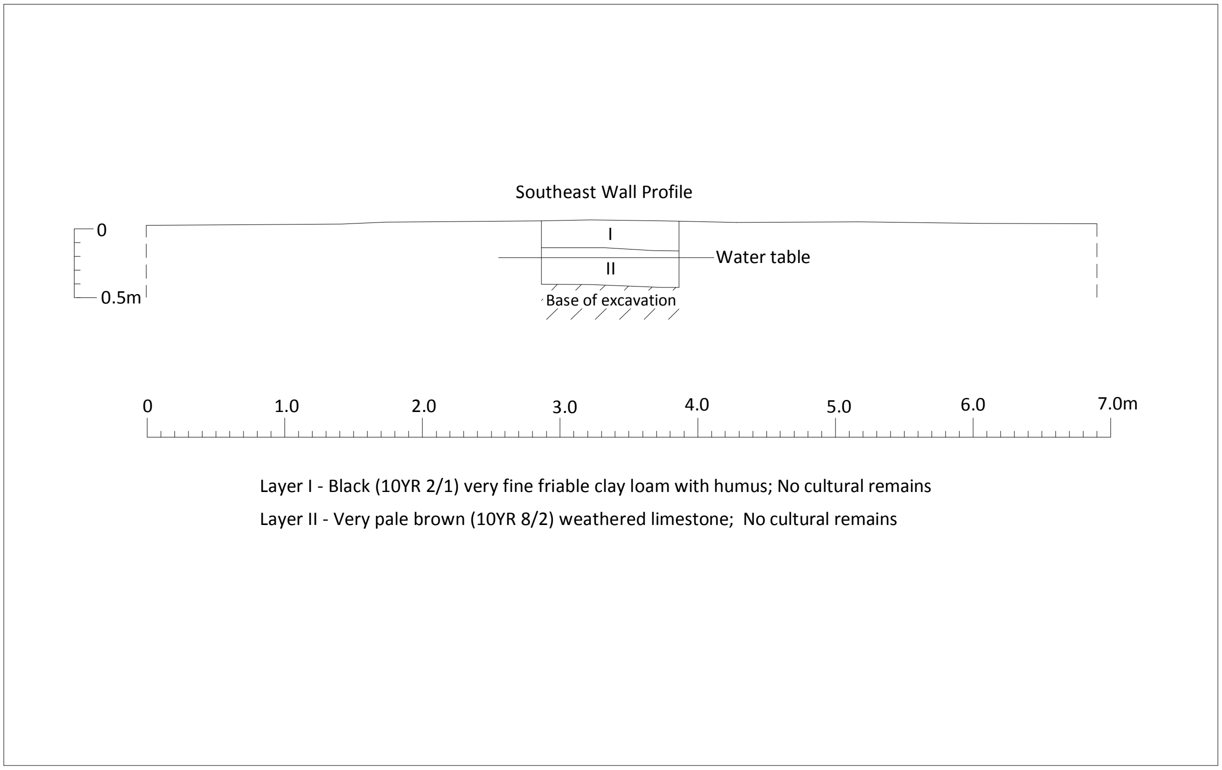


Figure B-219. Profile of BT-E-15-8

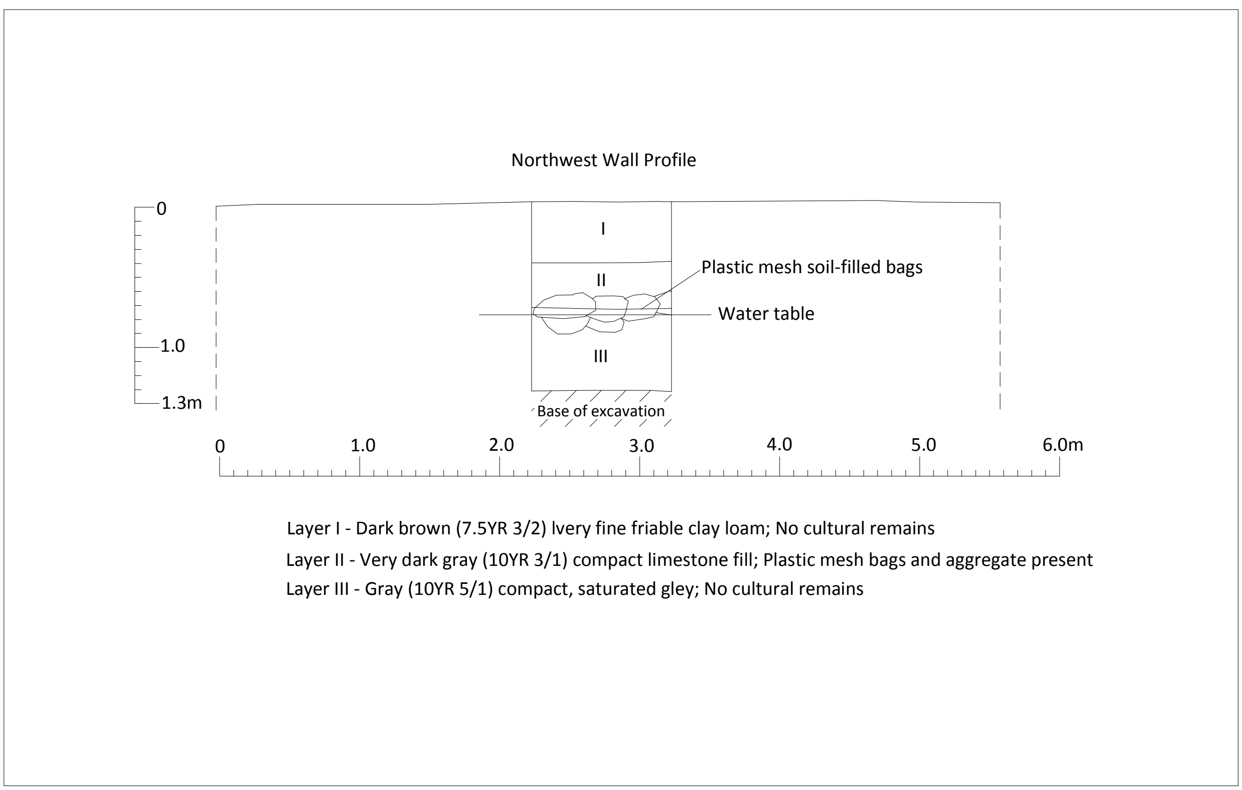


Figure B-220. Profile of BT-E-16-1

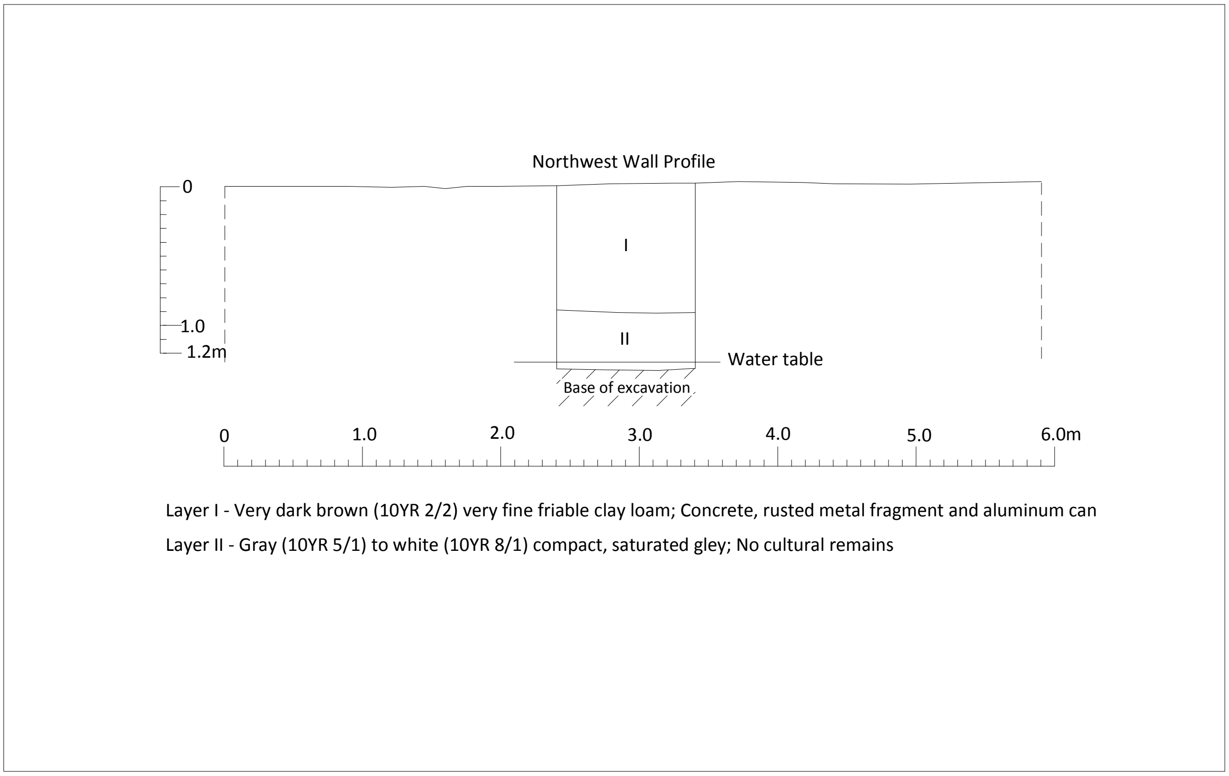


Figure B-221. Profile of BT-E-16-2

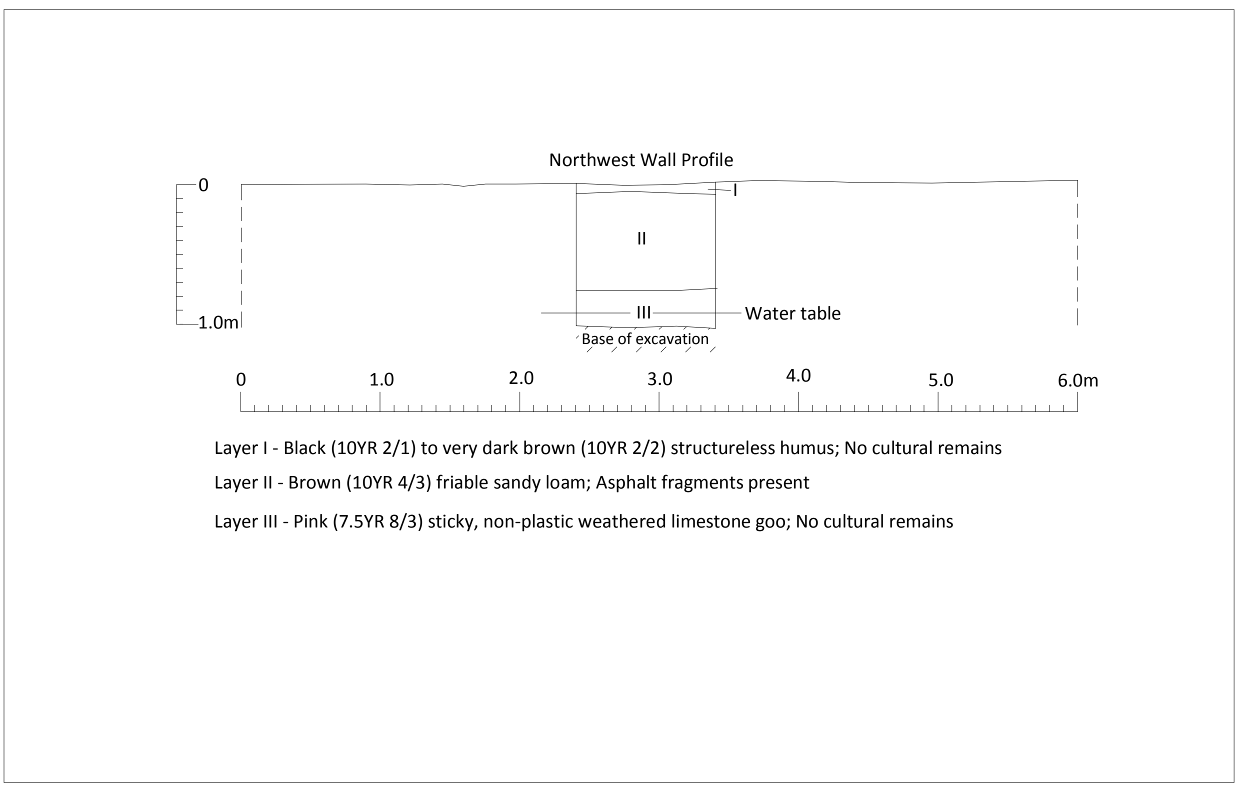


Figure B-222. Profile of BT-E-16-3

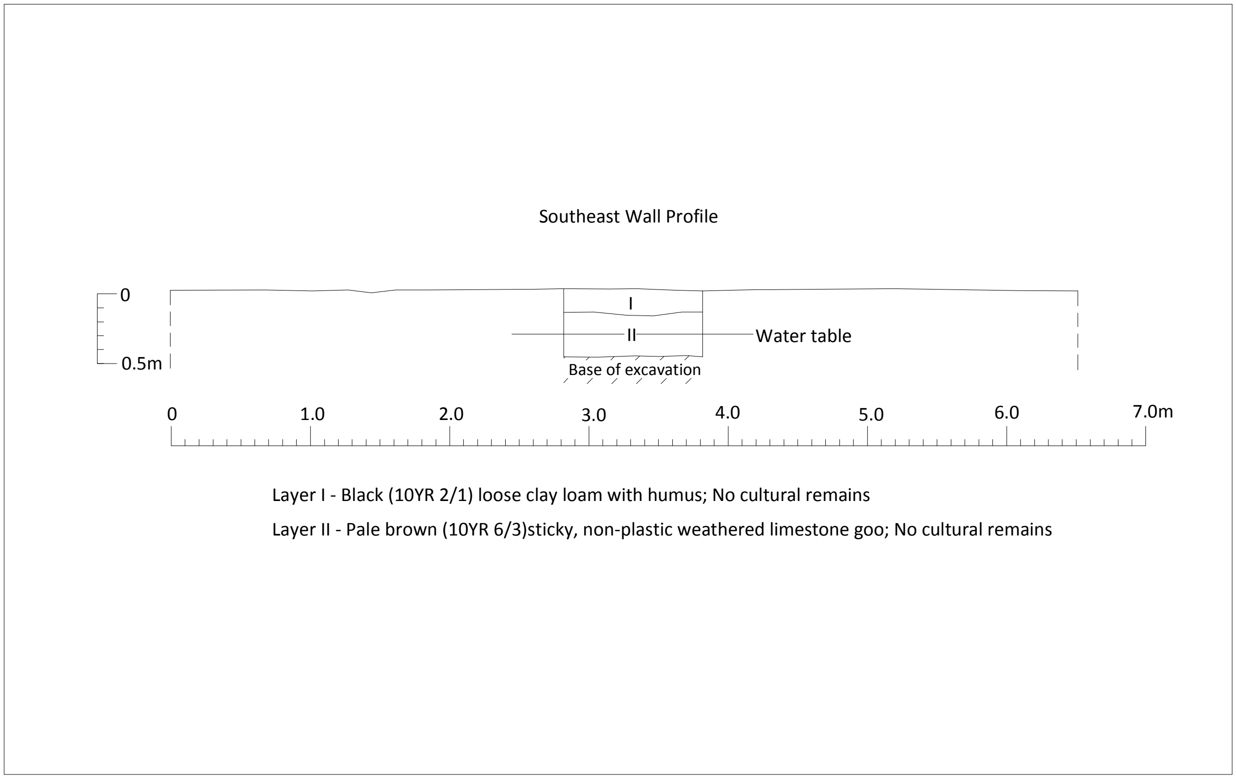


Figure B-223. Profile of BT-E-16-4

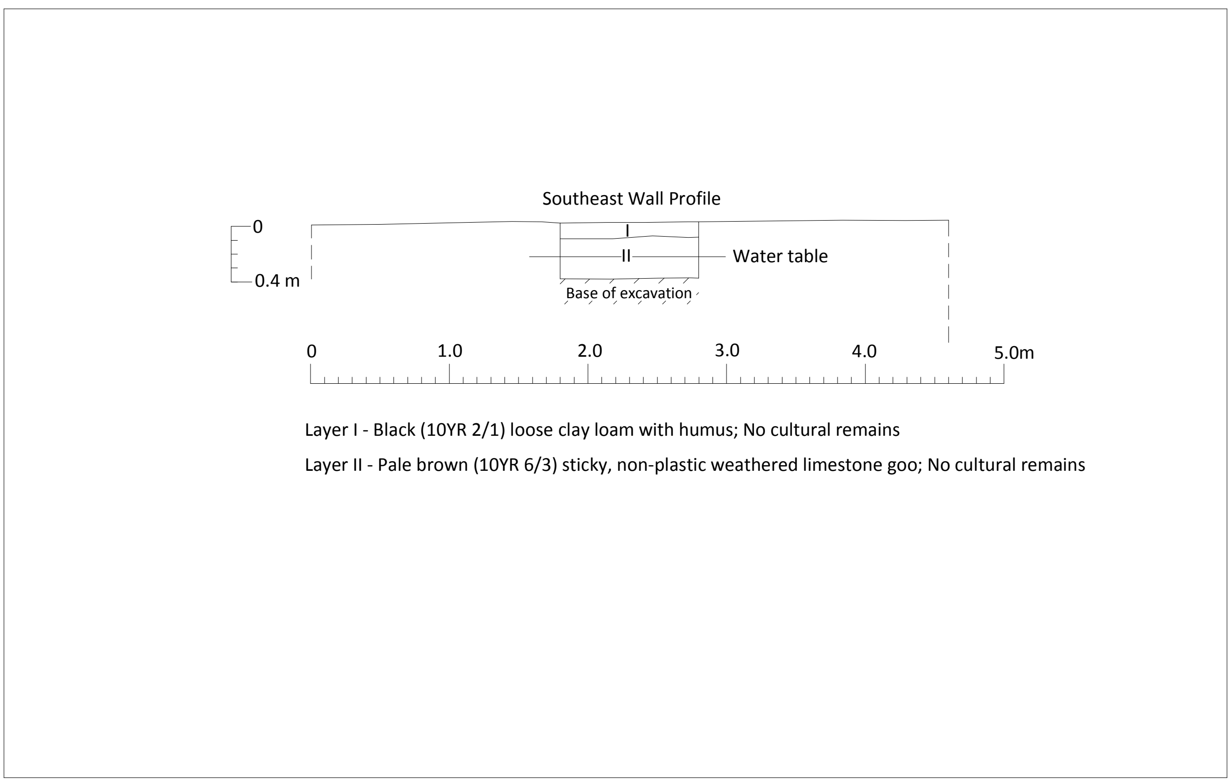
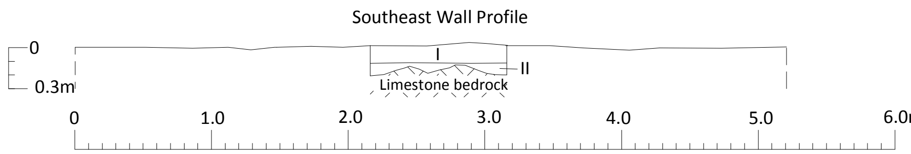


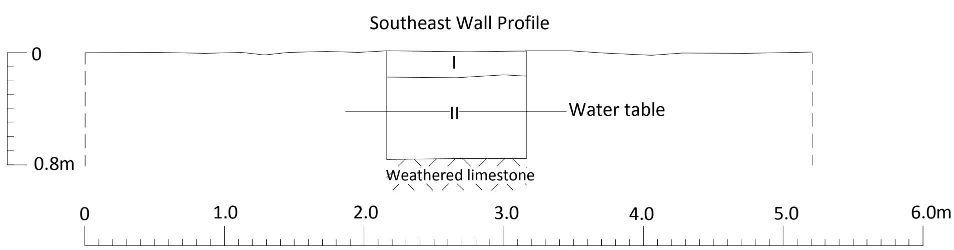
Figure B-224. Profile of BT-E-16-5



Layer I - Very dark brown (10YR 2/2) loose clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) compact clay loam; No cultural remains

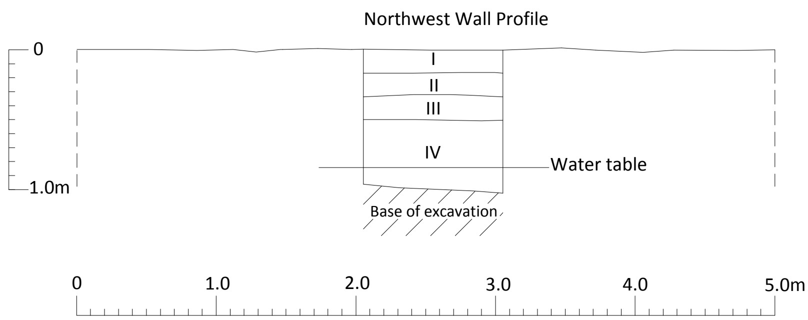
Figure B-225. Profile of BT-E-16-6



Layer I - Very dark brown (10YR 2/2) very fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) moderately compact clay loam; No cultural remains

Figure B-226. Profile of BT-E-16-7



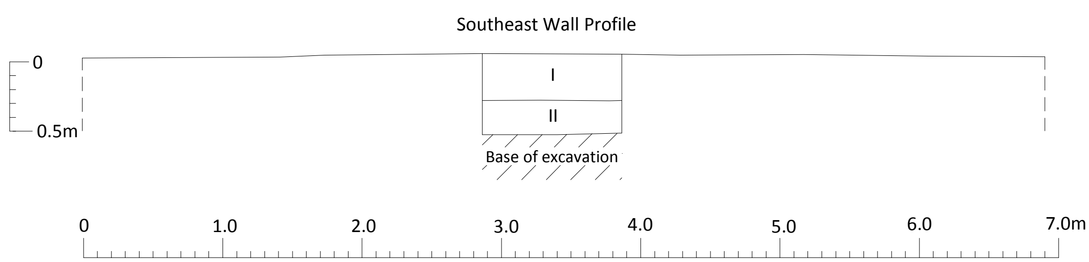
Layer I - Very dusky red (2.5YR 2.5/2) loose silt loam; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) very fine friable sandy loam; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) very fine friable clay loam; No cultural remains

Layer IV - Pale brown (10YR 6/3) weathered limestone; No cultural remains

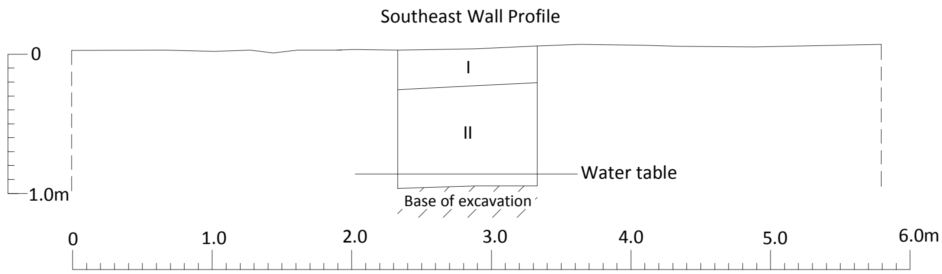
Figure B-227. Profile of BT-E-16-8



Layer I - Very dark brown (7.5YR 2.5/2) fine fraiable clay; No cultural remains

Layer II - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

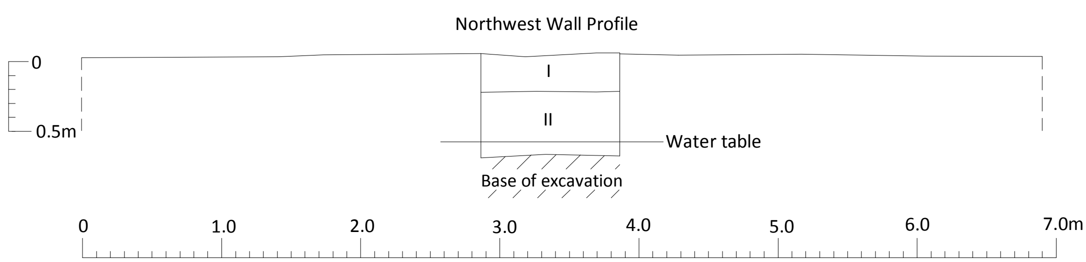
Figure B-228. Profile of BT-E-16-9



Layer I - Dark brown (7.5YR 3/3) structureless humus; No cultural remains

Layer II - Light gray (10YR 7/2) weathered limestone; No cultural remains

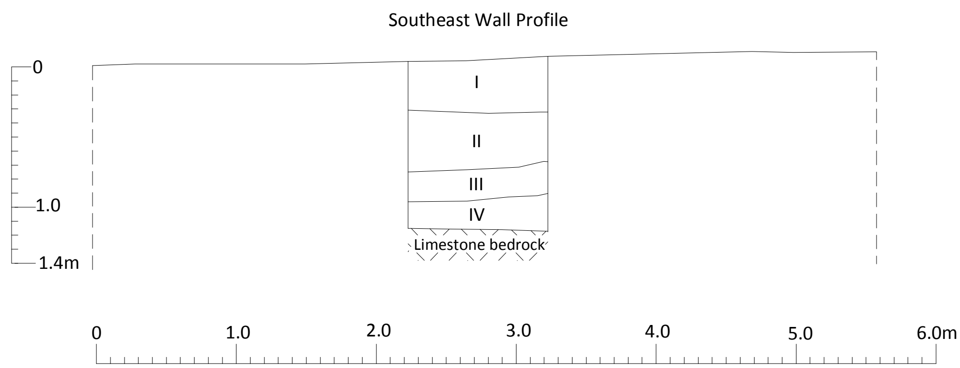
Figure B-229. Profile of BT-E-16-10



Layer I - Black (10YR 2/1) fine friable clay loam with humus; No cultural remains

Layer II - Brown (10YR 4/3) fine friable clay; No cultural remains

Figure B-230. Profile of BT-E-16-11



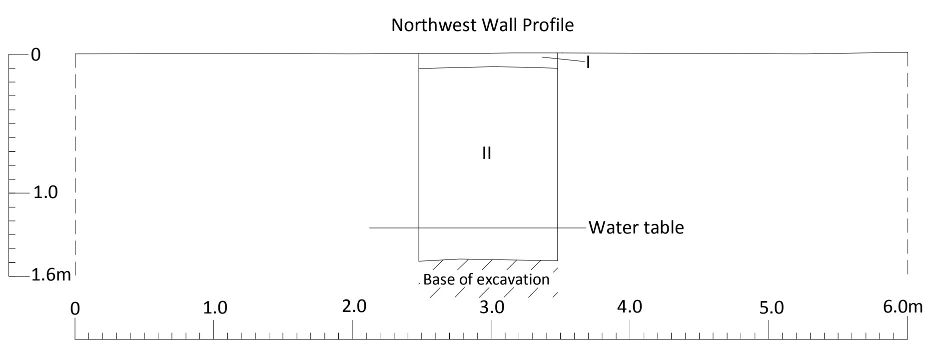
Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; Asphalt and fabric present

Layer II - Brown (10YR 5/3) fine friable sandy clay loam; Aggregate present

Layer III - Dark grayish brown (10YR 4/2) massive clay; No cultural remains

Layer IV -Very dark gray (10YR 3/1) non-plastic, sticky gley; No cultural remains

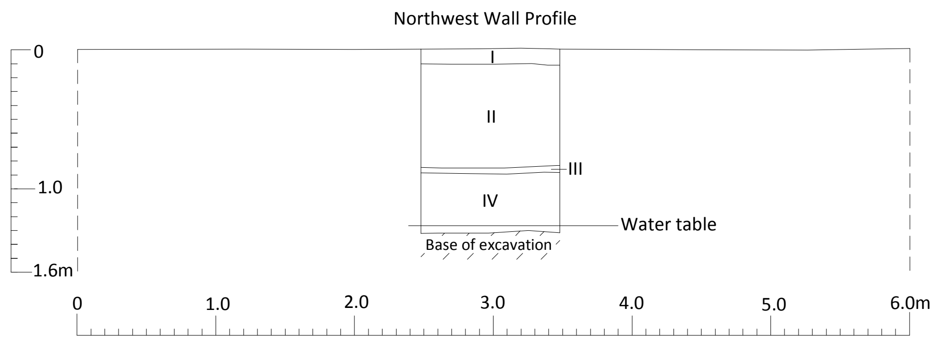
Figure B-231. Profile of BT-E-17-1



Layer I - Very dark gray (7.5YR 3/1) to dark brown (7.5YR 3/2) fine fraiable clay loam; No cultural remains

Layer II - Brown (10YR 5/3) fine friable sandy clay loam; No cultural remains

Figure B-232. Profile of BT-E-17-2



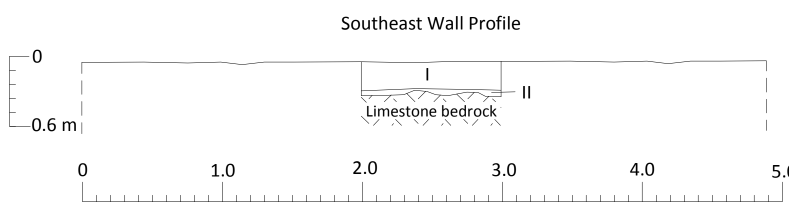
Layer I - Very dark gray (7.5YR 3/1) to dark brown (7.5YR 3/2) lfine friable clay loam; No cultural remains

Layer II - Brown (10YR 5/3) fine friable sandy clay loam; No cultural remains

Layer III - Black (7.5YR 2.5/1) loose decomposing organic material (peat); No cultural remains

Layer IV - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

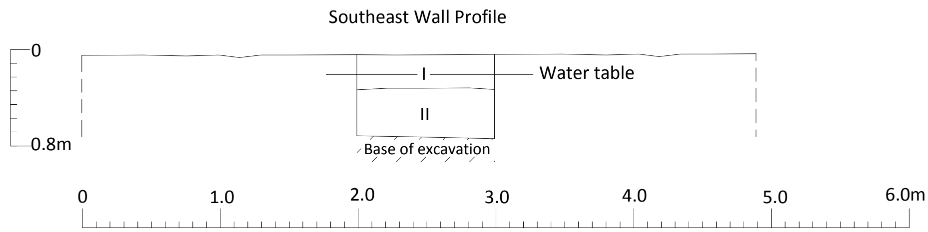
Figure B-233. Profile of BT-E-17-3



Layer I - Very dark brown (10YR 2/2) to black (10YR 2/1) fine friable clay loam with humus; No cultural remains

Layer II - Dark brown (7.5YR 3/3) fine friable clay loam; No cultural remains

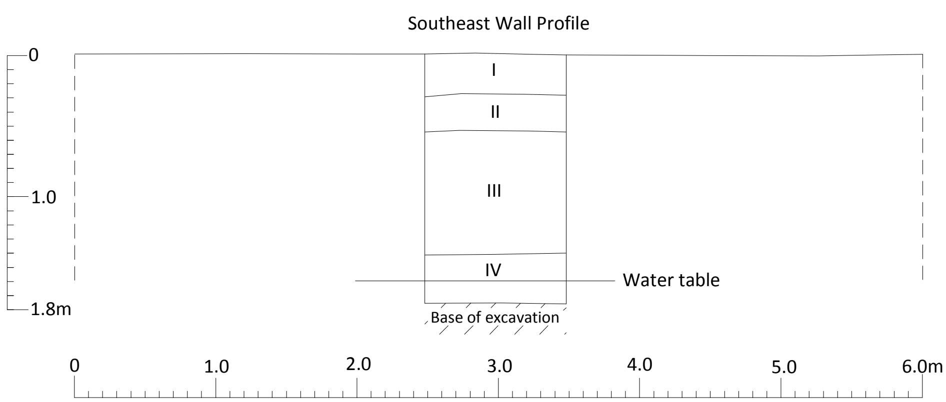
Figure B-234. Profile of BT-E-17-4



Layer I - Black (10YR 2/1) lfine friable clay loam with humus; No cultural remains

Layer II - Gray (10YR 6/1) sticky, plastic gley; No cultural remains

Figure B-235. Profile of BT-E-17-5



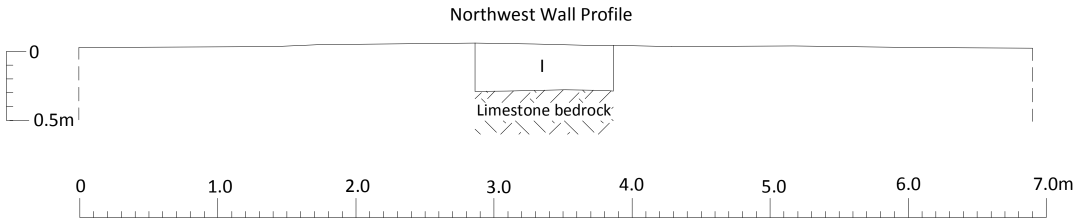
Layer I - Very dark grayish brown (10YR 3/2) fine friable slightly sandy clay loam; No cultural remains

Layer II - Light brownish gray (10YR 6/2) single grain sand; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) fine friable sandy clay loam; No cultural remains

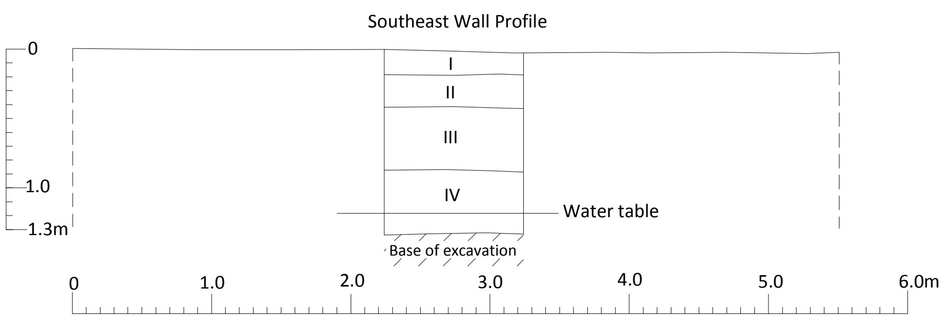
Layer IV - Weathered limestone; No cultural remains

Figure B-236. Profile of BT-E-17-6



Layer I - Very dark brown (7.5YR 2.5/2) fine friable sandy clay loam; No cultural remains

Figure B-237. Profile of BT-E-17-7



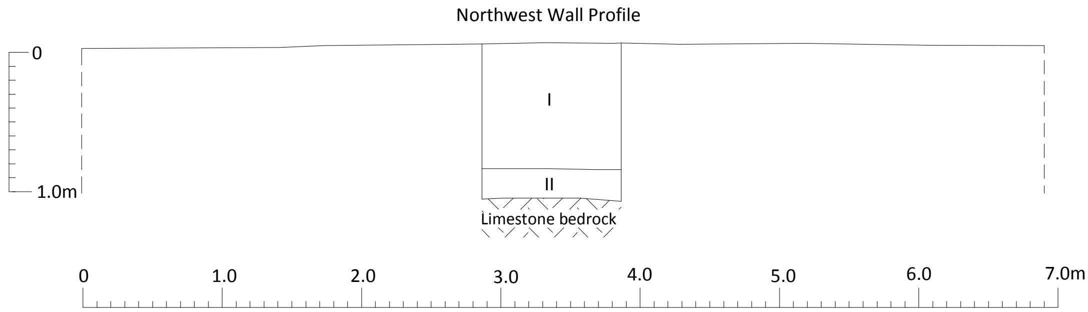
Layer I - Very dark grayish brown (10YR 3/2) fine friable clay loam with humus; No cultural remains

Layer II - Light gray (10YR 7/2) compact limestone fill; Aggregate present

Layer III - Very dark grayish brown (10YR 3/2) compact sandy clay loam; Asphalt fragments present

Layer IV - Pale brown (10YR 6/3) massive clay; No cultural remains

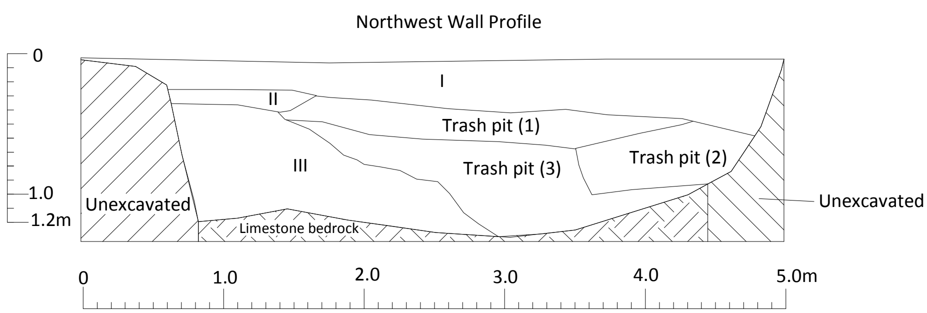
Figure B-238. Profile of BT-E-17-8



Layer I - Dark brown (10YR 3/3) to dark yellowish brown (10YR 4/4) fine friable clay loam; Metal wire present

Layer II - Dark grayish brown (10YR 4/2) massive clay; No cultural remains

Figure B-239. Profile of BT-E-17-9



Layer I - Dark brown (7.5YR 3/2) fvery fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable sandy loam; No cultural remains

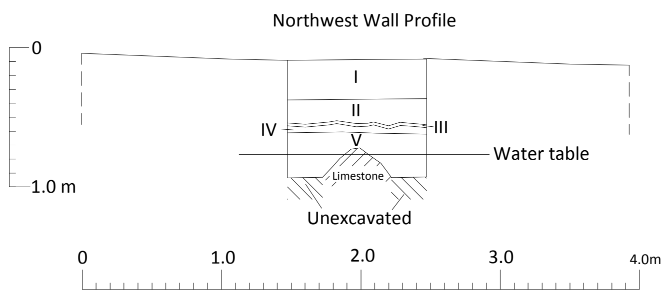
Layer III - Brownish yellow (10YR 6/6) weathered limestone sand; No cultural remains

Trash pit (Layer 1) - Yellowish brown (10YR 5/4) fine friable sandy clay loam pit fill; Glass bottle and charcoal present

Trash pit (Layer 2) - Dark brown (7.5YR 3/4) fine friable sandy loam pit fill; No cultural remains

Trash pit (Layer 3) - Brown (10YR 4/3) fine friable clay loam pit fill; Ceramics, nails, burned wood and charcoal present

Figure B-240. Profile of BT-E-18-1



Layer I - Very dark brown (7.5YR 2.5/2) fine friable clay loam; No cultural remains

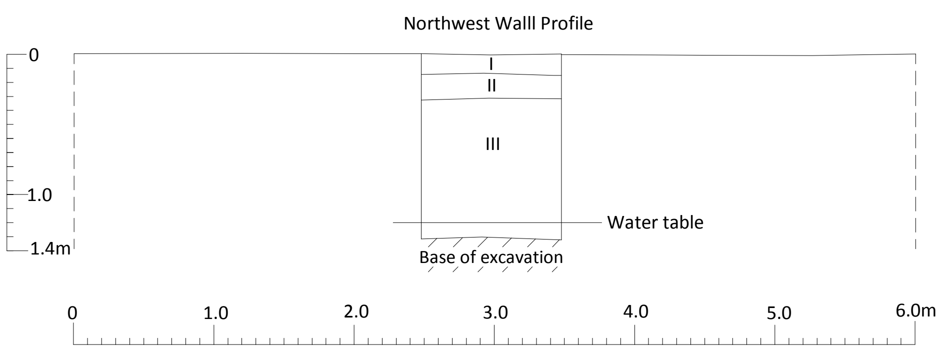
Layer II - Brown (10YR 4/3) fine friable clay loam; No cultural remains

Layer III - Black (10YR 2/1) loose decomposing organic material; No cultural remains

Layer IV - Dark brown (7.5YR 3/3) fine friable clay loam alluvium; No cultural remains

Layer V - Dark gray (7.5YR 4/1) non-plastic, sticky gley; No cultural remains

Figure B-241. Profile of BT-E-18-2

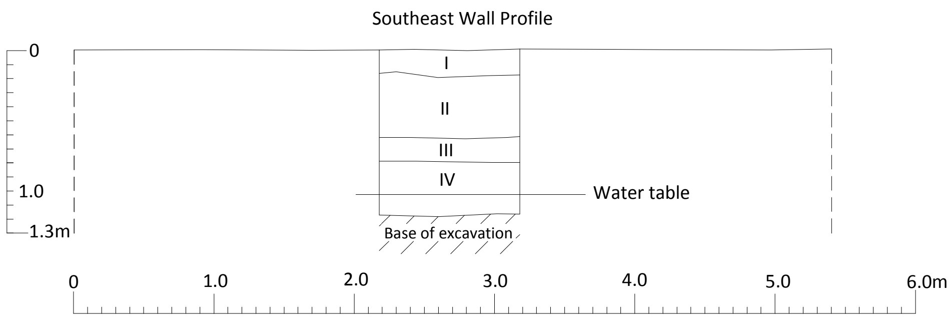


Layer I - Very dark gray (7.5YR 3/1) fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) fine friable clay loam; No cultural remains

Layer III - Brownish yellow (10YR 6/6) weathered conglomerate; No cultural remains

Figure B-242. Profile of BT-E-18-3



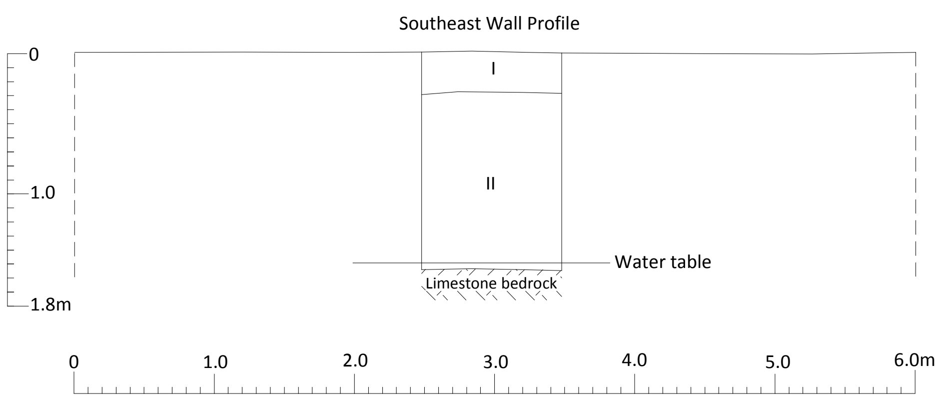
Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) fine friable clay loam alluvium; No cultural remains

Layer III - Dark yellowish brown (10YR 4/4) fine friable clay loam alluvium; No cultural remains

Layer IV - Very pale brown (10YR 8/2) weathered conglomerate; No cultural remains

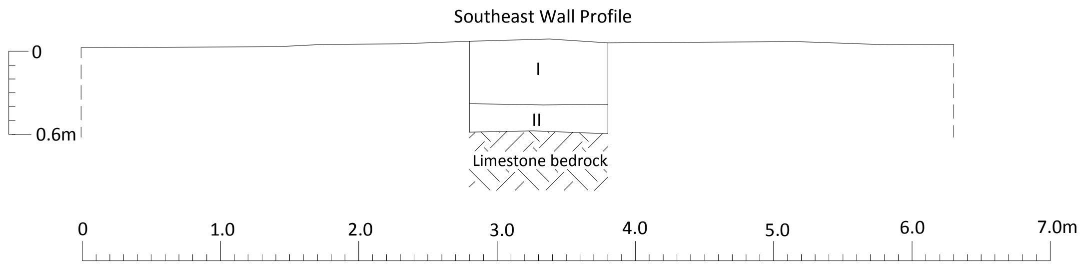
Figure B-243. Profile of BT-E-18-4



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) loose sandy loam; No cultural remains

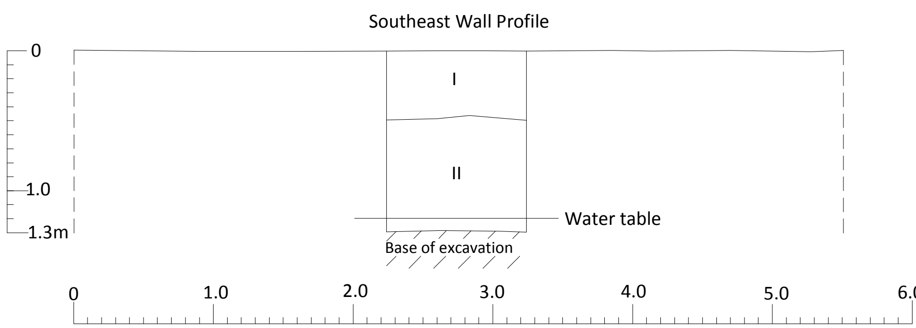
Figure B-244. Profile of BT-E-18-5



Layer I - Very dark grayish brown (10YR 3/2) fine friable clay loam; Metal wire present

Layer II - Dark grayish brown (10YR 4/2) fine friable clay loam; No cultural remains

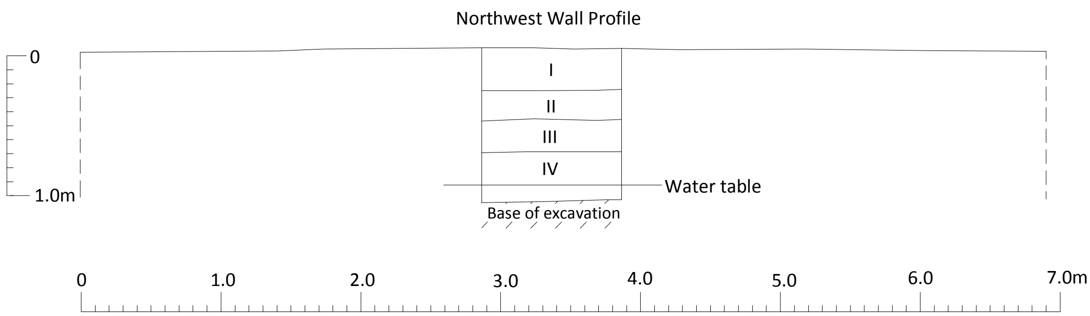
Figure B-245. Profile of BT-E-18-6



Layer I - Very dark grayish brown (10YR 3/2) loose sandy clay loam; Plastic fragments present

Layer II - Very pale brown (10YR 8/2) weathered limestone with pockets of brown (10YR 5/3) clay; No cultural remains

Figure B-246. Profile of BT-E-18-7



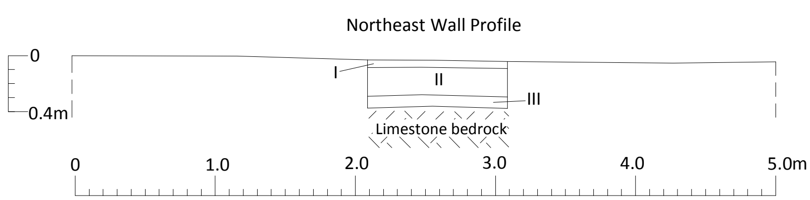
Layer I - Very dark grayish brown (10YR 3/2) loose sandy clay loam; Plastic fragments and bottle glass present

Layer II - Dark brown (10YR 3/3) compact sandy clay loam; No cultural remains

Layer III - Brown (10YR 4/3) massive clay; No cultural remains

Layer IV - Light gray (10YR 7/2) weathered limestone; No cultural remains

Figure B-247. Profile of BT-E-18-8

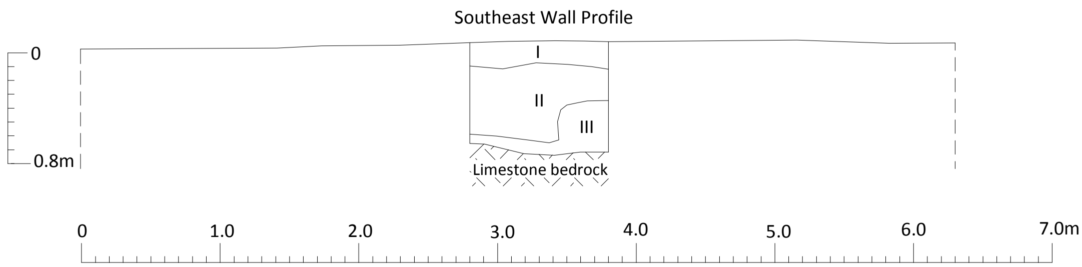


Layer I - Dark brown (10YR 3/3) structureless clay loam with humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) fine friable clay loam; No cultural remains

Layer III - Dark yellowish brown (10YR 3/4) fine friable clay loam; No cultural remains

Figure B-248. Profile of BT-E-18-9

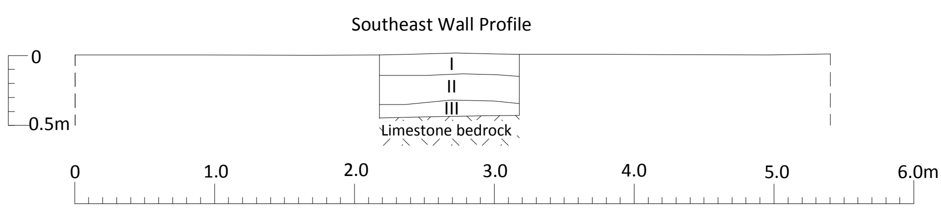


Layer I - Dark brown (7.5YR 3/2) very fine friable clay loam; No cultural remains

Layer II - Brown (10YR 5/3) very fine friable sandy loam; No cultural remains

Layer II - Dark brown (7.5YR 3/4) moderately compact clay loam; No cultural remains

Figure B-249. Profile of BT-E-19-1

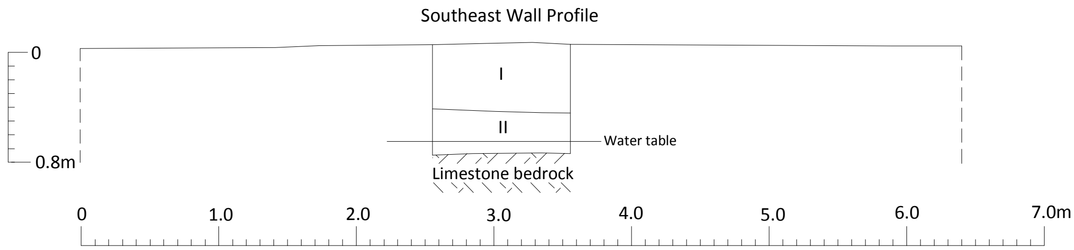


Layer I - Very dark grayish brown (10YR 3/2)very fine friable clay loam; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) very fine friable clay loam; No cultural remains

Layer III - Dark brown (10YR 3/3) moderately compact clay; No cultural remains

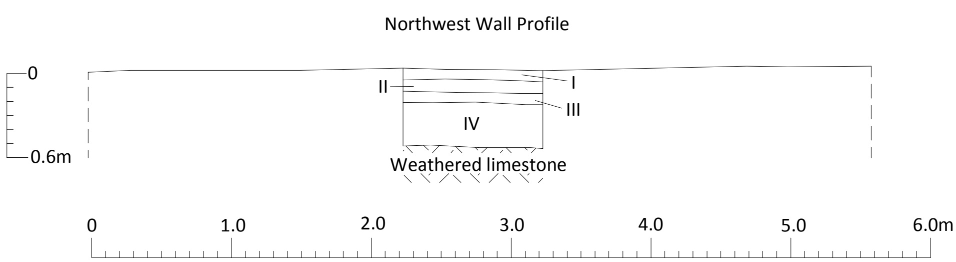
Figure B-250. Profile of BT-E-19-2



Layer I - Very dark grayish brown (10YR 3/2) loose silty clay loam; No cultural remains

Layer II - Dark gray (10YR 4/1) to dark grayish brown (10YR 4/2) compact, saturated gley; No cultural remains

Figure B-251. Profile of BT-E-19-3



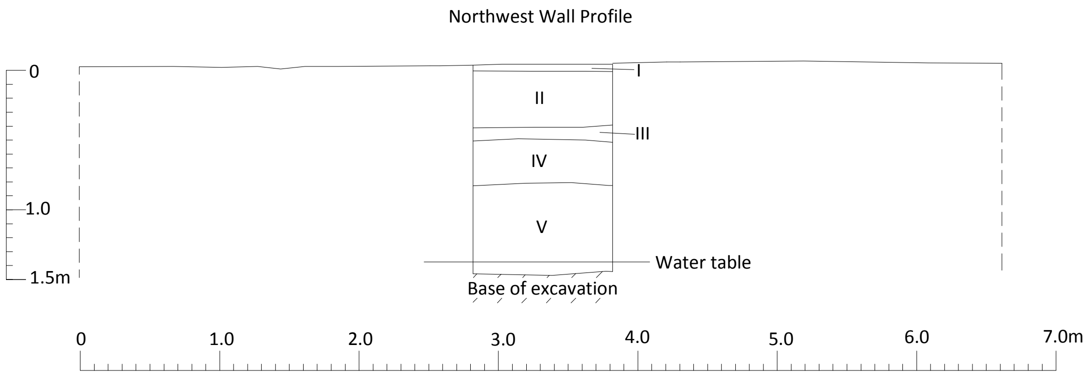
Layer I - Black (7.5YR 2.5/1) to very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 5/3) loose sand; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) crushed basalt; Aggregate present

Layer IV - Dark grayish brown (10YR 4/2) very fine friable sandy clay loam; No cultural remains

Figure B-252. Profile of BT-E-19-4



Layer I - Black (10YR 2/1) structureless humus; No cultural remains

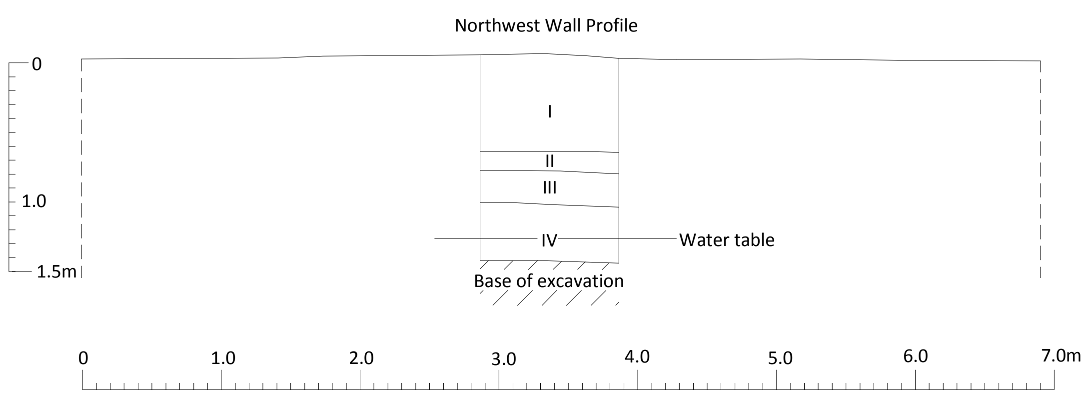
Layer II - Brown (10YR 4/3) loose silty sand fill; PVC pipe present

Layer III - Black (10YR 2/1) compact limestone fill; Aggregate present

Layer IV - Very dark grayish brown (10YR 3/2) very fine friable sandy clay loam; No cultural remains

Layer V - Dark grayish brown (10YR 4/2) massive clay; No cultural remains

Figure B-253. Profile of BT-E-19-5



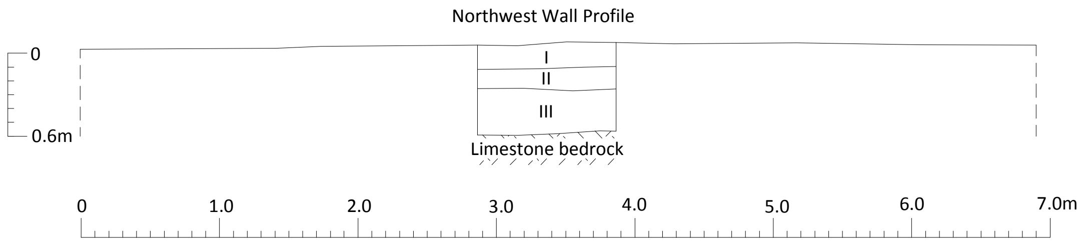
Layer I - Very dark grayish brown (10YR 3/2) to dark brown (10YR 3/3) very fine friable sandy clay loam; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) very fine friable clay loam; No cultural remains

Layer III - Brown (10YR 5/3) to grayish brown (10YR 5/2) massive clay; No cultural remains

Layer IV - Dark yellowish brown (10YR 4/4) massive clay; No cultural remains

Figure B-254. Profile of BT-E-19-6

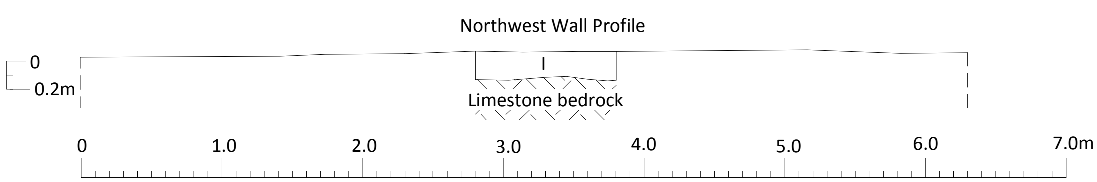


Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Brown (10YR 4/3) very fine friable clay; No cultural remains

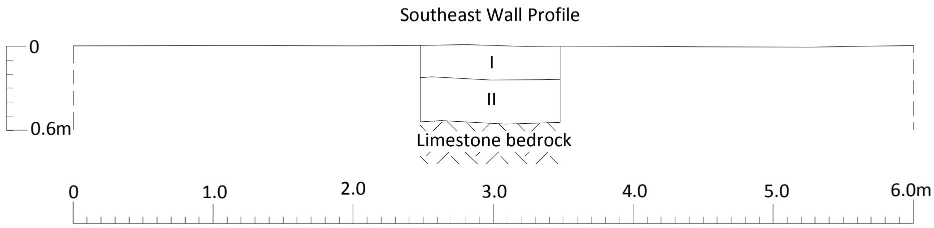
Layer III - Dark grayish brown (10YR 4/2) to dark gray (10YR 4/1)massive clay; No cultural remains

Figure B-255. Profile of BT-E-19-7



Layer I - Very dark brown (7.5YR 2.5/2) lstructureless humus; No cultural remains

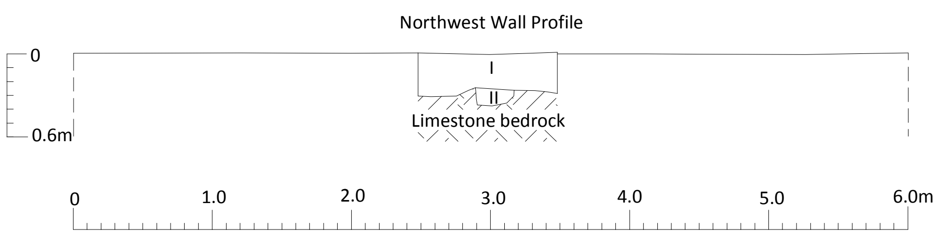
Figure B-256. Profile of BT-E-19-8



Layer I - Dark reddish brown (5YR 3/3) fine friable clay loam; No cultural remains

Layer II - Brown (10YR 4/3) loose sandy loam; No cultural remains

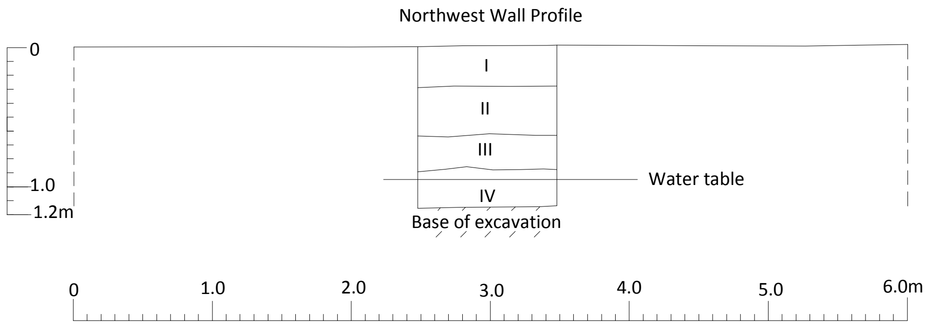
Figure B-257. Profile of BT-E-20-1



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/3) compact clay loam; No cultural remains

Figure B-258. Profile of BT-E-20-2



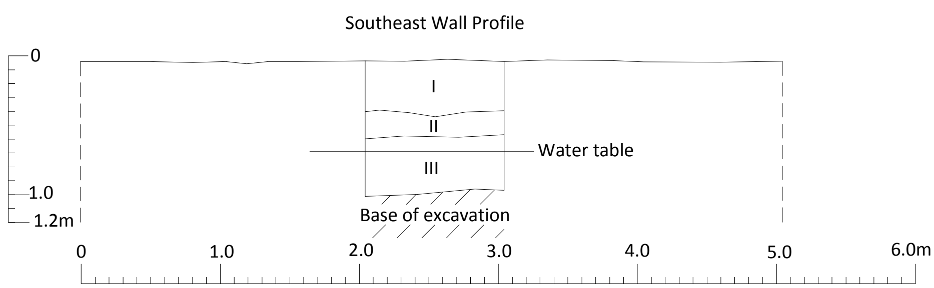
Layer I - Dark grayish brown (10YR 4/2)fine friable clay loam; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) fine friable clay loam; Aggregate present

Layer III - Brown (10YR 4/3) non-sticky, plastic clay; No cultural remains

Layer IV - Weathered limestone; No cultural remains

Figure B-259. Profile of BT-E-20-3

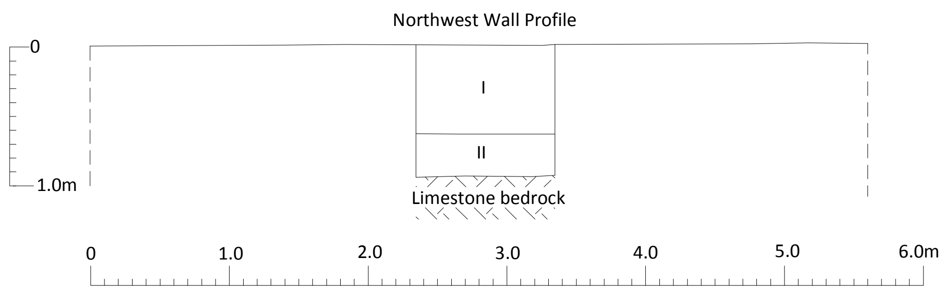


Layer I - Dark grayish brown (10YR 4/2) loose clay loam; Aggregate present

Layer II - Brown (10YR 4/3) compact clay alluvium; No cultural remains

Layer III - Dark gray (10YR 4/1) sticky, plastic gley; No cultural remains

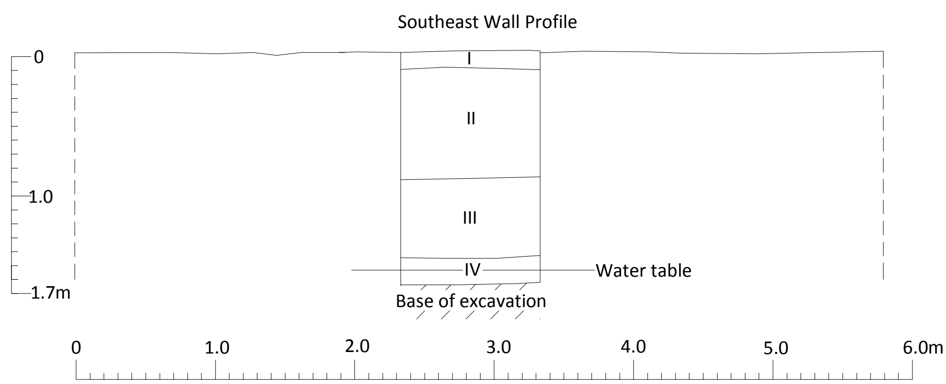
Figure B-260. Profile of BT-E-20-4



Layer I - Brown (10YR 4/3)single grain sand; Aggregate present

Layer II - Dark grayish brown (10YR 4/2) fine friable sandy clay loam; No cultural remains

Figure B-261. Profile of BT-E-20-5



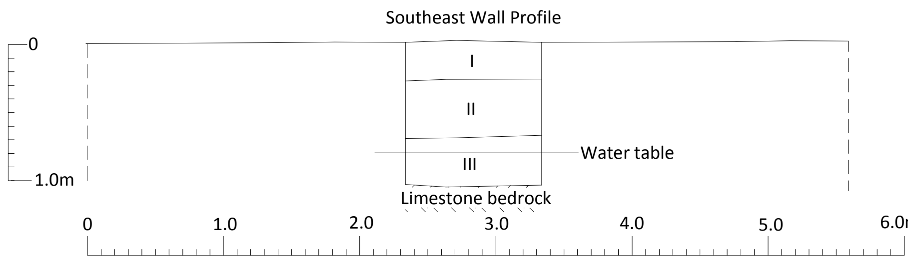
Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/3) fine friable clay loam; No cultural remains

Layer III - Pinkish white (7.5YR 8/2) weathered limestone; No cultural remains

Layer IV - Dark gray (10YR 4/1) non-sticky, non-plastic gley; No cultural remains

Figure B-262. Profile of BT-E-20-6

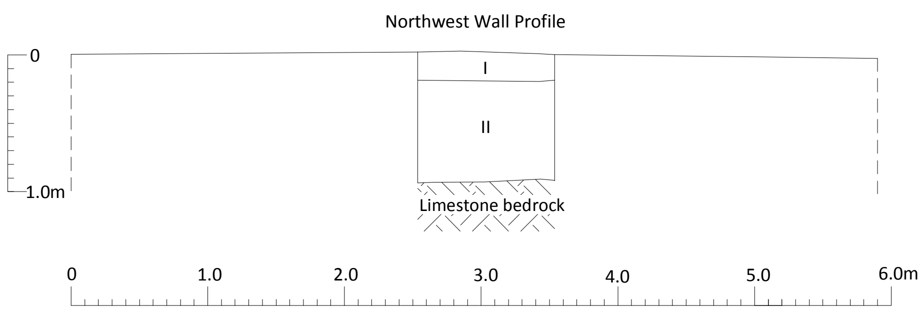


Layer I - Very dark grayish brown (10YR 3/2) fine friable silty loam; No cultural remains

Layer II - Light brownish gray (10YR 6/2) fine friable clay loam; No cultural remains

Layer III - Dark gray (10YR 4/1) non-sticky, plastic gley; No cultural remains

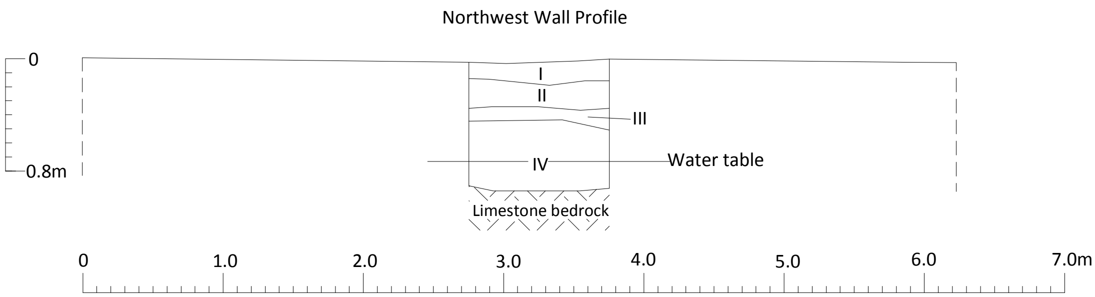
Figure B-263. Profile of BT-E-20-7



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2) fine friable silty clay loam; Plastic, glass, metal, fabric, milled lumber and aluminum cans present

Figure B-264. Profile of BT-E-21-1



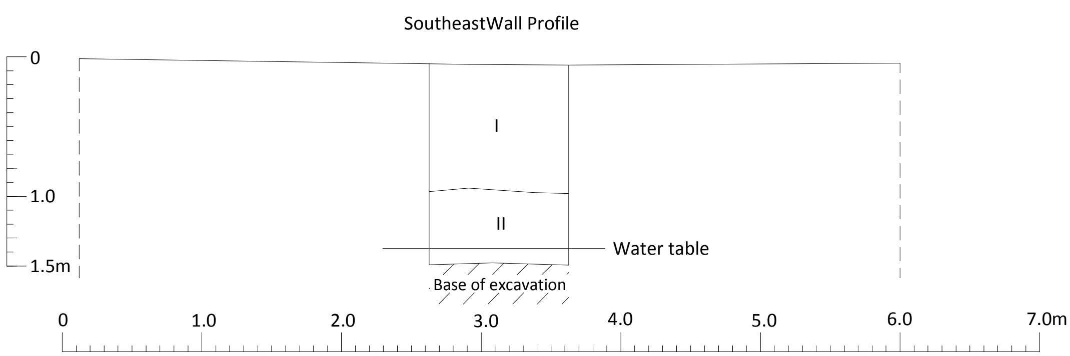
Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Light gray (10YR 7/2) compact limestone and clay; No cultural remains

Layer III - Brown (10YR 5/3) non-sticky, plastic clay; No cultural remains

Layer IV - Dark greenish gray (Gley 10Y 4/1) sticky, plastic gley; No cultural remains

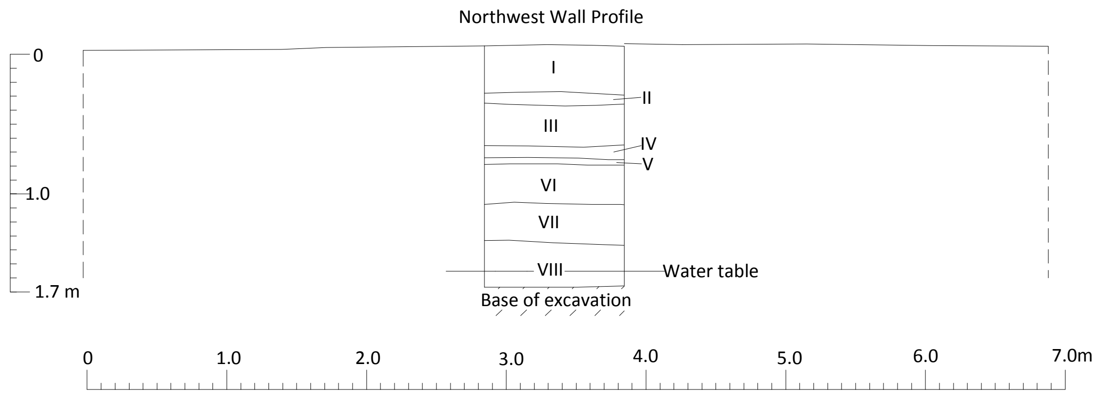
Figure B-265. Profile of BT-E-21-2



Layer I - Brown (10YR 4/3) to dark grayish brown (10YR 4/2) loose silty loam; Plastic pipe present

Layer II - Light brownish gray (10YR 6/2) to pale brown (10YR 6/3) weathered limestone; No cultural remains

Figure B-266. Profile of BT-E-21-3



Layer I - Dark reddish brown (5YR 3/4) very fine friable clay; No cultural remains

Layer II - Brown (10YR 4/3) to yellowish brown (10YR 5/4) fine slighlty clayey silt; Aggregate present

Layer III - Dark brown (7.5YR 3/3) massive clay; No cultural remains

Layer IV - Very dark brown (10YR 2/2) very fine friable sandy clay; Aggregate present

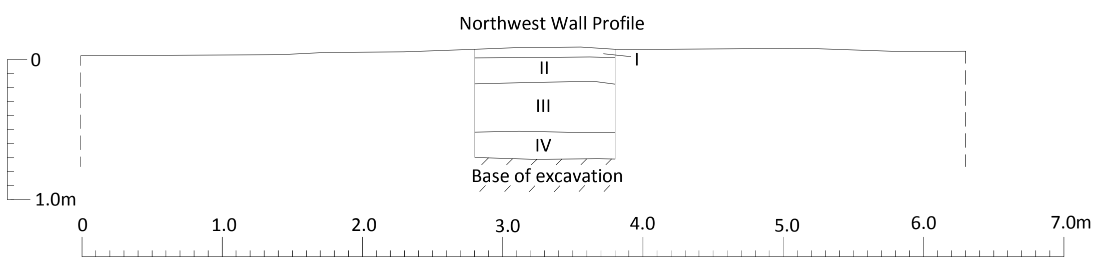
Layer V - Dark brown (10YR 3/3) very fine friable clay; No cultural remains

Layer VI - Light gray (10YR 7/2) weathered limestone; No cultural remains

Layer VII - Brown (10YR 4/3) massive clay; No cultural remains

Layer VIII - Pale brown (10YR 6/3) weathered limestone; No cultural remains

Figure B-267. Profile of BT-E-21-4



Layer I - Very dark grayish brown (10YR 3/2) very fine friable sandy loam recent duff and fill; No cultural remains

Layer II - Very pale brown (10YR 7/3) compact limestone; Aggregate present

Layer III - Dark yellowish brown (10YR 3/4) very fine friable sandy clay loam; No cultural remains

Layer IV - Very pale brown (10YR 8/3) weathered limestone; No cultural remains

Figure B-268. Profile of BT-E-21-5

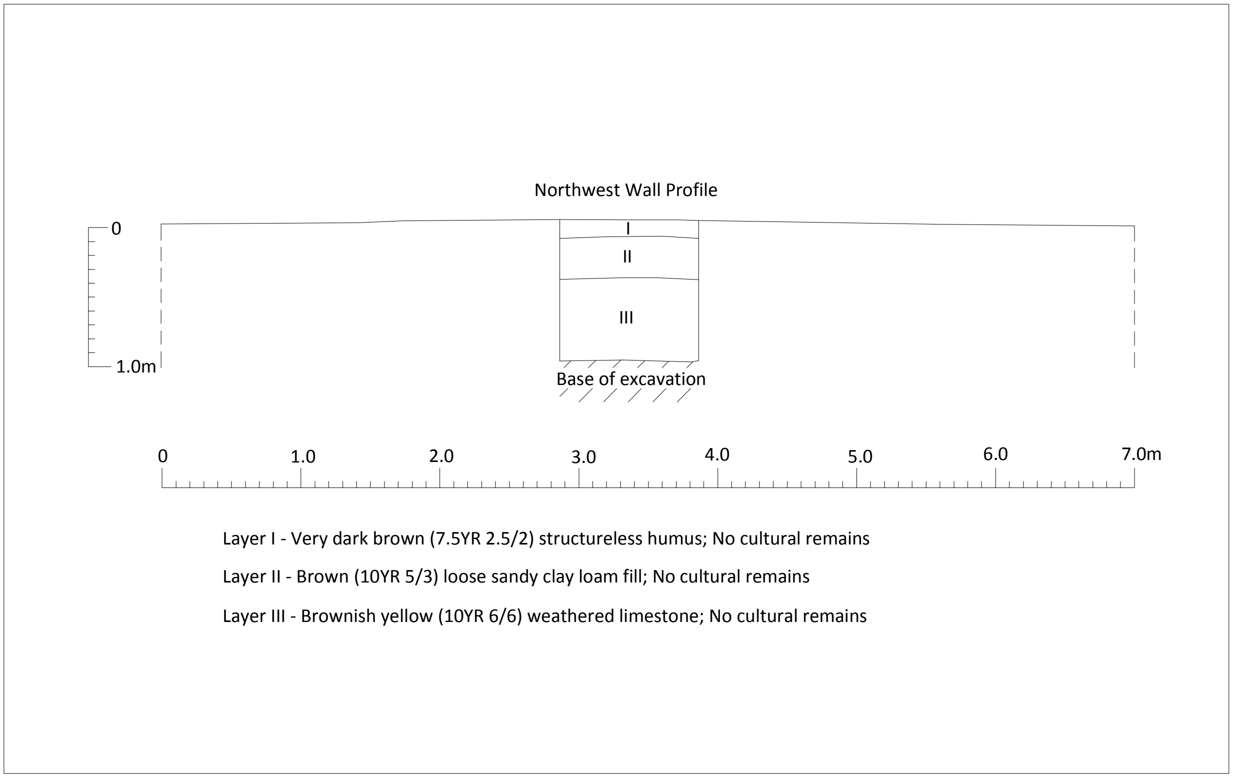


Figure B-269. Profile of BT-E-21-6

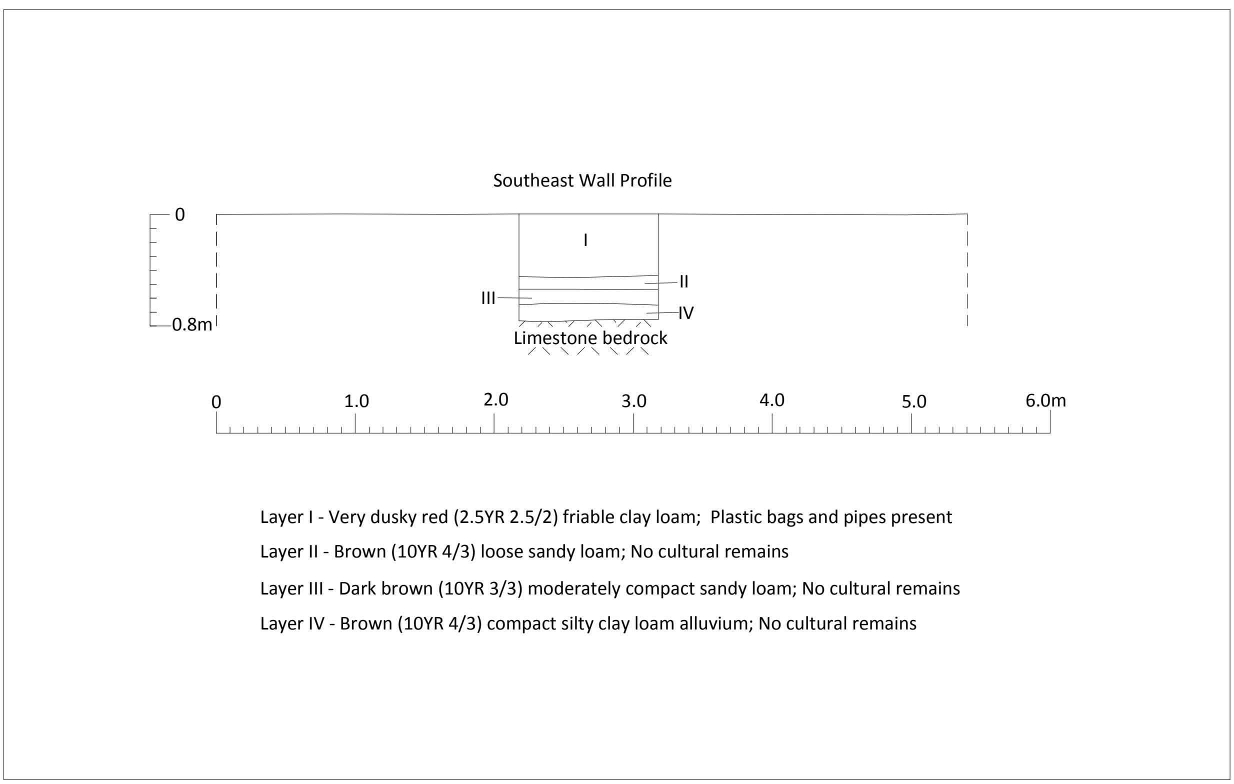


Figure B-270. Profile of BT-E-22-1

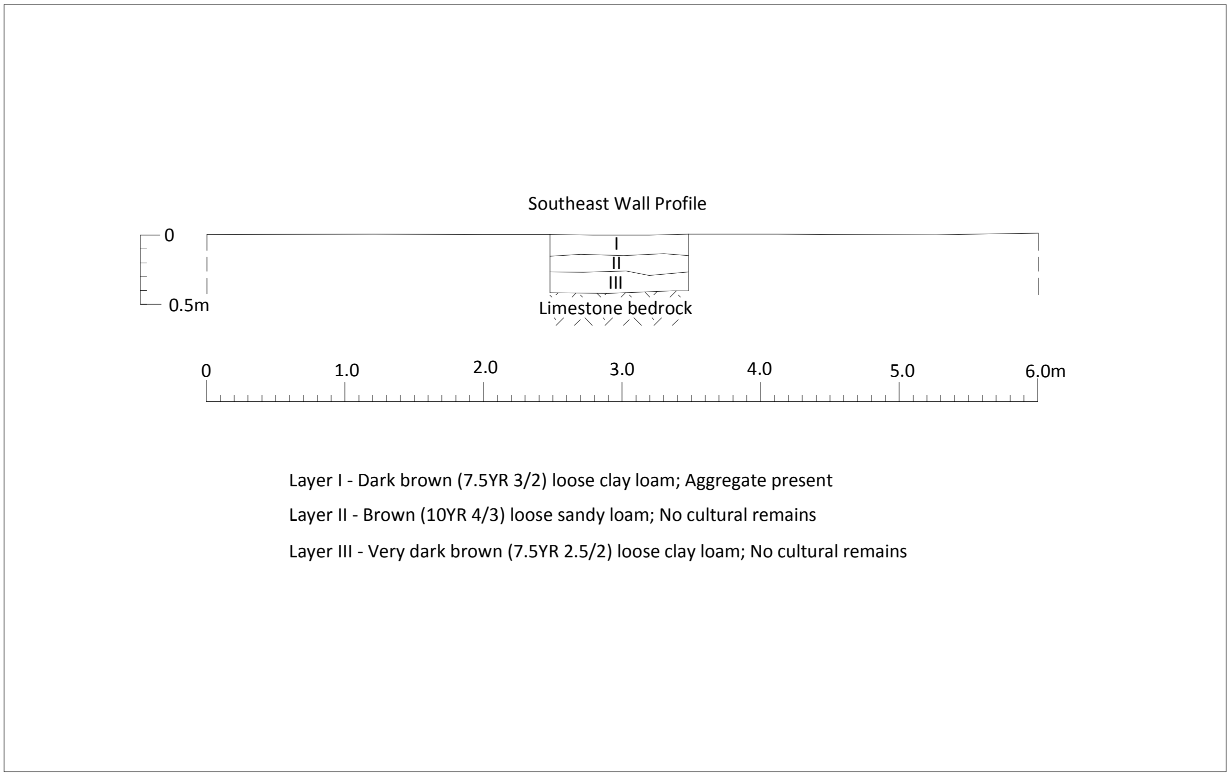


Figure B-271. Profile of BT-E-22-2

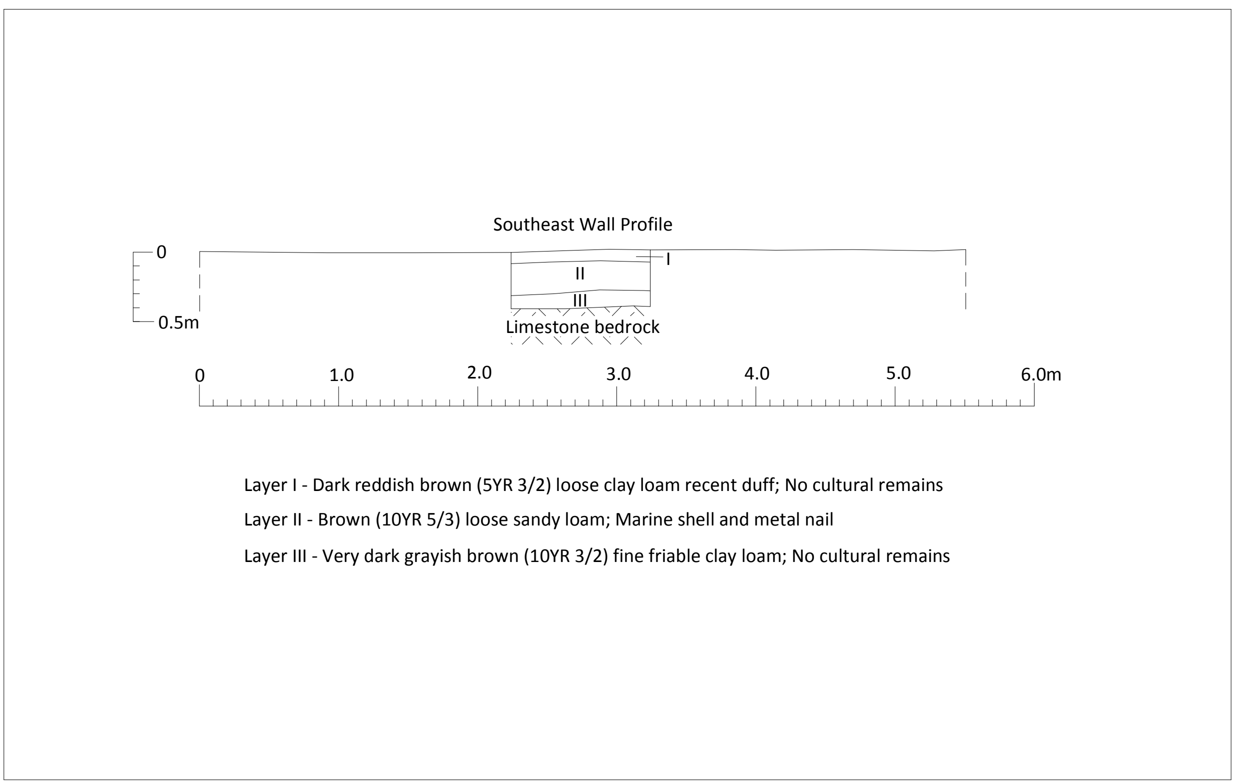
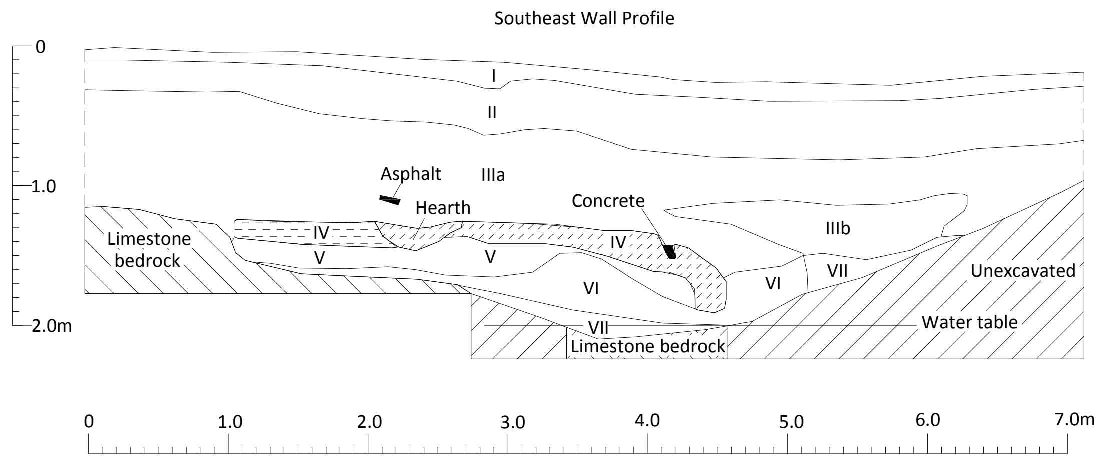


Figure B-272. Profile of BT-E-22-3



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) to dark brown (10YR 3/3) loose clay loam; Copper wire and 20% limestone aggregate for Site 7275

Layer IIIa - Dark grayish brown (10YR 4/2) to dark brown (10YR 3/3) moderately compacted clay loam; Copper wire, asphalt, concrete and 70% limestone aggregatefor Site 7275

Hearth - Black (10YR 2/1) fine friable clay loam hearth; Charcoal

Layer IIIb - Light yellowish brown (10YR 6/4) loose sand; 80% limestone aggregate for Site 7275

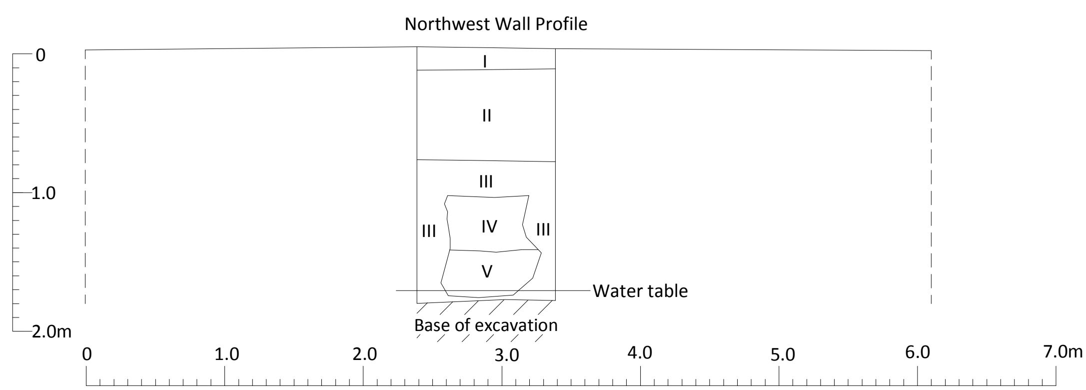
Layer IV - Black (7.5YR 2.5/1) fine friable clay loam; 7296 cultural deposit (Basalt flakes, marine shells, urchin, kukui nutshells and charcoal)

Layer V - Brown (7.5YR 4/4) very fine friable oxidized clay loam; No cultural remains

Layer VI - Very pale brown (10YR 7/3) weathered limestone; No cultural remains

Layer VII - Brown (10YR 5/3) non-sticky, plastic clay; No cultural remains

Figure B-273. Profile of BT-E-22-4



Layer I - Dark brown (7.5YR 3/2) fine friable clay loam ; No cultural remains

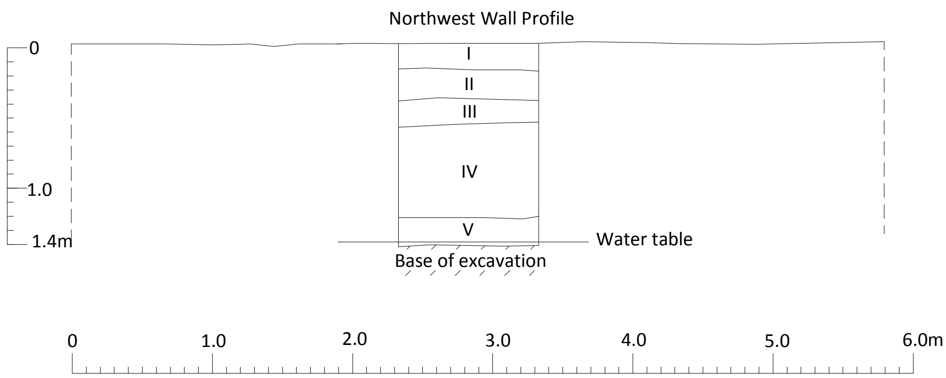
Layer II - Dark grayish brown (10YR 4/2) moderately compact sandy loam; No cultural remains

Layer III - Light brownish gray (10YR 6/2) weathered limestone; No cultural remains

Layer IV - Very dark grayish brown (10YR 3/2) fine friable clay loam; No cultural remains

Layer V - Dark grayish brown (10YR 4/2) sticky, pastic clay; No cultural remains

Figure B-274. Profile of BT-E-22-4b



Layer I - Dark grayish brown (10YR 4/2) loose clay loam; Aggregate present

Layer II - Light yellowish brown (10YR 6/4) loose clay loam; Aggregate present

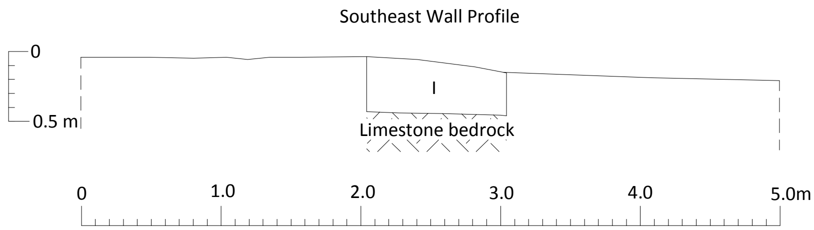
Layer III - Dark grayish brown (10YR 4/2) fine friable clay loam alluvium: No cultural remains

Layer IV - Brown (7.5YR 4/3) massive clay loam; No cultural remains

Layer V - Weathered limestone; No cultural remains

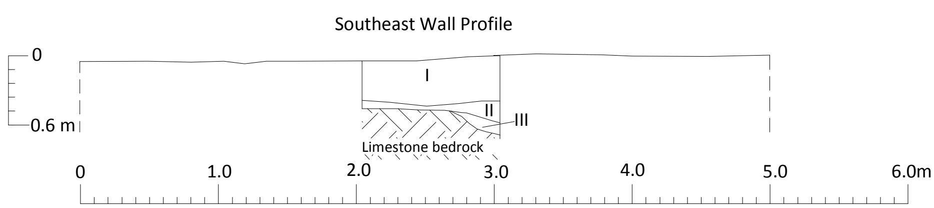
Figure B-275. Profile of BT-E-22-5

Area F Trenches



Layer I - Very dark brown (7.5YR 2.5/2) loose clay loam alluvium; No cultural remains

Figure B-276. Profile of BT-F-1-1

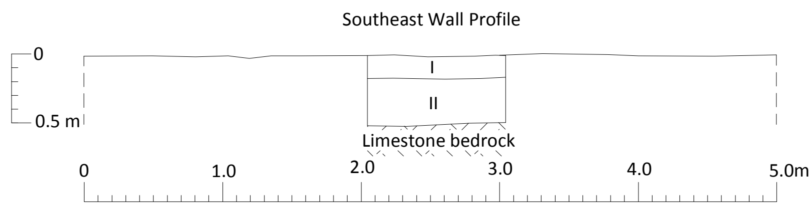


Layer I - Dark brown (7.5YR 3/3) loose clay loam with humus; Glass bottles present

Layer II - Black (5YR 2.5/1) loose clay loam buried A horizon; No cultural remains

Layer III - Brown (7.5YR 4/4) clay loam; No cultural remains

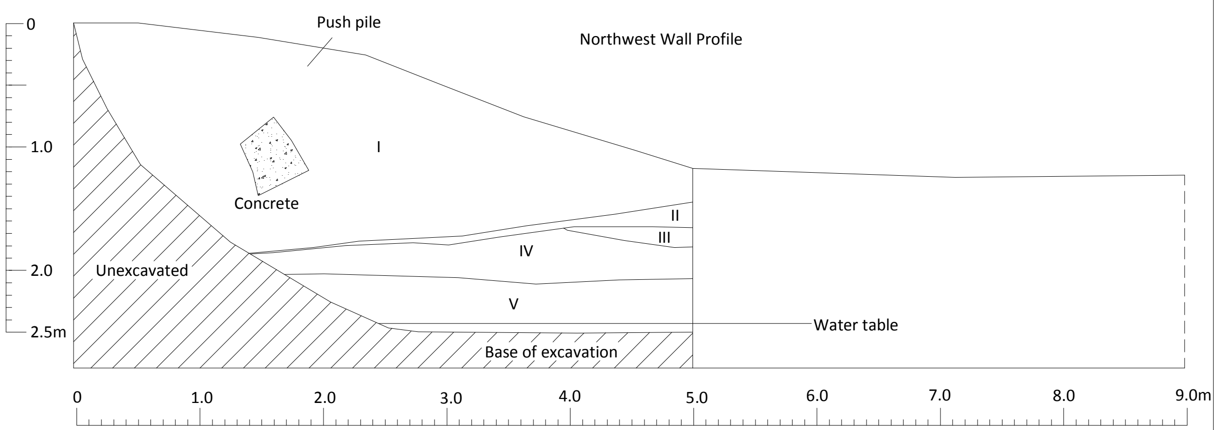
Figure B-277. Profile of BT-F-1-2



Layer I - Dark brown (7.5YR 3/3) loose clay loam with humus; Crusher rock present

Layer II - Dark brown (7.5YR 3/2) blocky clay; No cultural remains

Figure B-278. Profile of BT-F-1-3



Layer I - Dark brown (7.5YR 3/2) loose redeposited clay loam;Concrete present

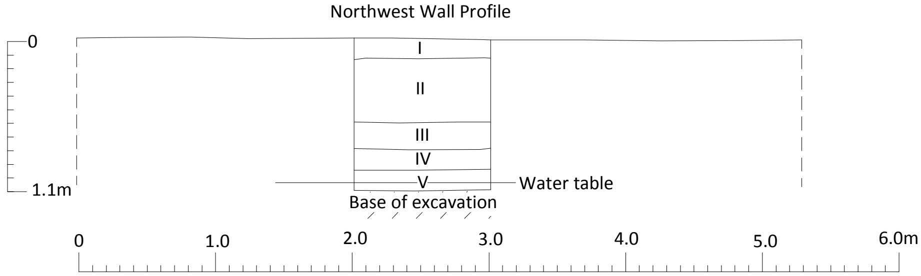
Layer II - Black (7.5YR 2/1) friable clay loam and decomposing organic layer; No cultural remains

Layer III - Dark brown (7.5YR 3/3) friable clay alluvium; No cultural remains

Layer IV - Very dark grayish brown (10YR 3/2) compact clay; No cultural remains

Layer V - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-279. Profile of BT-F-2-1



Layer I - Very dark gray (7.5YR 3/1) loose clay loam with humus; No cultural remains

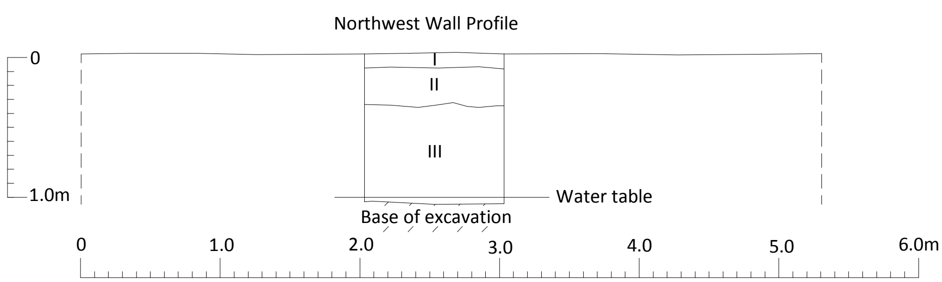
Layer II - Brown (7.5YR 4/3) friable clay alluvium; No cultural remains

Layer III - Very dark gray (10YR 3/1) compact clay alluvium; No cultural remains

Layer IV - Gray (10YR 5/1) `saturated gley; No cultural remains

Layer V - Very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2) peat; No cultural remains

Figure B-280. Profile of BT-F-2-2

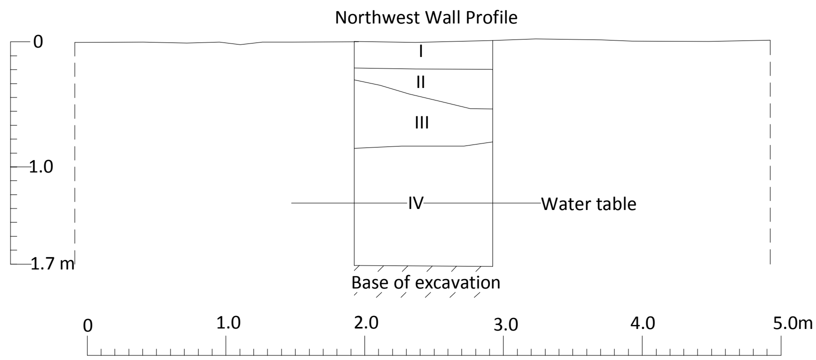


Layer I - Very dark gray (7.5YR 3/1) loose clay loam with humus; No cultural remains

Layer II - Brown (7.5YR 4/3) friable clay alluvium; No cultural remains

Layer III - Very dark gray (10YR 3/1) saturated gley; No cultural remains

Figure B-281. Profile of BT-F-2-3



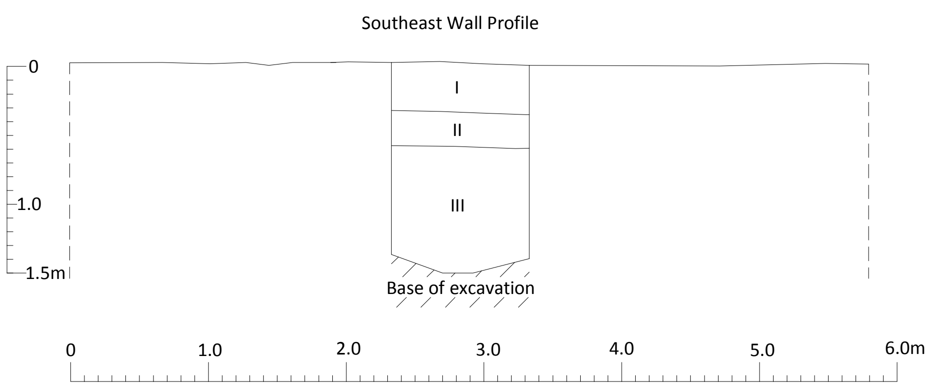
Layer I - Very dark gray (7.5YR 3/1) loose clay loam with humus; No cultural remains

Layer II - Brown (7.5YR 4/4) loose clayey sand; No cultural remains

Layer III - Brown (7.5YR 4/3) friable clay alluvium; No cultural remains

Layer IV - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-282. Profile of BT-F-2-4

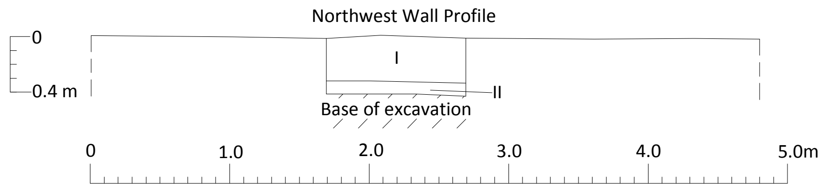


Layer I - Very dark grayish brown (10YR 3/2) friable clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/2) blocky clay; No cultural remains

Layer III - Very pale brown (10YR 8/3 to 10YR 7/3) weathered limestone; No cultural remains

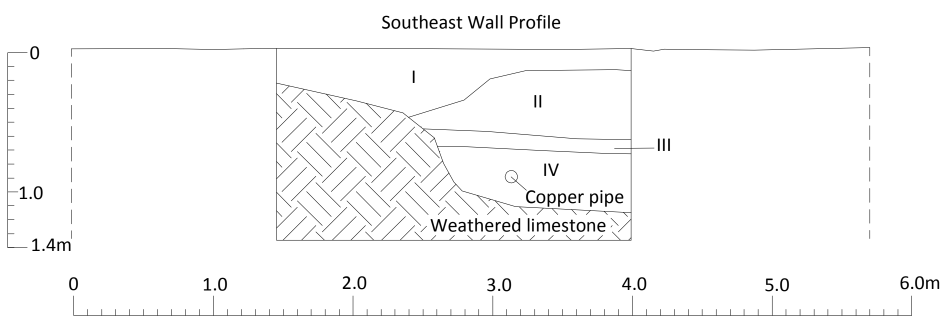
Figure B-283. Profile of BT-F-2-5



Layer I - Pale brown (10YR 6/3) compact sand fill; No cultural remains

Layer II - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-284. Profile of BT-F-2-6



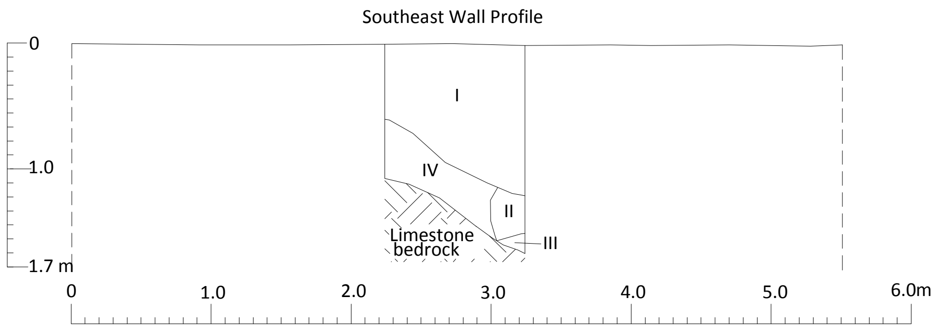
Layer I - Dark brown (7.5YR 3/3) friable clay; No cultural remains

Layer II - Light brownish gray (10YR 6/2) loose sand fill; No cultural remains

Layer III - Light brownish gray (10YR 6/2) friable clay and sand fill; No cultural remains

Layer IV - Pale brown (10YR 6/3) compact sand fill; Copper pipe present

Figure B-285. Profile of BT-F-2-7



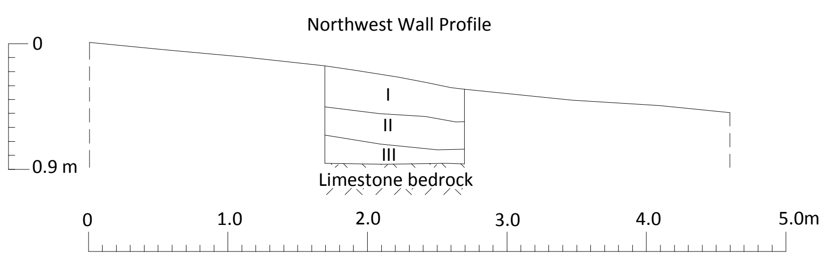
Layer I - Very dark brown (7.5YR 2.5/2) loose clay loam; Barbed wire present

Layer II - Dark brown (7.5YR 3/2) to dark gray (10YR 4/1) friable clay alluvium; No cultural remains

Layer III - Dark gray (10YR 4/1) saturated gley; No cultural remains

Layer IV - Yellowish brown (10YR 5/4) loose sand; No cultural remains

Figure B-286. Profile of BT-F-3-1

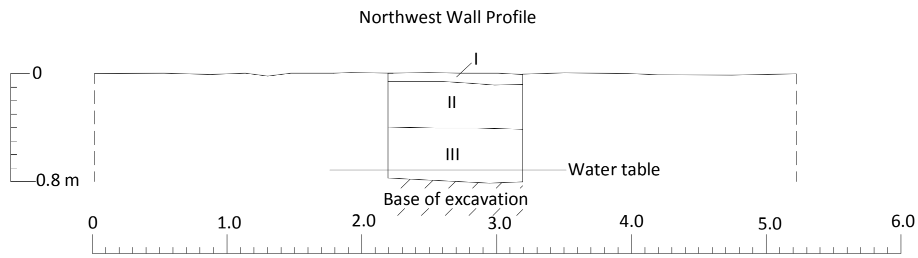


Layer I - Dark brown (7.5YR 3/2) friable silty clay alluvium; No cultural remains

Layer II - Reddish yellow (7.5YR 6/6) loose sand; No cultural remains

Layer III - Dark brown (7.5YR 3/2) friable clay loam; No cultural remains

Figure B-287. Profile of BT-F-3-2

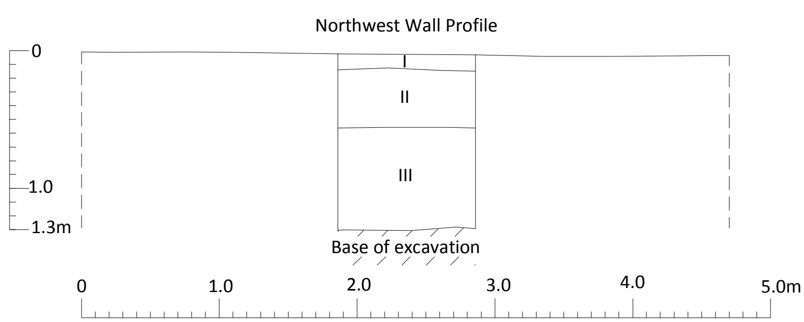


Layer I - Very dark gray (7.5YR 3/1) loose clay loam with humus; Bottle glass

Layer II - Dark brown (7.5YR 3/2 and 7.5YR 3/3) friable clay loam alluvium ; No cultural remains

Layer III - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-288. Profile of BT-F-3-3

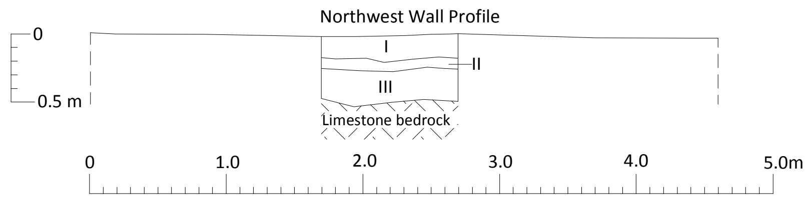


Layer I - Dark brown (7.5YR 3/2) loose clay loam with humus; No cultural remains

Layer II - Dark brown (7.5YR 3/3) loose clay; No cultural remains

Layer III - Dark gray (7.5YR 4/1) blockyclay; No cultural remains

Figure B-289. Profile of BT-F-3-4

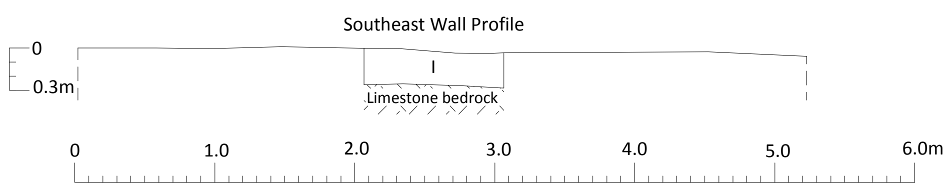


Layer I - Very dark gray (7.5YR 3/1) loose clay loam with humus; Aggregate present

Layer II - Gray (7.5YR 5/1) loose silty sand fill; Aggregate present

Layer III - Dark brown (7.5YR 3/2) friable clay loam ; No cultural remains

Figure B-290. Profile of BT-F-3-5



Layer I - Yellowish brown (10YR 5/4) to dark brown (10YR 3/3) loose sandy loam; No cultural remains

Figure B-291. Profile of BT-F-3-6

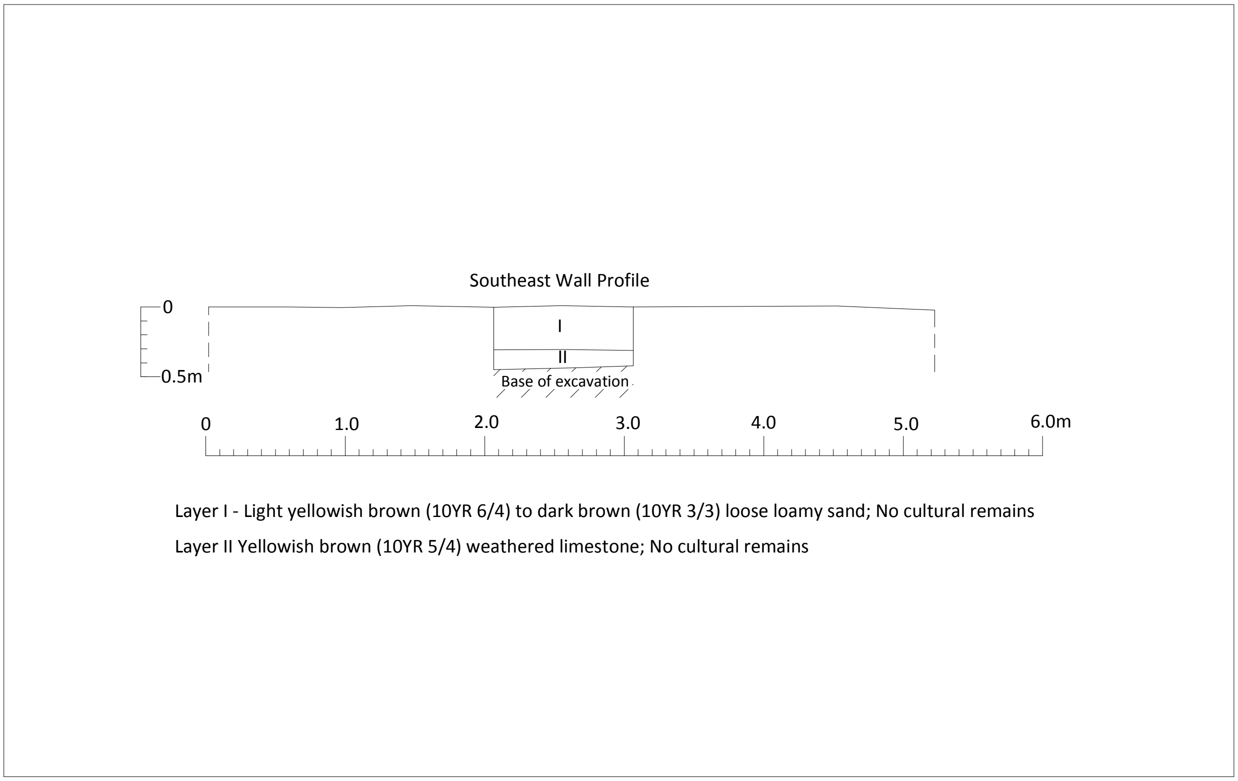


Figure B-292. Profile of BT-F-3-7

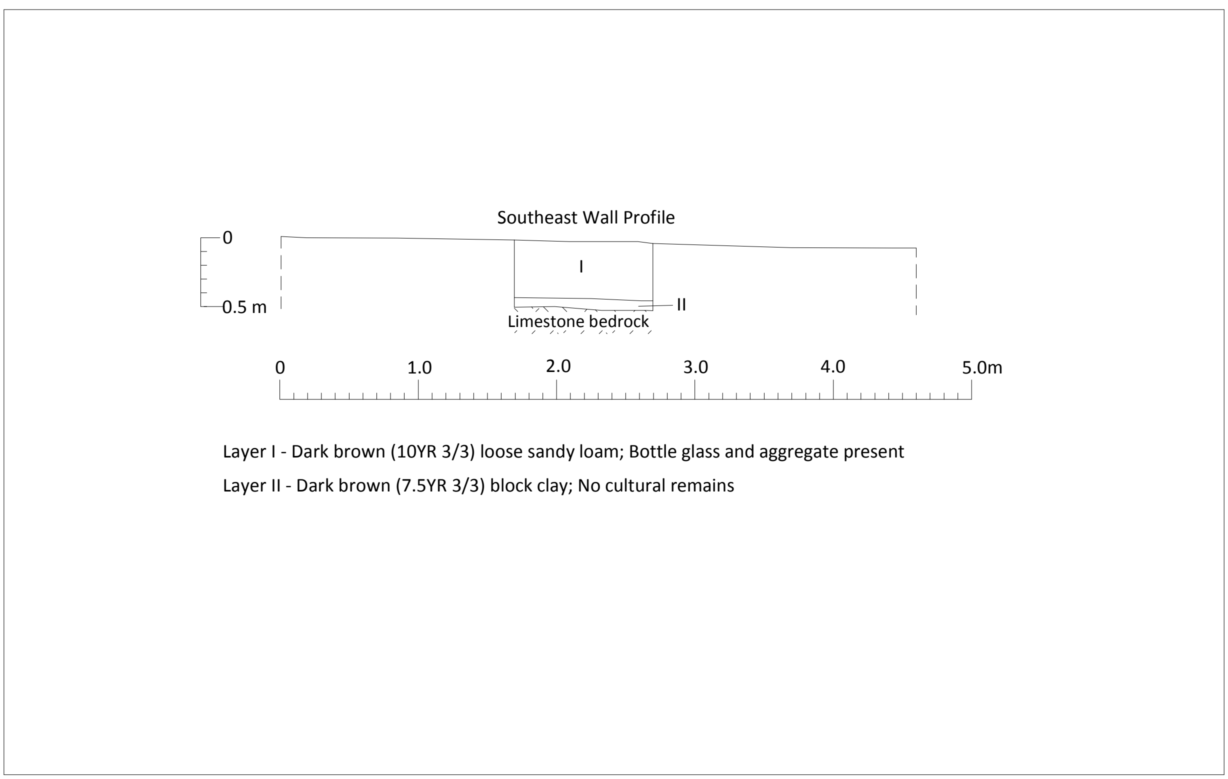
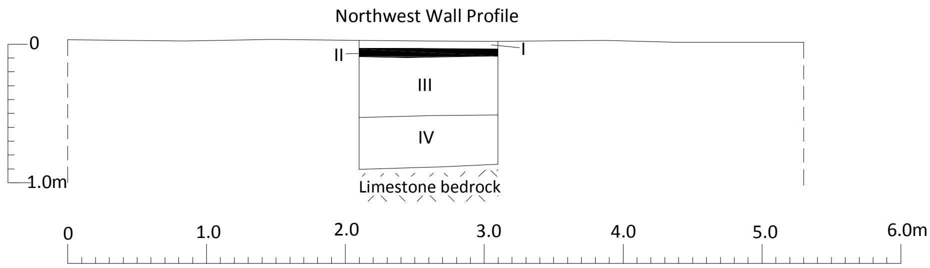


Figure B-293. Profile of BT-F-3-8



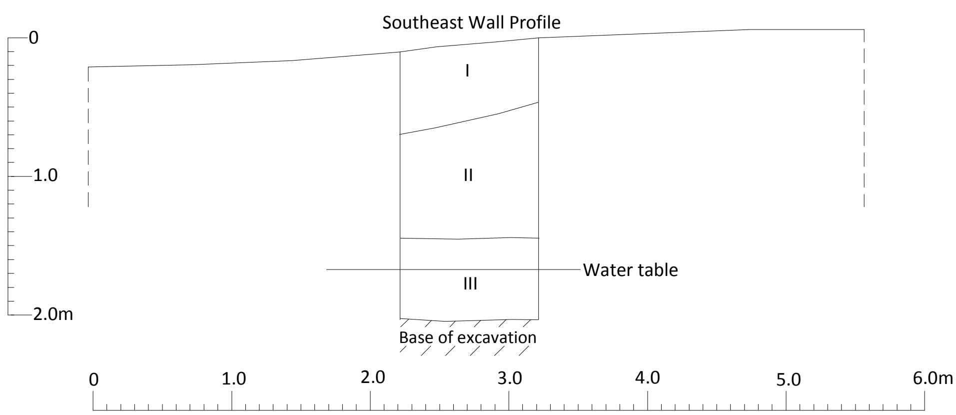
Layer I -Dusky red (2.5YR 3/4) friable sandy clay; Crusher rock present

Layer II - Black (10YR 2/1) intact asphalt layer

Layer III - Yellowish brown (10YR 5/4) to very pale brown (10YR 7/4) compact crushed limestone fill; Aggregate present

Layer IV - Brown (7.5YR 4/3) massive clay; No cultural remains

Figure B-294. Profile of BT-F-3-9



Layer I - Brown (7.5YR 4/2) to dark brown (7.5YR 3/2) loose clay loam; No cultural remains

Layer II - Brown (10YR 5/3) to light yellowish brown (10YR 6/4) sand; No cultural remains

Layer III - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-295. Profile of BT-F-4-1

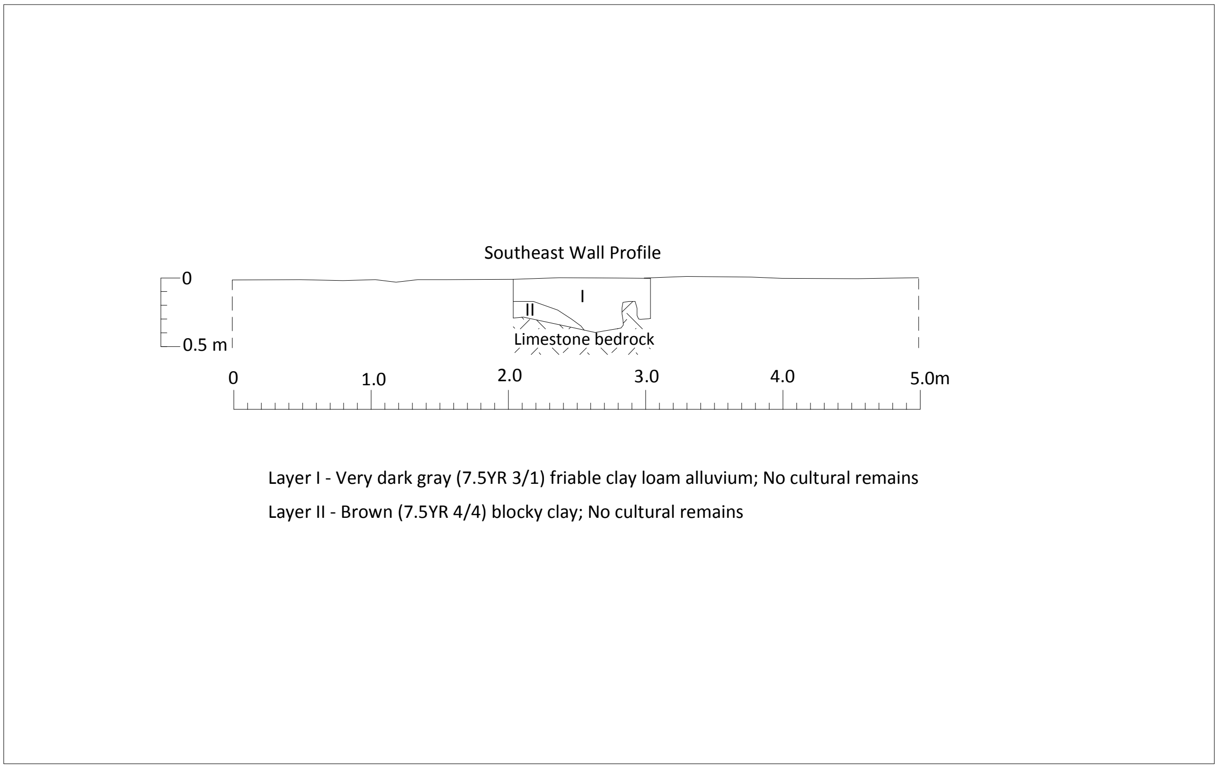


Figure B-296. Profile of BT-F-4-2

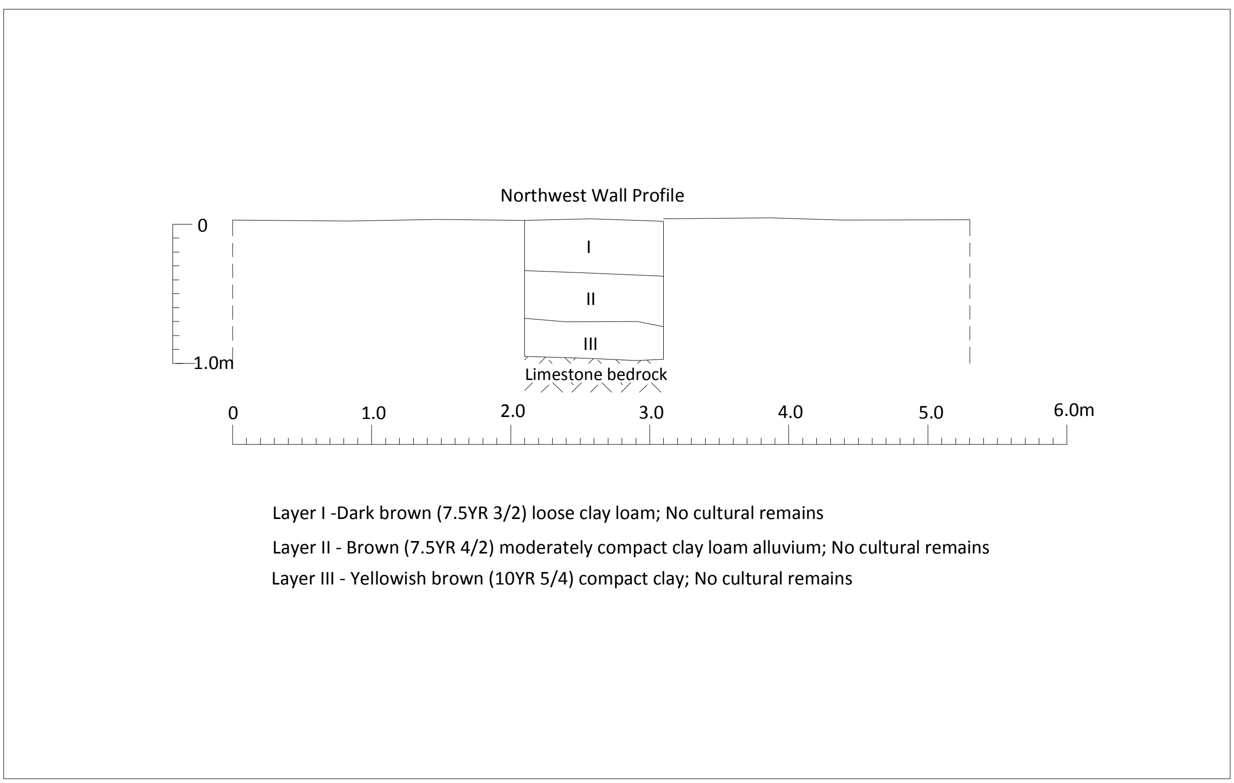
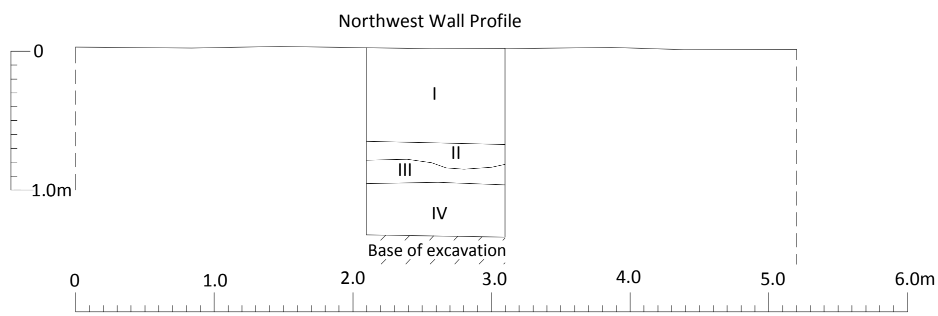


Figure B-297. Profile of BT-F-4-3



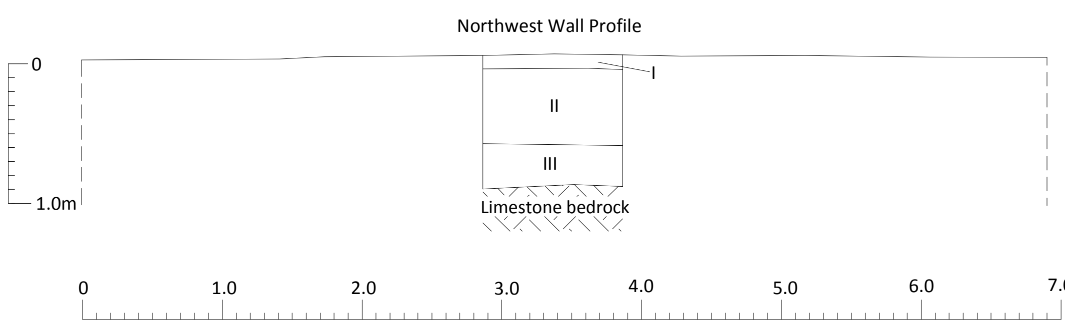
Layer I - Very dark grayish brown (10YR 3/2) friable clay loam; No cultural remains

Layer II - Very pale brown (10YR 8/2) weathered limestone; No cultural remains

Layer III - Dark brown (7.5YR 3/3) massive clay; No cultural remains

Layer IV - Very pale brown (10YR 7/3) decomposing limestone; No cultural remains

Figure B-298. Profile of BT-F-4-4

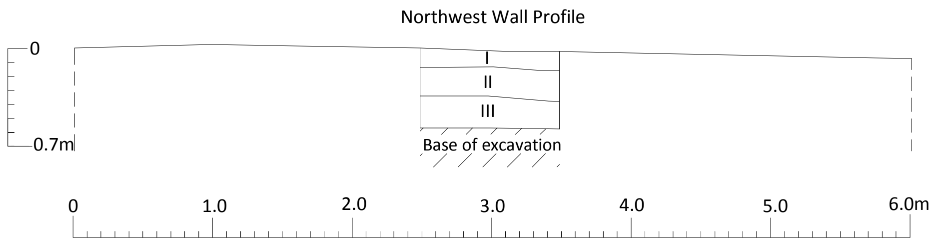


Layer I - Very dark brown (10YR 2/2) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) to very pale brown (10YR 7/3) beach sand with clay loam pockets; Fiberglass and fabric present

Layer III - Dark yellowish brown (10YR 3/4) massive clay; No cultrual remains

Figure B-299. Profile of BT-F-4-5

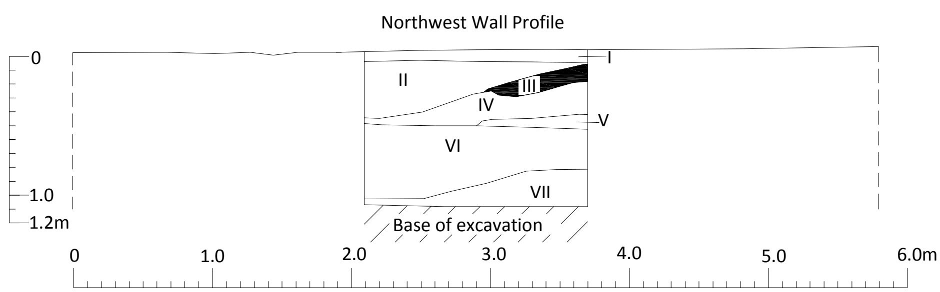


Layer I - Dark reddish brown (5YR 3/3) to brown (10YR 4/3) loose sandy clay loam; No cultural remains

Layer II - Dark brown (10YR 3/3) compact clay alluvium; No cultural remains

Layer III - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-300. Profile of BT-F-4-6



Layer I - Dark brown (10YR 3/3) structureless humus; No cultural remains

Layer II - Very dark grayish brown (10YR 3/2) to very pale brown (10YR 7/3) loose sandy clay loam; Ashpalt fragments present

Layer III - Black (10YR 2/1) intact asphalt layer

Layer IV - Pale brown (10YR 6/3) to very pale brown (10YR 8/3) compact crushed limestone fill; Aggregate present

Layer V - Grayish brown (10YR 5/2) compact basalt gravel fill; Aggregate present

Layer VI - Dark brown (7.5YR 3/3) massive clay; No cultural remains

Layer VII - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-301. Profile of BT-F-4-7

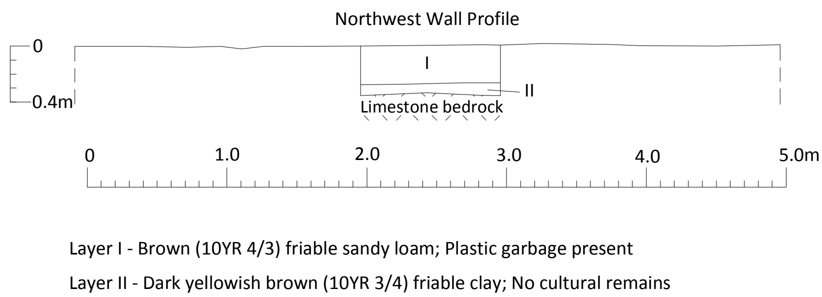


Figure B-302. Profile of BT-F-4-8

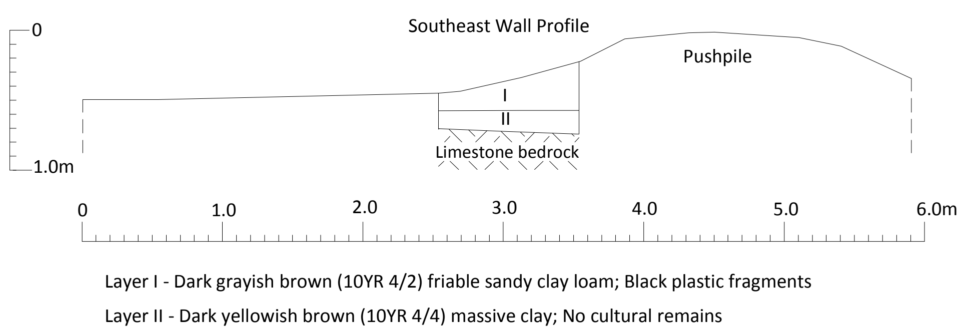


Figure B-303. Profile of BT-F-4-9

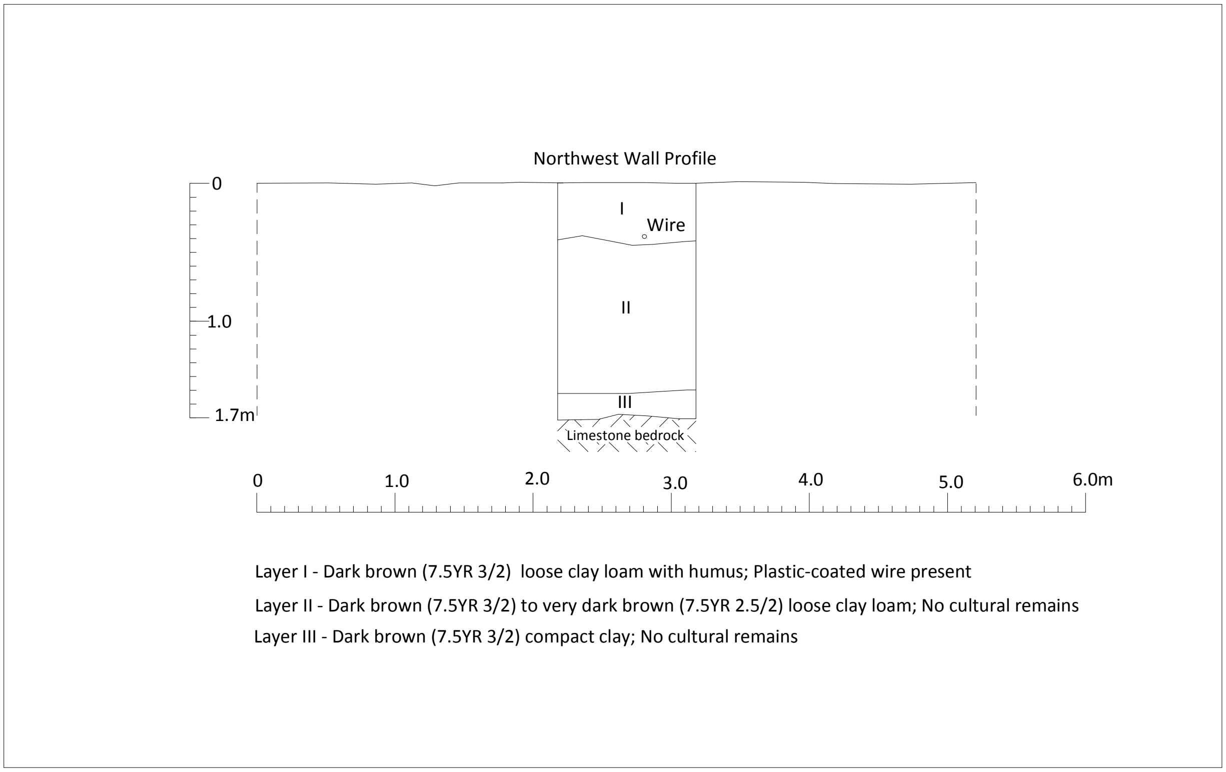


Figure B-304. Profile of BT-F-5-1

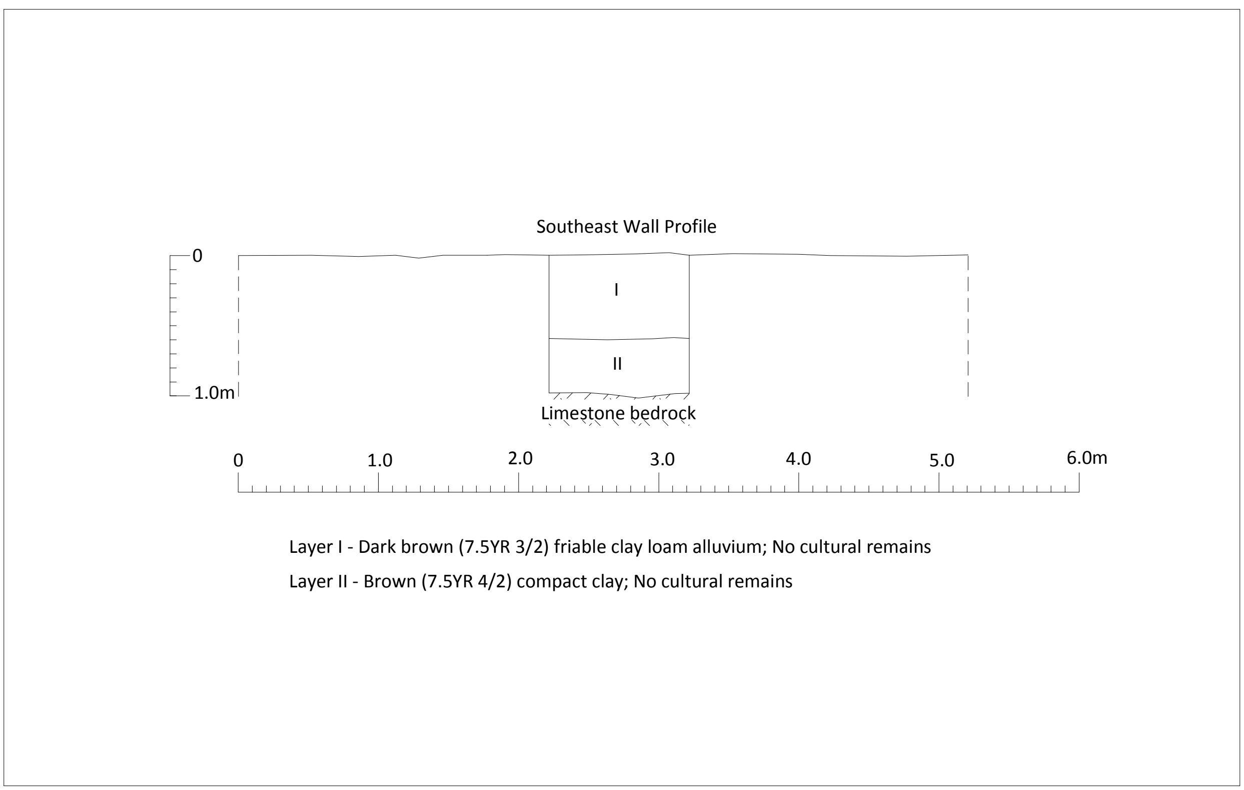


Figure B-305. Profile of BT-F-5-2

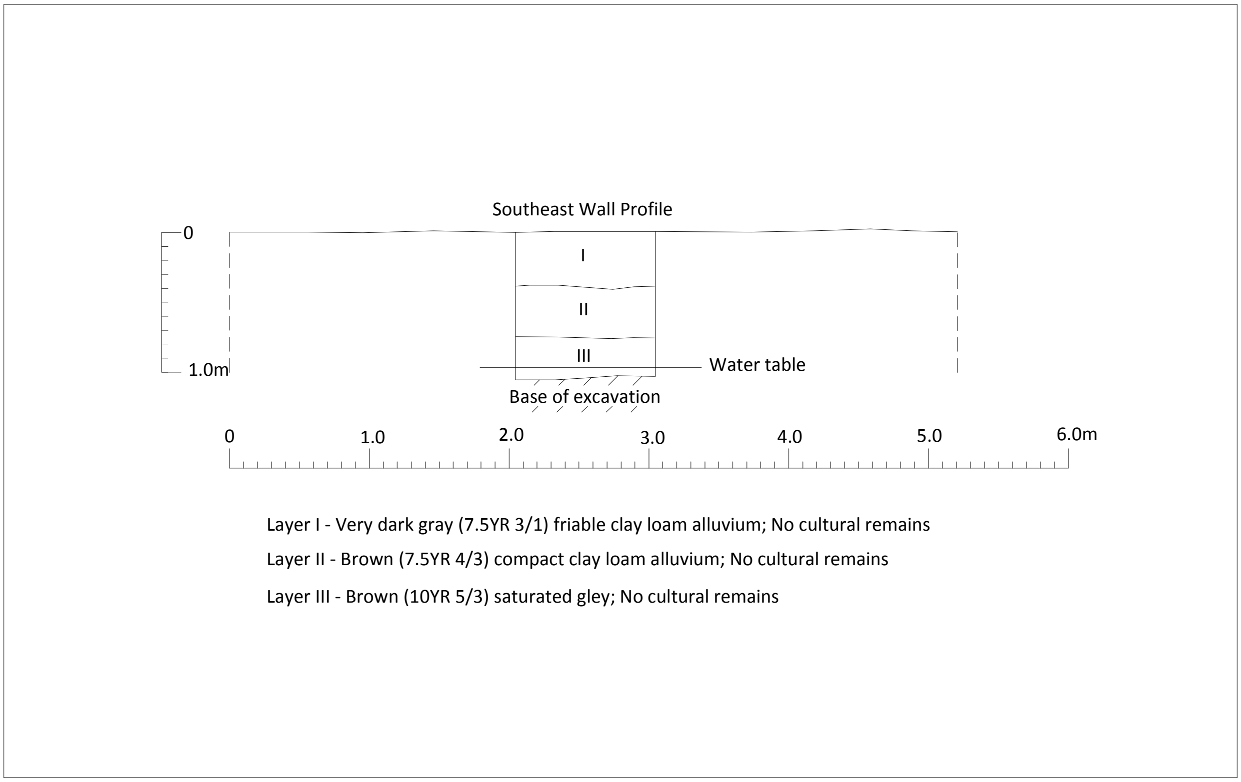


Figure B-306. Profile of BT-F-5-3

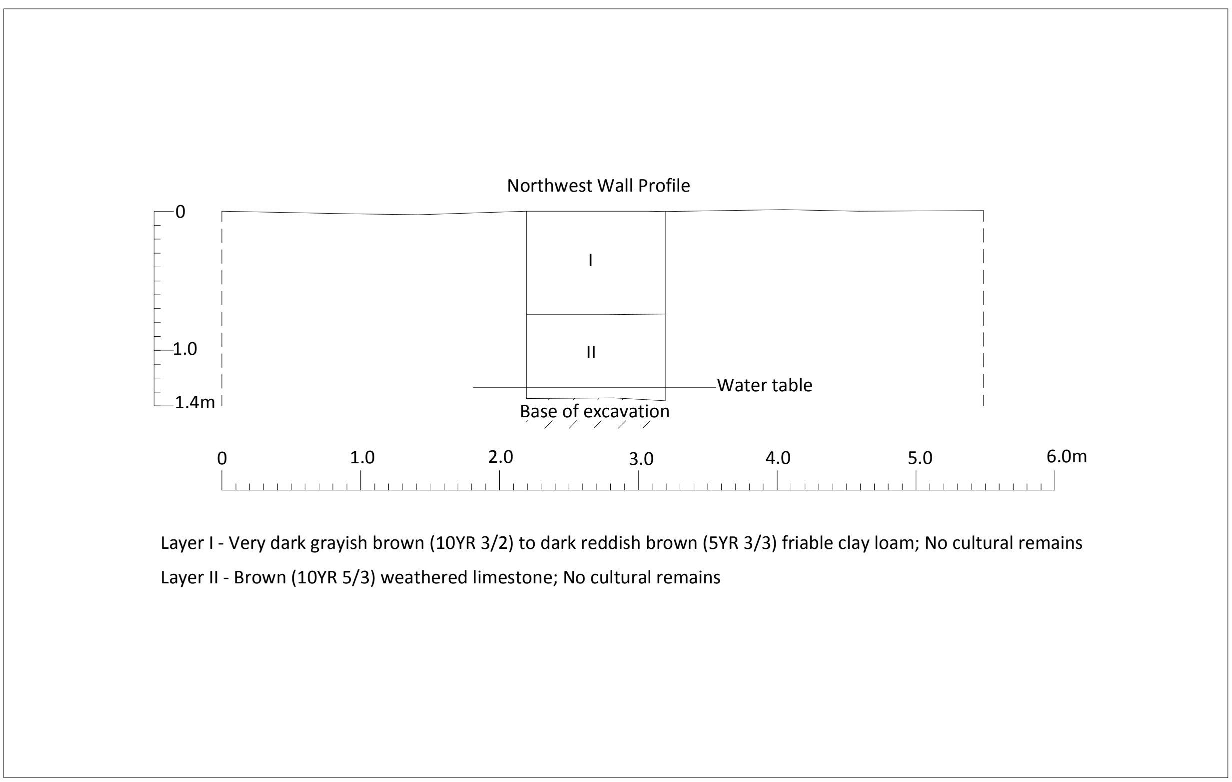
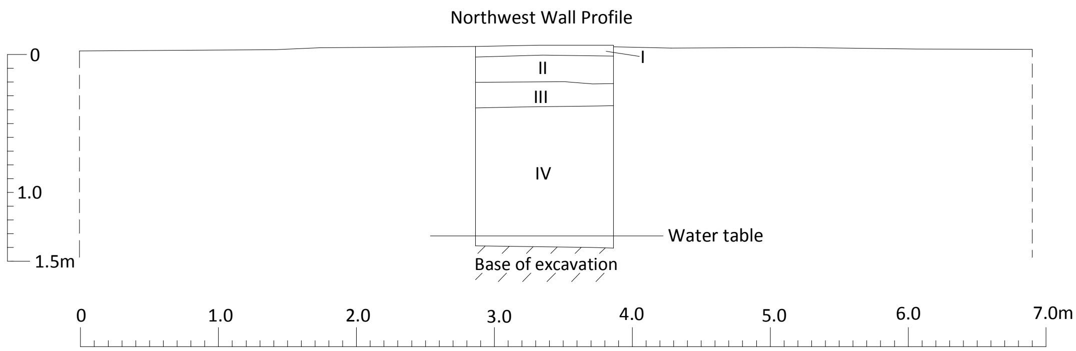


Figure B-307. Profile of BT-F-5-4



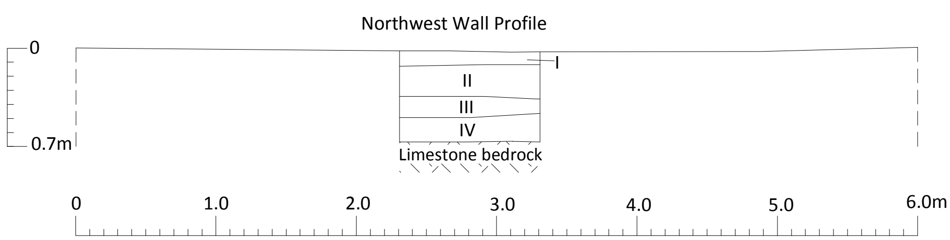
Layer I - Very dark brown (7.5YR 2.5/2) structureless humus; No cultural remains

Layer II - Very pale brown (10YR 7/4 to 10YR 8/4) loose sand fill; No cultural remains

Layer III - Very dark grayish brown (10YR 3/2) friable clay loam; No cultural remains

Layer II - Very pale brown (10YR 7/4) to white (10YR 8/1) weathered limestone; No cultural remains

Figure B-308. Profile of BT-F-5-5



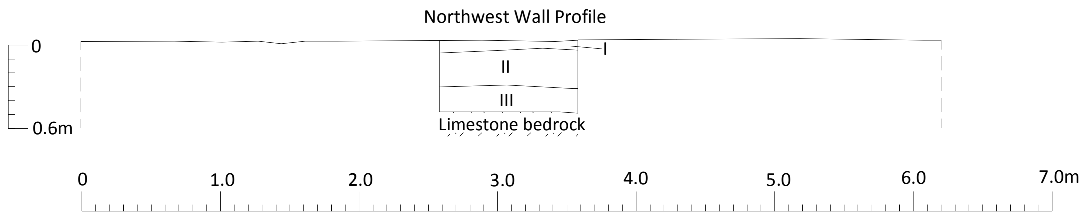
Layer I - Concrete slab

Layer II - Pale brown (10YR 6/3) compact crushed limestone fill; Aggregate present

Layer III - White (10YR 8/1) weathered limestone; No cultural remains

Layer IV - Dark yellowish brown (10YR 3/4) compact clay; No cultural remains

Figure B-309. Profile of BT-F-5-6

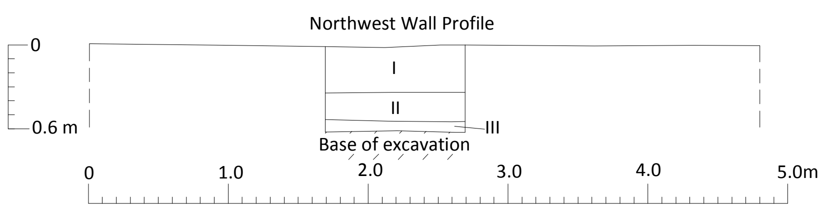


Layer I - Very dark brown (7.5YR 2.5/2) loose humus; No cultural remains

Layer II - Dark brown (10YR 3/3) friable clay loam allluvium; No cultural remains

Layer III - Dark yellowish brown (10YR 4/4) compact clay; No cultural remains

Figure B-310. Profile of BT-F-5-7

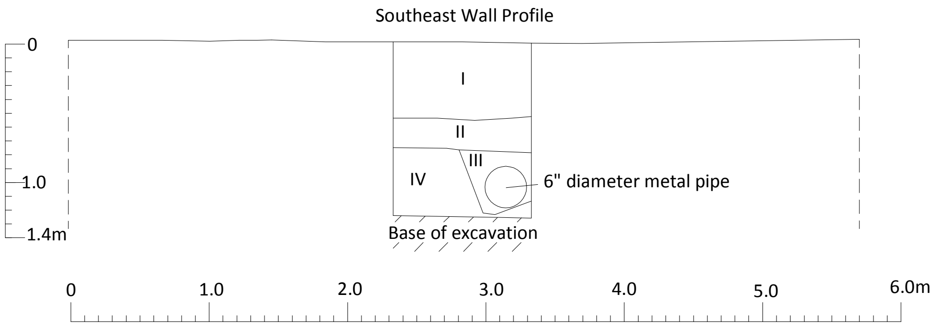


Layer I - Dark grayish brown (10YR 4/2) loose sandy clay loam; No cultural remains

Layer II - Dark brown 7.5YR 3/3) massive sandy clay loam; No cultural remains

Layer III - Yellowish brown (10YR 5/6) weathered limestone; No cultural remains

Figure B-311. Profile of BT-F-5-8



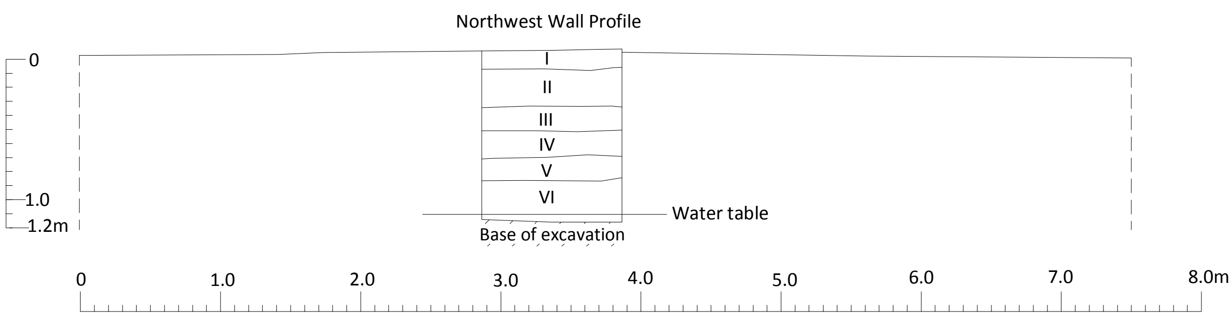
Layer I - Dark grayish brown (10YR 4/2) loose sandy loam; No cultural remains

Layer II - Brown (10YR 4/3) friable sandy clay loam; Bottle glass and aggregate present

Layer III - Brown (10YR 4/3) to dark grayish brown (10YR 4/2) friable sandy loam and sandy clay loam fill; Metal pipe

Layer IV - Yellowish brown (10YR 5/4) weathered limestone; No cultural remains

Figure B-312. Profile of BT-F-5-9



Layer I - Very dark gray (10YR 3/1) loose humus; Modern trash and basalt aggregate present

Layer II - Brown (10YR 5/3) to dark yellowish brown (10YR 4/4) compact crushed limestone fill; Wire and aggregate present

Layer III - Very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2) friable clay loam alluvium; No cultural remains

Layer IV - Light gray (10YR 7/2) to grayish brown (10YR 5/2) weathered limestone; No cultural remains

Layer V - Gray (10YR 5/1) massive clay; No cultural remains

Layer VI - Brown (10YR 4/3) massive clay; No cultural remains

Figure B-313. Profile of BT-F-5-10

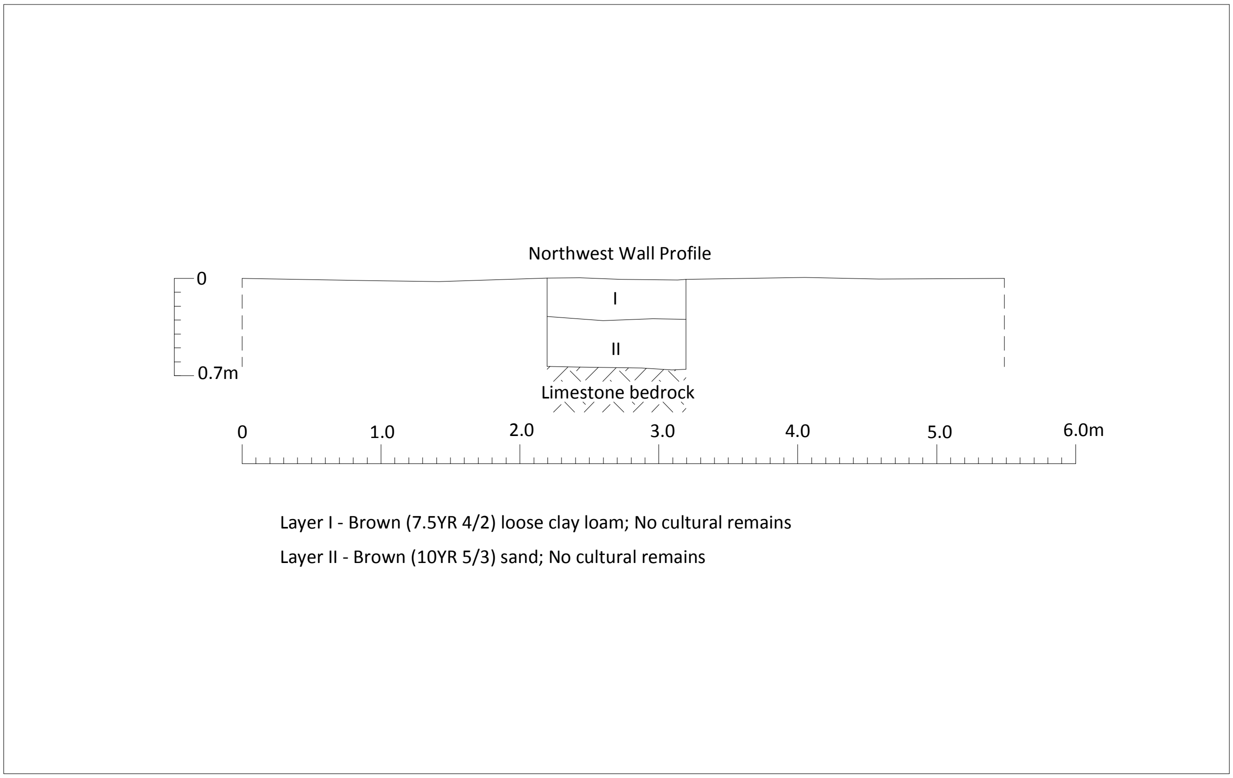


Figure B-314. Profile of BT-F-6-1

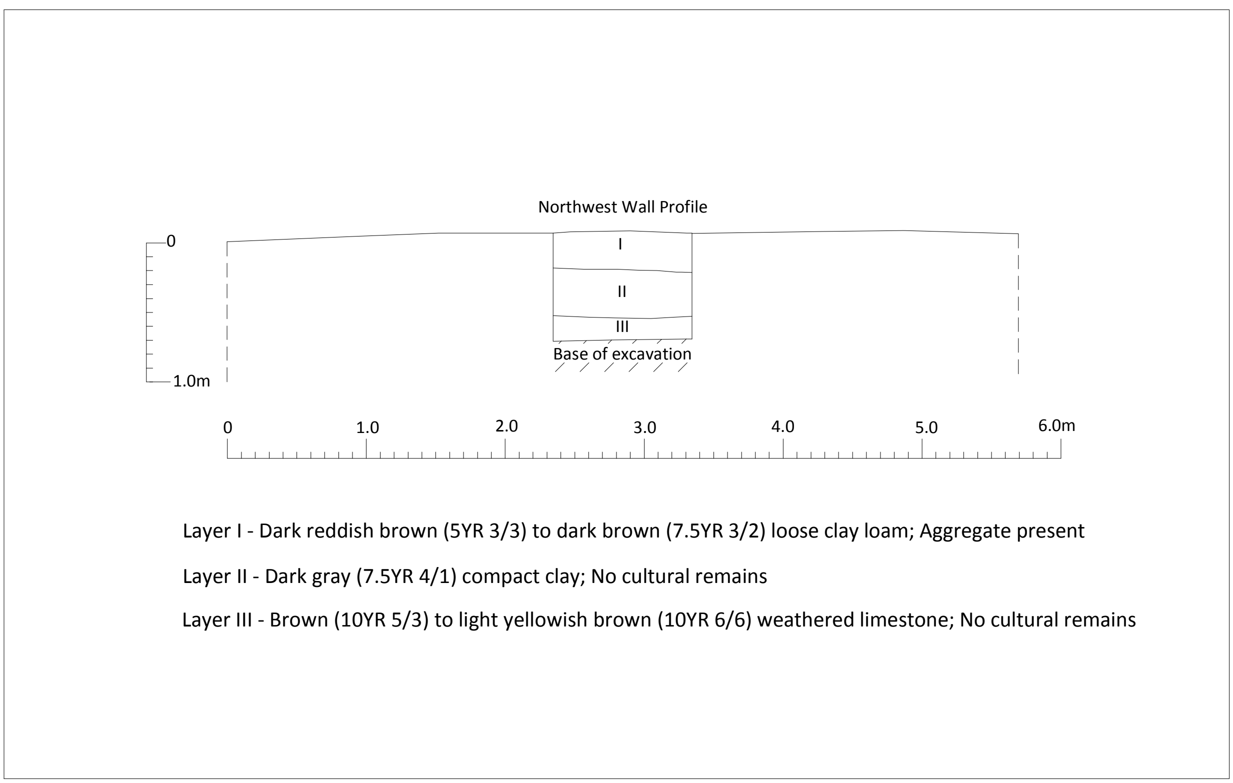
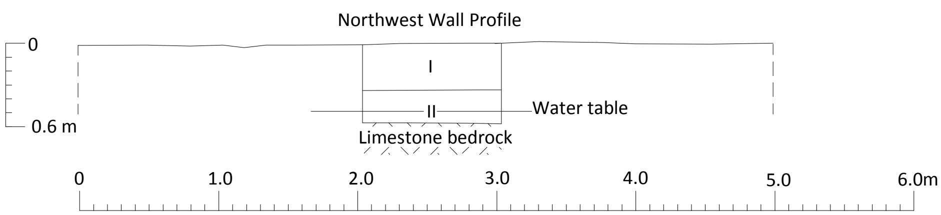


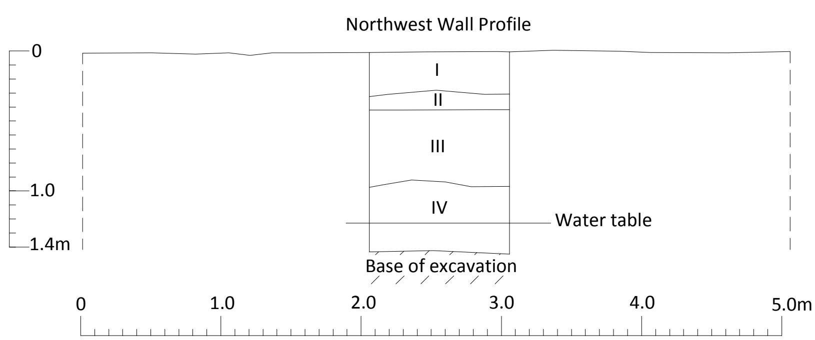
Figure B-315. Profile of BT-F-6-2



Layer I - Dark brown (7.5YR 3/2) friable clay loam alluvium; No cultural remains

Layer II - Gray (7.5YR 5/1) saturated gley; No cultural remains

Figure B-316. Profile of BT-F-7-1



Layer I - Brown (7.5YR 4/4) loose clay loam; No cultural remains

Layer II - Very dark gray (7.5YR 3/1) friable clay loam alluvium; No cultural remains

Layer III - Brown (7.5YR 4/2) compact clay alluvium; No cultural remains

Layer IV - Light gray (7.5YR 7/1) saturated gley; No cultural remains

Figure B-317. Profile of BT-F-7-2

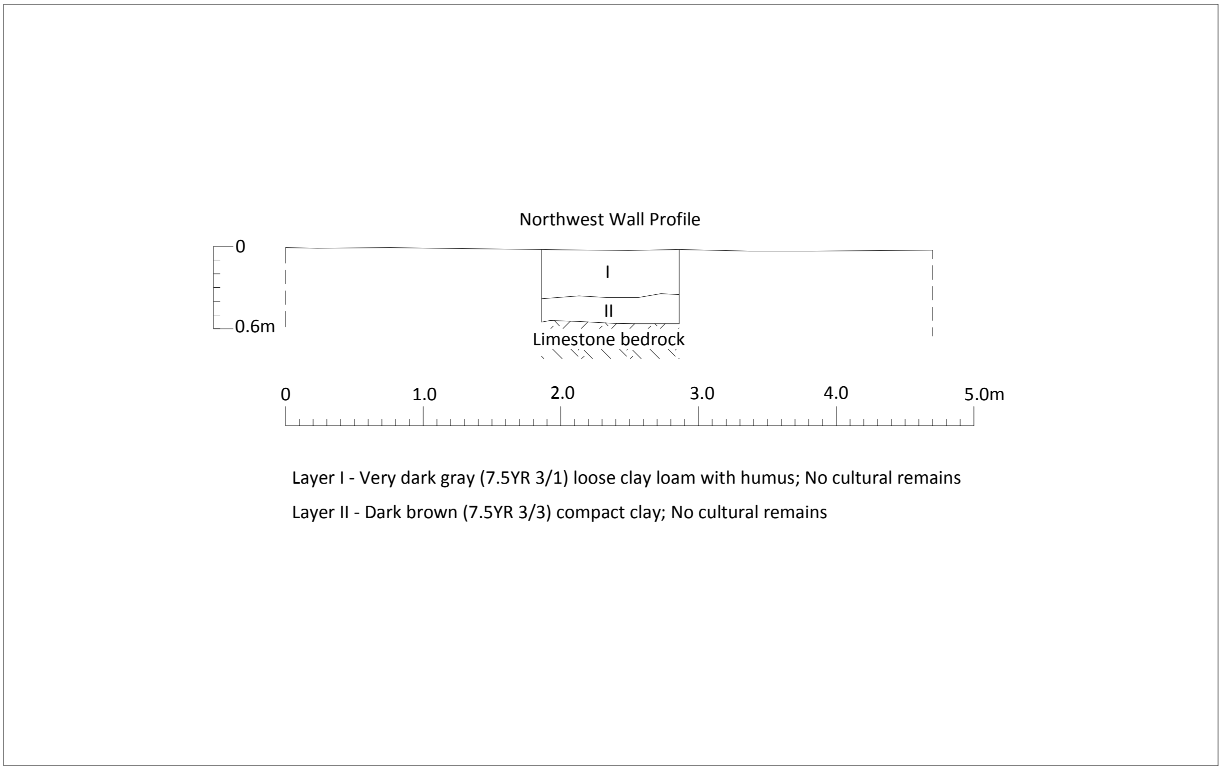


Figure B-318. Profile of BT-F-8-1

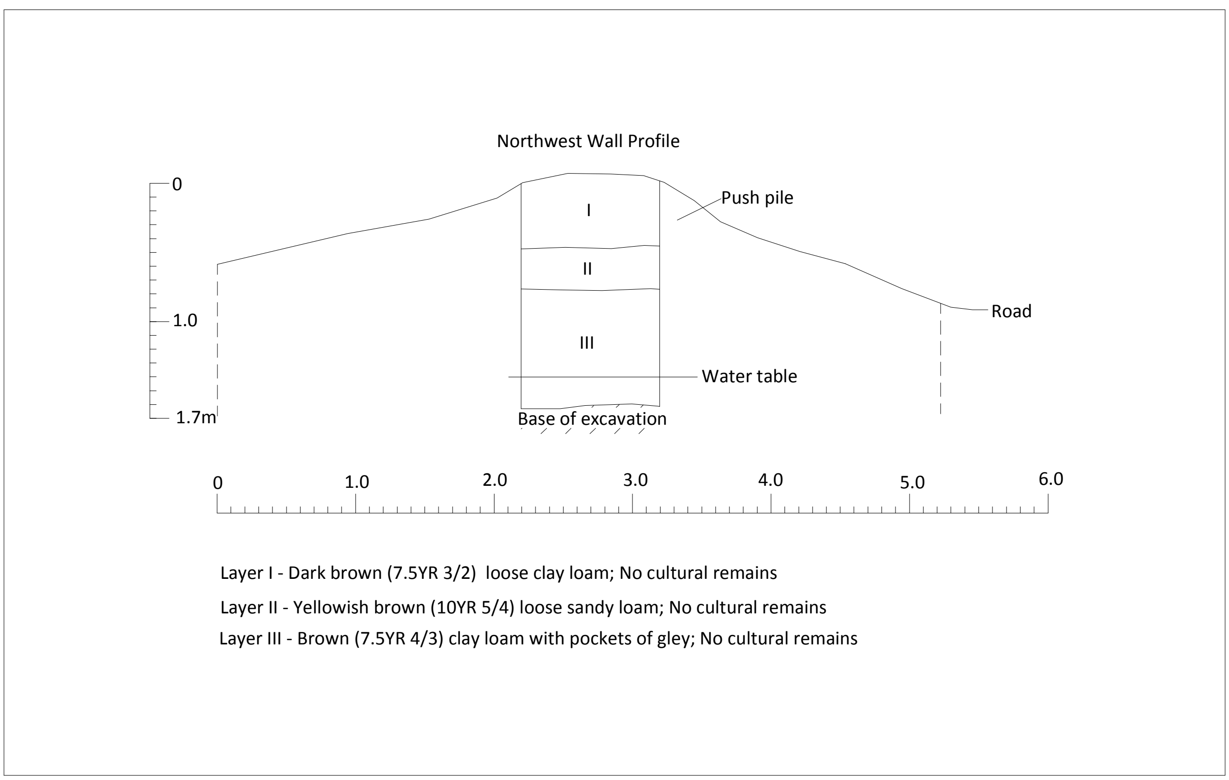


Figure B-319. Profile of BT-F-8-2

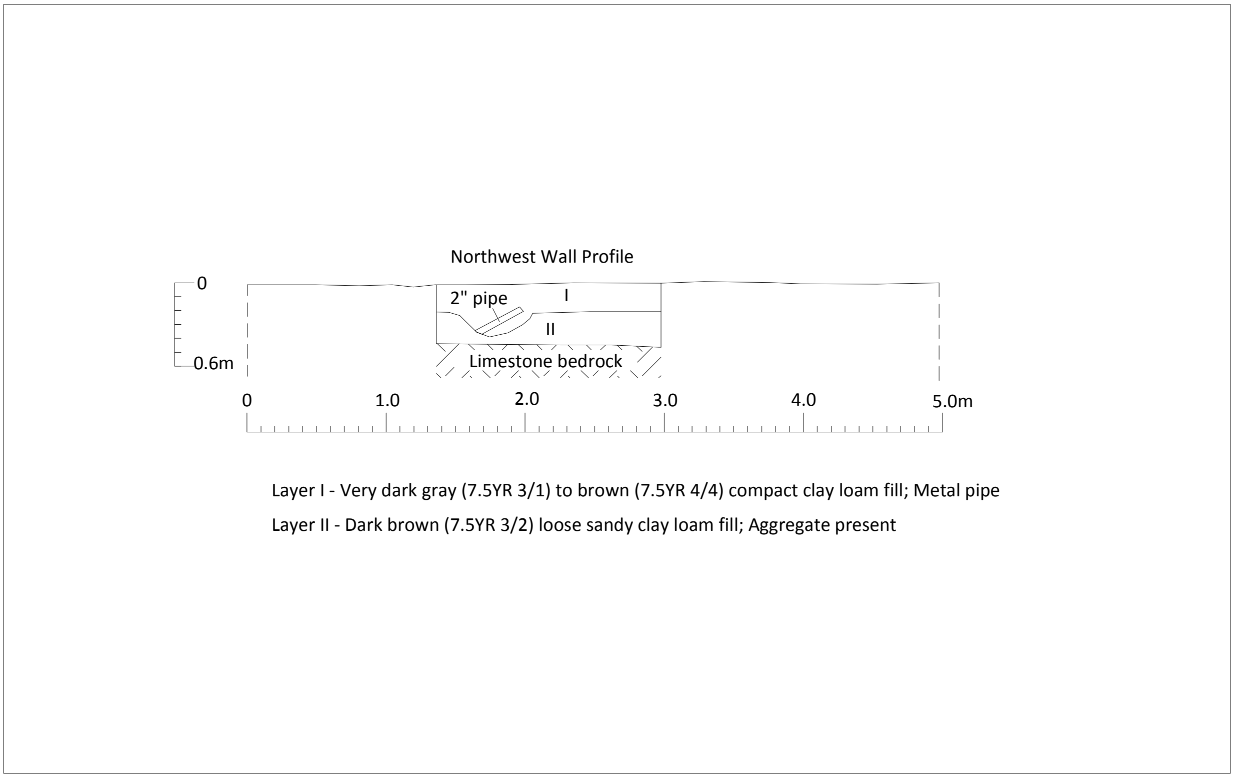


Figure B-320. Profile of BT-F-9-1

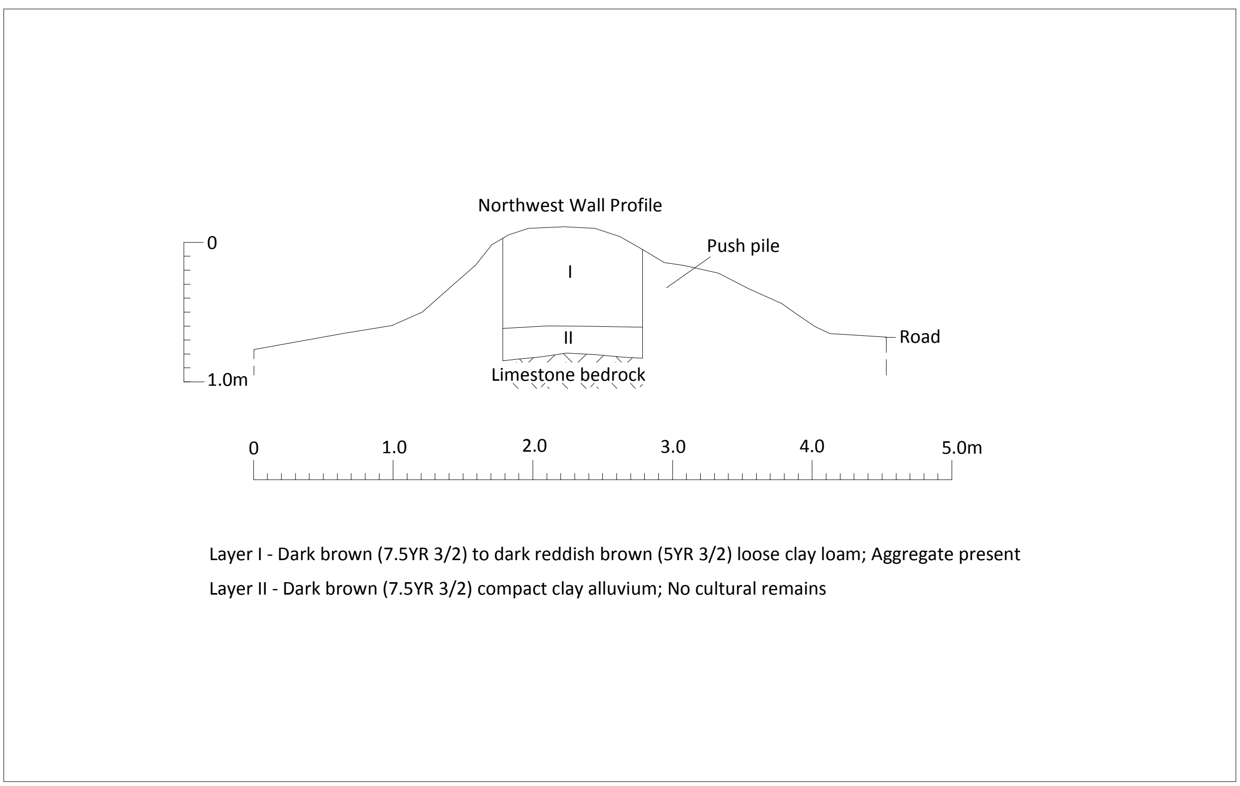
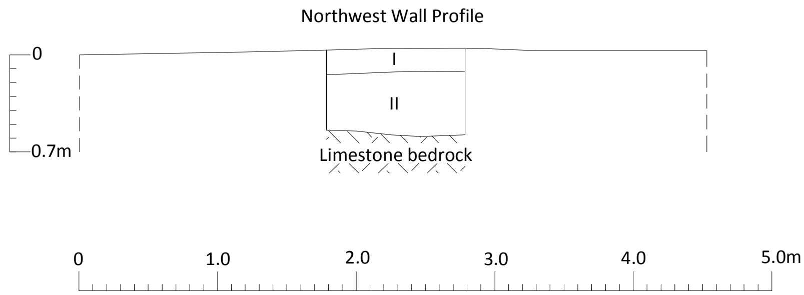


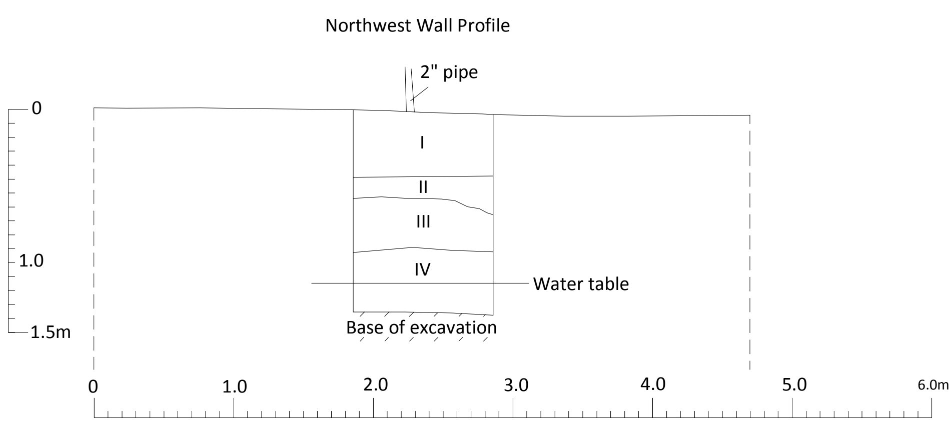
Figure B-321. Profile of BT-F-9-2



Layer I - Very dark gray (7.5YR 3/1) moderately compact clay loam with humus; Plastic and glass present

Layer II - Brown (10YR 5/3) loose sandy clay loam; No cultural remains

Figure B-322. Profile of BT-F-10-1



Layer I - Dark brown (7.5YR 3/2) to dark reddish brown (5YR 3/3) loose sandy clay loam; 2" metal pipe

Layer II - Yellowish brown (10YR 5/4) to light yellowish brown (10YR 6/4) loose sand fill; 6" metal sewer pipe

Layer IIII - Dark brown (7.5YR 3/2) compact clay alluvium; No cultural remains

Layer IV - Gray (10YR 5/1) saturated gley; No cultural remains

Figure B-323. Profile of BT-F-10-2

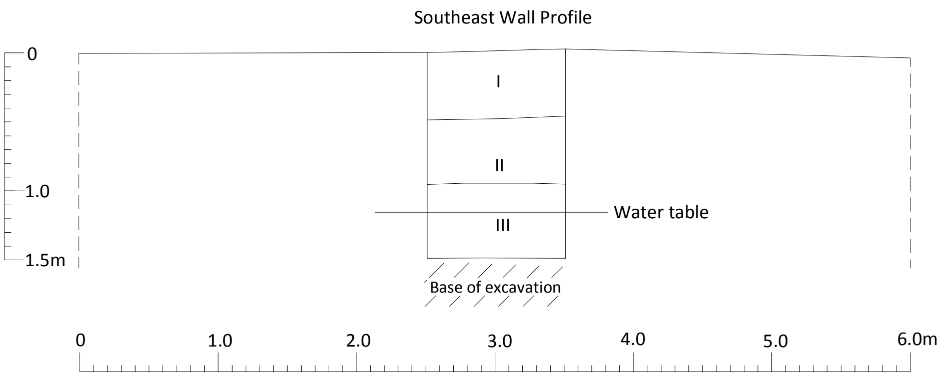


Figure B-324. Profile of BT-F-11-1

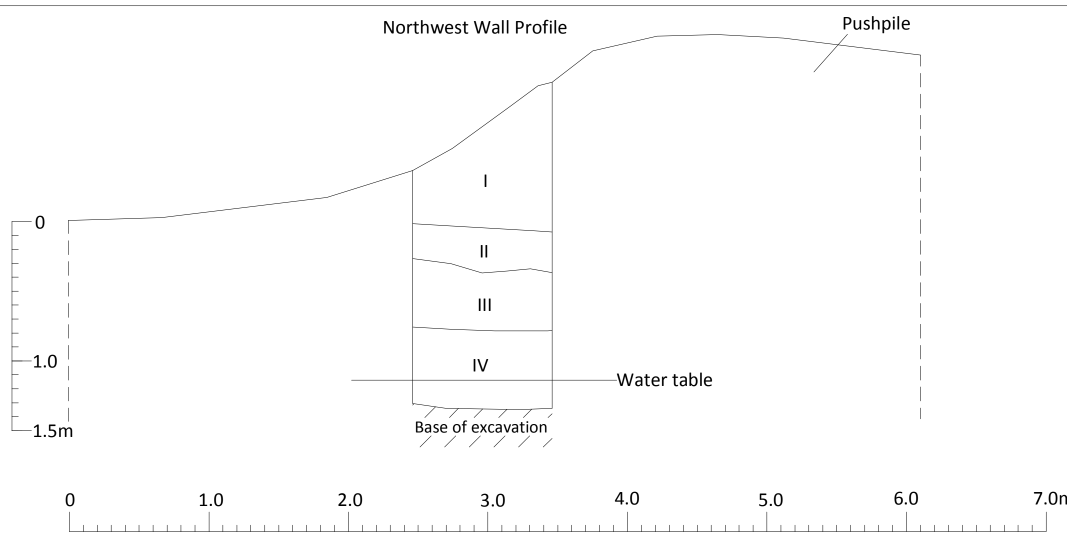
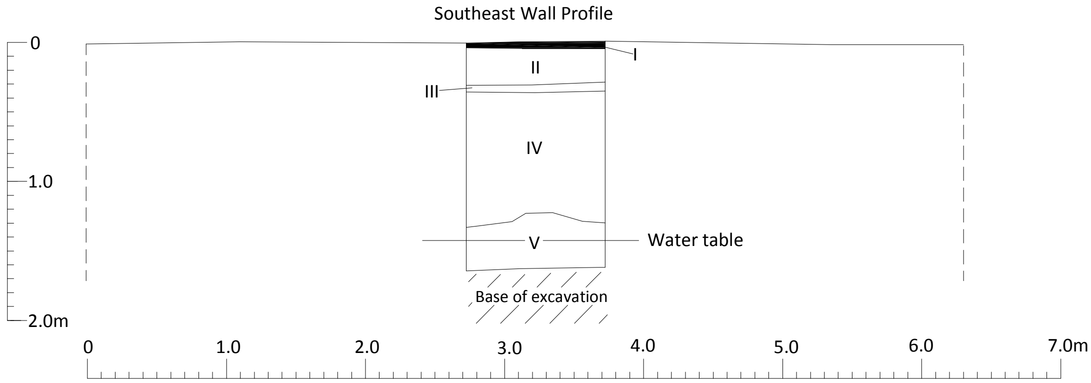


Figure B-325. Profile of BT-F-11-2



Layer I - Black (10YR 2/1) intact asphalt layer

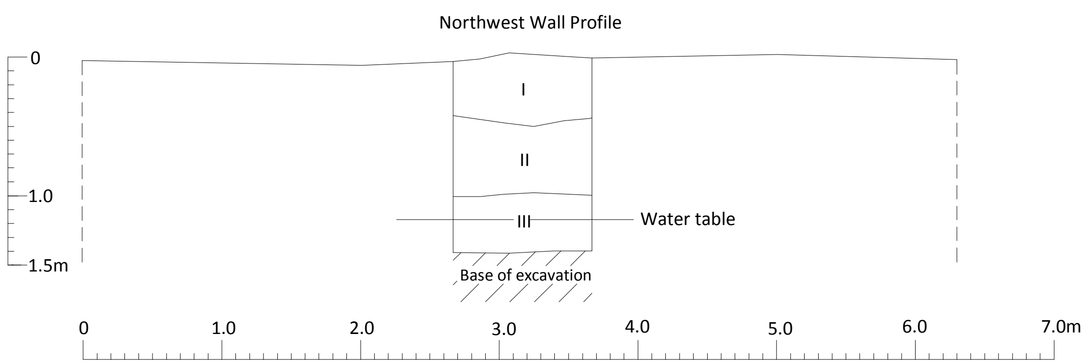
Layer II - Very pale brown (10YR 7/4) to light yellowish brown (10YR 6/4) compact limestone gravel fill; Aggregate present

Layer III - Dark grayish brown (10YR 4/2) compact clay loam alluvium; No cultural remains

Layer IV - Very pale brown (10YR 7/4) weathered limestone; No cultural remains

Layer V - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-326. Profile of BT-F-12-1



Layer I - Dark brown (7.5YR 3/3) friable clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/3) friable clay loam alluvium; No cultural remains

Layer III - Dark gray (7.5YR 4/1) saturated gley; No cultural remains

Figure B-327. Profile of BT-F-12-2

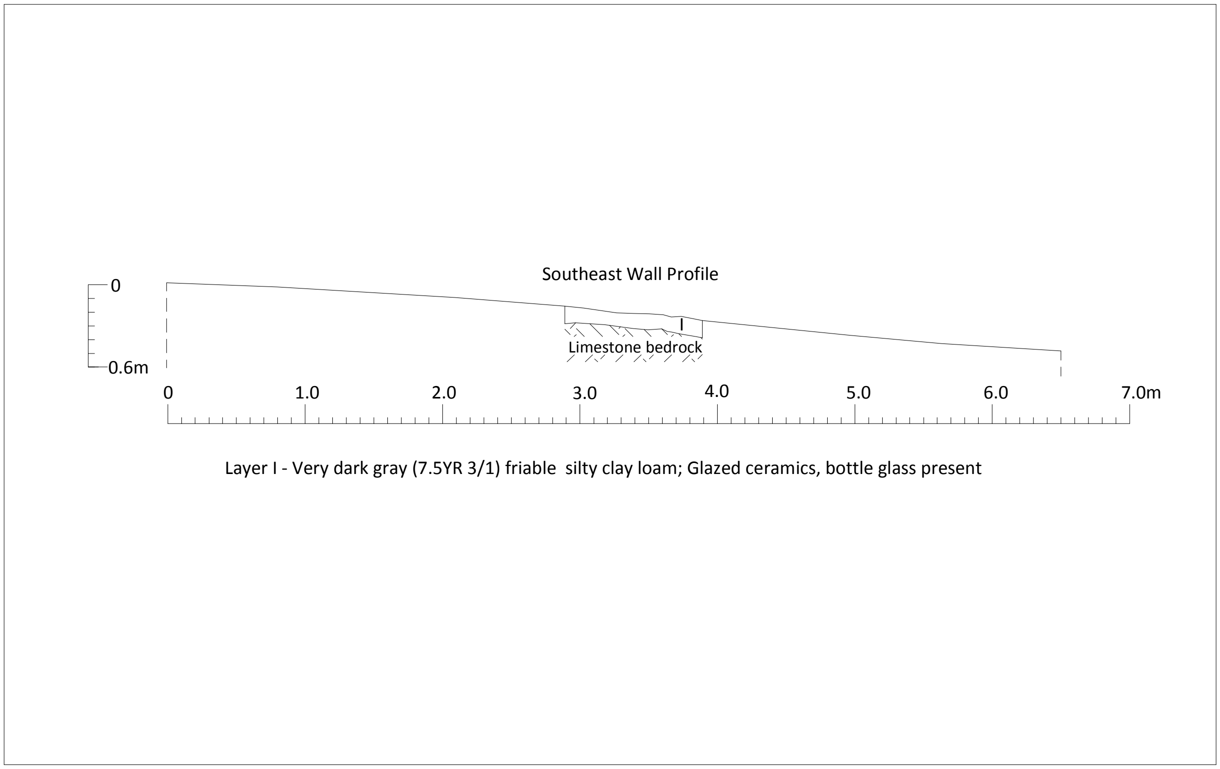


Figure B-328. Profile of BT-F-13-1

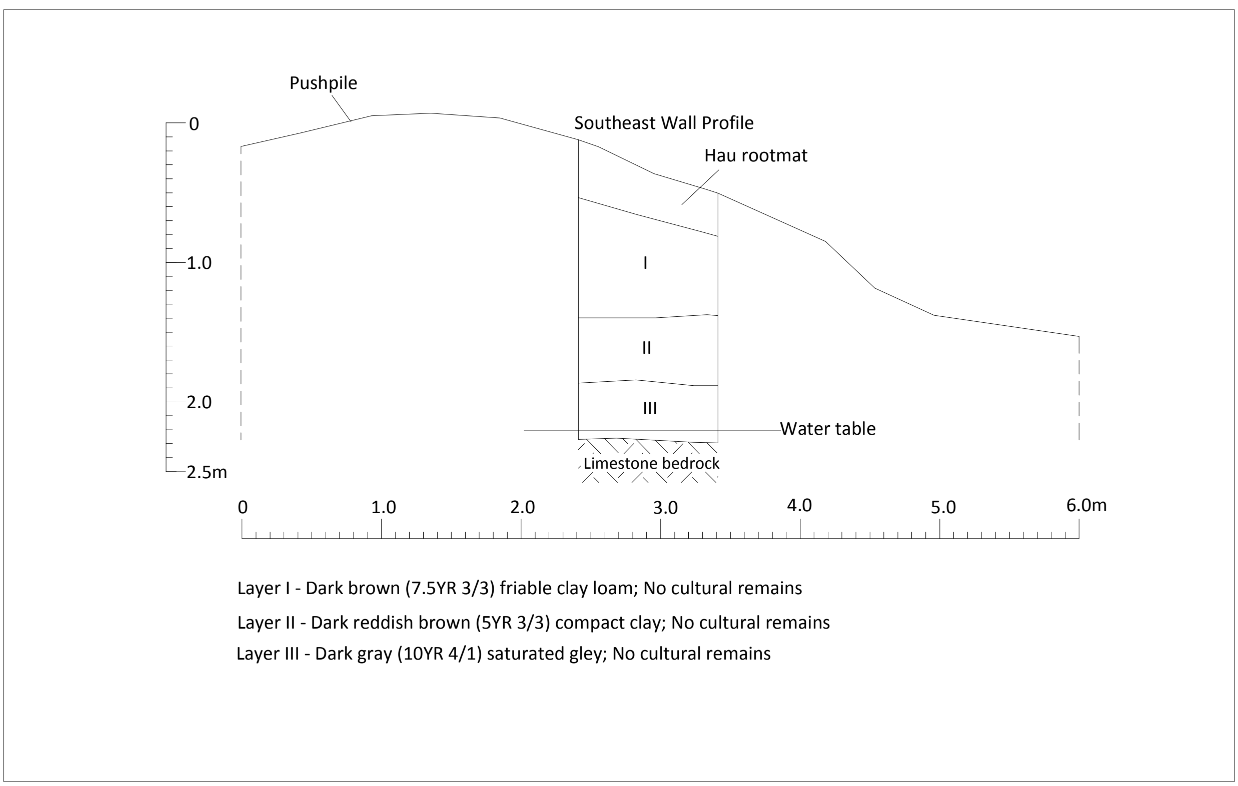


Figure B-329. Profile of BT-F-13-2

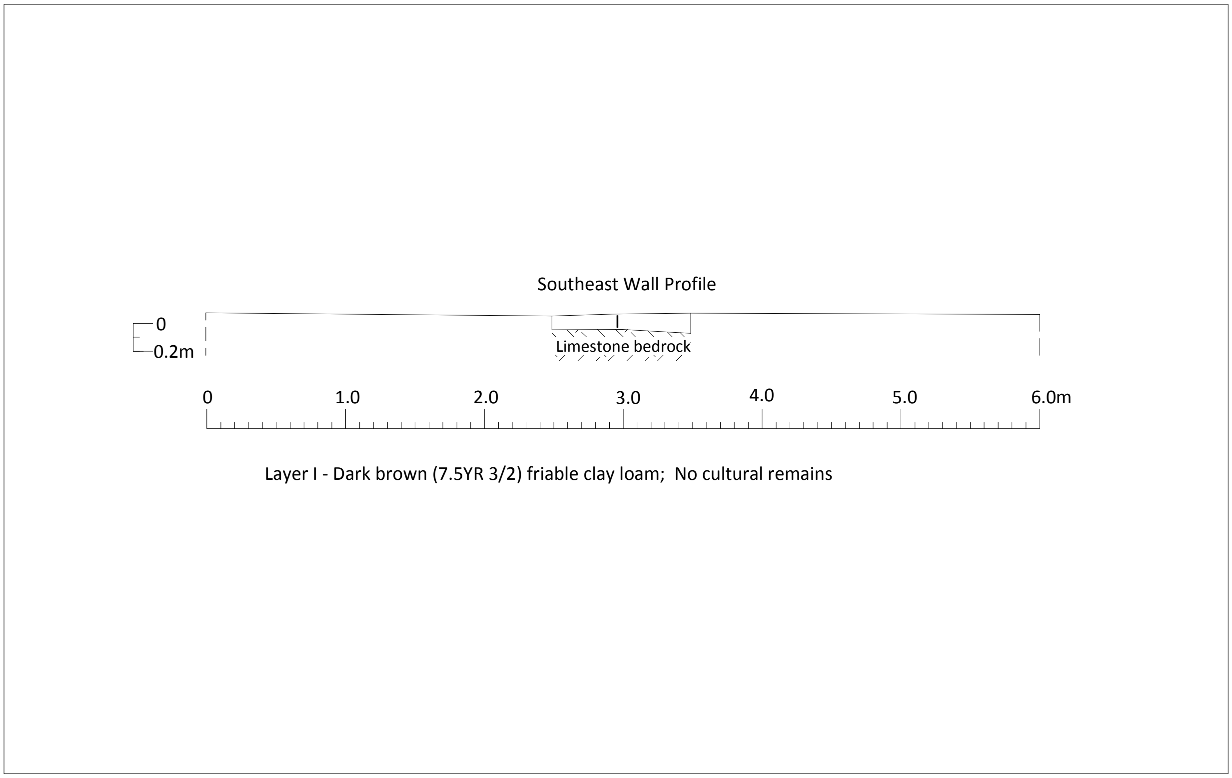


Figure B-330. Profile of BT-F-14-1

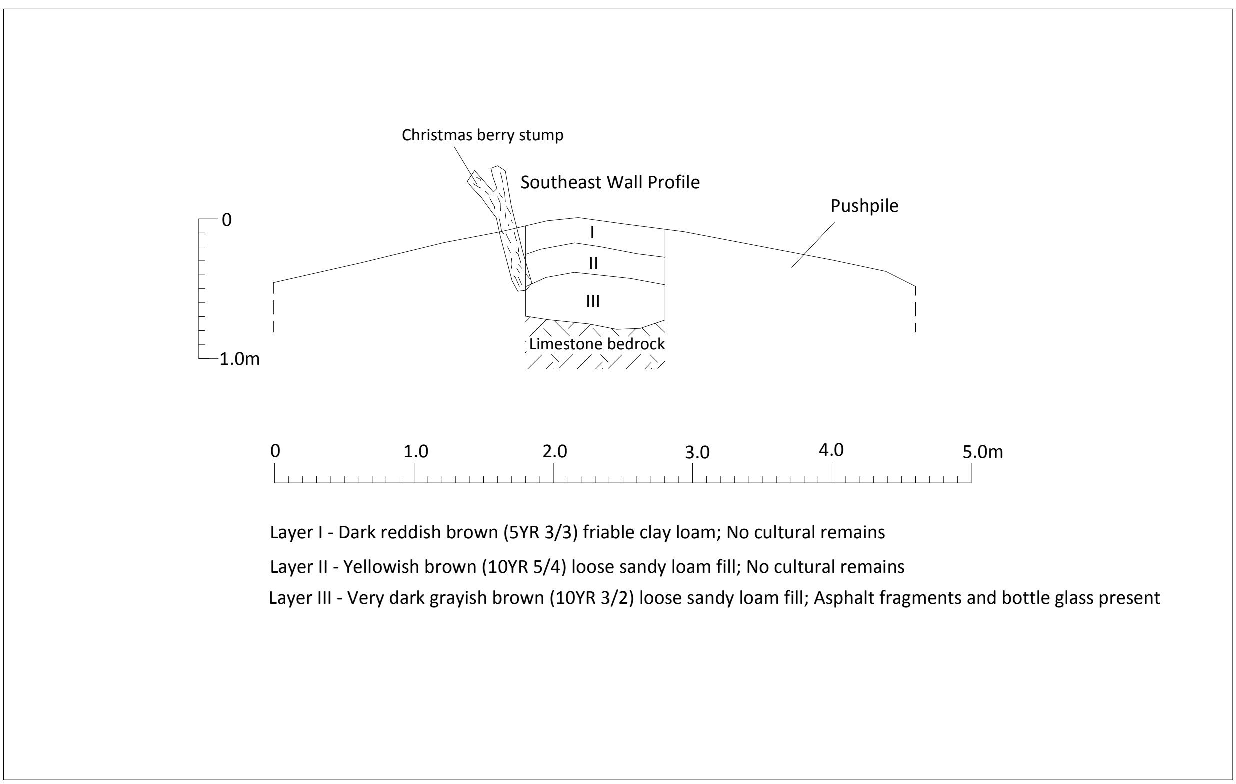
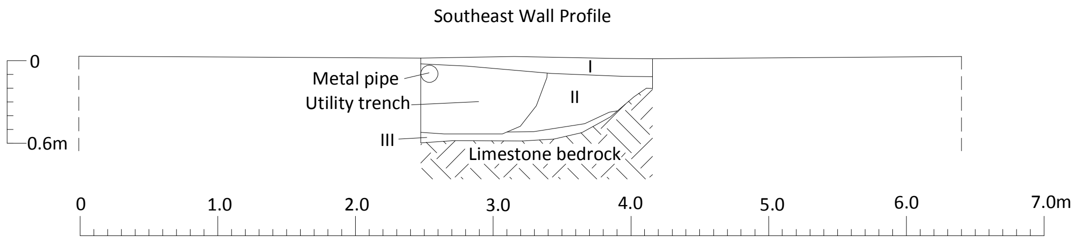


Figure B-331. Profile of BT-F-14-2



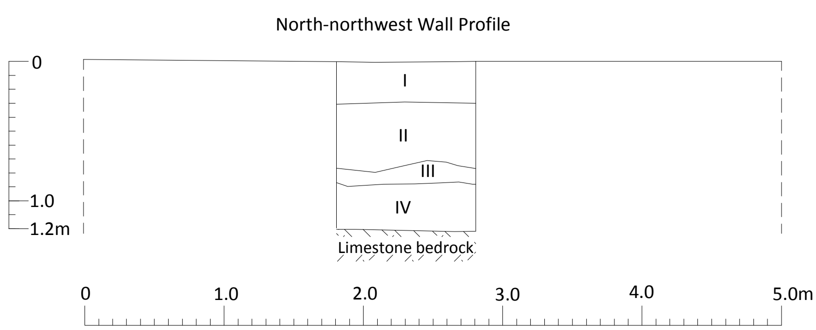
Layer I - Black (7.5YR 2.5/1) loose clay loam with humus; No cultural remains

Layer II - Dark grayish brown (10YR 4/2) friable clay loam; No cultural remains

Utility trench - Very pale brown (10YR 7/3) loose fine sand fill; 8" metal pipe present

Layer III - Dark gray (10YR 4/1) saturated gley; No cultural remains

Figure B-332. Profile of BT-F-15-1



Layer I - Dark brown (7.5YR 3/3) friable silt loam; No cultural remains

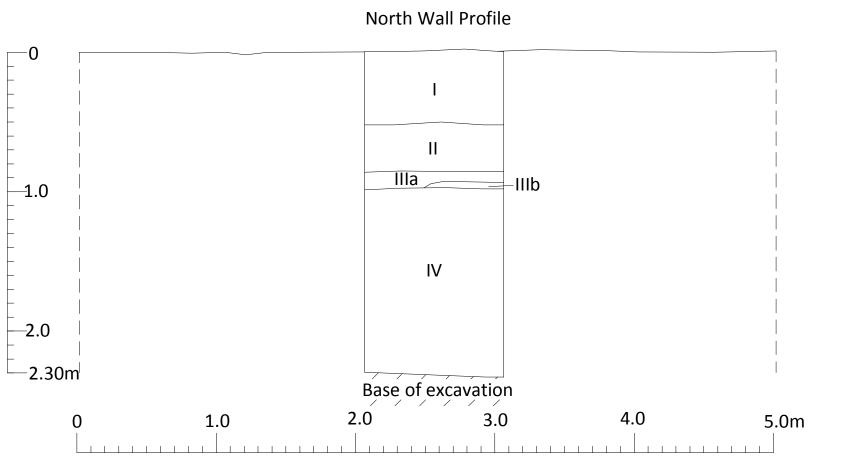
Layer II - Pale brown (10YR 6/3) to brown (10YR 4/3) compact crushed limestone fill; Aggregate and concrete fragments

Layer III - Yellowish brown (10YR 5/4) loose silty sand fill; No cultural remains

Layer IV - Dark reddish brown (5YR 3/3) compact clay; No cultural remains

Figure B-333. Profile of BT-F-15-2

Area G Trenches



Layer I - Dark brown (7.5YR 3/2) loose clay loam; plow zone; No cultural remains

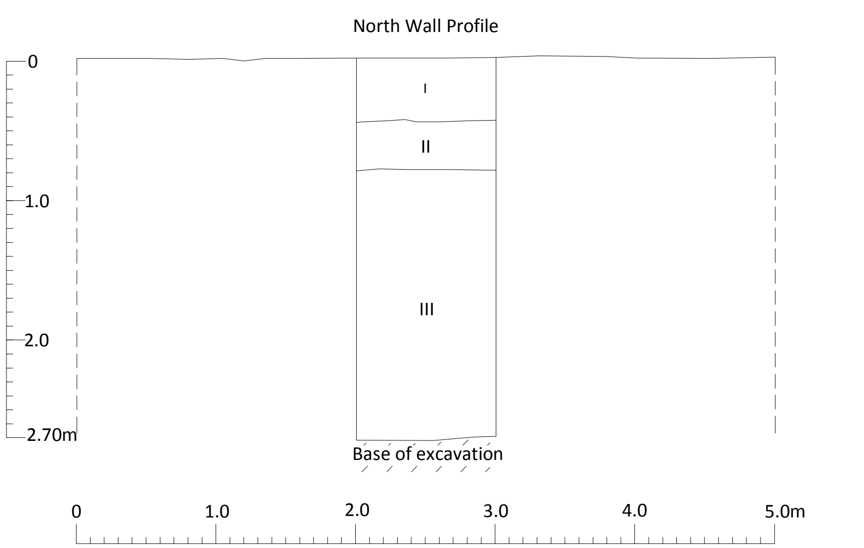
Layer II - Dark brown (7.5YR 3/3) blocky clay alluvium; No cultural remains

Layer IIIa - Dark brown (7.5YR 3/2) compact clay loam alluvium; No cultural remains

Layer IIIb - Lens of dark brown (7.5YR 3/3) compact clay loam alluvium; No cultural remains

Layer IV - Dark brown (7.5YR 3/4) compact clay alluvium; No cultural remains

Figure B-334. Profile of BT-G-2-1

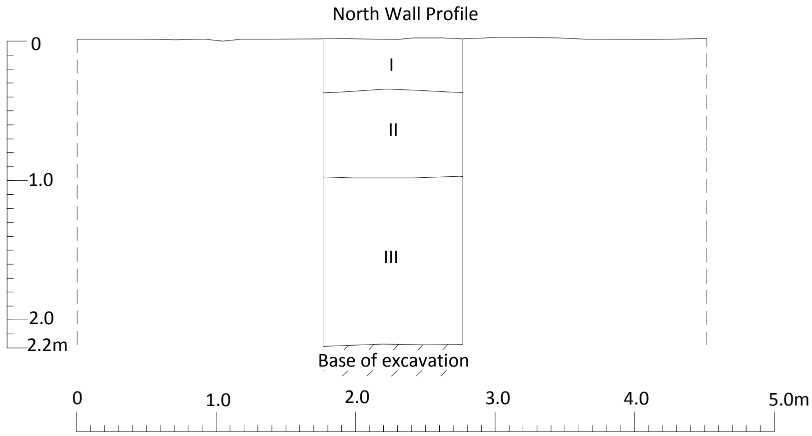


Layer I - Very dark brown (7.5YR 2.5/2) loose clay loam; plow zone; No cultural remains

Layer II - Dark brown (7.5YR 3/2) blocky clay alluvium; No cultural remains

Layer III - Dark brown (7.5YR 3/4) compact clay alluvium; No cultural remains

Figure B-335. Profile of BT-G-2-2

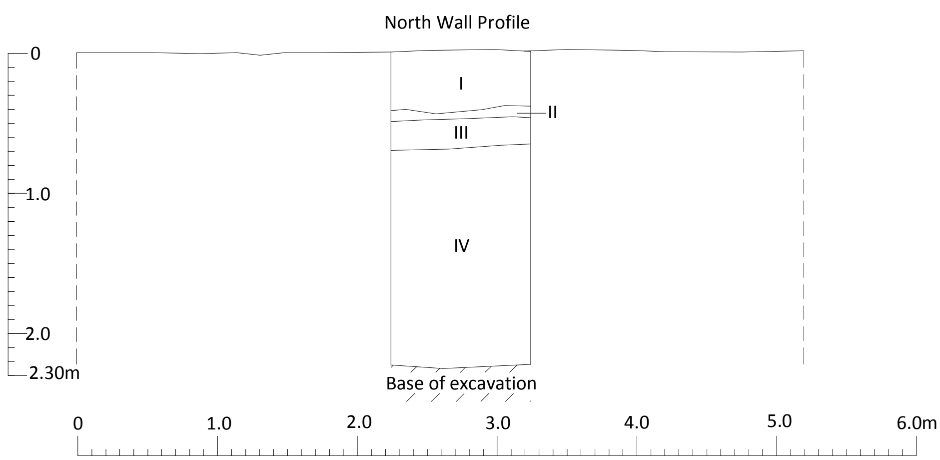


Layer I - Very dark brown (7.5YR 2.5/2) loose clay loam; plow zone; Modern trash present

Layer II - Dark brown (7.5YR 3/4) blocky clay alluvium; No cultural remains

Layer III - Dark brown (7.5YR 3/4) compact clay alluvium; No cultural remains

Figure B-336. Profile of BT-G-2-3



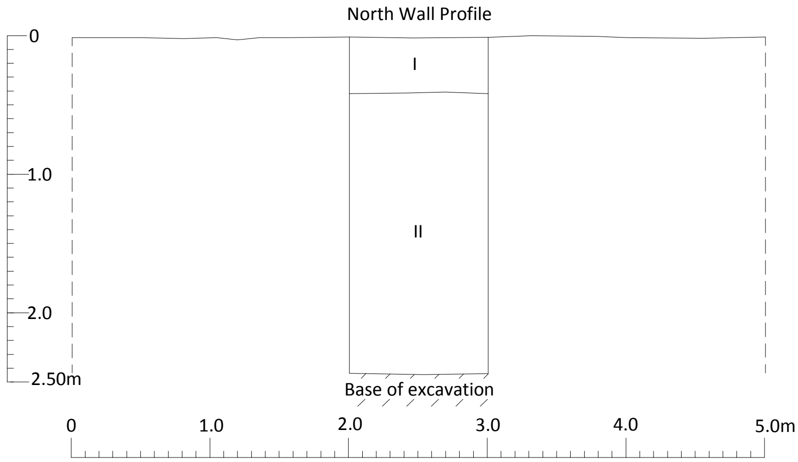
Layer I - Dark brown (7.5YR 3/3) loose clay loam; plow zone; No cultural remains

Layer II - Dark brown (7.5YR 3/4) compact clay alluvium; No cultural remains

Layer III - Dark brown (7.5YR 3/3) loose clay loam alluvium; No cultural remains

Layer IV - Dark brown (7.5YR 3/4) compact clay alluvium; No cultural remains

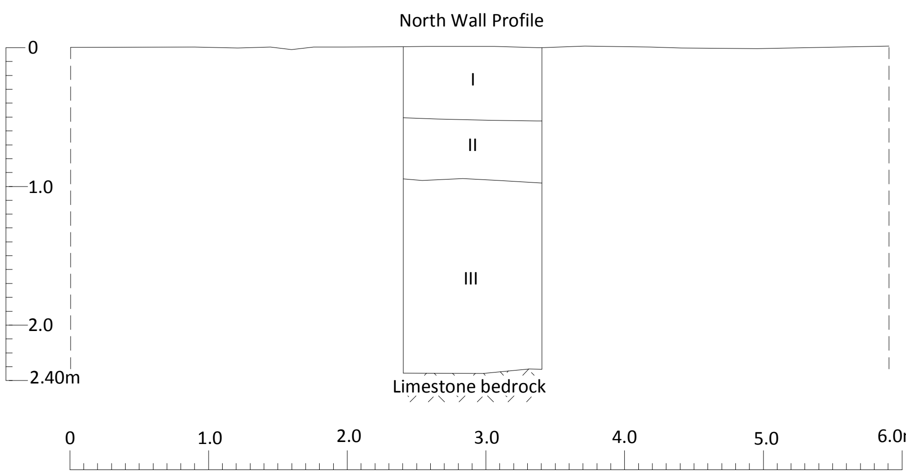
Figure B-337. Profile of BT-G-3-1



Layer I - Very dark brown (7.5YR 2.5/2) loose clay loam; plow zone; No cultural remains

Layer II - Dark brown (7.5YR 3/4) massive clay alluvium; No cultural remains

Figure B-338. Profile of BT-G-3-2



Layer I - Dark brown (7.5YR 3/3) loose clay loam; plow zone; No cultural remains

Layer II - Mottled dark brown (7.5YR 3/3 and 7.5YR 3/4) blocky clay loam; No cultural remains

Layer II - Dark brown (7.5YR 3/3) clay alluvium; No cultural remains

Figure B-339. Profile of BT-G-4-1

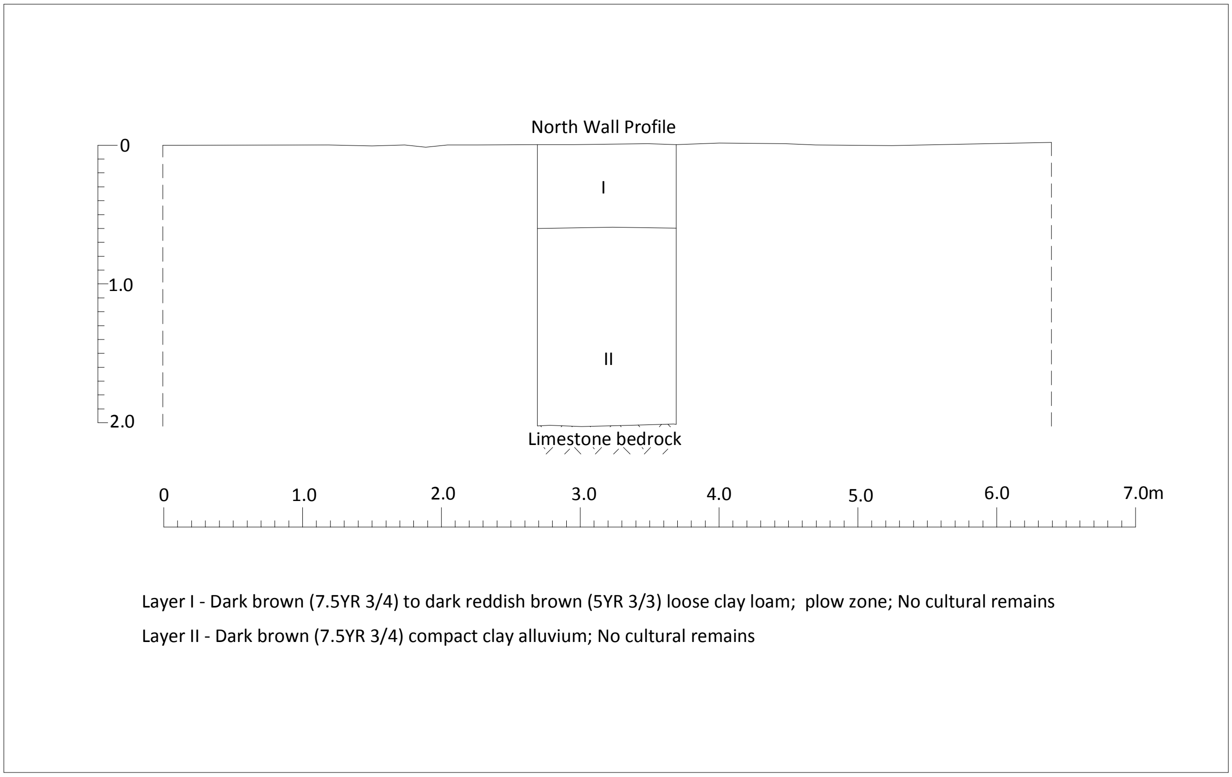


Figure B-340. Profile of BT-G-4-2

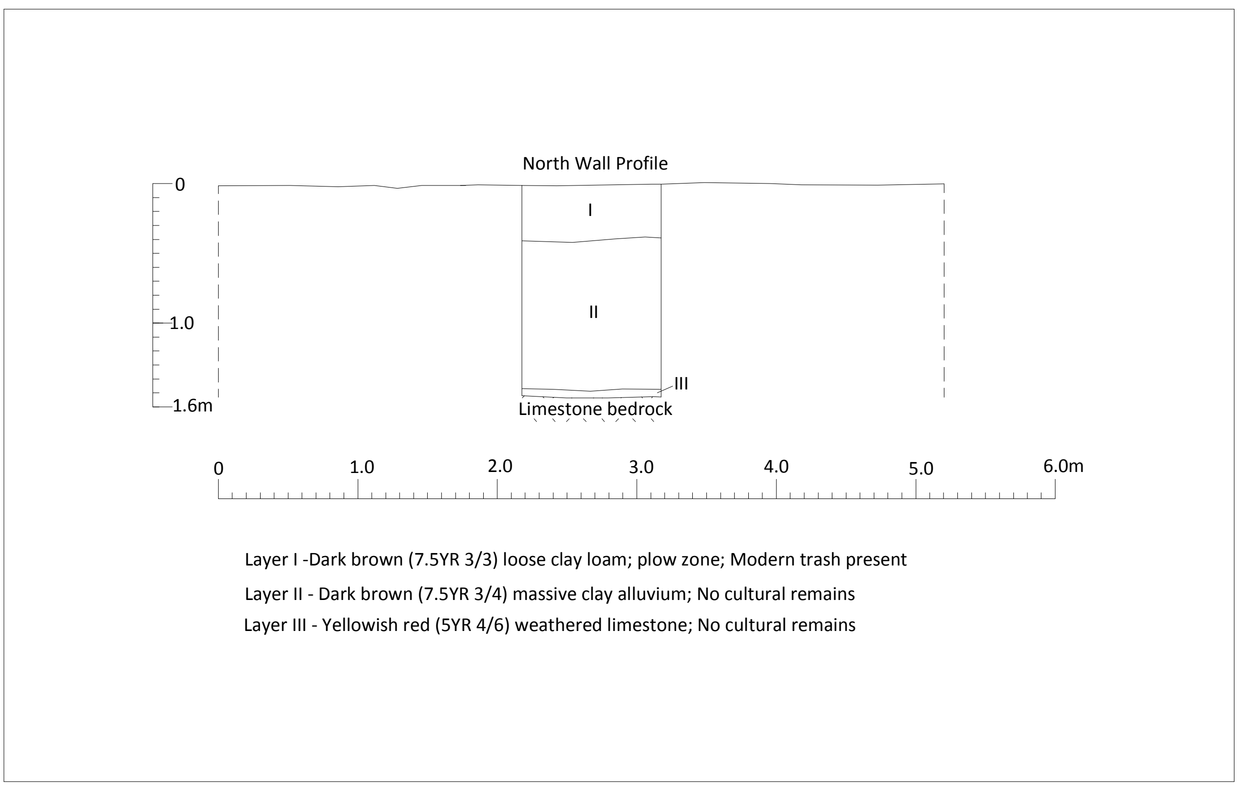


Figure B-341. Profile of BT-G-4-3

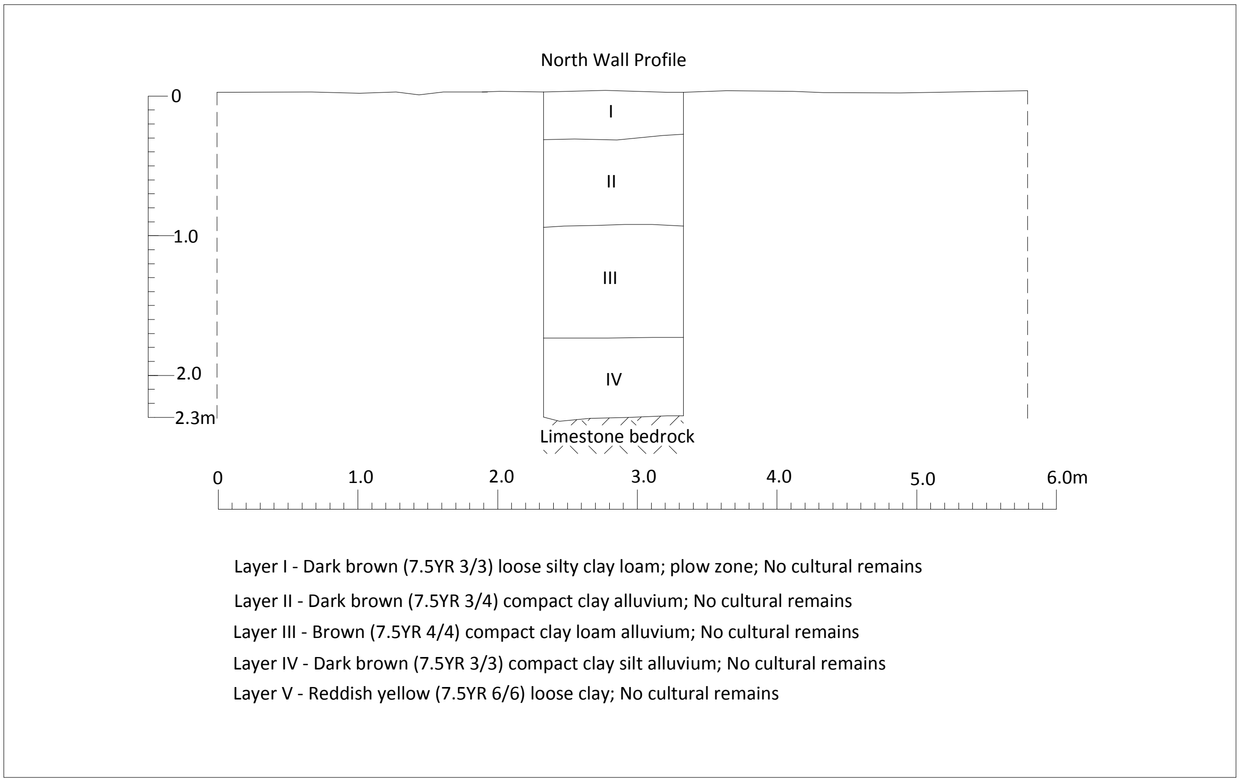


Figure B-342. Profile of BT-G-5-1

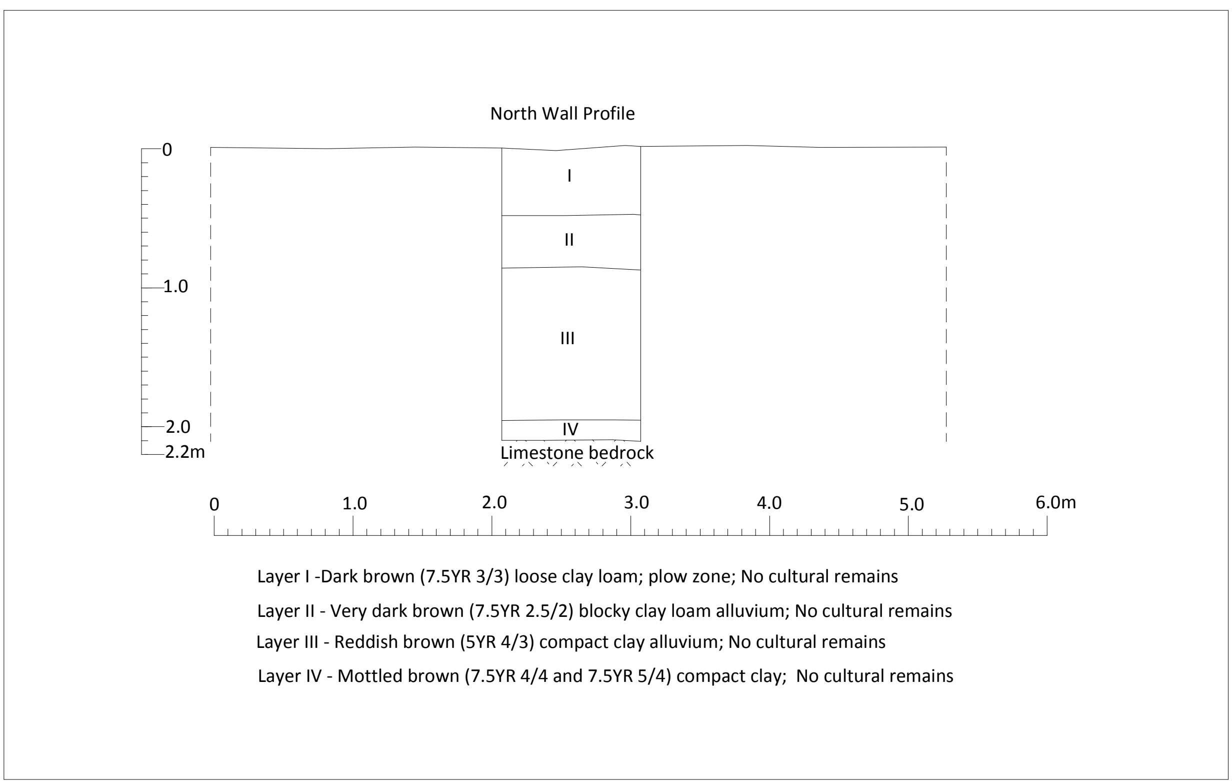
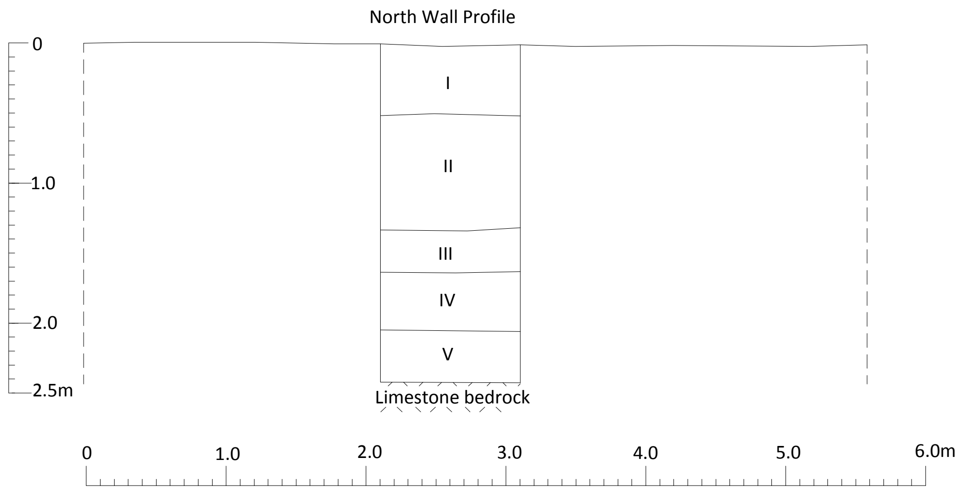


Figure B-343. Profile of BT-G-5-2



Layer I -Dark brown (7.5YR 3/3) loose clay loam; plow zone; No cultural remains

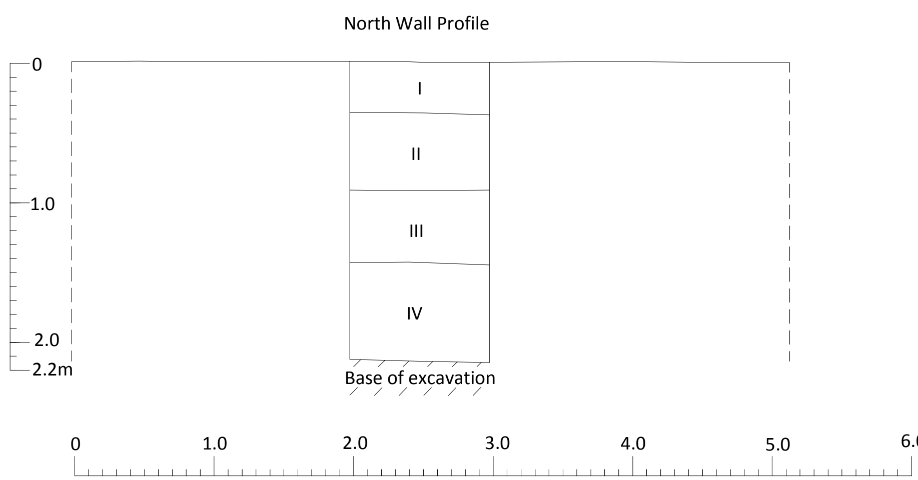
Layer II - Very dark brown (7.5YR 3/4) compact clay loam alluvium; No cultural remains

Layer III - Brown (7.5YR 4/4) compact silty clay loam alluvium; No cultural remains

Layer IV - Dark brown (7.5YR 3/3) moderately clayey silt; No cultural remains

Layer V - Reddish yellow (7.5YR 6/6) loose clay; No cultural remains

Figure B-344. Profile of BT-G-5-3



Layer I - Dark reddish brown (5YR 3/3) loose silty clay loam; plow zone; No cultural remains

Layer II - Dark reddish brown (5YR 3/3) and reddish brown (5YR 4/4) moderately compact silty clay loam alluvium; No cultural remains

Layer III - Dark reddish brown (5YR 3/3) compact clay alluvium; No cultural remains

Layer IV - Brown (7.5YR 4/4) to dark brown (7.5YR 4/3) coarse clay; No cultural remains

Figure B-345. Profile of BT-G-6-1

APPENDIX C- Trench Stratigraphy

Test Area A Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
A-1-1	7.50	2.05	Decomposing limestone bedrock	I	0.0-0.5	0.50	Very dark brown	7.5YR 2.5/3	Sandy clay loam	Fine, Friable	10% limestone gravel	Distinct/irregular	Reworked	Plow zone	Basalt
				II	0.5-0.95	0.45	Yellowish red	5YR 5/8	Sand	Coarse	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				III	0.95-1.05	0.10	Very pale brown	10YR 8/4	Sand	Coarse	10% reef rubble	Distinct/wavy	Marine deposited	Intact	-
				IV	1.05-2.05	1.00	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Very Coarse	100% weathered decomposing limestone	-	Residual	Intact	-
A-1-2	6.60	2.60	Decomposing limestone bedrock	I	0.0-0.8	0.80	Very dark brown	10YR 2/2	Sandy clay loam	Fine, Friable	10% limestone and basalt gravel & pebbles	Distinct/wavy	Fill- push pile	Redeposited	Plastic hose, basalt
				II	0.8-1.25	0.45	Dark brown	7.5YR 3/3	Sandy clay loam	Fine, Friable	10% limestone gravel & pebbles	Distinct/irregular	Reworked alluvium	Plow zone	Volcanic glass core
				III	1.25-1.6	0.35	Strong brown	7.5YR 5/6	Sand	Coarse	sparse reef rubble	Abrupt/wavy	Marine deposited	Intact	-
				IV	1.6-1.64	0.04	Brown	7.5YR 5/2	Calcium	Cemented	-	Abrupt/wavy	Precipitate	Intact	-
				V	1.64-2.0	0.36	Very pale brown	Mottled 10YR 8/3 & 10YR 8/4	Sand	Coarse	20% limestone gravel	Distinct/wavy	Marine deposited	Intact	-
				VI	2.0-2.6	0.60	Very pale brown	10YR 8/1	Limestone	Compact	100% weathered decomposing	-	Bedrock	Intact	-
A-1-3	7.40	2.85	Decomposing limestone bedrock	I	0.0-1.17	1.17	Dark brown	10YR 3/3	Sandy clay loam	Fine, Friable	50% limestone gravel, pebbles, cobbles and boulders	Distinct/wavy	Fill- push pile	Redeposited	Limestone aggregate
				II	1.17-1.45	0.28	Dark brown	7.5YR 3/3	Sandy clay loam	Fine, Friable	10% limestone gravel & pebbles	Distinct/irregular	Reworked	Plow zone	-
				III	1.45-2.15	0.70	Reddish yellow	7.5YR 6/6	Sand	Coarse	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				IV	2.15-2.85	0.70	Very pale brown & light gray	Mottled 10YR 8/2 & 10YR 7/2	Sand	Coarse	100% weathered decomposing limestone	-	Residual	Intact	-
A-2-1	6.80	1.95	Decomposing limestone bedrock	I	0.0-0.33	0.33	Very dark brown	10YR 2/2	Sandy clay loam	Fine, Friable	30% basalt crusher rock	Distinct/wavy	Fill	Redeposited	Basalt
				II	0.33-0.76	0.43	Very dark brown	7.5YR 2.5/3	Sandy clay loam	Fine, Friable	sparse reef rubble	Distinct/irregular	Reworked	Plow zone	-
				III	0.76-1.4	0.64	Pink	Mottled 7.5YR 8/3 & 7.5YR 8/4	Sand	Single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				IV	1.4-1.95	0.55	White	10YR 8/1	Sand & gravel	Coarse	100% weathered decomposing	-	Residual	Intact	-
A-2-2	5.70	1.20	Decomposing limestone bedrock	I	0.0-0.5	0.50	Dark brown	7.5YR 3/2	Sandy clay loam	Fine, Friable	sparse limestone gravel	Distinct/irregular	Reworked	Plow zone	-
				II	0.5-0.75	0.25	Reddish yellow	7.5YR 6/6	Sand	Single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				III	0.75-1.12	0.37	Very pale brown	10YR 7/3	Sand	Fine, single grain	sparse calcium carbonate	Distinct/wavy	Marine deposited	Intact	-
				IV	1.12-1.2	0.08	Very pale brown	10YR 7/3	Sand & gravel	Coarse	100% limestone	Abrupt/wavy	Residual	Intact	-
A-2-3	6.60	2.10	Decomposing limestone bedrock	I	0.0-0.23	0.23	Dark brown	7.5YR 3/3	Sandy loam	Fine, Friable	10% limestone gravel	Abrupt/wavy	Reworked	Plow zone	-
				II	0.23-0.3	0.07	Light yellowish brown	10YR 6/4	Sand	Loose, single grain	sparse reef rubble	Abrupt/smooth	Poss. Storm surge?	Disturbed	-
				III	0.3-0.61	0.31	Dark brown	7.5YR 3/3	Sandy loam	Fine, Friable	10% limestone gravel & pebbles	Distinct/irregular	Reworked	Plow zone	-
				IV	0.61-0.9	0.04	Reddish yellow	7.5YR 6/6	Sand	Fine, sinlge grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				V	0.9-1.35	0.45	Very pale brown	10YR 8/2	Sand	Coarse	sparse reef rubble & calcium carbonate lenses	Distinct/wavy	Marine deposited	Intact	-
				VI	1.35-2.1	0.75	White	10YR 8/1	Sand	Coarse	100% weathered decomposing	-	Residual	Intact	-
A-3-1	5.60	2.10	Decomposing limestone bedrock	I	0.0-0.16	0.16	Light yellowish brown	10YR 6/4	Clay loam	Compact	90% crushed limestone	Abrupt/smooth	Fill- push pile	Redeposited	Limestone aggregate
				II	0.16-0.36	0.20	Dark brown	7.5YR 3/2	Sandy clay loam	Fine, Friable	sparse limestone gravel	Distinct/irregular	Reworked	Plow zone	-
				III	0.36-1.4	1.04	Reddish yellow	7.5YR 6/6	Sand	Coarse	sparse reef rubble	Abrupt/wavy	Marine deposited	Intact	-
				IV	1.4-1.5	0.10	Very pale brown	10YR 7/3	Weathered limestone	Compact	-	Abrupt/wavy	Bedrock	Intact	-
				V	1.5-2.1	0.60	Very pale brown	10YR 8/2	Sand	Fine	100% decomposing limestone	-	Residual	Intact	-
A-3-2	6.30	2.15	Decomposing limestone bedrock	I	0.0-0.66	0.66	Very dark brown	7.5YR 2.5/3	Sandy clay loam	Fine, Friable	1% limestone and basalt gravel, pebbles	Distinct/irregular	Reworked alluvium	Plow zone	Waterworn basalt pebble
				II	0.66-1.52	0.86	Reddish yellow	Mottled 7.5YR 7/6 & 7.5YR 6/6	Sand	Coarse, single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				III	1.52-2.15	0.63	Very pale brown	10YR 8/2	Weathered sand	Coarse	100% weathered decomposing	-	Residual	Intact	-

Test Area A Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
A-3-3	5.80	1.95	Decomposing limestone bedrock	I	0.0-0.45	0.45	Very dark brown	7.5YR 2.5/3	Sandy clay loam	Fine, Friable	sparse limestone gravel	Distinct/irregular	Reworked	Plow zone	-
				II	0.45-1.25	0.80	Strong brown	7.5YR 5/8	Sand	Coarse	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				III	1.25-1.95	0.75	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse	100% weathered decomposing limestone	-	Residual	Intact	-
A-4-1	6.00	2.00	Water table	I	0.0-0.3	0.30	Very dark grayish brown & dark brown	Mottled 10YR 3/2 & 10YR 3/3	Sandy loam	Fine, Friable	-	Distinct/irregular	Reworked alluvium	Plow zone	-
				II	0.3-1.25	0.95	Very pale brown	Mottled 10YR 7/4 & 10YR 8/2	Sand	Coarse, single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				-	1.25	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				III	1.25-2.0	0.73	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	100% weathered decomposing limestone	-	Residual	Intact	-
A-4-2	6.70	2.30	Water table	I	0.0-0.45	0.45	Dark brown	10YR 3/3	Sandy loam	Fine, Friable	-	Distinct/irregular	Reworked	Plow zone	-
				II	0.45-1.34	0.89	Reddish yellow & very pale brown	Mottled 7.5YR 6/6 & 10YR 7/4	Sand	Coarse, single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				-	1.34	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				III	1.34-2.3	0.83	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	100% weathered decomposing limestone	-	Residual	Intact	-
A-4-3	6.80	2.00	Water table	I	0.0-0.45	0.45	Dark brown	10YR 3/3	Sandy loam	Fine, Friable	-	Distinct/irregular	Reworked	Plow zone	Plastic
				II	0.45-1.45	0.83	Very pale brown	Mottled 10YR 8/3 & 10YR 8/4	Sand	Coarse, single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				-	1.28	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				III	1.45-2.0	0.60	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	100% weathered decomposing limestone	-	Residual	Intact	-
A-5-1	7.10	2.30	Water table	I	0.0-0.2	0.20	Very dark grayish brown & dark brown	Mottled 10YR 3/2 & 10YR 3/3	Silt loam	Unconsolidated	50% organics, 10% limestone gravel	Diffuse/wavy	Fill	Redeposited	-
				II	0.2-0.42	0.22	Pale brown	10YR 6/3	Sandy loam	Loose	95% crushed limestone	Distinct/wavy	Fill	Redeposited	Limestone aggregate
				III	0.42-1.1	0.68	Dark brown & brown	Mottled 7.5YR 3/4 & 7.5YR 5/3	Clay loam	Fine, Friable	70% limestone cobbles, pebbles & gravel and 10% basalt pebbles & gravel	Abrupt/smooth	Fill	Redeposited	Limestone & basalt aggregate
				IV	1.1-1.56	0.46	Brown	10YR 3/3	Clay loam	Fine, Friable	10% limestone gravel and pebbles	Distinct/wavy	Banded Fill	Redeposited	Chrome handle, asphalt, sparse charcoal
				V	1.56-2.3	0.74	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	sparse reef rubble	-	Marine deposited	Intact	-
A-5-2	6.80	2.48	Water table	I	0.0-0.22	0.22	Dark reddish	5YR 3/3	Clay loam	Fine, Friable	50% basalt gravel and pebbles	Distinct/wavy	Fill	Redeposited	Basalt
				II	0.22-0.44	0.22	Dark gray & dark grayish brown	Mottled 10YR 4/1 & 10YR 4/2	Loamy sand	Loose, single grain	sparse basalt pebbles	Distinct/irregular	Reworked alluvium	Plow zone	Basalt aggregate
				III	0.44-1.95	1.51	White & very pale brown	Mottled 10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	sparse reef rubble (concretions, waterworn coral & marine shells)	Distinct/wavy	Marine deposited	Intact	-
				-	1.69	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				IV	1.95-2.48	0.53	White	10YR 8/1	Sand	Coarse, single	100% weathered decomposing	-	Residual	Intact	-

Test Area A Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
A-5-3	6.90	2.70	Water table	I	0.0-0.4	0.40	Brown	10YR 5/3	Clay loam	Fine, Friable	80% limestone boulers, cobbles, pebbles & gravel; 5% basalt pebbles	Abrupt/wavy	Fill- probable OR&L RR grade,	Secondary deposit	Limestone & basalt
				II	0.4-0.54	0.14	Dusky red	2.5YR 3/4	Clay	Blocky	50% limestone pebbles & gravel, and basalt gravel	Abrupt/smooth	Fill- probable OR&L RR grade,	Redeposited	Limestone & basalt
				III	0.54-0.85	0.31	Very dark grayish brown & dark brown	Mottled 10YR 3/2 & 10YR 3/3	Silty sand	Loose, unconsolidated	sparse waterworn basalt pebbles and gravel	Distinct/irregular	Reworked alluvium	Plow zone	Plastic fragments, plastic fork, charcoal flecks
				IV	0.85-2.3	1.45	Very pale brown	Mottled 10YR 8/3 & 10YR 8/4	Sand	Coarse, single grain	-	Distinct/wavy	Marine deposited	Intact	-
				-	2.3	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				V	2.3-2.7	0.37	White	10YR 8/1	Sand	Coarse, single	100% weathered decomposing	-	Residual	Intact	-
A-5-4	7.00	2.37	Water table	I	0.0-0.38	0.28	Dusky red	2.5YR 3/4	Clay	Blocky	40% weathered basalt gravel and	Smooth	Fill	Redeposited	-
				II	0.38-0.7	0.42	Very dark grayish brown	10YR 3/2	Silty sand	Loose, single grain	10% subangular basalt pebbles	Distinct/irregular	Reworked alluvium	Plow zone	*Conus* sp. shell
				III	0.7-2.2	1.50	Very pale brown	Mottled 10YR 8/3 & 10YR 7/3	Sand	Coarse, single grain	sparse reef rubble (waterworn coral)	Distinct/wavy	Marine deposited	Intact	-
				IV	2.2-2.37	0.17	White	10YR 8/1	Sand	Coarse, single	100% weathered decomposing	-	Residual	Intact	-
A-6-1	5.50	1.75	Water table	I	0.0-0.64	0.64	Brown	10YR 5/3	Sandy clay loam	Friable	80% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill	Redeposited	Limestone aggregate
				II	0.64-0.95	0.36	Brown & light yellowish brown	Mottled 10YR 4/3 & 10YR 6/4	Silty sand	Loose, single grain	-	Distinct/irregular	Reworked alluvium	Plow zone	-
				III	0.95-1.75	0.80	Very pale brown	10YR 8/3	Sand	Coarse, single	1% reef rubble (waterworn coral)	-	Marine deposited	Intact	-
A-6-2	6.90	2.70	Water table	I	0.0-0.55	0.55	Very dark gray & very dark grayish brown	Mottled 10YR 3/1 & 10YR 3/2	Silty sand	Loose, single grain	-	Distinct/irregular	Reworked alluvium	Plow zone	-
				II	0.55-2.5	1.95	Very pale brown	Mottled 10YR 8/3 & 10YR 7/3	Sand	Coarse, single grain	1% reef rubble (waterworn coral)	Distinct/wavy	Marine deposited	Intact	-
				III	2.5-2.7	0.20	White	10YR 8/1	Sand	Coarse, single	100% weathered decomposing	-	Residual	Intact	-
A-6-3	7.80	2.50	Water table	I	0.0-0.45	0.45	Dark grayish brown & brown	Mottled 10YR 4/2 & 10YR 4/3	Silty sand	Loose, single grain	sparse limestone gravel and pebbles	Distinct/irregular	Reworked alluvium	Plow zone	-
				II	0.45-2.3	1.85	Very pale brown	Mottled 10YR 8/3 & 10Yr 7/3	Sand	Coarse, single grain	sparse reef rubble (waterworn coral)	Distinct/wavy	Marine deposited	Intact	-
				III	2.3-2.5	0.20	White	10YR 8/1	Sand	Coarse, single grain	99% decomposing limestone & 1% waterworn coral pebbles & gravel	-	Residual	Intact	-
A-7-1	7.50	1.66	Water table	I	0.0-0.33	0.33	Dark brown & brown	Mottled 7.5YR 3/3 & 7.5YR 4/3	Sandy loam	Fine, Friable	-	Distinct	Reworked alluvium	Plow zone	-
				II	0.33-0.55	0.22	Very dark gray & black	Mottled 10YR 3/1 & 10YR 2/1	Silty sand	Loose, single grain	sparse reef rubble & terrestrial gastropods	Distinct/smooth	Buried A horizon-alluvial	Intact	-
				III	0.55-0.64	0.09	Brown	10YR 5/3	Slightly silty sand	Loose, single grain	sparse reef rubble (waterworn coral & marine shells); stained from A horizon	Distinct/smooth	Marine deposited	Intact	-
				IV	0.64-1.16	0.52	Light gray & very pale brown	Mottled 10YR 7/2 & 10YR 7/3	Sand	Coarse, single grain	sparse reef rubble (waterworn coral & marine shells)	Distinct/smooth	Marine deposited	Intact	-
				V	1.16-1.33	0.17	White	10YR 8/1	Lithified sand	Compacted, single grain	-	Distinct/smooth	Marine deposited	Intact	-
				VI	1.33-1.66	0.33	White	10YR 8/1	Sand	Coarse, single	100% weathered decomposing	-	Residual	Intact	-
A-7-2	5.50	2.25	Water table	I	0.0-0.35	0.35	Dark brown	10YR 3/3	Silty loam	Fine, Friable	-	Distinct/wavy	Reworked	Plow zone?	-
				II	0.35-2.0	1.65	Reddish yellow	7.5YR 6/6	Sand	Single grain	1% reef rubble (coral)	Distinct/wavy	Marine deposited	Intact	-
				III	2.0-2.25	0.25	White	10YR 8/1	Sand	Single grain	100% weathered decomposing	-	Residual	Intact	-

Test Area A Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
A-8-1	6.70	2.40	Water table	I	0.0-0.2	0.20	Very dark brown	10YR 2/2	Loamy sand	Loose	1% subangular basalt pebbles	Distinct/smooth	Fill	Redeposited	Plastic fragments
				II	0.2-0.48	0.28	Very dark grayish brown	10YR 3/2	Loamy sand	Compact	1% subangular basalt gravel & limestone pebbles; sparse marine shells	Distinct/irregular	Reworked alluvium	Plow zone	Basalt aggregate
				III	0.48-0.56	0.08	Strong brown	7.5YR 4/6	Slightly silty sand	Single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				IV	0.56-1.47	0.91	Very pale brown	Mottled 10YR 8/2 & 10YR 8/4	Sand	Loose, single grain	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				V	1.47-1.6	0.13	Reddish yellow	7.5YR 7/6	Lithified sand	Compact	sparse reef rubble	Distinct/wavy	Marine deposited	Intact	-
				VI	1.6-2.4	0.80	White	10YR 8/1 & 10YR 8/2	Sand	Coarse, single grain	100% weathered decomposing limestone	-	Residual	Intact	-
A-9-1	8.00	2.60	Decomposing limestone bedrock & Water table	I	0.0-0.15	0.15	Dark reddish	5YR 3/3	Clay	Blocky	-	Abrupt/smooth	Fill	Redeposited	-
				II	0.15-0.25	0.10	Pale brown & dark grayish brown	Mottled 10YR 6/6 & 10YR 4/2	Sand	Loose, unconsolidated	-	Abrupt/smooth	Fill	Redeposited	-
				III	0.25-0.5	0.25	Black	10YR 2/1	Loamy sand	Loose, single grain	-	Distinct/irregular	Reworked alluvium	Plow zone	Waterworn basalt pebble
				IV	0.5-1.4	0.90	Very pale brown	Mottled 10YR 8/3 & 10YR 7/4	Sand	Single grain	sparse reef rubble	Abrupt/wavy	Marine deposited	Intact	-
				Trash Pit	0.5-1.4	0.90	Very pale brown	10YR 7/3	Loamy sand	-	20th Century refuse	Abrupt/smooth	Plantation era trash pit fill	Intrusive into Layer IV	Glass bottles (condiment, medicine, cosmetic), Japanese glazed ceramic teacup, butchered pig & goat bones, sanitary cans; rusted metal; metal & plastic screw caps (post-1936)
				V	1.4-2.6	1.20	-	-	Limestone & clay	-	100% weathered decomposing	-	Bedrock	Intact	-
A-10-1	6.20	2.50	Water table (artesian well)	I	0.0-0.35	0.35	Dark brown	10YR 3/3	Silty sand	Loose	1% limestone gravels & pebbles	Distinct/irregular	Reworked	Plow zone	-
				II	0.35-0.9	0.55	Light gray & very pale brown	Mottled 10YR 7/2 & 10YR 7/4	Sand	Coarse, single grain	sparse reef rubble	Distinct/smooth	Marine deposited	Intact	-
				III	0.9-1.02	0.12	Strong brown	7.5YR 4/6	Sand	Coarse, single	sparse reef rubble	Diffuse/wavy	Marine deposited	Intact	-
				IV	1.02-2.5	1.48	Brown	7.5YR 4/4	Clay	Massive	-	-	Alluvial	Intact	-

Test Area B Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
B-1-1	4.60	1.43	Decomposing limestone bedrock	I	0.0-0.35	0.35	Dark brown	7.5YR 3/3	Sandy clay loam	Fine, friable crumb	sparse limestone gravel	Abrupt/wavy	Push pile fill	Redeposited	Rubber hose, aluminum can
				II	0.35-0.57	0.22	Brown & very pale brown	Mottled 10YR 4/3 & 10YR 7/3	Silty sand	Loose, single grain	sparse limestone gravels & pebbles	Abrupt/irregular	Possible tsunami?	Intact	Sparse charcoal
				III	0.57-1.15	0.58	White & very pale brown	Mottled 10YR 8/1 & 10YR 7/4	Sand	Loose, single grain	60% limestone gravel & pebbles	Distinct/smooth	Marine deposited	Intact	-
				IV	1.15-1.43	0.25	Brown	7.5YR 4/4	Clay (alluvial)	Massive	50% weathered limestone (residual)	Abrupt/wavy	Alluvial, Residual	Intact	
				V	1.43+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-1-2	4.80	0.87	Decomposing limestone bedrock	I	0.0-0.12	0.12	Very pale brown & white	Mottled 10YR 7/4 & 10YR 8/1	Sand	Coarse, single grain	50% organic material	Abrupt/wavy	Push pile fill	Redeposited	-
				II	0.12-0.3	0.18	Brown	10YR 5/3	Sandy loam	Fine, friable	sparse limestone gravel	Abrupt/smooth	Alluvium	Intact	-
				III	0.3-0.5	0.20	Very pale brown & light yellowish brown	Mottled 10YR 7/4 & 10YR 6/4	Sand	Compacted, single grain	sparse reef rubble (marine shells)	Diffuse/wavy	Marine deposited	Intact	-
				IV	0.5-0.87	0.37	Brown	7.5YR 4/4	Clay (alluvial)	Massive	10% weathered limestone gravel, pebbles & cobbles (residual)	Abrupt/wavy	Alluvial	Intact	-
				V	0.87+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-1-3	5.20	0.42	Decomposing limestone bedrock	I	0.0-0.12	0.12	Dark brown	10YR 3/3	Sandy clay loam	Fine, friable	-	Distinct/wavy	Alluvium	Intact	-
				II	0.12-0.42	0.30	Brown	10YR 4/3	Clay	Fine, friable	sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				III	0.42+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-1-4	5.40	0.16	Decomposing limestone bedrock	I	0.0-0.16	0.18	Dark brown	7.5YR 3/3	Clay loam	Fine, friable crumb	10% limestone gravel	Abrupt/wavy	Alluvium	Intact	-
				II	0.16+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-
B-2-1	4.80	0.80	Decomposing limestone bedrock	I	0.0-0.28	0.28	Brown	10YR 5/3	Slightly silty sand	Loose, single grain	-	Distinct/irregular	Tsunami Deposit?	Intact (disturbance on surface from horses)	-
				II	0.28-0.5	0.22	Very pale brown	10YR 7/4	Sand	Fine, single grain	-	Diffuse/wavy	Aeolian?	Intact	-
				III	0.5-0.8	0.30	Strong brown	7.5YR 4/6	Sandy clay	Single grain	sparse limestone cobbles	Abrupt/wavy	Alluvial	Intact	-
				IV	0.8+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-2-2	5.00	0.60	Decomposing limestone bedrock	I	0.0-0.35	0.35	Dark brown	10YR 3/3	Sandy clay loam	Fine, friable	10% limestone gravel & pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.35-0.6	0.25	Brown	7.5YR 4/4	Clay	Massive	< 10% limestone gravel & pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.6+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-2-3	6.20	0.34	Decomposing limestone bedrock	I	0.0-0.2	0.20	Dark brown	7.5YR 3/2	Clay loam	Fine, friable	20% limestone gravel & pebbles	Abrupt/wavy	Alluvium	Intact	-
				II	0.2-0.34	0.14	Dark brown	7.5YR 3/4	Clay	Fine, friable	10% limestone gravel & pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.34+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-2-4	5.20	0.38	Decomposing limestone bedrock	I	0.0-0.23	0.23	Dark brown	7.5YR 3/2	Clay loam	Fine, friable	< 10% limestone gravel	Distinct/wavy	Alluvium	Intact	-
				II	0.23-0.38	0.15	Dark brown	7.5YR 3/4	Clay	Fine, friable	< 10% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				III	0.38+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-3-1	4.70	1.26	Decomposing limestone bedrock	I	0.0-0.28	0.28	Dark brown	10YR 3/3	Loamy sand	Loose, single	< 10% limestone gravel	Distinct/wavy	Marine deposited	Intact	-
				II	0.28-0.49	0.21	Dark brown	7.5YR 3/4	Sandy loam	Compacted, fine, friable crumb	< 10% limestone gravel	Distinct/wavy	Alluvium?	Intact	-
				III	0.49-0.9	0.41	Very pale brown	10YR 7/4	Sand	Loose, single	1% reef rubble (coral, marine shells)	Abrupt/wavy	Marine deposited	Intact	-
				IV	0.9-1.26	0.36	Brown	7.5YR 3/4	Clay	Massive	sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				V	1.26+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-3-2	5.50	0.45	Decomposing limestone bedrock	I	0.0-0.25	0.25	Dark brown	7.5YR 3/3	Sandy clay loam	Fine, friable	< 10% limestone gravel & pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.25-0.45	0.20	Brown	7.5YR 4/4	Clay	Massive	< 10% limestone gravel & pebbles	Abrupt/wavy	Alluvial	Intact	WWII-era amber glass bottle bases (2) duraglass
				III	0.45+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-

Test Area B Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
B-3-3	6.30	0.22	Decomposing limestone bedrock	I	0.0-0.22	0.25	Dark brown	7.5YR 3/3	Sandy clay loam	Fine, friable crumb	< 10% limestone gravel & pebbles	Abrupt/wavy	Alluvium	Intact	-
				II	0.22+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-
B-3-4	6.00	1.65	Decomposing limestone bedrock	I	0.0-0.28	0.28	Brown & white	Mottled 10YR 4/3 & 10YR 8/1	Clay loam	Compacted, fine, friable crumb	95% crushed limestone	Abrupt/wavy	Fill	Redeposited	limestone aggregate
				II	0.28-1.27	0.99	Dark reddish	5YR 3/3	Clay	Massive	sparse limestone gravel	Distinct/wavy	Alluvial	Intact	-
				III	1.27-1.65	0.38	Yellowish brown	10YR 5/4	Clay	Non-sticky,	80% weathered decomposing limestone	Abrupt/wavy	Bedrock	Intact	-
B-3-5	4.70	1.32	Decomposing limestone bedrock	I	0.0-0.6	0.50	Dark brown	7.5YR 3/2	Clay loam	Fine, friable crumb	50% limestone & basalt gravel & pebbles	Abrupt/wavy	Push pile fill	Redeposited	basalt aggregate, asphalt frags, plastic frags.
				II	0.23-1.09	0.40	Brown	10YR 4/3	Sandy clay loam	Fine, friable	40% limestone gravel & pebbles	Abrupt/wavy	Push pile fill	Redeposited	basalt
				III	0.41-0.44	0.04	Light gray & light brownish gray	Mottled 10YR 7/2 & 10YR 6/2	Sand	Loose, single grain	-	Abrupt/wavy	Alluvial?	Redeposited, truncated or disturbed	-
				IV	0.44-1.32	0.33	Dark reddish	5YR 3/2	Clay	Massive	sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				V	1.32+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-4-1	5.00	1.56	Decomposing limestone bedrock	I	0.0-0.10	0.10	Brown	10YR 5/3	Silty sand	Compact, single grain	-	Abrupt/wavy	Marine deposited	Intact	-
				II	0.10-0.27	0.17	Very pale brown & pale brown	Mottled 10YR 7/3 & 10YR 6/3	Slightly silty sand	Loose, single grain	-	Abrupt/wavy	Possible tsunami	Intact	Bottle glass fragments c. WW II-era
				III	0.27-0.40	0.23	Brown & very pale brown	Mottled 10YR 4/3 & 10YR 8/2	Silty sand	Moderately compacted	-	Abrupt/wavy	Probable tsunami	Intact	-
				Pit	0.40-0.87	0.47	Pale brown & brown	Banded 10YR 6/3 & 10YR 5/3	Slightly silty sand	Single grain	No inclusions visible; originates @ base of Layer III, intrusive into Layer IV	Diffuse	Fill (natural?)	Intact	None visible
				IV	0.40-0.100	0.60	White	10YR 8/1	Sand	Loose, single	Sparse concretions	Distinct/wavy	Aeolian	Intact	-
				-	0.9	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				V	1.0-1.42	0.42	Very pale brown	Mottled 10YR 8/2 & 10YR 8/3	Sand	Coarse	50% reef rubble	Diffuse/wavy	Marine deposited	Intact	*Nerita* shell fragments
				VI	1.42-1.56	0.14	Yellowish red & Reddish yellow	5YR 5/8 & 5YR 6/8	Slightly silty sand	Coarse	100% weathered decomposing limestone	-	Bedrock	Intact	-
B-4-2	5.50	1.30	Decomposing limestone bedrock	I	0.0-0.5	0.50	Very dark grayish brown	10YR 3/2	Sandy clay loam	Fine, friable crumb	sparse limestone gravel	Abrupt/wavy	Alluvium	Intact	-
				II	0.5-0.85	0.35	Reddish yellow	7.5YR 6/6	Slightly silty sand	Single grain	10% reef rubble (limestone & coral)	Distinct/wavy	Marine deposited	Intact	-
				III	0.85-1.3	0.45	Brown	7.5YR 5/4	Clay	Massive	20% limestone gravel & pebbles	Abrupt/wavy	Alluvial	Intact	-
				IV	1.3+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-4-3	5.40	0.12	Decomposing limestone bedrock	I	0.0-0.12	0.12	Dark brown	7.5YR 3/3	Clay	Fine, friable crumb	10% limestone gravel & crushed basalt	Abrupt/wavy	Fill	Redeposited	basalt aggregate
				II	0.12+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-
B-4-4	5.70	0.60	Decomposing limestone bedrock	I	0.0-0.15	0.15	Dark brown	10YR 3/3	Clay loam	Fine, friable	sparse limestone gravel	Distinct/wavy	Fill	Redeposited	-
				II	0.15-0.43	0.28	Brown & very dark grayish brown	Mottled 10YR 5/3 & 10YR 3/2	Silty sand	Single grain	-	Abrupt/wavy	Aeolian	Redeposited? Disturbed	-
				III	0.43-0.6	0.17	Dark brown	7.5YR 3/2	Clay	Massive	sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				IV	0.6+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-4-5	5.20	1.09	Decomposing limestone bedrock	I	0.0-0.83	0.83	Very dark brown & dark grayish brown	Mottled 7.5YR 2.5/3 & 10YR 4/2	Sandy clay	Fine, friable crumb	15% limestone gravel, pebbles & cobbles	Abrupt/wavy	Banded Fill	Redeposited	Asphalt fragments & basalt
				II	0.83-1.09	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-

Test Area B Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
B-5-1	6.20	1.15	Decomposing limestone bedrock	I	0.0-0.30	0.30	Pale brown	10YR 6/3	Slightly silty sand	Single grain	-	Abrupt/wavy	Marine deposited	Intact (possibly disturbed over pit)	Electric wire, plastic frags
				Pit I-a	0.20-0.60	0.40	Dark gray	10YR 4/1	Slightly silty sand	Compact, single grain	Pit originates near base of Layer I, intrusive into Layers II & IV	Abrupt/wavy	*Imu* fill (modern)	Secondary deposit	*Conus* shell
				Pit I-b	0.60-0.85	0.25	Grayish brown with light gray	Mottled 10YR 5/2 & 10YR 7/2	Sand	Loose, single grain	Pit originates near base of Layer I, intrusive into Layers II & IV	Distinct/wavy	*Imu* fill (modern)	Secondary deposit	Compacted ash
				Pit I-c	0.85-1.15	0.30	Grayish brown & white	Mottled 10YR 5/2 & 10YR 8/1	Slightly silty sand	Loose, single grain	Pit originates near base of Layer I, intrusive into Layers II & IV	Distinct/smooth	*Imu* fill (modern)	Secondary deposit	Juvenile pig bones at base of pit
				II	0.22-1.15	0.93	White	10YR 8/1	Sand	Loose, single	Sparse concretions	Abrupt/wavy	Aeolian	Intact	-
				-	0.9	-	-	-	Calcium	Cemented	-	-	Precipitate	Intact	-
				III	0.9-0.96	0.06	Very pale brown	10YR 8/4	Sand	Coarse	-	Abrupt/wavy	Marine deposited	Intact	-
				IV	0.35-0.7	0.35	Gray & light gray banded	Banded 10YR 6/1 & 10YR 7/2	Sand	Loose, single grain	Probable draft for pit (*imu*)	Unknown	Fill	Redeposited	-
				V	0.96+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-5-2	5.20	0.80	Decomposing limestone bedrock	I	0.0-0.17	0.17	Dusky red	2.5YR 3/4	Clay	Fine, friable	sparse limestone gravel	Abrupt/wavy	Fill	Redeposited	Irrigation pipe
				II	0.17-0.45	0.28	Brown	10YR 4/3	Sandy clay loam	Fine, friable	10% limestone gravel & pebbles	Distinct/wavy	Marine deposited	Disturbed-churned	Plastic
				III	0.45-0.65	0.20	Pale brown	10YR 6/3	Silty Sand	Loose, single	20% limestone gravel	Distinct/wavy	Marine deposited	Intact?	-
				IV	0.65-0.8	0.15	Dark brown	7.5YR 3/3	Clay	Massive	sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				V	0.8+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-5-3	5.80	1.04	Decomposing limestone bedrock	I	0.0-0.38	0.38	Dark brown	10YR 3/3	Sandy clay loam	Fine, friable	20% limestone gravel, pebbles & cobbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.38-0.83	0.45	Dark brown	7.5YR 3/4	Clay loam	Fine, friable crumb	30% limestone gravel & pebbles	Abrupt/wavy	Fill	Redeposited	Asphalt fragments
				III	0.83-0.92	0.09	Very pale brown	Mottled 10YR 8/2 & 10YR 7/3	Sand	Loose, single grain	-	Abrupt/wavy	Marine deposited	Intact	-
				IV	0.92-1.04	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-5-4	7.20	2.20	Decomposing limestone bedrock	I	0.0-0.2	0.20	Dark reddish	5YR 3/4	Clay	Fine, friable	sparse limestone gravel	Abrupt/smooth	Imported Fill	Redeposited	-
				II	0.2-0.95	0.75	Dark brown	Mottled 7.5YR 3/2 & 7.5YR 3/3	Clay	Fine, friable crumb	50% limestone gravel, pebbles, cobbles & boulders	Abrupt/wavy	Fill	Redeposited	-
				Pit	0.95-2.2	0.25	Brown & dark brown	Mottled 10YR 4/3 & 10YR 3/3	Clay	Loose, fine, friable crumb	20% limestone gravel; green waste	Abrupt/wavy	Trash pit fill	Secondary deposit	Milled lumber, garden hose, plastic
				III	1.55-2.0	0.45	Dark brown	7.5YR 3/3	Clay	Massive	-	Distinct/smooth	Alluvial	Intact	-
				IV	2.0-2.2	0.20	Brown	10YR 5/3	Clay (alluvial)	Massive	10% weathered limestone gravel	Distinct/smooth	Alluvial, Residual	Intact	-
				V	2.2+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-6-1	6.70	2.80	Water table	I	0.0-0.11	0.11	Brown	10YR 5/3	Silty sand	Compacted, single grain	-	Abrupt/wavy	Marine deposited?	Intact	-
				II	0.11-0.28	0.17	Brown & pale brown	Mottled 10YR 4/3 & 10YR 6/3	Silty sand	Compacted, single grain	sparse limestone gravels & pebbles	Abrupt/wavy	Probable tsunami	Intact	-
				III	0.28-2.8	2.52	Very pale brown	Mottled 10YR 8/2 & 10YR 7/3	Sand	Loose, single grain	5% lithified chunks & sparse calcium carbonate precipitate laminates	Water table	Aeolian	Intact	1 coral fragment

Test Area B Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
B-6-2	3.00	0.60	Human burial encountered	I	0.0-0.24	0.24	Brown & pale brown	Mottled 10YR 4/3 & 10YR 6/3	Slightly silty sand	Moderately compacted	sparse limestone gravels & pebbles	Distinct/irregular	Cultural Deposit; Site 7288	Probably partially disturbed over burial- possible tsunami?	volcanic glass, burned *kukui* nutshells, marine shells
				Burial Pit	0.35-0.40 (cranium)	unknown	Very pale brown	Mottled 10YR 8/2 & 10YR 7/3	Sand (matrix of redeposited Layer II- pit outline not discernible)	Loose, single grain	human cranium at depth indicated; depth & dimensions of pit not visible in matrix	pit not visible, assumed intrusive into Layer II from Layer I	Human primary burial; Site 7288	Intact	Juvenile (c. 8 yrs) *in situ* primary burial @35-40 cm bgs
				II	0.2-0.6	0.40	Very pale brown	Mottled 10YR 8/2 to 10YR 7/3	Sand	Loose, single grain	-	Unexcavated	Aeolian	Intact	-
B-6-3	5.80	1.95	Decomposing limestone bedrock	I	0.0-0.25	0.25	Dark reddish	5YR 3/4	Clay	Fine, friable	sparse limestone gravel	Abrupt/smooth	Imported Fill	Redeposited	-
				Pit	0.25-1.5	1.25	Black & very dark grayish brown	Mottled 10YR 2/1 & 10YR 3/2	Clay	Fine, friable crumb	20% limestone gravel	Abrupt/wavy	Fill- modern trash	Secondary deposit	Recent garbage
				II	0.25-1.75	1.50	Dark brown	7.5YR 3/2	Clay	Massive	-	Distinct/smooth	Alluvial	Intact	-
				III	1.75-1.95	0.20	Brown	10YR 4/3	Clay	Massive	-	Distinct/smooth	Alluvial	Intact	-
				IV	1.95+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-6-4	4.90	1.25	Water table	I	0.0-0.7	0.70	Dusky red	2.5YR 3/2	Clay	Fine, friable	sparse basalt gravel	Distinct/smooth	Imported Fill	Redeposited	-
				II	0.7-0.92	0.22	Pale brown	10YR 6/3	Clay	Fine, friable	20% limestone gravel	Distinct/smooth	Alluvial	Intact	-
				III	0.92-1.25	0.33	Brown	10YR 4/2	Clay	Massive	-	Water table	Alluvial	Intact	-
B-7-1	6.90	2.65	Water table	I	0.0-0.1	0.10	Very dark grayish brown	10YR 3/2	Silty sand	Compacted, single grain	-	Abrupt/wavy	Aeolian?	Intact	-
				II	0.1-2.65	2.55	Very pale brown	10YR 8/2	Sand	Loose, single grain	5% lithified s& chunks; calcium carbonate precipitate laminates; sparse b&s of waterworn marine shells (from storms?)	Water table	Aeolian dune with bedded marine deposits	Intact	2 old utility trenches, 1 poss. post mold
B-7-2	5.10	1.40	Decomposing limestone bedrock	I	0.0-0.56	0.56	Very dark gray	10YR 3/1	Clay	Fine, friable crumb	40% limestone & basalt gravel & pebbles	Abrupt/smooth	Imported Fill	Redeposited	Limestone & basalt
				II	0.56-1.0	0.44	Yellowish brown	10YR 5/4	Slightly silty sand	Very fine, single grain	sparse coral	Distinct/smooth	Marine deposited	Intact	-
				III	1.0-1.4	0.40	Brown	10YR 5/3 & 10YR 4/3	Very slightly silty sand	Coarse, single grain	< 10% limestone gravel & pebbles	Abrupt/wavy	Marine deposited	Intact	-
				IV	1.4+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-7-3	6.40	2.70	Water table	I	0.0-0.2	0.20	Dark brown	7.5YR 3/3	Clay	Fine, friable	15% limestone & basalt gravel	Abrupt/smooth	Imported Fill	Redeposited	-
				II	0.2-1.17	0.97	Dark yellowish brown	10YR 3/4	Sandy clay loam	Fine, friable crumb	20% limestone gravel, pebbles & cobbles	Abrupt/wavy	Fill	Redeposited	-
				Pit	1.17-1.8	0.63	Light gray & dark brown	Mottled 10YR 7/2 & 7.5YR 3/4	Clay loam	Fine, friable crumb	15% limestone gravel & pebbles	Distinct/wavy	Fill- modern trash	Secondary deposit- churned	Ziploc bags, Gatorade bottles, Budwiser cans, sporks
				III	1.8-2.08	0.28	Yellowish brown	10YR 5/4	Loamy sand	Single grain	limestone gravel & pebbles	Abrupt/smooth	Marine deposited	Intact	-
				IV	2.08-2.18	0.10	White	10YR 8/1	Weathered limestone	-	-	Abrupt/wavy	Bedrock over void	Intact	-
				V	2.18-2.7+	0.52	Brown	10YR 4/3	Clay	Massive	-	Water table	Alluvial fill in void	Intact	-
B-8-1	5.30	2.70	Water table	I	0.0-0.15	0.15	Grayish brown	10YR 5/2	Slightly silty sand	Single grain	-	Abrupt/wavy	Aeolian	Intact	-
				II	0.15-1.6	1.45	Very pale brown	10YR 8/2	Sand	Single grain	-	Abrupt/wavy	Aeolian	Intact	-
				III	1.6-2.7	1.10	Very pale brown	10YR 7/3	Sand	Coarse, single	-	Water table	Marine deposited	Intact	-

Test Area B Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
B-8-2	5.60	1.55	Decomposing limestone bedrock	I	0.0-0.33	0.33	Brown & grayish brown	Mottled 7.5YR 4/4 & 10YR 5/2	Clay and silty sand	Compacted, fine, friable crumb	50% limestone & basalt gravel & pebbles	Abrupt/wavy	Imported Fill	Redeposited	Plastic bag
				II	0.33-0.51	0.18	Very pale brown	10YR 8/2	Beach sand	Loose, single grain	sparse waterworn marine shells & limestone gravel	Abrupt/smooth	Storm deposit (or tsunami?)	Intact	-
				III	0.51-0.87	0.36	Dark brown	7.5YR 3/3	Silty sand	Compacted, single grain	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.87-1.32	0.45	Strong brown	7.5YR 5/6	Silty sand	Compacted, single grain	sparse limestone gravel	Diffuse/wavy	Marine deposited	Intact	-
				V	1.32-1.55	0.23	Brown	10YR 5/3	Sand	Loose, single	sparse coral & limestone gravel	Abrupt/wavy	Marine deposited	Intact	-
				VI	1.55+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-8-3	4.50	0.75	Decomposing limestone bedrock	I	0.0-0.25	0.25	Dark brown	7.5YR 3/3	Clay	Compact	10% limestone pebbles & cobbles	Abrupt/wavy	Imported Fill	Redeposited	Irrigation pipe
				II	0.25-0.75	0.50	Dark yellowish brown	10YR 4/4	Loamy sand	Single grain & crumb	10% limestone gravel	-	Alluvium	Intact	-
				III	0.75+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-9-1	5.70	2.65	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.2	0.10	Light gray & very pale brown	Mottled 10YR 7/2 & 10YR 7/3	Sand	Compacted, single grain	10% limestone gravel	Abrupt/smooth	Fill	Redeposited	-
				III	0.2-0.65	0.30	Dark grayish brown & very pale brown	Mottled 10YR 4/2 & 10YR 7/3	Silty sand	Compacted, single grain	10% limestone gravel & pebbles	Abrupt/wavy	Fill	Redeposited	-
				IV	0.5-2.3	1.80	Very pale brown & brown	7.5YR 3/3 & pockets of 10YR 4/3	Sandy clay	Massive	20% limestone gravel, pebbles & cobbles	Abrupt/smooth	Fill	Redeposited	-
				V	2.3-2.65	0.35	Light brownish	10YR 6/2	Sand	Coarse, single	100% decomposing limestone	Abrupt/wavy	Residual	Intact	-
				VI	2.65+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-9-2	5.20	1.54	Decomposing limestone bedrock	I	0.0-0.42	0.42	Brown	10YR 4/3	Sandy clay loam	Compacted, fine, friable crumb	20% limestone & 10% weathered basalt gravel & pebbles	Abrupt/smooth	Imported Fill	Redeposited	-
				II	0.42-0.66	0.24	Pale brown	10YR 6/3	Silty sand	Fine, friable crumb	60% limestone gravel, pebbles & cobbles	Abrupt/smooth	Fill	Redeposited	limestone & basalt
				III	0.66-0.82	0.16	Very pale brown	10YR 7/3	Silty sand	Compacted, single grain	90% crushed limestone	Abrupt/smooth	Crushed limestone fill	Redeposited	limestone & basalt
				IV	0.82-0.9	0.08	Brown	10YR 4/3	Sandy clay loam	Compacted, fine, friable crumb	10% limestone gravel & pebbles	Abrupt/smooth	Alluvium	Intact	-
				V	0.9-1.54	0.64	Strong brown	7.5YR 4/6	Silty Sand (Beach Sand- stained calcareous sand)	Compact, single grain	sparse fine gravel limestone, coral, fragments & marine shells	Abrupt/wavy	Marine deposited	Intact	-
				VI	1.54+	-	-	-	Limestone	-	100% weathered decomposing	-	Bedrock	Intact	-
B-10-1	5.60	2.60	Water table	I	0.0-0.1	0.10	Brown	7.5YR 5/4	Loamy sand	Fine, friable crumb	50% limestone gravel	Abrupt/wavy	Fill	Redeposited	2 utility trenches, irrigation pipe
				II	0.1-2.6	2.50	Very pale brown	10YR 8/2	Sand	Loose, single	lithified s& chunks	Water table	Aeolian dune	Intact	-
B-10-2	5.80	2.50	Water table	I	0.0-0.1	0.10	Brown	7.5YR 5/3	Sand	Single grain	50% organic duff	Abrupt/wavy	Aeolian	Intact	-
				II	0.1-2.5	2.40	White & very pale brown	10YR 8/1 & 10YR 8/2	Sand	Loose, single grain	Sparse concretions	Water table	Aeolian dune	Intact	-
B-10-3	5.00	1.85	Decomposing limestone bedrock	I	0.0-0.88	0.88	Dark reddish brown & very dark	5YR 3/4 & 7.5YR 2.5/3	Sandy clay	Blocky	50% limestone gravel, pebbles & cobbles & basalt crusher rock	Abrupt/wavy	Banded Fill	Redeposited	basalt aggregate
				II	0.88-1.34	0.46	Dark reddish brown & dark gray & yellowish brown	Mottled 5YR 4/4 & 10YR 4/1 & 10YR 5/8	Clay	Platy	-	Abrupt/smooth	Fill	Redeposited	-
				III	1.34-1.56	0.22	Very dark gray	7.5YR 3/1	Silty Sand	Compact, fine, single grain	-	Abrupt/wavy	Marine deposited	Intact?	-
				IV	1.56-1.85+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-

Test Area C Trench Stratigraphy

Backhoe Trench	Trench length (m)	Trench width (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
C-1-1	7.60	2.00	3.40	Safety limitations	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.1-0.83	0.62	Light gray & grayish brown	Mottled 10YR 7/2 & 10YR 5/2	Sand	Single grain	-	Distinct/wavy	Fill	Redeposited	-
					Pit	0.7-3.26	2.50	Dark gray & Gray	10YR 4/1 & 10YR 5/1	Sand	-	98% WW II refuse	Distinct	Fill-WW II trash	Secondary deposit	Glass bottles (1 dated 1943), tile, batteries, railroad rail
					III	0.6-3.4	2.80	Very pale brown	Mottled 10YR 8/2 & 10YR 8/3	Sand	Single grain	Root concretions & carbonate precipitate	Unexcavated	Aeolian	Intact dune	-
					-	1.7	-	Very pale brown	10YR 8/2 & 10YR 8/3	Calcium carbonate	Cemented	-	-	Precipitate	Intact	-
					-	1.8	-	Very pale brown	10YR 8/2 & 10YR 8/3	Calcium carbonate	Cemented	-	-	Precipitate	Intact	-
C-2-1	7.20	6.00	4.90	Safety limitations	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.08-0.4	0.32	Light brownish gray	10YR 6/2	Sand	Loose, single grain	-	Abrupt/wavy	Aeolian	Intact	-
					Pit	0.5-0.69	0.64	-	-	-	-	1940s broken glass bottles, no sediment	Distinct	Fill-WW II trash	Secondary deposit	Colorless & brown beverage glass bottles, crown cap
					III	0.4-0.44	0.04	Gray	10YR 6/1	Calcium carbonate	Laminated	Rootlets	Abrupt/wavy	Precipitate	Intact	-
					IV	0.44-4.9	4.46	Light gray & very pale brown	Mottled 10YR 7/2 & 10YR 7/4	Sand	Single grain	-	Unexcavated	Aeolian	Intact dune	-
C-2-2	7.70	2.00	2.28	Safety limitations	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
					II	0.07-0.18	0.11	Pale brown	10YR 6/3	Slightly loamy sand	Single grain	-	Distinct/smooth	Fill or tsunami infill	Redeposited	-
					III	0.07-1.12	1.05	Light brownish gray	10YR 6/2	Sand	Single grain	-	Abrupt/wavy	Tsunami infill or trash pit backfill	Redeposited	Broken glass throughout
					Pit	0.1-2.28	2.20	Grayish brown & light gray	10YR 5/2 with pockets of 10YR 7/2	Slightly loamy sand	Single grain	-	Distinct	Fill-WW II trash	Secondary deposit	USQMC 1941 ceramic tableware; cosmetic, beverage & condiment glass bottles; brick, large casing
					IV	1.12-2.28	1.16	Very pale brown	10YR 8/2	Sand	Moderately compacted	laminated bands, some semi-lithified	Unexcavated	Aeolian	Intact dune	-
C-3-1	4.80	4.30	2.50	Safety limitations	I	0.0-0.12	0.12	Dark brown	7.5YR 3/2	Humus	Structureless	100% organic material	Abrupt/smooth	Recent duff	Intact	-
					II	0.12-0.2	0.08	Very pale brown	10YR 8/3	Sand	Loose	-	Abrupt/smooth	Aeolian	Intact	-
					III	0.2-0.29	0.09	Light brownish gray & very pale brown	Banded 10YR 6/2 & 10YR 7/3	Banded Sand	Loose	-	Abrupt/smooth	Possible storm or tsunami deposits	Intact	-
					IV	0.29-0.62	0.33	Pale brown	10YR 6/3	Semi-lithified cemented sand	Massive	-	Abrupt/wavy	Aeolian	Intact	-
					V	0.62-2.5	1.88	Very pale brown	10YR 8/2	Fine sand	Loose, single grain	Suspended granular concretions	Unexcavated	Aeolian	Intact	-

Test Area C Trench Stratigraphy

Backhoe Trench	Trench length (m)	Trench width (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
C-3-2	6.70	2.00	3.50	Safety limitations	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.07-0.3	0.23	Light brownish gray	10YR 6/2	Sand	Single grain	10% limestone gravel and pebbles	Abrupt/smooth	Fill	Redeposited	-
					III	0.3-1.55	1.25	Very pale brown, light gray, & light brownish gray	10YR 8/2, 10YR 7/2 & 10YR 6/2	Undulating, banded sand	Single grain	Reef rubble	Abrupt/wavy	Tsunami (1957 and/or 1946)	Intact	sparse broken glass evenly distributed throughout
					IV	1.55-2.08	0.53	Very pale brown	10YR 8/2	Sand	Single grain	Root concretions	Distinct/wavy	Aeolian	Intact	-
					V	2.08-3.5	1.42	Very pale brown & light gray	10YR 8/2 & 10YR 7/2	Undulating, banded sand	Compacted	-	Unexcavated	Possible Tsunami	Intact	-
C-4-1	5.50	2.00	2.50	Safety limitations	I	0.0-0.1	0.10	Dark brown	7.5YR 3/3	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.1-0.78	0.68	Very pale brown & white	10YR 8/2 & 10YR 8/1	Sand	Loose	-	Diffuse/wavy	Aeolian	Intact	Modern trash pit: beer cans, food wrappers, beer bottles
					III	0.78-2.5	1.72	White & very pale brown	10YR 8/1 & 10YR 8/2	Sand	Semi-lithified	-	Unexcavated	Aeolian	Intact	-
C-4-2	7.40	2.00	3.50	Safety limitations	I	0.0-0.25	0.25	Dark brown	7.5YR 3/3	Clay	Very fine, friable	-	Abrupt/wavy	Fill	Redeposited	Norfolk Pine nursery deposit
					II	0.25-0.37	0.12	Gray & light gray	10YR 6/1 & 10YR 7/1	Sand	Loose	-	Distinct/wavy	Aeolian	Disturbed	4" PVC pipe, electrical wires for Norfolk Pine nursery
					III	0.37-0.7	0.33	White & very pale brown	10YR 8/1 & 10YR 8/2	Sand	Loose	-	Diffuse/wavy	Aeolian	Intact	-
					IV	0.7-3.5	2.80	White & very pale brown	10YR 8/1 & 10YR 8/2	Sand	Lithified	-	Unexcavated	Aeolian	Intact	-
C-5-1	6.20	2.00	2.40	Safety limitations	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
					II	0.1-2.4	2.30	Very pale brown	10YR 8/2	Sand	Loose, single grain	laminated horizontally banded intact aeolian sand; weathered & waterworn marine shells & sparse concretions suggests marine deposition, too	Unexcavated	Aeolian & marine deposited	Intact dune	-
C-5-2	7.00	2.00	2.35	Safety limitations	I	0.0-0.08	0.08	Brown	10YR 4/3	Sand	Loose	50% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.08-1.75	1.67	Very pale brown	10YR 8/2	Sand	Semi-lithified	rootlets	Diffuse/wavy	Aeolian	Intact	PVC pipe and electrical wires for Norfolk Pine nursery
					III	1.75-2.35	0.60	Very pale brown	10YR 8/2	Sand	Lithified w/pockets of loose sand	concretions around roots	Unexcavated	Aeolian	Intact	-
C-6-2	7.30	2.55	2.70	Safety limitations	I	0.0-0.09	0.09	Brown	10YR 4/3	Sand	Loose, stained	50% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.09-2.0	1.91	Very pale brown	10YR 8/2	Sand	Semi-lithified	banded diagonally; slopes 10 degrees from horizontal north, toward sea	Distinct/wavy	Aeolian	Intact	-
					III	2.0-2.7	0.70	Very pale brown	10YR 8/2	Sand	Loose, single grain	-	Unexcavated	Aeolian	Intact	-

Test Area C Trench Stratigraphy

Backhoe Trench	Trench length (m)	Trench width (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
C-7-1	13.20	1.32	3.00	Safety limitations	I	0.0-0.10	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/smooth	Recent duff	Intact	-
					II	0.03-0.30	0.11	Pale brown	10YR 6/3	Sand	Loose, single grain	-	Distinct/wavy	Aeolian	Intact	-
					III	0.06-0.40	0.22	Gray & black	10YR 5/1 & 7.5YR 2.5/1	Sand	Compacted	Carbon-stained matrix; sparse coral	Distinct/wavy & Diffuse/wavy	Aeolian Infill	Redeposited	Faunal (prob. *Sus*) bones, coral pebble
					IV	0.20-0.80	0.40	Light brownish gray & pale brown	10YR 6/2 & 10YR 6/3	Sand	Moderately compacted	-	Distinct/wavy	Aeolian Infill	Redeposited	-
					V	0.48-0.70	0.16	Very pale brown	10YR 8/2 & 10YR 8/3	Sand	Loose	-	Abrupt/wavy	Aeolian Infill	Redeposited	-
					VI	0.40-1.00	0.58	Pale brown & brown	10YR 6/3 & 10YR 5/3	Sand	Moderately compacted	-	Abrupt/wavy	Aeolian Infill	Redeposited	-
					VII	0.28-3.00	2.10	Very pale brown	10YR 8/3	Sand	Single grain	Concretions	Unexcavated	Aeolian	Intact	-
C-7-2	7.00	2.00	3.20	Safety limitations	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
					II	0.07-0.32	0.25	Very pale brown	10YR 8/2 & 10YR 7/4	Sand	Very loose, single grain	-	Abrupt/smooth	Aeolian-possible fill	Redeposited	-
					III	0.32-0.55	0.22	Pale brown & brown	10YR 6/3 & 10YR 5/3	Sand	Moderately compacted	Concretions	Distinct/wavy & Abrupt/wavy	Aeolian	Intact	-
					IV	0.55-0.95	0.40	Very pale brown	10YR 8/2	Sand	Single grain, moderately compacted	Large concretions	Distinct/wavy	Aeolian	Intact	-
					V	0.95-3.20	2.25	Very pale brown	10YR 8/3 & 10YR 8/2	Sand	Single grain	sparse concreted chunks	Unexcavated	Aeolian	Intact	-
C-7-3	8.00	2.00	2.55	Safety limitations	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
					II	0.05-0.23	0.18	Brown	10YR 5/3	Sand	Single grain	60% limestone gravel, pebbles & cobbles	Abrupt/wavy	Fill from golf course	Redeposited	-
					III	0.23-1.28	1.05	Very pale brown	10YR 8/2	Sand	Loose, single grain	-	Abrupt/smooth	Fill from golf course	Redeposited	-
					IV	1.28-1.55	0.27	Dark reddish brown	5YR 3/3	Clay loam	Very fine, friable	-	Abrupt/wavy	Fill from golf course	Redeposited	-
					V	1.55-2.55	1.00	Very pale brown	10YR 7/4	Sand	Very fine	Root concretions increasing with depth	-	Aeolian	Intact dune	-
C-8-1	6.00	4.00	2.00	Safety limitations	I	0.0-0.05	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Abrupt/wavy	Recent duff	Intact	-
					II	0.06-0.31	0.17	Very pale brown & pale brown	10YR 7/3 & 10YR 6/3	Sand	Loose , unconsolidated	-	Abrupt/wavy	Aeolian	Intact	-
					IIIa	0.16-0.53	0.20	Dark gray & very dark grayish brown	10YR 4/1 & 10YR 3/2	Sand	Moderately compacted	-	Abrupt/wavy	Aeolian Infill	Redeposited	sparse charcoal
					IIIb	0.34-0.89	0.33	Dark gray	10YR 4/1	Sand	-	-		Aeolian Infill	Redeposited	-
					IIIc	0.32-0.72	0.35	Grayish brown, light brownish gray & dark grayish brown	10YR 5/2, 10YR 6/2 & 10YR 4/2	Sand	-	-		Aeolian Infill	Redeposited	-
					IIId	0.31-1.02	0.50	Pale brown	10YR 6/3	Sand	-	-		Aeolian Infill	Redeposited	-
					IIIe	0.79-1.12	0.07	Dark gray	10YR 4/1	Sand	-	-		Aeolian Infill	Redeposited	-
					IIIf	1.0-1.39	0.28	Brown	10YR 5/3	Sand	-	-		Aeolian Infill	Redeposited	-
					IIIg	0.98-1.29	0.06	Very dark gray	10YR 3/1	Sand	-	-		Aeolian Infill	Redeposited	-
					IV	0.23-2.0	1.78	Very pale brown	10YR 8/3	Sand	Moderately compacted	-	Unexcavated	Aeolian	Intact	-

Test Area C Trench Stratigraphy

Backhoe Trench	Trench length (m)	Trench width (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
C-8-2	5.50	1.50	2.62	Decomposing limestone bedrock	I	0.0-0.6	0.36	Brown	7.5YR 4/3	Loamy sand	Loose, v. fine friable crumb	grass	Distinct/wavy	Fill	Redeposited	-
					II	0.28-1.08	0.40	White & light brownish gray	10YR 8/1 & 10YR 6/2	Sand	Single grain, moderately compacted	-	Distinct/wavy	Fill	Redeposited	-
					III	0.8-1.18	0.09	White	10YR 8/1	Sand	Loose, unconsolidated	-	Distinct/wavy	Aeolian	Intact (surface truncated)	-
					IVa	0.84-1.17	0.26	Gray	10YR 5/1	Slightly loamy sand	Compacted, single grain	waterworn marine shells	Diffuse/wavy	Tsunami	Intact	Sparse charcoal
					IVb	1.04-1.2	0.13	Dark gray	10YR 4/1	Sand	Compacted, single grain	-	Diffuse/wavy	Tsunami	Intact	-
					V	1.12-2.62	1.40	Very pale brown	10YR 8/2 & 10YR 8/3	Sand	Moderately compacted	-	Abrupt	Aeolian	Intact dune	-
					VI	2.62+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-
C-8-3	5.30	1.25	1.03	Decomposing limestone bedrock	I	0.0-0.67	0.67	Dusky red	2.5YR 4/4	Clay	Compacted	10% limestone gravel	Abrupt/wavy	Fill	Redeposited	Asphalt fragments & 3-inches of gravel on surface
					II	0.67-1.03	0.36	Dark grayish brown	10YR 4/2	Clay loam	Compacted	75% limestone & basalt gravel, pebbles and cobbles	Abrupt/wavy	Fill	Redeposited	limestone & baslt aggregate
					III	1.03+	-	-	-	Limestone	-	100% weathered decomposing limestone	-	Bedrock	Intact	-
C-9-1	5.50	1.50	1.90	Safety limitations	I	0.0-0.23	0.23	Dark grayish brown	10YR 4/2	Stained sand	Loose	10% organic material (ironwood)	Diffuse/wavy	Recent duff	Disturbed	4" PVC pipe, electrical wires
					II	0.23-0.9	0.55	Very pale brown & light brownish gray	Mottled 10YR 8/2 & 10YR 6/2	Sand	Moderately compacted	-	Distinct/wavy	Aeolian	Intact	-
					III	variable 0.65-0.9	0.04	Grayish brown	10YR 5/2	Calcium carbonate	Cemented, Laminated	-	Abrupt/wavy	Precipitate	Intact	-
					IV	0.69-1.9	1.20	Very pale brown	10YR 8/2 & 10YR 8/3	Sand	Moderately compacted, single grain	-	-	Aeolian dune	Intact	-
C-9-2	7.80	1.50	1.60	Safety limitations	I	0.0-0.2	0.20	Dark brown & dark yellowish brown	10YR 3/3 & 10YR 3/4	Sandy clay loam	Very fine, friable	Modern trash	Distinct/wavy	Fill	Redeposited	Plastic, glass, milled lumber
					II	0.2-1.6	1.40	Light gray & very pale brown	10YR 7/2 & 10YR 8/2	Sand	Compacted, single grain	Dense root concretions	Unexcavated	Aeolian dune	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-0-1	5.00	2.20	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-1.75	1.65	Very pale brown	10YR 8/2 & 8/3	Sand	Fine	-	Abrupt/smooth	Aeolian dune	Intact	-
				III	1.75-2.2	0.50	Light gray	Gley 1 7/N	Sand	Fine, saturated	-	Unexcavated	Aeolian dune	Intact	-
D-1-1	5.50	1.31	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.32	0.22	Yellowish brown	10YR 5/4	Sand	Loose, single	Roots & organic staining	Abrupt/wavy	Aeolian	Intact	-
				III	0.32-0.75	0.43	Very pale brown & pale brown	10YR 7/3 & 10YR 6/3	Sand	Single grain	Roots; pebble, cobble & boulder-sized chunks of semi-lithified sand	Abrupt/wavy	Aeolian	Intact	-
				IV	0.75-1.01	0.26	Pink	7.5YR 8/3 & 7.5YR 8/4	Sand	Single grain	Roots at interface between Layers III & IV	Abrupt/wavy	Aeolian	Intact	-
				V	1.01-1.31	0.30	Light gray	10YR 7/1	Silty sand	Single grain	-	Unexcavated	Aeolian	Intact	-
D-1-2	7.00	2.80	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/3	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.3	0.20	Light brownish gray	10YR 6/2	Sand	Loose	-	Distinct/wavy	Aeolian	Intact	-
				III	0.3-0.8	0.50	Very pale brown	10YR 8/3	Sand	Compacted	-	Abrupt/wavy	Aeolian dune	Intact	-
				IV	0.8-0.84	0.04	Gray	10YR 6/1	Calcium carbonate	Cemented, Laminated	Rootlets; carbonate lenses	Abrupt/wavy	Precipitate	Intact	-
				V	0.84-2.8	1.96	Very pale brown	Mottled 10YR 8/3 & 10YR 8/4	Sand	Moderately compacted	-	Unexcavated	Aeolian dune	Intact	-
D-2-1	8.00	1.70	Water table	I	0.0-0.12	0.12	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.12-0.47	0.35	Dark grayish brown	10YR 4/2	Loamy Sand	Compacted	80% lithified sand chunks; slight organic staining	Distinct/wavy	Aeolian & tsunami	Intact dune with localized tsunami deposited material	Electrical wires, utility trenches
				III	0.38-0.45	0.07	Black	7.5YR 2.5/1	Loamy sand	Very fine friable crumb	carbon-stained	Distinct/wavy	Cultural deposit Site 7289	Intact, truncated on north side	1 *Cellana* shell, 4 basalt flakes, charcoal
				IV	0.38-0.61	0.23	Brown	Mottled 10YR 4/3 & 7.5YR 5/4	Slightly loamy sand	Single grain, compacted	organic staining	Distinct/wavy	Cultural deposit Site 7289	Intact; upper boundary maybe disturbed by Layer II	Charcoal flecks
				V	0.47-0.95	0.48	Very pale brown	10YR 8/2	Sand	Compacted	-	Distinct/wavy	Aeolian dune	Intact	-
				VI	0.83-1.05	0.22	Light gray	10YR 7/2	Sand	Compacted, semi-lithified	Laminated calcium carbonate precipitate lenses throughout	Distinct/wavy	Aeolian dune	Intact	-
				VII	0.93-1.4	0.47	Very pale brown	10YR 8/2	Sand	Single grain	Lithified sand chunks	Distinct/wavy	Aeolian dune	Intact	-
				VIII	1.4-1.7	0.30	White	10YR 8/1	Sand	Very fine single grain	-	Unexcavated	Aeolian dune	Intact	-
D-2-1b	6.00	2.00	Water table	I	0.0-0.1	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.45	0.32	Grayish brown & brown	10YR 5/2 & 7.5YR 4/3	Slightly loamy sand	Loose, single grain	-	Distinct/wavy	Aeolian	Intact	-
				III	0.3-0.54	0.19	Dark grayish brown, grayish brown & brown	10YR 4/2, 10YR 5/2 & 10YR 5/3	Loamy sand	Moderately compacted	10% limestone gravel; waterworn marine shells; sparse charcoal flecks throughout	Distinct/wavy	House floor; Site 7289	Intact	*Conus* , *Nerita polita* , bivalve shells; crab claw, urchin, non-human mammal bones, burned *kukui* nutshell & charcoal
				Burial Pit	0.52-1.12	0.60	Very pale brown	10YR 8/2	Sand	Loose, single grain	Subfloor pit, indistinct in profile; originates in Layer III, intrusive into Layer IV to interface with Layer V	Indistinct	Burial pit; Site 7289	Intact	Adult male *in situ* primary burial @ 0.96-1.12 m bs
				IV	0.33-1.12	0.60	Very pale brown	10YR 8/2	Sand	Loose, single	-	Abrupt/wavy	Aeolian	Intact	
				V	1.04-1.5	0.42	Very pale brown	10YR 8/2	Sand	Semi-lithified	-	Abrupt/wavy	Aeolian	Intact	
				VI	1.4-1.9	0.43	Very pale brown	10YR 8/2	Sand	Loose, single	-	Distinct/wavy	Aeolian	Intact	-
				VII	1.84-2.04	0.20	White	Gley 1 8/N	Sand	Single grain, saturated	-	Unexcavated	Aeolian	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-2-1c	5.50	2.20	Water table	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.2	0.15	Pale brown	10YR 6/3	Sand	Single grain	-	Distinct/wavy	Aeolian	Disturbed (tsunami?)	-
				III	0.2-0.7	0.50	Very pale brown	10YR 8/2	Sand	Single grain	-	Distinct/wavy	Aeolian dune	Intact	-
				IV	0.7-0.8	0.10	Pale brown	10YR 6/1	Calcium carbonate	Cemented, Laminated	carbonate lenses	Distinct/wavy	Precipitate	Intact	-
				V	0.8-1.15	0.35	Very pale brown	10YR 8/3	Sand	Semi-lithified	Lithified sand chunks	Distinct/wavy	Aeolian dune	Intact	-
				VI	1.15-2.2	1.05	Very pale brown	10YR 8/2	Sand	Loose	Sparse lithified sand chunks	Unexcavated	Aeolian dune	Intact	-
D-2-1d	6.50	2.20	Water table	I	0.0-0.6	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.04-0.68	0.25	Very pale brown	10YR 8/2	Sand	Loose, single	-	Distinct/wavy	Fill or storm surge	Redeposited? Intact?	
				III	0.4-0.72	0.17	Gray	10YR 5/1	Loamy sand	Compacted	50% crushed basalt	Distinct/wavy	Fill- associated with golf course vista lawn	Secondary Deposit	Basalt aggregate
				IV	0.56-0.8	0.26	Grayish brown	10YR 5/2	Loamy sand	Compacted	Sparse limestone gravel	Distinct/wavy	Cultural deposit Site 7289	Intact	Charcoal, juvenile *Sus scrofa* bones
				V	0.75-1.2	0.49	Very pale brown	10YR 8/3	Sand	Single grain	-	Distinct/wavy	Aeolian dune	Intact	-
				VI	1.04-1.28	0.15	Grayish brown	10YR 5/2	Calcium carbonate	Cemented, Laminated	-	Distinct/wavy	Precipitate	Intact	-
				VII	1.2-1.96	0.80	Very pale brown	10YR 8/3	Sand	Loose, single	-	Distinct/wavy	Aeolian dune	Intact	-
				VIII	1.96-2.2	0.28	Light gray	10YR 7/1	Sand	Loose, single	-	Unexcavated	Aeolian dune	Intact	-
D-2-2	7.50	2.75	Water table	I	0.0-0.09	0.09	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.09-0.25	0.14	Light yellowish brown	10YR 6/4	Sand	Loose, single grain	slight organic staining	Distinct/wavy	Aeolian	Intact	-
				III	0.25-1.05	0.80	Very pale brown & gray	Mottled 10YR 8/3 & 10YR 6/1	Sand	Single grain	-	Abrupt/wavy	Aeolian dune (stabilized)	Intact	-
				IV	1.05-1.1	0.05	Gray	10YR 6/1	Sand	Compacted	calcium carbonate precipitate lenses	Abrupt/wavy	Aeolian dune	Intact	-
				V	1.1-2.75	1.60	Very pale brown	10YR 8/2	Sand	Loose	-	Unexcavated	Aeolian dune	Intact	-
D-3-1	7.90	2.65	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.37	0.27	Light yellowish gray & pale brown	10YR 6/2 & 10YR 6/3	Sand	Loose, single grain	organic staining; lithified sand chunks	Distinct/wavy	Aeolian	Intact	-
				III	0.37-0.56	0.19	Very pale brown & gray	Mottled 10YR 8/3 & 10YR 6/1	Sand	Compacted	calcium carbonate precipitate lenses	Abrupt/wavy	Aeolian dune	Intact	-
				IV	0.56-0.6	0.04	Gray	10YR 6/1	Sand	Compact	Rootlets; carbonate lenses	Abrupt/wavy	Aeolian dune	Intact	-
				V	0.6-2.65	2.05	Very pale brown	10YR 8/3	Sand	Loose	-	Unexcavated	Aeolian dune	Intact	-
D-4-1	6.50	1.95	Water table	I	0.0-0.06	0.06	Very dark grayish brown	10YR 3/2	Sandy loam	Fine friable crumb	Root mat; sparse limestone gravel	Abrupt/smooth	Fill- for golf course turf (vista lawn)	Secondary Deposit	-
				II	0.06-0.13	0.07	Black	10YR 2/1	Asphalt layer	Compacted	Aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.13-0.76	0.63	Light brownish gray & yellowish brown	10YR 6/2 & 10YR 5/4	Sandy loam	Banded, fine friable crumb	60% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill-bedding for WW II runway Site 7275	Secondary Deposit	Limestone aggregate
				IV	0.76-1.28	0.52	Very pale brown	10YR 8/3 & 10YR 8/4	Sand	Single grain, moderately compacted	Sparse carbonate precipitate	Abrupt/wavy	Aeolian dune	Intact	-
				V	1.28-1.32	0.04	Gray & light brownish gray	10YR 6/1 & 10YR 6/2	Calcium carbonate	Cemented, Laminated	-	Abrupt/wavy	Precipitate	Intact	-
				VI	1.32-1.65	0.33	Very pale brown	10YR 8/3	Sand	Loose, single	40% lithified sand chunks	Distinct/wavy	Aeolian dune	Intact	-
				VII	1.65-1.95	0.30	White	7.5YR 8/1	Silty sand	Single grain, moderately compacted	-	Unexcavated	Aeolian dune	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-5-1	6.00	2.06	Water table	I	0.0-0.14	0.10	Dark grayish brown & light brownish gray	10YR 4/2 & 10YR 6/2	Loamy sand	Single grain	Grass root mat	Abrupt/smooth	Fill (tsunami?)	Redeposited	-
				II	0.09-0.2	0.10	Black	10YR 2/1	Intact asphalt layer	Compacted	Aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.17-0.44	0.16	Very dark grayish brown & yellowish brown	10YR 3/2 & 10YR 5/4	Clay loam	Very fine friable crumb	80% limestone gravel	Abrupt/smooth	Banded fill-bedding for WW II runway Site 7275	Secondary Deposit	Limestone aggregate
				IV	0.35-0.53	0.13	Very dark gray & very dark grayish brown	10YR 3/1 & 10YR 3/2	Loamy sand	Single grain	Carbon-stained; sparse limestone gravel; waterworn marine shells	Abrupt/wavy	Cultural deposit; Site 7290	Intact; partially truncated by runway fill at upper surface	Charcoal
				V	0.36-0.56	0.09	Pale brown	10YR 6/3	Sand	Single grain; thin wavy beds	Sparse limestone gravel	Abrupt/wavy	Storm surge/ tsunami?	Intact	-
				VI	0.42-0.9	0.35	Very dark gray & grayish brown	Mottled 10YR 3/1 & 10YR 5/2	Slightly loamy sand	Single grain	Carbon-stained; sparse limestone gravel; waterworn marine shells	Abrupt/wavy	Cultural deposit; Site 7290	Intact	Volcanic glass core, *Trochus intextus*, charcoal
				VII	0.7-1.03	0.25	Very pale brown	10YR 8/2	Sand	Single grain, slightly	Sparse carbonate precipitate	Abrupt/wavy	Aeolian/Beach	Intact	-
				VIII	1.05-1.2	0.12	White	10YR 8/1	Calcium carbonate	Cemented, Laminated	-	Abrupt/wavy	Precipitate	Intact	
				IX	1.15-2.06	0.92	Very pale brown	10YR 8/3	Sand	Single grain, slightly	-	Unexcavated	Aeolian/Beach	Intact	-
D-6-1	5.50	1.55	Water table	I	0.0-0.43	0.43	Brown	10YR 5/3	Sandy clay loam	Compacted	80% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill-for WW II runway Site 7275	Secondary Deposit	Limestone aggregate
				II	0.17-0.43	0.26	Black & very dark brown	7.5YR 2.5/1 & 10YR 2/2	Loamy sand	Single grain, compacted; banded	Sparse limestone gravel	Abrupt/wavy	Cultural deposit; Site 7290	Intact	*Conus*, *Tellina*, & indeterminate bivalve shells; charcoal
				III	0.3-0.56	0.26	Dark grayish brown, pale brown & grayish brown	10YR 4/2 & 10YR 6/3 & 10YR 5/2	Sand	Single grain	-	Diffuse/wavy	Storm deposits (multiple)	Intact	-
				IV	0.46-0.86	0.40	Very dark grayish brown	10YR 3/2	Sandy loam	Very fine friable	Sparse limestone gravel & waterworn marine shells	Diffuse/wavy	Cultural deposit; Site 7290	Intact	*Cypraea* shell & charcoal flecks
				V	0.73-1.55	0.82	Very pale brown	10YR 7/3	Slightly silty sand	Very fine single grain	Sparse carbonate precipitate; 20% limestone gravel & pebbles; weathered coral	-	Aeolian dune/ Beach	Intact	-
D-6-2	6.75	1.37	Water table	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.37	0.32	Brown	10YR 5/3	Sandy clay loam	Compacted	80% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill-for WW II runway Site 7275	Secondary Deposit	Limestone aggregate
				III	0.37-0.57	0.20	White	10YR 8/1	Sand	Compacted	weathered limestone; roots (lower)	Abrupt/wavy	Aeolian	Intact	-
				IV	0.57-1.37	0.80	Light gray	10YR 7/2	Silty sand	Very fine	Roots (upper)	Unexcavated	Aeolian	Intact	-
D-7-1	5.05	1.38	Decomposing limestone bedrock	I	0.0-0.08	0.08	Dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.04-0.26	0.14	Light brownish gray	10YR 6/2	Limestone	Compacted	100% crushed limestone gravel	Distinct/wavy	Fill-for WW II runway Site 7275	Secondary Deposit	Limestone aggregate
				III	0.14-0.59	0.26	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb,	Sparse limestone gravel & pebbles	Abrupt/smooth	Alluvium	Intact	-
				IV	0.33-0.85	0.25	Very dark gray	7.5YR 3/1	Sandy clay loam	Fine friable crumb	Sparse limestone gravel & pebbles; waterworn marine shells	Distinct/wavy	Cultural deposit; Site 7290	Intact	*Cypraea* shell, probable avian bones, charcoal flecks
				V	0.33-1.38	0.80	Very pale brown	10YR 8/2	Limestone	Coarse	Weathered, decomposing bedrock	Unexcavated	Residual	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-7-2	7.20	1.45	Decomposing limestone bedrock & Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.52	0.44	Light brownish gray & light gray	10YR 6/2 & 10YR 7/2	Limestone	Compacted	100% crushed limestone gravel	Distinct/wavy	Fill-for WW II runway or revetment area Site 72725	Secondary Deposit	Limestone aggregate
				III	0.52-0.76	0.24	Very dark grayish brown & dark grayish brown	10YR 3/2 & 10YR 4/2	Sandy clay loam	Very fine friable	20% limestone gravel, pebbles and cobbles	Abrupt & Distinct/wavy	Buried A horizon; Alluvium	Intact	-
				IV	0.76-1.0	0.24	Dark yellowish	10YR 4/4	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and	Abrupt/wavy	Alluvial	Intact	-
				V	1.0-1.45	0.45	-	-	Limestone	Coarse	100% weathered, decomposing bedrock	Unexcavated	Residual	Intact	-
D-8-1	7.60	1.32	Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.33	0.25	Dark grayish brown	10YR 4/2	Clay loam	Compacted	60% limestone gravel and pebbles	Abrupt/wavy	Fill-for WW II runway Site 7275	Secondary Deposit	Metal pipe; limestone aggregate
				III	0.33-0.75	0.42	Brown & dark grayish brown	10YR 4/3 & 10YR 4/2	Sandy clay loam	Very fine friable crumb	50% limestone gravel and pebbles	Abrupt & Distinct/wavy	Alluvium	Intact	-
				IV	0.75-1.14	0.39	Dark grayish brown	10YR 4/2	Clay	Very fine friable crumb	50% weathered limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				V	1.14-1.32	0.18	Very pale brown	7.5YR 3/1	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
D-8-2	6.80	1.45	Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.45	0.37	Dark grayish brown	10YR 4/2	Sandy loam	Compacted	80% crushed limestone gravel, pebbles and cobbles	Distinct/wavy	Fill-for WW II runway or revetment area Site 7275	Redeposited- fill? Intact- secondary deposit?	Limestone aggregate
				III	0.45-0.7	0.25	Brown & pale brown	Banded 10YR 4/3 & 10YR 6/3	Slightly silty sand	Single grain	-	Distinct/wavy	Tsunami- outflow?	Intact	-
				IV	0.7-0.9	0.20	Very pale brown	10YR 8/2	Beach sand	Single grain	-	Distinct/wavy	Tsunami inflow?	Intact	-
				V	0.9-1.18	0.28	Very dark grayish brown	10YR 3/2	Clay loam	Very fine friable	Sparse limestone gravel	Unexcavated	Buried A horizon; Alluvium	Intact	-
				VI	1.18-1.45	0.25	Black & very dark grayish brown	7.5YR 2.5/1 & 10YR 3/2	Tropical peat	Vegetal mat	100% organic (partially decomposed logs)	Below water table; only seen in back dirt:	Anaerobic Alluvial	Intact	-
D-8-3	8.10	2.38	Decomposing limestone bedrock & Water table	I	0.0-0.65	0.57	Grayish brown	10YR 5/2	Sandy loam	Compacted	60% limestone gravel, pebbles and cobbles; waterworn marine shells	Abrupt/wavy	1946 Tsunami- outflow?	Intact	*Cypraea* & Mytilidae shells; urchin, crab claw
				II	0.16-0.78	0.13	Light gray	10YR 7/2	Beach sand	Coarse	-	Abrupt/wavy	Tsunami- inflow?	Intact	3/4-inch diameter steel cable
				III	0.29-0.84	0.09	Black	10YR 2/1	Intact asphalt layer	Compacted	Asphalt aggegrate	Abrupt/wavy	Asphalt pavement WW II revetment area Site 7275	Intact	Asphalt
				IV	0.36-1.67	0.83	Yellowish brown	10YR 5/4	Silty sand	Very fine friable	80% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill-for WW II pavement Site	Secondary Deposit	Limestone aggregate
				V	1.15-1.7	0.11	Very dark gray	10YR 3/1	Sandy clay loam	Very fine friable, compacted	Sparse limestone gravel	Diffuse/wavy	Buried A horizon; Alluvium	Intact	-
				VI	1.26-2.38	0.62	Light gray	10YR 7/2	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-9-1	6.80	1.30	Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.15	0.07	Black	10YR 2/1	Intact asphalt layer	Compacted	Asphalt aggegrate	Abrupt/smooth	Asphalt pavement WW II runway or revetment area Site 7275	Intact	Asphalt
				III	0.15-0.4	0.25	Light brownish gray	10YR 6/2	Sandy clay loam	Compacted	90% crushed limestone	Abrupt/smooth	Fill- for WW II pavement Site	Secondary Deposit	Limestone aggregate
				IV	0.4-0.75	0.35	Brown	10YR 4/3	Sandy clay loam	Compact	50% limestone gravel and pebbles	Diffuse/wavy	Fill- bedding for WW II upper fill Site 7275	Secondary Deposit	Limestone aggregate
				V	0.75-1.3+	0.55+	-	-	Limestone	Compact with voids	pebbles, cobbles & boulders	Unexcavated	Fill- bedding for WW II upper fill Site 7275	Secondary Deposit	Limestone aggregate
D-9-2	7.80	1.30	Water table	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.12	0.07	Black	10YR 2/1	Intact asphalt layer	Compacted	Asphalt aggegrate	Abrupt/smooth	Pavement- WW II revetment area Site 7275	Intact	Asphalt
				III	0.12-0.48	0.36	Light gray	10YR 7/2	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill-bedding for pavement Site	Secondary Deposit	Limestone aggregate
				IV	0.48-0.95	0.47	Brown	10YR 4/2 & 7.5YR 4/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles & cobbles	Distinct/wavy	Fill- bedding for WW II upper fill Site 7275	Secondary Deposit	Limestone aggregate
				V	0.95-1.3	0.35	Dark yellowish	10YR 4/4	Clay	Massive	weathered limestone	Unexcavated	Alluvial	Intact	-
D-9-3	5.70	2.50	Water table	I	0.0-0.91	0.70	Brown	10YR 4/3	Sandy loam	Unconsolidated	60% limestone gravel, pebbles, cobbles and boulders	Abrupt/smooth	Tsunami- outflow	Intact	Sheet metal fragments; limestone aggregate
				II	0.26-1.0	0.07	Black	10YR 2/1	Intact asphalt layer	Compacted	Asphalt aggegrate	Abrupt/smooth	Pavement- WW II revetment area Site 7275	Intact	Asphalt
				III	0.34-1.68	0.70	Grayish brown , very pale brown & dark yellowish	10YR 5/2, 10YR 8/2 & 10YR 4/4	Sandy clay loam	Compacted	95% crushed limestone gravel, pebbles & cobbles	Distinct/wavy	Fill-bedding for pavement Site 7275	Secondary Deposit	Limestone aggregate
				IV	1.18-2.0	0.38	Very dark grayish brown	10YR 3/2	Clay loam	Very fine friable	10% limestone gravel and pebbles	Diffuse & Distinct/wavy	Buried A horizon; Alluvium; possibly cultural	Intact	Bivalve shell, crab claw, sparse charcoal flecks
				V	2.13-2.5	0.48	Very pale brown	10YR 8/2	Clay	Massive	Weathered limestone	-	Alluvial	Intact	-
D-10-1	4.80	0.56	Decomposing limestone bedrock	I	0.0-0.25	0.25	Brown	10YR 4/3	Sandy clay loam	Very fine friable	75% limestone gravel and pebbles	Distinct/wavy	Fill- for WW II revetment area Site 7275	Intact secondary deposit?	Limestone aggregate
				II	0.25-0.4	0.15	Yellowish brown	10YR 5/4	Sandy clay loam	Very fine friable	80% limestone gravel and pebbles	Distinct/wavy	Fill- for revetment area; Site 7275	Intact secondary deposit?	Limestone aggregate
				III	0.4-0.56	0.26	Dark gray	10YR 4/1	Clay	Massive	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.56+	-	-	-	Limestone	-	100% weathered, decomposing bedrock	-	Bedrock	Intact	-
D-10-2	6.90	1.02	Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.4	0.33	Brown & very pale brown	7.5YR 5/4 & 10YR 8/2	Sandy clay loam	Unconsolidated	Crushed limestone	Distinct/wavy	Fill- WW II revetment area Site 7275	Secondary Deposit	Limestone aggregate
				III	0.4-0.55	0.15	Very dark grayish brown	10YR 3/2	Clay loam	Very fine friable	Sparse limestone gravel	Distinct/wavy	Buried A horizon; Alluvium	Intact	-
				IV	0.55-1.02	0.47	Grayish brown	10YR 5/2	Clay	Massive	-	Unexcavated	Alluvial	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-10-3	8.50	1.05	Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.48	0.41	Pinkish gray	7.5YR 7/2	Beach sand	Coarse	-	Distinct/wavy	Probable tsunami	Intact	-
				III	0.48-0.77	0.29	Very dark gray & dark gray	10YR 3/1 & 10YR 4/1	Sandy clay loam	Very fine friable	Very sparse limestone gravel; waterworn marine shells	Distinct/wavy	Buried A horizon; Alluvium	Intact	-
				IV	0.52-0.77	0.25	Dark brown	10YR 3/3	Clay loam	Very fine friable	-	Distinct/wavy	Alluvial	Intact	-
				Va	0.68-1.05	0.32	Light brownish gray	10YR 6/2	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
				Vb	0.70-1.05	0.35	Black & very dark grayish brown	Mottled Gley 1 2.5/N & 10YR 3/2)	Clay	Massive	-	Unexcavated; diffuse boundary btwn Va & Vb	Alluvial	Intact	-
				VI	1.05+	Below water table	Black	7.5YR 2.5/1	Tropical peat	Vegetal mat	100% organic (partially decomposed sticks)	Below water table; only seen in back dirt;	Anaerobic Alluvial	Intact	-
D-11-1	5.90	0.68	Decomposing limestone bedrock	I	0.0-0.28	0.28	-	-	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- revetment area Site 7275	Secondary Deposit	Limestone aggregate
				II	0.28-0.68	0.40	-	-	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-11-2	5.20	1.10	Decomposing limestone bedrock & Water table	I	0.0-0.1	0.10	Pale brown & grayish brown	10YR 6/2 & 10YR 5/2	Silty sand	Loose	50% organic material; sparse limestone gravel	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.45	0.35	Yellowish brown	10YR 5/4	Sandy clay loam	Unconsolidated	80% crushed limestone	Distinct/wavy	Fill- revetment area Site 7275	Secondary Deposit	Limestone aggregate
				III	0.45-1.1	0.65	Very pale brown	10YR 8/2	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-11-3	7.00	0.80	Decomposing limestone bedrock & Water table	I	0.0-0.05	0.05	Pale brown	10YR 6/2	Silty sand	Unconsolidated, single grain	30% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.25	0.20	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable crumb	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.25-0.39	0.14	Very dark grayish brown & black	10YR 3/2 & 10YR 2/1	Clay	Massive	-	Distinct/wavy	Alluvial	Intact	-
				IV	0.39-0.8	0.41	Pink	7.5YR 8/3	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-12-1	6.90	0.90	Water table	I	0.0-0.4	0.40	Yellowish brown	10YR 5/4	Sandy clay loam	Unconsolidated	80% limestone gravel, pebbles & cobbles	Distinct/wavy	Fill- WW II revetment area Site 7275	Secondary Deposit	Limestone aggregate
				II	0.4-0.7	0.30	Dark grayish brown & very dark grayish brown	10YR 4/2 & 10YR 3/2	Clay	Very fine friable crumb	-	Distinct/wavy	Alluvial	Intact	-
				III	0.7-0.9	0.20	Grayish brown	10YR 6/1	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
D-12-2	5.90	1.50	Water table	I	0.0-0.63	0.63	Dark yellowish brown	10YR 3/4	Sandy clay loam	Loose, unconsolidated	80-90% limestone gravel, pebbles, cobbles & boulders	Distinct/wavy	Fill- WW II revetment area Site 7275	Secondary Deposit	Limestone aggregate
				II	0.38-1.05	0.67	Very dark gray & black	10YR 3/1 & 10YR 2/1	Silt loam	Very fine friable crumb	Sparse limestone gravel; waterworn marine shells	Distinct/wavy	Cultural deposit; Alluvial; Site 7291	Intact; partially truncated by runway fill at upper surface	*Conus abbreviatus* & *Nerita picea* shells, unburned *kukui* nutshells, charcoal, coral pebble
				Pit	0.73-1.17	0.44	Very dark gray & black	10YR 3/1 & 10YR 2/1	Silt loam	Very fine friable crumb	Sparse limestone gravel; waterworn marine shells; intrusive into Layer III	Distinct	Pit-possible post mold	Intact	*Nerita picea* shells, charcoal
				III	0.68-1.5	0.82	Very pale brown	10YR 8/2	Sand	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-12-3	6.60	1.03	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Sandy loam	Loose	50% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.58	0.48	Pale brown & yellowish red	10YR 6/3 & 5YR 4/6	Sandy clay loam & clumps of clay	Very fine friable	90% limestone gravel, pebbles, cobbles & boulders	Distinct/wavy	Fill- revetment area Site 7275	Secondary Deposit	Limestone aggregate
				III	0.58-1.0	0.42	Brown	7.5YR 4/3	Clay loam	Very fine friable	50% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				IV	1.0-1.03	0.03	Brown	7.5YR 4/4	Clay	Very fine friable	50% limestone gravel	Abrupt	Alluvial	Intact	-
				V	1.03+	-	-	-	Limestone	-	100% weathered, decomposing bedrock	-	Bedrock	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-13-1	5.85	1.19	Decomposing limestone bedrock	I	0.0-0.8	0.80	Dark grayish brown & grayish brown	10YR 4/2 & 10YR 5/2	Sandy clay loam	Moderately compacted	20% limestone gravel and pebbles	Diffuse/wavy	Fill-for golf course	Redeposited	-
				II	0.8-1.0	0.20	Dark grayish brown	10YR 4/2	Slightly sandy clay loam	Very fine friable, compacted	Sparse limestone gravel	Distinct/wavy	Alluvium	Intact	-
				III	1.0-1.19	0.19	Very dark grayish brown & very dark gray	10YR 3/2 & 10YR 3/1	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				IV	1.19+	-	-	-	Limestone	-	100% weathered, decomposing bedrock	-	Bedrock	Intact	-
D-13-2	6.40	1.28	Decomposing limestone bedrock & Water table	I	0.0-0.64	0.64	Very pale brown	10YR 8/2	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill-revetment area Site 7275	Secondary Deposit	Limestone aggregate
				II	0.62-1.14	0.52	Reddish brown	5YR 4/3	Clay	Very fine friable	80% limestone gravel, pebbles, cobbles and boulders	Distinct/wavy	Fill- revetment area Site 7275	Secondary Deposit	Limestone aggregate
				III	1.15-1.28	0.33	-	-	Limestone	Coarse	Weathered, decomposing bedrock; black organic staining at interface between Layers II & III is the possible remnant of cultural deposit removed	Unexcavated	Residual	Intact	-
D-13-3	6.90	2.00	Decomposing limestone bedrock & Water table	I	0.0-0.63	0.47	Dark grayish brown	10YR 4/2	Very sandy loam	Loose, unconsolidated	30% limestone gravel & pebbles	Distinct/wavy	Tsunami- outflow	Intact	Marston matting from runway; limestone aggregate
				II	0.44-0.6	0.13	Light gray	10YR 7/2	Beach Sand	Unconsolidated	Clean	Abrupt/smooth	Tsunami- inflow	Intact-pocket	-
				III	0.31-0.64	0.12	Very pale brown & pale brown	10YR 7/3 & 10YR 6/3	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill- revetment area Site 7275	Secondary Deposit	Limestone aggregate
				IV	0.55-1.04	0.46	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable crumb	60% limestone gravel, pebbles and cobbles; waterworn marine shells	Distinct/wavy	Cultural deposit- Alluvium Site 7291	Intact	*Cypraea* , *Nerita picea* & Mytilidae shells, urchin, crab claw, probable *Canis* bone, burned *kukui* nutshell & charcoal
				V	0.92-1.08	0.17	Pinkish gray	7.5YR 6/2	Silty clay	Very compacted	-	Distinct/wavy	Alluvial	Intact	-
				VI	1.06-2.0	0.94	White	10YR 8/1	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-14-1	5.90	0.95	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.54	0.47	Very dark grayish brown	10YR 3/2	Sandy clay loam	Fine friable crumb, loose	20% limestone gravel and pebbles	Distinct/wavy	Tsunami? Fill?- WW II revetment area	Tsunami- Intact? Fill-Secondary deposit?	-
				III	0.54-0.8	0.26	Very dark grayish brown	10YR 3/2	Sandy clay loam	Fine friable crumb	Sparse limestone gravel	Distinct/smooth	Alluvium	Intact	-
				IV	0.8-0.95+	-	White	10YR 8/1	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-14-2	6.30	1.52	Water table	I	0.0-0.12	0.10	Brown	10YR 5/3	Sandy clay loam	Loose	Roots & organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.0-0.59	0.50	Strong brown	7.5YR 4/6	Clay	Compacted	30% limestone gravel, pebbles and cobbles	Abrupt/wavy	Tsunami? Fill?-revetment area Site 7275	Tsunami- Intact? Fill-Secondary deposit?	Limestone aggregate
				III	0.47-0.78	0.30	Black	7.5YR 2.5/1	Carbon-stained Clay loam	Very fine friable crumb	30% limestone gravel and pebbles	Abrupt to Diffuse/wavy	Cultural deposit- Alluvium Site 7291	Intact- upper surface possibly truncated	*Conus* , *Cypraea* & indeterminate marine shells (1 burned); fish cranial bone & charcoal
				IV	0.64-1.5	0.60+	Light brown & grayish brown	7.5YR 6/3 & 10YR 5/2	Clay	Massive	weathered limestone	Unexcavated	Alluvial	Intact	-
				V	0.38-1.52	1.10+	White	10YR 8/1	Limestone	Coarse	100% weathered, decomposing bedrock	Unexcavated	Residual	Intact	-

Test Area D Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
D-14-3	10.25	3.80	Decomposing limestone bedrock	I	0.0-1.14	1.14	Pale brown & dark grayish brown	10YR 6/3 & 10YR 4/2	Loamy sand	Coarse, compacted	50% limestone gravel, pebbles and cobbles	Indistinct/ arbitrary (trench stepped- boundary coul be > or < than	Storm surge or tsunami draw back? Fill?	Intact- tsunami or Redeposited- fill?	-
				II	1.14-1.8	0.66	Pale brown & dark grayish brown	10YR 6/3 & 10YR 4/2	Wavy, banded, interbedded loamy sand	Coarse, compacted	50% limestone gravel, pebbles and cobbles	Distinct/wavy	Storm surge or tsunami	Intact	-
				III	1.8-3.03	1.23	Grayish brown & dark grayish brown	10YR 5/2 & 10YR 4/2	Sandy clay loam	Very fine friable	50-60% limestone gravel, pebbles, cobbles and boulders	Distinct/wavy	Tsunami- outflow	Intact	-
				IV	3.03-3.53	0.50	Very pale brown (sand) & dark grayish brown (clay)	10YR 7/3 & 10YR 4/2	Beach sand with pockets of clay	Unconsolidated (sand); massive (clay)	40% limestone gravel and pebbles	Distinct/wavy	Tsunami- inflow	Intact	-
				V	3.53-3.66	0.13	Black	7.5YR 2.5/1	Loam	Compacted	Carbon-stained deposit; sparse limestone gravel	Distinct/wavy	Cultural deposit- Alluvium Site 7291	Intact- upper surface probably truncated	*Conus*, *Nerita picea*, Mytilidae & *Tellina palatam* shells, urchin, crab claw, coral pebble & charcoal
				VI	3.66-3.8	0.14	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable	-	Abrupt	Alluvial	Intact	-
				VII	3.8+	-	-	-	Limestone	-	100% weathered, decomposing bedrock	-	Bedrock	Intact	-
D-15-1	7.10	1.47	Decomposing limestone bedrock & Water table	I	0.0-0.1	0.10	Grayish brown & brown	10YR 5/2 & 10YR 5/3	Loamy sand	Single grain	10% limestone gravel and pebbles	Distinct/wavy	Aeolian dune	Intact	-
				II	0.1-0.8	0.70	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable	20% limestone gravel, pebbles and	Distinct/wavy	Alluvium	Intact	-
				III	0.67-1.08	0.41	Very dark gray	10YR 3/1	Clay loam	Massive	organically stained matrix; 40% limestone cobbles	Diffuse/wavy	Alluvial	Intact	-
				IV	1.03-1.29	0.26	Yellowish brown	10YR 5/4	Clay	Massive	80% weathered limestone	Diffuse/wavy	Alluvial-Residual	Intact	-
				V	1.05-1.47	0.42	Light gray & very pale brown	10YR 7/2 & 10YR 7/3	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-15-2	5.50	1.42	Decomposing limestone bedrock	I	0.00-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (roots)	Abrupt/wavy	Recent duff	Intact	-
				II	0.05-0.65	0.60	Yellowish brown & very pale brown	10YR 5/4 & 10YR 8/2	Silty sand	Loose	90% crushed limestone	Distinct/wavy	Fill- WW II revetment area Site 7275	Secondary Deposit	Limestone aggregate
				III	0.65-1.42	0.77	White	10YR 8/1	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-
D-15-3	8.60	1.64	Decomposing limestone bedrock & Water table	I	0.0-0.12	0.10	Dark reddish brown	5YR 3/3	Clay	Compacted	Sparse limestone gravel & duff	Abrupt/smooth	Fill-for golf course	Redeposited	-
				II	0.08-0.21	0.09	Black	10YR 2/1	Intact asphalt layer	Compacted	Aggregate	Abrupt/smooth	Asphalt pavement WW II revetment area Site 7275	Intact	Asphalt
				III	0.17-0.62	0.32	Very pale brown	10YR 7/3	Limestone	Compacted	100% crushed limestone gravel, pebbles & cobbles	Abrupt/wavy	Fill-bedding for WW II asphalt	Intact	Limestone aggregate
				IV	0.4-0.60	0.20	Brown	10YR 4/3 & 10YR 5/3	Silty sand	Compacted	10% limestone gravel and pebbles	Distinct & Abrupt/smooth	Aeolian	Intact	Charcoal flecks
				V	0.50-0.80	0.16	Black	7.5YR 2.5/1	Sandy clay loam	Compacted	10% limestone gravel and pebbles	Distinct to Diffuse/wavy	Cultural deposit- Alluvial; Site 7291	Intact- upper surface possibly truncated	*Conus* & *Nerita picea* shells collected; pencil urchin spine- not collected
				VI	0.74-1.64+	0.73+	Light gray	10YR 7/2	Limestone	Coarse	100% weathered, decomposing bedrock	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-1-1	5.00	1.70	Decomposing limestone bedrock & Water table	I	0.0-1.2	1.20	Dark grayish brown & brown	10YR 4/2 & 10YR 4/3	Sandy clay loam	Very fine friable	Sparse limestone gravel	Distinct/wavy	Push pile fill	Redeposited	Glass Royal Crown cola bottle, mesh cloth
				II	1.2-1.7	0.50	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-2-1	7.60	0.88	Water table	I	0.0-0.25	0.25	Grayish brown	10YR 5/2	Sandy clay loam	Moderately Compacted	90% crushed limestone gravel, pebbles and cobbles	Abrupt/smooth	Fill- WW II revetment area north of runway Site 7275	Secondary deposit; possibly disturbed from golf course or road	Limestone aggregate
				II	0.25-0.46	0.21	Very dark gray	10YR 3/1	Clay loam	Blocky	10% limestone cobbles, pebbles and gravel	Abrupt/smooth	Alluvial	Intact	-
				III	0.46-0.66	0.20	Yellowish brown	10YR 5/4	Clay	Massive	sparse weathered limestone gravel	Diffuse/wavy	Alluvial	Intact	-
				IV	0.66-0.88	0.22	Very pale brown	10YR 7/3	Sandy clay	Massive	Weathered, decomposing limestone	-	Alluvial	Intact	-
E-2-2	7.70	0.55	Decomposing limestone bedrock	I	0.0-0.37	0.37	Dark grayish brown	10YR 4/2	Sandy loam	Very fine friable	40% limestone gravel and pebbles	Diffuse	Fill- for WW II runway north shoulder Site 7275	Redeposited from golf course or road	Limestone aggregate
				II	0.37-0.55	0.18	Dark grayish brown & brown	10YR 4/2 & 10YR 4/3	Sandy clay loam	Very fine friable	30% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
				III	0.55+	-	-	-	Limestone	-	-	-	Bedrock	Intact	-
E-2-3	5.80	1.42	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.07-0.26	0.19	Brown	10YR 5/3	Clay loam	Compacted	95% crushed limestone	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.26-0.86	0.60	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Asphalt fragments, limestone aggregate
				IV	0.86-0.91	0.05	Very dark gray & black	10YR 3/1 & 10YR 2/1	Clay	Massive	Sparse limestone gravel and pebbles	Distinct/wavy	Cultural deposit; Alluvial, Site 7292	Intact	-
				V	0.91-1.05	0.14	Dark gray	10YR 4/1	Clay	Massive	10% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				VI	1.05-1.18	0.13	Gray	10YR 6/1	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				VII	1.18-1.42+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-2-3b	5.20	1.50	Decomposing limestone bedrock	I	0.0-0.7	0.70	Dusky red	2.5YR 3/3	Clay	Compacted	10% limestone gravel and pebbles	Abrupt/smooth	Fill-for gravel road intersection near airfield	Secondary deposit	Limestone aggregate
				II	0.7-1.2	0.50	Yellowish brown	7.5YR 5/4	Clay	Compacted	10% limestone gravel , pebbles, cobbles and boulders	Abrupt/smooth	Fill- road bedding	Secondary deposit	Limestone aggregate
				III	1.2-1.5+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-3-1	7.00	1.27	Water table	I	0.0-0.08	0.08	Very pale brown	7.5YR 2.5/3	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.6	0.52	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable	90% crushed limestone gravel and pebbles	Distinct/wavy	Fill- for WW II runway north shoulder Site 7275	Secondary deposit	Limestone aggregate
				III	0.6-1.0	0.40	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				IV	1.0-1.11	0.11	Dark yellowish brown	10YR 4/4	Clay	Massive	-	Distinct/wavy	Alluvial	Intact	-
				V	1.11-1.27	0.16	Bluish gray	G2 5/1	Gley	Massive	20% limestone gravel and pebbles	Unexcavated	Anaerobic Alluvial	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-3-2	5.5	1.06	Decomposing limestone bedrock	I	0.0-0.07	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.07-0.28	0.21	Brown, light yellowish brown & yellowish brown	10YR 4/4, 10YR 6/4 & 10YR 5/4	Sandy clay loam	Compacted, banded	60% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.28-0.56	0.28	Pale brown	10YR 6/3	Silty sand	Compacted	90% limestone gravel and pebbles	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.56-0.64	0.08	Black	7.5YR 2.5/1	Sandy clay loam	Very fine friable	30% limestone gravel and pebbles	Distinct/wavy	Cultural deposit; Alluvium, Site 7292	Intact	Basalt flake, *Cypraea* shell
				V	0.64-0.92	0.28	Light brownish	10YR 6/2	Silty sand	Single grain	-	Distinct/wavy	Aeolian	Intact	-
				VI	0.92-1.06+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-3-2b	4.70	0.56	Decomposing limestone bedrock	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.38	0.33	Very dark grayish brown	10YR 3/2	Silty loam	Loose, fine friable crumb	10% limestone gravel and pebbles; 5% crushed basalt	Distinct/wavy	Fill- from golf course or runway	Redeposited	Basalt aggregate
				III	0.38-0.56+	0.18	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-3-2c	4.50	0.50	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.34	0.27	Pale brown	10YR 6/3	Clay loam	Fine friable crumb, moderately compacted	80% crushed limestone	Abrupt/smooth	Fill- for WW II runway north shoulder Site 7275	Secondary deposit	Limestone aggregate
				III	0.34-0.5	0.16	Brown	10YR 4/3	Clay loam	Fine friable crumb	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	
				III	0.40-0.52	0.09	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-3-3	5.4	1.30	Decomposing limestone bedrock (water line = artesian well not water table)	I	0.0-0.06	0.06	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.06-0.2	0.14	Brown	7.5YR 5/4	Clay loam	Compacted	70% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.2-0.43	0.23	Gray to light browish gray	10YR 6/1-6/2	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IVa	0.43-0.59	0.16	Dark gray & very dark gray	7.5YR 4/1 & 7.5YR 3/1	Clay loam	Moderately Compacted	20% limestone gravel and pebbles	Diffuse	Cultural deposit; Alluvium Site 7292	Intact	Charcoal flecks
				IVb	0.59-0.67	0.08	Black	7.5YR 2.5/1	Clay	Very compacted	Carbon-stained matrix; sparse limestone gravel and pebbles	Diffuse	Cultural deposit; Alluvial, Site 7292	Intact	-
				V	0.67-0.85	0.18	Brown	10YR 4/3	Clay	Massive	-	Distinct	Alluvial	Intact	-
				VI	0.85-1.3	0.45	Very pale brown	10YR 8/2 & 10YR 7/4	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-3-3b	4.90	1.20	Water table	I	0.0-0.09	0.09	Dark brown	10YR 3/3	Clay loam	Fine friable crumb	30% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- from runway or road construction	Redeposited	Limestone aggregate
				II	0.09-0.4	0.31	White	10YR 8/1	Limestone	Compacted	100% crushed limestone	Diffuse/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.4-1.0	0.60	Brown & dark yellowish brown	10YR 4/3 & 10YR 4/4	Clay loam	Fine friable crumb	60% limestone pebbles, cobbles & boulders	Diffuse/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	1.0-1.2	0.20	Dark gray	10YR 4/1	Clay	Massive	10% limestone gravel	Diffuse/wavy	Alluvial	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-3-4	5.70	1.15	Decomposing limestone bedrock	I	0.0-0.38	0.38	Dark brown	7.5YR 3/3	Clay loam	Very fine friable	10% limestone gravel and pebbles	Abrupt/wavy	Fill- from road grading	Redeposited	Limestone aggregate
				II	0.38-0.83	0.45	Light brownish gray	10YR 6/2	Clay loam	Compacted	90% crushed limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.83-1.15	0.32	Very pale brown	10YR 7/3	Sandy clay loam	Very fine friable	weathered limestone	Unexcavated	Alluvial	Intact	-
E-3-5	5.40	0.69	Decomposing limestone bedrock	I	0.0-0.1	0.10	Brown	7.5YR 4/3	Clay loam	Very fine friable	-	Abrupt/wavy	Fill	Redeposited	Silt fence
				II	0.1-0.17	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/wavy	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.17-0.46	0.29	Gray	10YR 5/1	Sandy clay loam	Very fine friable	85% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.46-0.69	0.20	Grayish brown	10YR 5/2	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				V	0.69+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-4-1	5.00	0.68	Decomposing limestone bedrock	I	0.0-0.09	0.09	Black	10YR 2/1	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.09-0.29	0.20	Very dark grayish brown	10YR 3/2	Sandy clay loam	Loose	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.29-0.39	0.10	Very dark grayish brown & dark brown	Mottled 10YR 3/2 & 7.5 YR 3/4	Clay loam	Compacted	10% limestone gravel and pebbles	Abrupt/smooth	Cultural deposit; Alluvium Site 7292	Intact	Charcoal flecks
				IV	0.39-0.68	0.27	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-4-1b	5.60	1.20	Decomposing limestone bedrock	I	0.0-0.1	0.10	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.1-0.65	0.55	Pale brown	10YR 6/3	Sandy clay loam	Compacted	70% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Glass, limestone aggregate
				III	0.65-1.2+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-4-2	5.60	1.16	Decomposing limestone bedrock	I	0.0-0.07	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.07-0.4	0.33	Brown	10YR 5/3	Sandy clay loam	Very fine friable crumb	60% limestone gravel and pebbles	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.4-0.49	0.09	Brown	7.5YR 4/4	Sandy clay loam	Very fine friable crumb	60% limestone gravel and pebbles	Abrupt/smooth	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.49-0.63	0.14	Very dark gray	7.5YR 3/1	Sandy clay loam	Very fine friable	10% limestone gravel; waterworn marine shells	Abrupt/wavy	Cultural deposit; Alluvium Site 7292	Intact; possibly truncated upper boundary	*Nerita picea* shell & charcoal
				V	0.63-0.71	0.08	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable	10% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				VI	0.71-0.93	0.22	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	Distinct/wavy	Bedrock over void	Intact	-
				VII	0.93-1.16	0.23	Yellowish brown	10YR 5/4	Clay	Massive	10% limestone gravel and pebbles	-	Alluvial fill in void	Intact	-
				VIII	1.16+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-4-2b	5.00	1.35	Water table	I	0.0-0.07	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.07-0.4	0.33	Dark yellowish brown	10YR 4/4	Clay	Fine friable crumb	90% crushed limestone	Abrupt/smooth	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.33-0.39	0.06	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact; discontinuous, truncated	Asphalt
				IV	0.39-0.5	0.11	White	10YR 8/1	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				V	0.5-0.65	0.15	Very dark gray & black	10YR 3/1 & 10YR 2/1	Clay loam	Fine friable crumb	20% limestone gravel and pebbles	Abrupt/smooth & wavy	Cultural deposit; Alluvium Site 7292	Intact; possibly truncated upper boundary	Charcoal
				VI	0.65-0.95	0.30	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	Diffuse/wavy	Bedrock over void	Intact	-
				VII	0.8-1.35	0.55	Brown	10YR 4/3	Clay	Massive	-	Unexcavated	Alluvial fill in void	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-4-2c	5.80	1.20	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.5	0.43	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb, loose	10% limestone gravel and pebbles	Abrupt/wavy	Fill- from golf course or runway	Redeposited	Asphalt fragments, limestone aggregate
				III	0.5-1.2	0.70	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-4-3	4.30	1.09	Decomposing limestone bedrock	I	0.0-0.06	0.06	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.06-0.21	0.15	Very pale brown	10YR 7/3	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.21-0.29	0.08	Brown	7.5YR 4/4	Sandy clay loam	Very fine friable crumb	70% limestone cobbles, pebbles and gravel	Abrupt/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.29-0.34	0.05	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable	10% limestone gravel and pebbles	Abrupt/wavy	Cultural deposit; Alluvium Site 7292	Intact; upper surface truncated by fill	*Cypraea* shell, charcoal
				V	0.34-1.09	0.75	Dark brown	7.5YR 3/4	Sandy clay loam	Very fine friable	Fissured & weathered limestone bedrock- boulders, cobbles, gravel and pebbles	-	Mixed Alluvial-Residual	Intact	-
E-4-3b	4.70	0.98	Decomposing limestone bedrock	I	0.0-0.6	0.60	Pale brown	10YR 6/3	Sandy clay loam	Compacted	50% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- for WW II runway south shoulder Site 7275	Secondary deposit	Limestone aggregate
				II	0.6-0.98	0.38	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-4-3c	5.00	1.05	Water table	I	0.0-0.07	0.07	Very dark brown	10YR 2/1	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.9	0.83	Very pale brown	10YR 3/2	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.5-0.94	0.20	Very dark gray & dark gray	10YR 3/2 & 7.5YR 3/4	Clay loam	Fine friable crumb	20% limestone gravel and pebbles	Distinct/wavy	Cultural deposit; Alluvium Site 7292	Intact; possibly truncated upper boundary	Charcoal
				IV	0.7-1.05	0.35	Dark yellowish brown & gray	10YR 8/2	Clay	Massive	-	-	Alluvial	Intact	-
E-4-4	5.50	1.03	Water table	I	0.0-0.1	0.10	Very dark brown	10YR 2/2	Clay loam	Fine friable crumb	50% organic material & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.35	0.25	Brown	10YR 4/3	Sandy clay loam	Compacted	90% limestone gravel, pebbles, cobbles & boulders	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.35-1.03	0.68+	Gary & dark gray	Mottled 7.5YR 5/1 & 7.5YR 4/1	Sandy clay loam	Compacted	90% limestone gravel, pebbles, cobbles & boulders	-	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
E-5-1	6.20	0.40	Decomposing limestone bedrock	I	0.0-0.15	0.15	Very dark brown	7.5YR 2.5/2	Clay loam	Very fine friable	40% limestone gravel and pebbles	Distinct/wavy	Recent duff	Intact	-
				II	0.15-0.27	0.12	Yellowish brown	10YR 5/4	Clayey sand	Compacted	80% limestone gravel and pebbles	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.27-0.4	0.13	Very pale brown	10YR 7/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-5-2	4.70	1.33	Water table	I	0.0-0.05	0.05	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.05-0.19	0.14	Light gray	10YR 7/1	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.19-0.56	0.37	Dark gray	10YR 4/1	Sandy clay loam	Compacted	50% limestone gravel and pebbles	Abrupt/smooth	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.56-0.73	0.17	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	Distinct/wavy	Bedrock over void	Intact	-
				V	0.73-1.33	0.60	Yellowish brown	10YR 5/4	Clay	Massive	-	Unexcavated	Alluvial fill in void	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-5-3	7.00	0.67	Decomposing limestone bedrock & Water table	I	0.0-0.23	0.23	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.23-0.67	0.44	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-5-4	5.70	0.87	Water table	I	0.0-0.1	0.10	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb	60% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.4	0.30	Light yellowish brown & yellowish brown	10YR 6/4 & 10YR 5/4	Sandy loam	Unconsolidated	80% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit disturbed by road grading	Limestone aggregate
				III	0.4-0.87	0.47+	Grayish brown	10YR 5/2	Sandy clay loam	Fine friable crumb	70% limestone gravel, pebbles and cobbles	-	Fill-- bedding for runway base course Site 7275	Secondary deposit disturbed by road grading	Fire brick, 6" PVC irrigation pipe, limestone aggregate
E-5-5	5.10	0.90	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.9	0.8+	Brown	10YR 5/3	Sandy clay loam	Compacted	90% limestone gravel, pebbles and cobbles	-	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
E-6-1	5.40	0.68	Decomposing limestone bedrock	I	0.0-0.09	0.09	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.09-0.26	0.17	Very pale brown	10YR 8/2	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.26-0.34	0.08	Yellowish brown	10YR 5/4	Sandy clay loam	Very fine friable	80% limestone gravel, pebbles and cobbles	Abrupt/smooth	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.34-0.68	0.34	Very pale brown	10YR 7/3 & 10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-6-2	6.20	1.05	Decomposing limestone bedrock	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Diffuse	Recent duff	Intact	-
				II	0.08-0.38	0.30	Grayish brown & dark grayish brown	10YR 5/2 & 10YR 4/2	Sandy clay loam	Very fine friable, loose	20% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill	Redeposited	-
				III	0.38-0.56	0.18	Dark yellowish brown	10YR 4/4	Clay	Massive	-	Diffuse	Alluvial	Intact	-
				IV	0.56-1.05+	0.49	Very pale brown	10YR 7/3	Sandy clay	Massive	100% weathered, decomposing limestone	Abrupt	Residual	Intact	-
E-6-3	5.50	0.98	Decomposing limestone bedrock	I	0.0-0.4	0.40	Very dark brown	10YR 2/2	Clay loam	Very fine friable, loose	10% limestone gravel and pebbles & crushed basalt	Abrupt/wavy	Fill- from road grading/bedding	Redeposited	Basalt aggregate
				II	0.4-0.98	0.58	Very pale brown	10YR 7/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-6-4	6.20	0.90	Decomposing limestone bedrock & Water table	I	0.0-0.29	0.29	Dark brown	10YR 3/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Diffuse	Fill- from road grading/bedding	Redeposited	Modern trash, plastic, limestone aggregate
				II	0.29-0.33	0.04	Very dark brown	10YR 2/2	Sandy clay loam	Very fine friable	20% organic material	Distinct/wavy	Buried recent duff	Intact	-
				III	0.33-0.65	0.32	Brown	10YR 5/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.65-0.9	0.25	Very pale brown	10YR 8/2	Sand	Very fine friable	100% Weathered, decomposing bedrock	Unexcavated	Residual	Intact	-
E-6-5	5.00	1.05	Water table	I	0.0-0.14	0.14	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.14-0.33	0.19	Very pale brown	10YR 8/2	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.33-0.82	0.49	Brown	7.5YR 4/3	Clay	Very fine friable	80% limestone gravel, pebbles, cobbles & boulders	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.82-1.05	0.23	Brown	10YR 4/3	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
E-7-1	6.00	0.88	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.45	0.35	Brown	10YR 5/3	Sandy clay loam	Very fine friable, loose	70% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.45-0.67	0.22	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable	50% limestone gravel and pebbles	Diffuse/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.67-0.88	0.21	Dark yellowish brown	10YR 4/4	Clay	Massive	-	-	Alluvial	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-7-2	5.80	0.96	Decomposing limestone bedrock	I	0.0-0.09	0.09	Very pale brown	7.5YR 2.5/2	Clay loam	Very fine friable	80% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.09-0.47	0.38	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable	80% weathered limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.47-0.96	0.49	Yellowish brown	10YR 5/4	Clay	Massive	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.9-0.96	.06+	Very pale brown	10YR 7/3	Sandy clay/Gley	Sticky, plastic	-	Unexcavated	Alluvial	Intact	-
				V	0.69-0.96+	0.25	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-7-3	5.00	0.98	Decomposing limestone bedrock & Water table	I	0.0-0.08	0.08	Dark brown	7.5YR 3/2	Sandy clay loam	Very fine friable	organic material	Diffuse	Recent duff	Intact	-
				II	0.08-0.3	0.22	Dark brown & brown	Mottled 7.5YR 3/3 & 7.5YR 4/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during road construction	4-inch PVC water pipeline & trench; asphalt fragments, limestone aggregate
				III	0.3-0.98	0.68	Very pale brown	10YR 7/3 & 10YR 8/2	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-7-4	5.00	0.80	Water table	I	0.0-0.3	0.30	Dark brown	10YR 3/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				II	0.3-0.59	0.29	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable	60% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.59-0.8	0.21	Very pale brown	10YR 8/2	Sandy clay loam	Very fine friable	60% weathered limestone gravel, pebbles and cobbles	Unexcavated	Alluvial	Intact?	-
E-7-5	5.70	0.76	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Dark brown	7.5YR 3/2	Humus	Structureless	100% organic material (ironwood)	Abrupt/wavy	Recent duff	Intact	-
				II	0.07-0.14	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.14-0.36	0.22	Brown	10YR 4/3	Sandy clay loam	Very fine friable	50% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.36-0.76	0.40	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-8-1	5.30	0.76	Decomposing limestone bedrock & Water table	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.4	0.35	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Abrupt/wavy	Bedrock over void	Intact	-
				III	0.4-0.57	0.17	Yellowish brown	10YR 5/4	Clay	Massive	< 10% limestone gravel	Abrupt/wavy	Alluvial fill in void	Intact	-
				V	0.57-0.76	0.19	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	Unexcavated	Bedrock	Intact	-
E-8-2	6.20	0.90	Decomposing limestone bedrock & Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.53	0.45	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Abrupt/wavy	Bedrock over void	Intact	-
				III	0.53-0.83	0.30	Yellowish brown	10YR 5/4	Clay	Massive	-	Distinct/wavy	Alluvial fill in void	Intact	-
				V	0.83-0.9	0.07	White	10YR 8/1	Clay	Massive	-	Unexcavated	Alluvial fill in void	Intact	-
E-8-3	5.30	1.58	Decomposing limestone bedrock & Water table	I	0.0-0.73	0.73	Dark brown	7.5YR 3/3	Sandy clay loam	Very fine friable	25% limestone gravel, pebbles and	Abrupt/smooth	Fill- push pile	Redeposited	Asphalt fragments
				II	0.73-0.77	0.04	Very dark gray	10YR 3/1	Sandy clay loam	Very fine friable	70% limestone gravel and pebbles	Abrupt/smooth	Fill- runway base course Site 7275	Redeposited during road construction	-
				III	0.77-1.00	0.23	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Distinct/wavy	Bedrock over void	Intact	-
				V	1.00-1.48	0.48	Pale brown & dark yellowish brown	10YR 6/3 & 10YR 4/4	Clay	Massive	20% limestone gravel and pebbles	Unexcavated	Alluvial fill in void	Intact	-
E-8-4	5.30	0.86	Decomposing limestone bedrock & Water table	I	0.0-0.15	0.15	Dark brown	7.5YR 3/3	Clay loam	Very fine friable	organic duff	Abrupt/wavy	Fill- from golf course or road	Redeposited	-
				II	0.15-0.23	0.08	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.23-0.62	0.39	Dark yellowish brown	10YR 4/4	Sandy clay loam	Loose	10% limestone gravel and pebbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	-
				V	0.62-0.86	0.24	Brown	10YR 5/2 & 7.5YR 5/4	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-9-1	6.30	1.08	Decomposing limestone bedrock	I	0.0-0.12	0.12	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.12-0.35	0.23	Dusky red	2.5YR 3/3	Clay loam	Very fine friable	40% limestone gravel	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				III	0.35-0.67	0.32	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable crumb	30% limestone gravel and pebbles	Abrupt/wavy	Fill- from golf course or pond	Redeposited	-
				V	0.67-1.08	0.41	White	10YR 8/1	Sand	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-9-2	6.50	0.95	Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.33	0.26	Dark grayish brown	10YR 4/2	Sandy clay loam	Loose, very fine friable crumb	80% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during road construction	-
				III	0.33-0.68	0.35	Dark grayish brown	10YR 4/2	Sandy clay loam	Very compacted	80% limestone gravel, pebbles, cobbles and boulders	Diffuse/wavy	Fill- runway bedding for base course Site 7275	Redeposited during road construction	-
				V	0.68-0.95	0.27	Grayish brown	10YR 5/2	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
E-9-3	6.30	1.20	Decomposing limestone bedrock & Water table	I	0.0-0.3	0.30	Very dark brown	7.5YR 2.5/2	Green waste	Structureless	100% organic material	Abrupt/wavy	Fill- push pile	Redeposited	Modern trash; Xmas lights, plastic
				II	0.3-1.05	0.75	Brown	10YR 5/3	Sandy clay loam	Very fine friable	80% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during road construction	Asphalt- large fragments
				III	1.05-1.2	0.15	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-9-4	4.50	0.36	Decomposing limestone bedrock	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Abrupt/smooth	Recent duff	Intact	-
				II	0.08-0.15	0.07	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.15-0.36+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-9-5	5.00	1.42	Decomposing limestone bedrock & Water table	I	0.0-0.25	0.25	Dusky red	2.5YR 3/2	Clay loam	Loose, very fine friable crumb	-	Diffuse/wavy	Fill- associated w/golf course	Redeposited	-
				II	0.25-0.5	0.25	Grayish brown	10YR 5/2	Clay loam	Compacted	80% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- runway base course Site 7275	Redeposited during golf course construction	-
				III	0.5-0.66	0.16	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable crumb	80% limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- runway bedding for base course Site 7275	Redeposited during golf course construction	-
				IV	0.66-0.9	0.24	Dark grayish brown	10YR 4/2	Sandy clay	Very fine crumb	20% limestone gravel, pebbles and cobbles	Diffuse/wavy	Alluvial	Intact	-
				V	0.9-1.26	0.36	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Distinct/wavy	Bedrock over void	Intact	-
				VI	1.26-1.42	0.16	Dark gray	10YR 4/1	Clay	Massive	-	Unexcavated	Alluvial fill in void	Intact	-
E-10-1	5.50	1.16	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Abrupt/smooth	Recent duff	Intact	-
				II	0.1-0.35	0.25	Brown	10YR 4/2	Clay loam	Very fine friable crumb	20% limestone gravel and pebbles	Abrupt/wavy	Fill- associated w/golf course	Redeposited	Plastic fragments
				III	0.35-1.16	0.81	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-10-2	5.20	0.54	Decomposing limestone bedrock	I	0.0-0.45	0.40	Brown	10YR 4/3	Clay loam	Loose, very fine friable crumb	20% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- from pond construction	Redeposited	black plastic
				II	0.40-0.54	0.14	Black & brown	7.5YR 2.5/1 & 10YR 5/3	Clay loam & clayey sand	Very fine friable crumb	< 10% limestone gravel	Abrupt/smooth	Cultural deposit; Alluvial, Site 7293	Intact; truncated from pond construction	urchin, charcoal & heat-altered rock
				III	0.40+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-10-3	6.60	0.90	Decomposing limestone bedrock	I	0.0-0.44	0.44	Very dark brown	10YR 2/2	Loam	Loose, very fine friable crumb	15% limestone gravel and pebbles	Distinct/wavy	Fill- near road	Redeposited	Modern trash: aluminum can, black plastic, asphalt
				II	0.44-0.54	0.10	Dark yellowish brown	10YR 4/4	Sandy clay loam	Very fine friable	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.54-0.68	0.14	Pale brown	10YR 6/3	Sand	Loose, single grain	< 10% limestone gravel and pebbles; sand derived from limestone substrate	Abrupt/smooth	Alluvial	Intact	-
				IV	0.68-0.79	0.11	Dark gray	10YR 4/1	Clay	Massive	-	Distinct/wavy	Alluvial	Intact	-
				V	0.79-0.9	0.11	White	10YR 8/1	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-10-4	5.90	0.72	Decomposing limestone bedrock	I	0.0-0.09	0.09	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.09-0.3	0.21	Very dark grayish brown	10YR 3/2	Clay loam	Compacted	95% crushed basalt- 2-inch	Distinct/wavy	Fill- road construction	Secondary deposit	Basalt aggregate
				III	0.3-0.72	0.42	Grayish brown	10YR 5/2	Sandy clay loam	Compacted	80% weathered limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during road construction	Asphalt fragments
				IV	0.72+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-10-5	5.20	0.98	Decomposing limestone bedrock & Water table	I	0.0-0.25	0.25	Very dusky red	2.5YR 2.5/2	Clay loam	Very fine friable	50% limestone gravel	Abrupt/wavy	Fill- runway base course Site 7275	Redeposited during golf course construction	Limestone aggregate
				II	0.25-0.45	0.20	Pale brown	10YR 6/3	Sandy clay loam	Very fine friable crumb	80% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway bedding for base course Site 7275	Redeposited during golf course construction	Limestone aggregate
				III	0.45-0.9	0.45	Very pale brown	10YR 8/2	Sand	Coarse	50% limestone gravel and pebbles	Abrupt/smooth	Alluvial	Intact	-
				IV	0.9-0.98	0.08	Yellowish brown	10YR 5/4	Clay	Sticky, plastic	-	Abrupt	Alluvial	Intact	-
				V	0.98+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-10-6	5.60	1.25	Decomposing limestone bedrock	I	0.0-0.36	0.36	Very dusky red	2.5YR 2.5/2	Clay loam	Coarse	50% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- associated w/golf course	Redeposited	Limestone aggregate
				II	0.36-0.56	0.20	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable	80% limestone gravel and pebbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during golf course construction	Asphalt fragments, limestone aggregate
				III	0.56-0.75	0.19	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable	50% limestone gravel and pebbles	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Redeposited during golf course construction	Limestone aggregate
				IV	0.75-1.25	0.50	Very pale brown	10YR 8/2	Sand	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-11-1	5.80	1.75	Decomposing limestone bedrock	I	0.0-0.75	0.75	Dark reddish brown	5YR 3/3	Sandy clay loam	Very fine friable crumb	15% limestone gravel, pebbles and cobbles; green waste	Distinct/smooth	Fill- push pile	Redeposited	Plastic, glass fragments, limestone aggregate
				II	0.41-0.5	0.09	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Distinct/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.5-0.62	0.11	Light gray	10YR 7/2	Limestone	Compacted	100% crushed limestone	Distinct/smooth	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.62-0.92	0.30	Yellowish brown	10YR 5/4	Sandy clay loam	Very fine friable crumb	70% limestone gravel, pebbles, cobbles and boulders	Abrupt/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				V	0.92-1.42	0.50	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-11-2	5.80	1.35	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Black	7.5YR 2.5/1	Clay loam	Structureless	60% organic material; 30% crushed	Abrupt/wavy	Recent duff	Redeposited	Asphalt fragments
				II	0.07-0.13	0.06	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.13-0.4	0.27	Light gray	10YR 7/2	Limestone	Compacted	100% crushed limestone	Abrupt/smooth	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.4-0.95	0.55	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable	80% weathered limestone	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	
				V	0.95-1.35	0.40	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-11-3	4.50	1.03	Decomposing limestone bedrock	I	0.0-0.1	0.10	Black	7.5YR 2.5/1	Clay loam	Structureless	60% organic material; 30% crushed asphalt fragments	Abrupt/wavy	Recent duff	Redeposited	Asphalt fragments
				II	0.1-0.19	0.09	Brown	10YR 4/3	Sandy clay loam	Very fine friable crumb	40% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- road grading	Redeposited	Limestone aggregate
				III	0.19-0.45	0.26	Brown	10YR 4/3	Sandy clay loam	Very fine friable crumb	40% limestone gravel, pebbles and cobbles	Distinct/wavy	Alluvial	Intact- upper surface truncated by grading	-
				IV	0.45-1.03	0.58	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-11-4	5.30	0.88	Water table	I	0.0-0.1	0.10	Black	7.5YR 2.5/1	Clay loam	Structureless	60% organic material; 30% crushed asphalt fragments	Distinct/wavy	Recent duff	Redeposited	Asphalt fragments
				II	0.1-0.62	0.52	Brown	10YR 5/3	Loamy sand	Very fine friable crumb	50% limestone gravel, pebbles and cobbles	Abrupt/smooth	Alluvial	Intact	-
				III	0.62-0.88	0.26	Light brownish gray	10YR 6/2	Sand	Single grain	-	-	Aeolian	Intact	-
E-11-5	5.50	1.00	Decomposing limestone bedrock	I	0.0-0.17	0.17	Black	7.5YR 2.5/1	Clay loam	Structureless	60% organic material; 30% crushed asphalt fragments	Distinct/wavy	Recent duff	Redeposited	Asphalt fragments
				II	0.17-0.25	0.08	Very pale brown	10YR 7/4	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.25-0.75	0.50	Brown	10YR 4/3	Sandy clay loam	Very fine friable	70% limestone gravel, pebbles and	Distinct/wavy	Alluvial	Intact	-
				IV	0.75-1.0	0.25	White	10YR 8/1	Limestone	Coarse	100% weathered, decomposing limestone	-	Residual	Intact	-
E-11-6	3.60	0.88	Decomposing limestone bedrock & Water table	I	0.0-0.24	0.24	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.24-0.88	0.64	Brown & Pinkish white	7.5YR 4/4 & 7.5YR 8/2	Sand	Coarse	100% weathered, decomposing limestone	-	Residual	Intact	-
E-11-7	5.00	1.25	Decomposing limestone bedrock & Water table	I	0.0-0.13	0.13	Very dusky red	2.5YR 2.5/2	Clay loam	Very fine friable crumb	10% limestone gravel and pebbles	Abrupt/smooth	Redeposited	Disturbed	-
				II	0.13-0.21	0.08	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.21-0.36	0.15	Brown	10YR 5/3	Sandy clay loam	Compacted	80% crushed limestone gravel, pebbles and cobbles	Diffuse/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.36-1.25	0.89	Very pale brown	10YR 8/2	Sand	Coarse	100% weathered, decomposing limestone	-	Residual	Intact	-
E-12-1	5.60	1.40	Decomposing limestone bedrock	I	0.0-0.6	0.60	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	30% limestone gravel, pebbles and cobbles	Abrupt/smooth	Fill- associated w/golf course	Redeposited	undecorated white earthenware fragment
				II	0.6-0.68	0.08	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.68-0.92	0.24	Brown & light gray	Mottled 10YR 5/3 & 10YR 7/2	Clay loam	Fine friable crumb	90% weathered limestone gravel and pebbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	-
				IV	0.92-1.4	0.48	Brown	10YR 4/3	Clay loam	Fine friable crumb	20% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				V	1.4+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-12-2	5.00	1.62	Decomposing limestone bedrock & Water table	I	0.0-0.06	0.06	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				II	0.06-0.5	0.44	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb	50% crushed limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				III	0.5-0.85	0.35	Dark brown & brown	Mottled 10YR 3/3 & 10YR 4/3	Clay loam	Compacted	20% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact- upper surface possibly truncated	-
				IV	0.85-1.1	0.25	Light brownish gray	10YR 6/2	Limestone	Weathered	100% decomposing limestone	Abrupt/smooth	Bedrock over void	Intact	-
				V	1.1-1.24	0.14	Brown	Mottled 10YR 4/2 & 5YR 3/4	Clay	Massive	Sparse limestone gravel	Distinct/smooth	Alluvial fill in void	Intact	-
				VI	1.24-1.62	0.38	Gray	10YR 5/1	Clay	Massive	Sparse limestone gravel	-	Alluvial fill in void	Intact	-
E-12-3	5.20	1.45	Decomposing limestone bedrock & Water table	I	0.0-0.06	0.06	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	75% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.06-0.3	0.24	Dark yellowish brown	10YR 4/4	Sandy clay loam	Fine friable crumb	70% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- runway base course Site 7275	Redeposited during road construction	Limestone aggregate
				III	0.3-0.73	0.43	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb	80% limestone gravel, pebbles and cobbles (predominantly cobbles)	Abrupt/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.73-1.0	0.27	Dark grayish brown	10YR 4/2	Clay	Massive	Sparse limestone gravel	Distinct/smooth	Alluvial	Intact	-
				V	1.0-1.45	0.35	Very pale brown	10YR 7/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-12-4	5.30	1.05	Decomposing limestone bedrock & Water table	I	0.0-0.15	0.15	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	80% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.15-0.4	0.25	Yellowish brown	10YR 5/4	Sandy clay loam	Fine friable crumb	60% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill-- bedding for runway base course or runway shoulder Site 7275	Secondary deposit	Limestone aggregate
				III	0.4-1.05	0.65	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-12-5	5.40	0.80	Water table	I	0.0-0.24	0.24	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	Sheet metal
				II	0.24-0.5	0.26	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	30% limestone gravel, pebbles and	Abrupt/smooth	Alluvial	Intact	-
				III	0.5-0.8	0.3+	Light greenish gray	G1 7/10GY	Gley	Non-sticky, slightly plastic	-	-	Residual	Intact	-
E-12-6	6.00	1.10	Decomposing limestone bedrock & Water table	I	0.0-0.12	0.12	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	80% organic material (ironwood) & roots	Abrupt/smooth	Recent duff	Intact	-
				II	0.12-0.2	0.08	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII runway Site 7275	Intact	Asphalt
				III	0.2-0.27	0.07	Very pale brown	10YR 7/4	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- runway base course Site 7275	Secondary deposit	Limestone aggregate
				IV	0.27-0.7	0.43	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	60% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill-- bedding for runway base course Site 7275	Secondary deposit	Limestone aggregate
				V	0.7-1.1	0.40	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-12-7	5.00	0.90	Decomposing limestone bedrock	I	0.0-0.25	0.25	Dark reddish brown	5YR 3/4	Clay	Sticky, fine friable crumb	Sparse limestone gravel	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				II	0.25-0.9	0.65	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-12-8	5.20	0.76	Decomposing limestone bedrock	I	0.0-0.21	0.21	Dark reddish brown	5YR 3/4	Clay	Sticky, fine friable crumb	Sparse limestone gravel	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				II	0.21-0.76	0.55	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-1	5.90	0.87	Decomposing limestone bedrock	I	0.0-0.08	0.24	Black	7.5YR 2.5/1	Humus	Structureless	100% organic material & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.08-0.32	0.24	Brown	10YR 5/3	Clay loam	Fine friable crumb	60% limestone gravel and pebbles	Distinct/wavy	Fill- associated w/golf course	Redeposited	-
				III	0.32-0.87	0.55	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-2	5.50	0.90	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	90% organic material (ironwood)	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.38	0.28	Dark grayish brown	10YR 4/2	Clay loam	Very fine friable crumb	80% weathered limestone	Abrupt/smooth	Fill- runway base course Site 7275	Secondary deposit; disturbed	Asphalt fragments
				III	0.38-0.46	0.08	Black	10YR 2/1	Clay loam	Very fine friable crumb	10% limestone gravel; oxidation	Abrupt & discontinuous	Alluvium- Buried A horizon?	Intact	Charcoal flecks
				IV	0.22-0.66	0.44	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	Distinct/wavy	Bedrock over void	Intact	-
				V	0.66-0.9	0.24+	Dark yellowish brown	10YR 4/4	Clay	Massive	< 10% limestone gravel	-	Alluvial fill in void	Intact	-
E-13-3	7.00	0.35	Water table	I	0.0-0.12	0.12	Black	10YR 2/1	Clay loam	Very fine friable crumb	50% organic material (ironwood, date palm)	Distinct/wavy	Recent duff	Intact	-
				II	0.12-0.35	0.23+	Brown	10YR 5/3	Clay	Very fine friable crumb	20% limestone gravel and pebbles	-	Alluvial	Intact	-
E-13-4	4.60	0.76	Water table	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	80% organic material (ironwood, date palm)	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.38	0.28	Brown	10YR 4/3	Sandy clay loam	Very fine friable crumb	10% limestone gravel and pebbles	Distinct/smooth	Alluvium	Intact	-
				III	0.38-0.76	0.38+	Dark grayish brown	10YR 4/2	Clay	Very fine friable crumb	70% weathered limestone	-	Alluvial	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-13-5	6.50	0.94	Water table	I	0.0-0.8	0.08	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	80% organic material (ironwood, date palm)	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.64	0.56	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.64-0.94	0.3+	Dark grayish brown	10YR 4/2	Clay	Fine friable crumb	10% limestone gravel	-	Alluvial	Intact	-
E-13-6	5.00	0.95	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	80% organic material & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.55	0.45	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	15% limestone gravel and pebbles	Abrupt/smooth	Fill- road construction	Redeposited (churned)	-
				III	0.45-0.67	0.22	Black	10YR 2/1	Loam	Fine friable crumb	10% limestone gravel and pebbles	Abrupt/smooth	Cultural deposit; Alluvium-buried A horizon, Site 7294	Intact; upper surface possibly truncated by road construction	Sparse fire-altered rock, 1 basalt flake, burned crab claw & sparse charcoal flecks
				IV	0.52-0.95	0.43	Dark gray & light gray	10YR 4/1 & 10YR 7/2	Limestone w/pockets of clay	Fine friable crumb	90% weathered and decomposing limestone	-	Residual	Intact	-
E-13-6b	4.95	1.12	Decomposing limestone bedrock	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.4	0.35	Brown	10YR 4/3	Clay loam	Very fine friable crumb	50% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Redeposited during road construction?	Limestone aggregate
				III	0.25-0.54	0.29	Yellowish brown	10YR 5/4	Clay loam	Very fine friable crumb	60% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Redeposited during road construction?	Limestone aggregate
				IV	0.29-0.98	0.69	Brown	10YR 4/3	Clay loam	Very fine friable crumb	50% limestone gravel, pebbles and cobbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7294	Intact; upper surface possibly truncated by road construction	*Theodoxus neglectus* shell
				V	0.95-1.12	0.17	Dark gray to Dark grayish brown	10YR 4/1 to 10YR 4/2	Clay	Very fine friable crumb	60% weathered limestone	-	Alluvial	Intact	-
E-13-6c	3.20	1.00	Decomposing limestone bedrock	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.45	0.37	Brown	10YR 4/3	Clay loam	Very fine friable crumb	15% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.4-0.85	0.45	Dark grayish brown	10YR 4/2	Clay loam	Very fine friable crumb	20% limestone gravel, pebbles & cobbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7294	Intact	Charcoal
				IV	0.84-1.0	0.16	Light gray & Very pale brown	10YR 7/2 & 10YR 7/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-6d	3.50	0.82	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.5	0.43	Brown	10YR 4/3	Clay loam	Very fine friable crumb	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.4-0.65	0.25	Dark grayish brown	10YR 4/2	Clay loam	Very fine friable crumb	40% weathered limestone gravel, pebbles & cobbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7294	Intact	*Cypraea* shell, charcoal
				IV	0.6-0.82	0.22	Light gray & Very pale brown	10YR 7/2 & 10YR 7/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-13-6e	3.00	0.80	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood)	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.44	0.37	Brown	10YR 4/3	Clay loam	Very fine friable	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.44-0.52	0.08	Very dark grayish brown & dark grayish brown	10YR 3/2 & 10YR 4/2	Clay loam	Very fine friable crumb	10% limestone gravel and pebbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7294	Intact	Very sparse charcoal flecks
				IV	0.52-0.72	0.20	Brown	10YR 5/3	Clay	Very fine friable crumb	30% weathered limestone	Distinct/wavy	Alluvial	Intact	-
				V	0.72-0.8	0.08	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-6f	3.00	1.05	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.48	0.41	Dark grayish brown	10YR 4/2	Clay loam	Very fine friable	30% limestone gravel and pebbles	Distinct/wavy	Fill- road construction	Redeposited	Plastic, aluminum pop cans
				III	0.48-1.05	0.57	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-6g	3.00	0.95	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (*haole koa*)	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.7	0.63	Dark yellowish brown & light yellowish brown	10YR 4/4 & 10YR 6/4	Clay loam	Very fine friable	95% crushed limestone	Distinct/wavy	Fill- WW II revetment area south runway shoulder Site 7275	Secondary deposit	Limestone aggregate
				III	0.7-0.75	0.05	Pale brown	10YR 6/3	Beach Sand	Fine, single grain	-	Distinct/wavy	Fill	Secondary deposit	-
				IV	0.75-0.95	0.20	Very pale brown	10YR 7/4	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-7	5.50	1.15	Decomposing limestone bedrock	I	0.0-0.15	0.15	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb	50% organic material & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.15-0.53	0.38	Brown	10YR 4/3	Loamy sand	Unconsolidated	30% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill- WW II revetment area south of runway Site 7275	Redeposited during road construction?	Limestone aggregate
				III	0.53-0.85	0.32	Pale brown & light brownish gray	10YR 6/3 & 10YR 6/2	Sand	Coarse, single grain	10% limestone gravel and pebbles	Abrupt/wavy	Fill- WW II revetment area south of runway Site 7275	Redeposited during road construction?	Sparse asphalt fragments, limestone aggregate
				IV	0.85-1.15	0.30	Dark grayish brown	10YR 4/2	Sandy clay	Fine friable crumb	10% limestone gravel	-	Alluvial	Intact	-
				V	1.15	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-13-8	5.70	0.72	Decomposing limestone bedrock	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Clay loam	Friable	-	Diffuse/wavy	Organic humus	Intact	-
				II	0.08-0.57	0.49	Dark grayish brown	10YR 4/2	Clay loam	Friable	20% limestone gravel, pebbles and	Abrupt/smooth	Redeposited	Disturbed	Asphalt fragments, plastic bag
				III	0.57-0.65	0.08	Black	10YR 2/1	Asphalt surface	Compacted	100% aggregate	Abrupt/smooth	Asphalt pavement WWII revetment area south of runway Site 7275	Intact	Asphalt
				IV	0.65-0.72	0.07	Very pale brown	10YR 7/4	Limestone	Structureless	100% pulverized limestone	-	Residual	Truncated surface graded for asphalt pavement	-
E-13-9	6.00	1.30	Decomposing limestone bedrock	I	0.0-0.22	0.22	Dark reddish brown	5YR 3/2	Clay loam	Fine friable crumb	15% limestone gravel and pebbles	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				II	0.22-0.85	0.63	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine crumb	25% limestone gravel and pebbles	Distinct/wavy	Fill- associated w/golf course	Redeposited	Large asphalt fragments
				III	0.85-1.3	0.45	Dark grayish brown	10YR 4/2	Clay	Very fine friable crumb	10% limestone gravel	Abrupt/smooth	Alluvial	Intact	-
				IV	1.3+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-14-1	5.00	0.43	Water table	I	0.0-0.43	0.43	Very dark gray	10YR 3/1	Clay loam	Very fine friable crumb	< 10% limestone gravel	-	Recent muck	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-14-2	5.70	1.07	Decomposing limestone bedrock	I	0.0-0.1	0.10	Dark brown	7.5YR 3/2	Clay loam	Structureless	80% organic material & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.86	0.76	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	30% limestone gravel, pebbles & cobbles	Abrupt/smooth	Fill- WW II revetment area south of runway Site 7275	Redeposited during road construction?	Asphalt fragments, steel fragments, glass bottle, limestone aggregate
				III	0.86-1.07	0.21	Gray	10YR 5/1	Clay	Non-sticky, super plastic	10% limestone gravel	Abrupt/smooth	Alluvial	Intact	-
				IV	1.07+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-14-3	6.50	1.25	Decomposing limestone bedrock & Water table	I	0.0-0.05	0.05	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.05-0.69	0.50	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	25% limestone cobbles, pebbles and	Diffuse/wavy	Fill	Redeposited	Limestone aggregate
				III	0.5-1.1	0.60	Yellowish brown to brown & Dark reddish brown	Mottled 10YR 5/4 to 10YR 5/3 and 5YR 3/3	Sandy clay loam	Fine friable crumb	70% weathered limestone	Diffuse/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	1.1-1.25	0.15	Dark gray	10YR 4/1	Clay	Sticky, plastic	10% limestone gravel	-	Alluvial	Intact	-
				V	1.25+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-14-4	6.80	1.07	Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.08-0.4	0.32	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	20% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	-
				III	0.4-0.9	0.50	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb	50% limestone gravel and pebbles	Distinct/smooth	Fill- WW II revetment area south of runway Site 7275	Secondary deposit, disturbed	Asphalt fragments, limestone aggregate
				IV	0.9-1.07	0.17	Dark gray	7.5YR 4/1	Clay	Sticky, plastic	30% limestone gravel and pebbles	-	Alluvial	Intact	-
E-14-5	5.7	0.59	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Clay loam	Very fine friable crumb	70% organic material (palm fronds) & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.07-0.2	0.13	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.2-0.43	0.23	Dark grayish brown	10YR 4/2	Clay	Non-sticky, plastic	10% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				IV	0.43-0.59	0.16	Light yellowish brown & light gray	Mottled 10YR 6/4 & 10YR 7/1	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-14-6	6.80	0.70	Water table	I	0.0-0.08	0.08	Very dark brown	7.5YR 2.5/2	Clay loam	Structureless	75% organic material & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.08-0.36	0.28	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	15% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	Sparse asphalt fragments
				III	0.36-0.56	0.20	Pale brown	10YR 6/3	Clay	Fine friable crumb	90% weathered limestone	Abrupt/smooth	Fissured bedrock over void	Intact	-
				IV	0.56-0.7	0.13	Dark gray	10YR 4/1	Clay	Non-sticky, plastic	20% limestone cobbles, pebbles and	-	Alluvial fill in void	Intact	-
E-14-7	6.90	0.60	Decomposing limestone bedrock	I	0.0-0.1	0.08	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.6	0.50	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb	10% limestone gravel and pebbles	Abrupt/smooth	Alluvium	Intact	-
				III	0.6+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-15-1	8.90	1.00	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb	50% organic material	Abrupt/wavy	Recent duff	Intact	-
				II	0.1-0.8	0.70	Brown	10YR 4/3	Sandy clay loam	Fine friable crumb	50% limestone gravel and pebbles; 10% asphalt fragments	Distinct/smooth	Fill- WW II south edge revetment area south of runway Site 7275	Secondary deposit, disturbed	Asphalt fragments, limestone aggregate
				III	0.8-0.9	0.10	Brown	10YR 5/3	Clay	Non-sticky, plastic	10% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				IV	0.9-1.0+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-15-2	5.60	1.40	Decomposing limestone bedrock	I	0.0-0.15	0.15	Dark grayish brown	10YR 4/2	Clay loam	Loose, unconsolidated	10% limestone gravel and pebbles	Diffuse/wavy	Fill	Redeposited	-
				II	0.15-0.45	0.30	Brown	10YR 4/3	Clay loam	Moderately compacted	10% limestone gravel and pebbles	Abrupt/wavy	Fill	Redeposited	-
				III	0.45-0.75	0.30	Dark grayish brown	10YR 4/2	Clay loam	Compacted	20% limestone cobbles, pebbles and gravel	Abrupt/smooth	Fill- WW II revetment area south of runway Site 7275	Secondary deposit, disturbed	Limestone aggregate
				IV	0.75-1.05	0.30	Very dark grayish brown & dark grayish brown	Mottled 10YR 3/2 & 10YR 4/2	Clay loam	Compacted	25% limestone cobbles, pebbles and gravel	Abrupt/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit, disturbed	Limestone aggregate
				V	1.05-1.4	0.35	Brown	10YR 4/3	Clay	Massive, compacted	15% weathered limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				VI	1.4+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-15-3	23.00	1.35	Decomposing limestone bedrock & Water table	I	0.0-0.32	0.08	Very dark brown	10YR 2/2	Humus	Structureless	100% organic material (ironwood) & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.04-0.56	0.40	Brown	10YR 4/3	Sandy clay loam	Very fine friable crumb, moderately compacted	20% limestone gravel and pebbles; roots	Diffuse/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				III	0.32-0.84	0.14	Yellowish brown	10YR 5/4	Silty sand	Moderately compacted	75% limestone gravel and pebbles	Abrupt/smooth	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	0.48-1.04	0.29	Very dark grayish brown	10YR 3/2	Slightly sandy clay loam	Fine friable crumb, compacted	10% limestone gravel and pebbles; waterworn marine shells	Abrupt/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7295	Intact	1 volcanic glass core, *Nerita picea* shell, charcoal
				V	0.82-1.35	0.30	Brown	10YR 4/3	Clay	Massive, saturated, compacted	-	-	Alluvial	Intact	-
				VI	1.00-1.28	0.05	Dark grayish brown & Black	Mottled 10YR 4/2 & 10YR 2/1	Gley	Saturated, compacted; patchy oxidation	-	-	Anaerobic Alluvial	Intact	-
				VII	0.80-1.32+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-15-3a	7.80	1.26	Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.4	0.33	Brown	10YR 5/3	Clay loam	Very fine friable	30% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				III	0.23-0.54	0.21	Brown & yellowish brown	10YR 5/3 & 10YR 5/4	Clay loam	Very fine friable	50% limestone gravel, pebbles & cobbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	0.53-0.75	0.20	Dark gray & very dark gray	7.5YR 4/1 & 7.5YR 3/1	Clay loam	Very fine friable	40% weathered limestone gravel & pebbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7295	Intact	-
				V	0.75-1.26	0.51	Dark yellowish brown	10YR 3/4	Clay	Massive	Weathered limestone gravel & pebbles	-	Alluvial	Intact	
E-15-3b	6.80	1.20	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.38	0.31	Brown	10YR 5/3	Clay loam	Very fine friable	30% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				III	0.3-0.61	0.31	Brown & yellowish brown	10YR 5/3 & 10YR 5/4	Clay loam	Very fine friable	50% limestone gravel, pebbles & cobbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	0.42-0.75	0.20	Dark gray & very dark gray	7.5YR 4/1 & 7.5YR 3/1	Clay loam	Very fine friable	40% weathered limestone gravel & pebbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7295	Intact	Very sparse charcoal flecks
				V	0.7-1.2	0.50	Dark yellowish brown	10YR 3/4	Clay	Massive	Weathered limestone	Abrupt	Alluvial	Intact	-
				VI	1.02-1.2	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-
E-15-3c	4.10	1.15	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.18	0.11	Brown	10YR 5/3	Clay loam	Very fine friable crumb	30% limestone gravel and pebbles	Diffuse/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				III	0.18-0.52	0.34	Brown & yellowish brown	10YR 5/3 & 10YR 5/4	Clay loam	Very fine friable crumb	50% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	0.52-1.15	0.63	Very dark grayish brown	10YR 3/2	Clay	Massive	-	-	Alluvial	Intact	-
				V	1.15+	-	-	-	Limestone	Weathered	100% decomposing limestone	Unexcavated	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-15-3d	4.00	0.89	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material (ironwood) & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.3	0.23	Brown	10YR 5/3	Clay loam	Very fine friable	30% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				III	0.16-0.77	0.61	Brown & yellowish brown	10YR 5/3 & 10YR 5/4	Clay loam	Very fine friable	50% limestone gravel and pebbles	Distinct/wavy	Fill- WW II revetment area south of runway Site 7275	Secondary deposit	Limestone aggregate
				IV	0.43-0.6	0.10	Dark gray & very dark gray	7.5YR 4/1 & 7.5YR 3/1	Clay loam	Very fine friable	40% weathered limestone gravel & pebbles	Distinct/wavy	Cultural deposit; Alluvium-buried A horizon, Site 7295	Intact	-
				V	0.6-0.65	0.05	Dark yellowish brown	10YR 3/4	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				VI	0.5-0.89+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-15-4	6.10	1.20	Decomposing limestone bedrock & Water table	I	0.0-0.04	0.04	Black	10YR 2/1	Humus	Structureless	100% organic material & roots	Abrupt/smooth	Recent duff	Intact	-
				II	0.04-0.75	0.71	Brown	10YR 5/3	Sandy clay loam	Very fine friable crumb	10% limestone gravel and pebbles; roots	Diffuse/wavy	Alluvium	Intact	-
				III	0.75-1.2	0.45	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-15-5	5.30	1.00	Decomposing limestone bedrock & Water table	I	0.0-0.17	0.17	Very dark brown	10YR 2/2	Clay loam	Loose, unconsolidated	50% organic material & abundant roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.17-0.4	0.23	Brown	10YR 5/3	Sandy clay loam	Loose, unconsolidated	30% limestone gravel and pebbles; abundant roots	Abrupt/smooth	Alluvium	Intact	-
				III	0.4-0.7	0.30	Dark gray	10YR 4/1	Sandy clay loam	Moderately compacted	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.7-1.0	0.30	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-15-6	7.30	1.19	Unsafe trench; severed water line	I	0.0-0.27	0.27	Dark brown	7.5YR 3/3	Clay loam	Fine friable crumb	40% limestone gravel and pebbles	Diffuse/wavy	Fill- associated w/golf course	Redeposited	Electrical lines, PVC water pipeline (golf course infrastructure)
				II	0.27-1.19	0.92	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb	90% limestone boulders, cobbles, gravel and pebbles	-	Fill- associated w/golf course	Redeposited	-
E-15-7	6.90	0.70	Decomposing limestone bedrock & Water table	I	0.0-0.1	0.10	Very dark grayish brown	10YR 3/2	Clay loam	Loose	50% organic material (*milo*)	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.32	0.22	Brown	10YR 5/3	Clay	Very fine friable	70% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				III	0.32-0.70+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-15-8	7.00	0.48	Decomposing limestone bedrock & Water table	I	0.0-0.20	0.20	Black	10YR 2/1	Clay loam	Very fine friable	organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.20-0.48	-	Very pale brown	10YR 8/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-16-1	5.90	1.50	Water table	I	0.0-0.43	0.43	Dark brown	7.5YR 3/2	Clay loam	Very fine friable crumb	30% limestone gravel, pebbles and cobbles	Abrupt/smooth	Imported Fill	Secondary deposit	-
				II	0.43-0.85	0.42	Very dark gray	10YR 3/1	Limestone	Compacted	100% crushed limestone- 1-inch	Abrupt/wavy	Fill- WW II between revetment area & barracks Site 7275	Secondary deposit	Limestone aggregate; Nylon mesh bags w/ black soil to stabilize base of aggregate fill
				III	0.85-1.5	0.65+	Gray	10YR 5/1	Gley	Compacted, saturated	-	-	Anaerobic Alluvial	Intact	-
E-16-2	5.90	1.50	Water table	I	0.0-0.9	0.90	Very dark brown	10YR 2/2	Clay loam	Very fine friable crumb	90% limestone small boulders, cobbles, gravel and pebbles	Abrupt/smooth	Fill	Redeposited	Concrete slab fragments, rusted metal, aluminum cans
				II	0.9-1.5	0.6+	Gray & white	10YR 5/1 & 10YR 8/1	Gley	Compacted, saturated	-	-	Anaerobic Alluvial	Intact	-
E-16-3	6.00	1.07	Decomposing limestone bedrock & Water table	I	0.0-0.07	0.07	Black & very dark brown	10YR 2/1 & 10YR 2/2	Humus	Structureless	100% organic material (ironwood) & roots	Abrupt/wavy	Recent duff	Intact	-
				II	0.07-0.75	0.68	Brown	10YR 4/3	Sandy loam	Friable	20% limestone gravel and pebbles	Abrupt/wavy	Fill- WW II revetment area south of runway Site 7275	Redeposited	Asphalt fragments
				III	0.75-1.07	0.32	Pink	7.5YR 8/3	Limestone	Sticky, non-plastic goo	100% weathered, decomposing bedrock	-	Residual	Intact	-
E-16-4	6.50	0.50	Decomposing limestone bedrock & Water table	I	0.0-0.16	0.16	Black	10YR 2/1	Clay loam	Loose, unconsolidated	50% organic material (ironwood)	Diffuse/wavy	Recent duff & alluvium	Intact?	-
				II	0.16-0.5	0.34	Pale brown	10YR 6/3	Limestone	Sticky, non-plastic goo	100% weathered, decomposing bedrock; muck	-	Residual	Intact	-
E-16-5	4.60	0.40	Decomposing limestone bedrock & Water table	I	0.0-0.1	0.10	Black	10YR 2/1	Clay loam	Loose	50-60% organic material; roots	Diffuse/wavy	Recent duff & alluvium	Intact?	-
				II	0.1-0.4	0.30	Pale brown	10YR 6/3	Limestone	Sticky, non-plastic goo	100% weathered, decomposing bedrock; muck	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-16-6	5.20	0.20	Decomposing limestone bedrock	I	0.0-0.13	0.13	Very dark brown	10YR 2/2	Clay loam	Loose, unconsolidated	60% organic material (ironwood) & roots; 10% limestone gravel and pebbles	Abrupt/wavy	Recent duff & alluvium	Intact?	-
				II	0.13-0.2	0.07	Brown	10YR 4/3	Clay loam	Compacted, discontinuous pockets	-	Abrupt/wavy	Alluvial	Intact	-
				III	0.13-0.2+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-16-7	5.20	0.75	Decomposing limestone bedrock & Water table	I	0.0-0.18	0.18	Very dark brown	10YR 2/2	Clay loam	Very fine friable crumb, loose, unconsolidated	10% organic material & roots; 10% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact?	-
				II	0.18-0.75	0.57	Brown	10YR 5/3	Sandy clay loam	Moderately compacted	20% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
E-16-8	5.00	1.00	Decomposing limestone bedrock & Water table	I	0.0-0.15	0.15	Very dusky red	2.5YR 2.5/2	Silt loam	Loose, unconsolidated	50% organic material & abundant roots; 10% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
				II	0.15-0.3	0.15	Dark grayish brown	10YR 4/2	Sandy loam	Very fine friable crumb	Abundant roots; 10% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
				III	0.3-0.45	0.15	Very dark grayish brown	10YR 3/2	Clay loam	Very fine friable	10% limestone gravel and pebbles	Diffuse/wavy	Alluvial	Intact	-
				IV	0.45-1.0	0.55	Pale brown	10YR 6/3	Limestone	Weathered, saturated	100% decomposing limestone	-	Residual	Intact	-
E-16-9	7.00	0.58	Decomposing limestone bedrock	I	0.0-0.36	0.36	Dark reddish brown	2.5YR 2.5/3	Clay	Fine friable crumb	Sparse limestone gravel	Distinct/wavy	Fill- associated w/golf course	Redeposited	-
				II	0.36-0.58+	0.22+	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-16-10	5.80	1.00	Decomposing limestone bedrock & Water table	I	0.0-0.27	0.27	Dark brown	7.5YR 3/3	Humus	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.27-1.0+	0.73+	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-16-11	7.50	0.60	Water table	I	0.0-0.25	0.25	Black	10YR 2/1	Clay loam	Fine friable crumb	50% organic material, roots; sparse limestone gravel	Distinct/smooth	Recent duff	Intact	-
				II	0.25-0.6	0.35+	Brown	10YR 4/3	Clay	Fine friable crumb	90% limestone gravel, pebbles & cobbles	-	Fill- associated w/road construction	Redeposited	-
E-17-1	5.60	1.20	Decomposing limestone bedrock	I	0.0-0.35	0.35	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	Sparse roots; 30% limestone cobbles, gravel and pebbles	Abrupt/smooth	Fill- push pile	Redeposited	Asphalt fragments; fabric @ interface between Layers I & II
				II	0.35-0.78	0.43	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb	95% crushed limestone	Abrupt/wavy	Fill- WW II between revetment area & barracks Site 7275	Secondary deposit	Limestone aggregate
				III	0.78-0.98	0.20	Dark grayish brown	10YR 4/2	Clay	Massive, plastic, non-sticky	< 5% limestone gravel	Diffuse/smooth	Alluvial	Intact	-
				IV	0.98-1.2	0.22	Very dark gray	10YR 3/1	Gley	Non-sticky, plastic	-	Abrupt/wavy	Anaerobic Alluvial	Intact	-
				V	1.2+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-17-2	7.80	1.50	Water table	I	0.0-0.12	0.12	Very dark gray & dark brown	7.5YR 3/1 & 7.5YR 3/2	Clay loam	Fine friable crumb, loose	5% organic material & roots; 15% limestone gravel	Distinct/wavy	Recent alluvium	Intact	-
				II	0.12-1.5	1.38+	Brown	10YR 5/3	Sandy clay loam	Fine friable crumb, loose	40% limestone boulders, cobbles, gravel and pebbles	-	Fill- WW II between revetment area & barracks Site 7275	Redeposited	-
E-17-3	6.00	1.30	Decomposing limestone bedrock & Water table	I	0.0-0.1	0.10	Very dark gray & dark brown	7.5YR 3/1 & 7.5YR 3/2	Clay loam	Fine friable crumb	Roots; 10% limestone gravel	Distinct/wavy	Fill	Redeposited	-
				II	0.1-0.84	0.74	Brown	7.5YR 4/2	Clay loam	Fine friable crumb	40% limestone cobbles, pebbles & gravel	Abrupt/smooth	Fill	Redeposited	-
				III	0.84-0.88	0.04	Black	7.5YR 2.5/1	Organic	Loose	100% decomposing organic material	Abrupt/smooth	Anaerobic muck	Redeposited	-
				IV	0.88-1.3+	0.42+	Very dark gray	10YR 3/1	Limestone	Very weathered	100% decomposing limestone	-	Residual	Intact	-
E-17-4	4.90	0.24	Decomposing limestone bedrock	I	0.0-0.21	0.21	Very dark brown & black	Mottled 10YR 2/2 & 10YR 2/1	Clay loam; humus	Loose	70% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.21-0.24	0.03	Dark brown	7.5YR 3/3	Clay loam	Fine friable crumb	-	Abrupt/ discontinuous	Alluvial	Intact	-
				III	0.24+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-17-5	4.90	0.45	Water table	I	0.0-0.25	0.25	Black	10YR 2/1	Clay loam	Fine friable crumb, loose	70% organic material & roots	Abrupt/smooth	Recent duff & alluvium	Intact	-
				II	0.25-0.45	0.20	Gray	10YR 6/1	Gley	Sticky, plastic	-	-	Anaerobic Alluvial	Intact	-
E-17-6	6.40	1.75	Decomposing limestone bedrock & Water table	I	0.0-0.3	0.30	Very dark grayish brown	10YR 3/2	Slightly sandy clay loam	Fine friable crumb	15% limestone gravel	Abrupt/smooth	Fill- associated w/golf course	Redeposited	-
				II	0.3-0.55	0.25	Light brownish gray	10YR 6/2	Beach sand	Single grain	20% limestone gravel	Abrupt/smooth	Fill- associated w/golf course	Redeposited	-
				III	0.55-1.4	0.85	Very dark grayish brown	10YR 3/2	Sandy clay loam	Fine friable crumb	20% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
				IV	1.4-1.75+	0.35+	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-17-7	7.00	0.36	Decomposing limestone bedrock	I	0.0-0.36	0.36	Very dark brown	7.5YR 2.5/2	Sandy clay loam	Fine friable crumb, loose	Roots; 20% limestone cobbles, gravel and pebbles	Abrupt/wavy	Fill- associated w/sod farm	Redeposited	-
				II	0.36+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-17-8	5.70	1.17	Water table	I	0.0-0.17	0.17	Very dark grayish brown	10YR 3/2	Sandy clay loam	Fine friable crumb	10% organic material; 60% limestone cobbles, gravel and pebbles	Distinct/wavy	Recent duff & Fill- associated w/road construction	Redeposited	-
				II	0.17-0.4	0.23	Light gray	10YR 7/2	Limestone	Compacted	100% crushed limestone	Abrupt/wavy	Fill- WW II between revetment area & barracks Site 7275	Secondary deposit	Limestone aggregate
				III	0.4-0.84	0.44	Very dark grayish brown	10YR 3/2	Sandy clay loam	Compacted	< 10% limestone gravel and pebbles	Distinct/wavy	Fill- WW II between revetment area & barracks Site 7275	Redeposited	Conglomerate, basalt & concrete fragment
				IV	0.84-1.17	0.33+	Pale brown	10YR 6/3	Clay	Massive	Sparse limestone gravel	-	Alluvial	Intact	-
E-17-9	7.10	1.10	Decomposing limestone bedrock	I	0.0-0.87	0.87	Banded Dark brown & Dark yellowish brown	10YR 3/3 & 10YR 4/4	Clay loam	Fine friable crumb	Roots; 50% limestone cobbles, pebbles & gravel	Distinct/wavy	Banded Fill- WW II between revetment area & barracks Site 7275	Redeposited	Steel wire
				II	0.87-1.1	0.23	Dark grayish brown	10YR 4/2	Clay	Massive	50% limestone gravel	Distinct/wavy	Alluvial	Intact	-
				III	1.1+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-18-1	4.70	1.44	Decomposing limestone bedrock & Water table	I	0.0-0.42	0.42	Dark brown	7.5YR 3/2	Clay loam	Very fine friable crumb	Roots; 20% limestone cobbles, pebbles & gravel	Abrupt/smooth	Fill	Redeposited	-
				II	0.2-0.35	0.15	Brown	10YR 4/3	Sandy loam	Very fine friable crumb	10% limestone gravel and pebbles	Abrupt/smooth	Fill	Redeposited	-
				Pit-IIa	0.22-0.62	0.40	Yellowish brown	10YR 5/4	Sandy clay loam	Fine friable crumb	Roots; 60% limestone gravel and pebbles	Abrupt/smooth	Historic pit fill	Intact- secondary deposit	Amber glass bottle (3-piece mold, crown cap finish), charcoal
				Pit-IIb	0.42-0.93	0.51	Dark brown	7.5YR 3/4	Sandy loam	Fine friable crumb	Roots; 10% limestone gravel and pebbles	Abrupt/smooth	Historic pit fill	Intact- secondary deposit	-
				Pit-IIc	0.4-1.24	0.84	Brown	10YR 4/3	Clay loam	Fine friable crumb	Roots; 10% limestone gravel and pebbles	Abrupt/smooth	Historic pit fill- plantation era?	Intact- secondary deposit	Charcoal, porcelain, nails, milled lumber (burned)
				III	0.32-1.24	0.92	Brownish yellow	10YR 6/6	Sand	Loose	95% weathered & decomposing limestone cobbles, pebbles, gravel	Abrupt/wavy	Residual	Intact; truncated by historic trash pits	-
				IV	0.96-1.44+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-18-2	3.60	0.84	Water table	I	0.0-0.28	0.28	Very dark brown	7.5YR 2.5/2	Clay loam	Fine friable crumb	Roots; 20% limestone gravel and pebbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.28-0.45	0.17	Brown	10YR 4/3	Clay loam	Fine friable crumb	50% limestone cobbles, pebbles & gravel	Abrupt/wavy	Fill	Redeposited	-
				III	0.45-0.47	0.02	Black	10YR 2/1	Organic	Loose	Roots; 100% decomposing organic	Abrupt/wavy	Anaerobic muck	Redeposited	-
				IV	0.47-0.52	0.05	Dark brown	7.5YR 3/3	Clay loam	Fine friable crumb	10% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				V	0.52-0.84+	0.32+	Dark gray	7.5YR 4/1	Gley	Non-sticky, plastic	-	-	Alluvial	Intact	-
E-18-3	6.00	1.30	Decomposing conglomerate bedrock & Water table	I	0.0-0.15	0.15	Very dark gray	7.5YR 3/1	Clay loam	Fine friable crumb, unconsolidated	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.15-0.32	0.17	Brown	10YR 4/3	Clay loam	Fine friable crumb, unconsolidated	10% limestone gravel and pebbles	Abrupt/wavy	Alluvium	Intact	-
				III	0.32-1.3	-	-	-	Conglomerate	Weathered	100% crushed shell conglomerate	-	Bedrock	Intact	-
E-18-4	5.40	1.18	Decomposing conglomerate bedrock & Water table	I	0.0-0.15	0.15	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb, unconsolidated	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.15-0.6	0.45	Brown	10YR 4/3	Clay loam	Fine friable crumb, unconsolidated	10% limestone gravel	Distinct/wavy	Alluvium	Intact	-
				III	0.6-0.78	0.18	Dark yellowish brown	10YR 4/4	Clay loam	Fine friable crumb, moderately compacted	10% limestone gravel	Abrupt/smooth	Alluvium	Intact	-
				IV	0.78-1.18	0.4+	Very pale brown	10YR 8/2	Conglomerate	Weathered	100% crushed shell conglomerate	-	Bedrock	Intact	-
E-18-5	6.30	1.70	Decomposing limestone bedrock & Water table	I	0.0-0.29	0.29	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	20% limestone gravel, pebbles & cobbles	Abrupt/wavy	Alluvium	Intact	-
				II	0.29-1.55	1.26	Brown	10YR 4/3	Sandy loam	Loose, unconsolidated	75% limestone gravel, pebbles, cobbles & boulders (size-sorted w/largest on bottom & progressively smaller toward	Distinct/wavy	Residual	Intact	-
				III	1.55-170+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-18-6	6.40	1.10	Decomposing limestone bedrock	I	0.0-0.45	0.45	Very dark grayish brown	10YR /32	Clay loam	Fine friable crumb	Roots; 20% limestone cobbles, pebbles & gravel	Distinct/wavy	Fill- associated w/sod farm	Redeposited	Electrical wire
				II	0.45-0.66	0.21	Dark grayish brown	10YR 4/2	Clay loam	Fine friable crumb	60% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.66+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-18-7	5.50	1.20	Water table	I	0.0-0.48	0.48	Very dark grayish brown	10YR 3/2	Sandy clay loam	Loose	30% limestone cobbles, pebbles & gravel	Distinct/wavy	Fill- associated w/sod farm	Redeposited	Plastic fragments
				II	0.48-1.20	0.72	Very pale brown & brown	10YR 8/2 & 10YR 5/3	Limestone & Clay	Weathered & Massive	Weathered, decomposing limestone with pockets of clay	-	Fissured bedrock with voids filled with alluvial clay	Intact	-
E-18-8	7.10	1.10	Decomposing limestone bedrock & Water table	I	0.0-0.3	0.30	Very dark grayish brown	10YR 3/2	Sandy clay loam	Loose	20% limestone cobbles, pebbles and gravel	Distinct/wavy	Fill- associated w/sod farm or road	Redeposited	Plastic fragments, bottle glass
				II	0.3-0.52	0.22	Dark brown	10YR 3/3	Sandy clay loam	Compacted	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				III	0.52-0.74	0.22	Brown	10YR 4/3	Clay	Massive	50% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				IV	0.74-1.1	0.36	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-18-9	5.00	0.32	Decomposing limestone bedrock	I	0.0-0.05	0.05	Dark brown	10YR 3/3	Clay loam	Structureless	50% organic material	Distinct/wavy	Recent duff & Fill- associated w/sod farm	Redeposited	-
				II	0.05-0.24	0.19	Dark grayish brown	10YR 4/2	Clay loam	Fine friable crumb	50% limestone gravel and pebbles	Distinct/wavy	Fill- associated w/sod farm	Redeposited	-
				III	0.24-0.32	0.08	Dark yellowish brown	10YR 3/4	Clay loam	Fine friable crumb	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				IV	0.32+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-19-1	6.30	0.75	Decomposing limestone bedrock	I	0.0-0.17	0.17	Dark brown	7.5YR 3/2	Clay loam	Very fine friable crumb, moderately compacted	Roots common	Abrupt/smooth	Fill- associated w/sod farm	Redeposited	-
				II	0.17-0.75	0.58	Brown	10YR 5/3	Sandy loam	Very fine friable, loose, unconsolidated	60% limestone cobbles, pebbles and gravel	Abrupt/wavy	Imported Fill	Secondary deposit	-
				III	0.4-0.75	0.35	Dark brown	7.5YR 3/4	Clay loam	Moderately compacted	-	Abrupt/smooth	Alluvial	Intact	-
				IV	0.75+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-19-2	5.40	0.44	Decomposing limestone bedrock	I	0.0-0.15	0.15	Very dark grayish brown	10YR 3/2	Clay loam	Very fine friable, loose, unconsolidated	> 10% limestone gravel	Diffuse/wavy	Fill- associated w/sod farm	Redeposited	-
				II	0.15-0.36	0.21	Very dark grayish brown & dark grayish brown	Mottled 10YR 3/2 & 10YR 4/2	Clay loam	Very fine friable, loose, unconsolidated	10% limestone gravel and pebbles	Abrupt/wavy	Fill- associated w/sod farm	Redeposited	-
				III	0.36-0.44	0.08	Dark brown	10YR 3/3	Clay	Moderately compacted	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.44+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-19-3	6.40	0.76	Decomposing limestone bedrock & Water table	I	0.0-0.48	0.48	Very dark grayish brown	10YR 3/2	Silty clay loam	Loose, unconsolidated	Roots; 20% limestone gravel and pebbles	Abrupt/smooth	Fill- associated w/sod farm	Redeposited	Colorless glass bottle
				II	0.48-0.76	0.28	Dark gray & dark grayish brown	Mottled 10YR 4/1 & 10YR 4/2	Gley	Compacted, saturated	Chunks of weathered limestone	-	Anaerobic Alluvial	Intact	-
				III	0.76+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-19-4	5.60	0.54	Decomposing limestone bedrock	I	0.0-0.08	0.08	Black & very dark brown	7.5YR 2.5/1 & 7.5YR 2.5/2	Humus	Structureless	100% organic material; roots common	Abrupt/smooth	Recent duff	Intact	-
				II	0.08-0.17	0.09	Brown	10YR 5/3	Beach sand	Loose, single grain	Roots common	Abrupt/smooth	Fill- sod farm	Redeposited	-
				III	0.17-0.23	0.06	Very dark grayish brown	10YR 3/2	Basalt	Crushed	Roots common; 95% crushed basalt gravel and pebbles (1-inch)	Abrupt/smooth	Fill	Secondary deposit	Basalt aggregate
				IV	0.23-0.54	0.31	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine friable crumb, loose, unconsolidated	Few roots; 10% limestone gravel & pebbles	Abrupt/wavy	Alluvium	Intact	-
				V	0.54+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-19-5	6.60	1.50	Water table	I	0.0-0.06	0.06	Black	10YR 2/1	Humus	Structureless	100% organic material; roots common	Abrupt/smooth	Recent duff	Intact	-
				II	0.06-0.44	0.38	Brown	10YR 4/3	Silty sand	Loose, single grain	Roots common	Abrupt/smooth	Imported Fill	Secondary deposit	2-inch PVC pipe
				III	0.44-0.53	0.09	Black	10YR 2/1	Limestone	Compacted	95-100% crushed limestone (1-inch	Abrupt/smooth	Fill	Secondary deposit	Limestone aggregate
				IV	0.53-0.85	0.32	Very dark grayish brown	10YR 3/2	Sandy clay loam	Very fine friable crumb, moderately compacted	20% limestone gravel and pebbles	Diffuse/wavy	Alluvium	Intact	-
				V	0.85-1.5+	0.65+	Dark grayish brown	10YR 4/2	Clay	Massive, compacted	-	-	Alluvial	Intact	
E-19-6	7.20	1.48	Water table	I	0.0-0.66	0.66	Very dark grayish brown & dark	10YR 3/2 & 10YR 3/3	Sandy clay loam	Very fine friable	70% limestone gravel, pebbles & cobbles	Distinct/wavy	Fill	Redeposited	-
				II	0.66-0.83	0.17	Very dark grayish brown & dark	10YR 3/2	Clay loam	Very fine friable	10% limestone gravel	Distinct/wavy	Alluvium	Intact	-
				III	0.83-1.05	0.22	Brown & grayish brown	10YR 5/3 & 10YR 5/2	Clay	Massive	Weathered limestone	Diffuse	Alluvial	Intact	-
				IV	1.05-1.48+	0.43+	Dark yellowish brown	10YR 4/4	Clay	Massive	-	-	Alluvial	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-19-7	6.90	0.61	Decomposing limestone bedrock	I	0.0-0.18	0.18	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material; roots common	Distinct/wavy	Recent duff	Intact	-
				II	0.18-0.32	0.14	Brown	10YR 4/3	Clay	Very fine friable crumb, loose	Sparse limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				III	0.32-0.61	0.29	Dark grayish brown & dark gray	10YR 4/2 & 10YR 4/1	Clay	Massive	Sparse limestone gravel	Abrupt	Alluvial	Intact	-
				IV	0.61+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-19-8	6.30	0.20	Decomposing limestone bedrock	I	0.0-0.2	0.20	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material; roots common	Abrupt/wavy	Recent duff	Intact	-
				II	0.20+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-20-1	6.40	0.53	Decomposing limestone bedrock	I	0.0-0.23	0.23	Dark reddish brown	5YR 3/3	Clay loam	Fine friable crumb	Roots & pockets of underlying Layer II matrix	Abrupt/wavy	Fill- associated w/sod farm	Redeposited	-
				II	0.23-0.53	0.30	Brown	7.5YR 5/6	Sandy loam	Loose	70% limestone cobbles, pebbles and	Abrupt/wavy	Alluvial	Intact	-
				III	0.53+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-20-2	6.50	0.40	Decomposing limestone bedrock	I	0.0-0.3	0.30	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb, loose	Roots; 10% limestone gravel and pebbles	Distinct/wavy	Fill- associated w/sod farm	Redeposited	-
				II	0.3-0.37	0.07	Dark brown	7.5YR 3/3	Clay loam	Compacted	< 5% limestone gravel ; discontinuous	Abrupt/wavy	Alluvial	Intact	-
				III	0.24-0.40+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-20-3	6.50	1.15	Decomposing limestone bedrock & Water table	I	0.0-0.3	0.30	Dark grayish brown	10YR 4/2	Clay loam	Fine friable crumb, loose	Roots; 15% limestone gravel	Distinct/wavy	Fill- associated w/sod farm	Redeposited	-
				II	0.3-0.65	0.35	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb, moderately compacted	25% limestone gravel and pebbles; sparse crushed basalt 1-inch gravel	Diffuse/wavy	Fill	Redeposited	Sparse basalt aggregate
				III	0.65-0.9	0.25	Brown	10YR 4/3	Clay	Non-sticky, plastic	< 10% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				IV	0.9-1.15+	0.25+	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-20-4	5.00	0.95	Water table	I	0.0-0.37	0.37	Dark grayish brown	10YR 4/2	Clay loam	Loose	Roots; 15% limestone gravel and pebbles; abundant basalt aggregate on surface	Distinct/wavy	Fill- associated w/sod farm	Redeposited	Basalt aggregate; 2-inch diam. PVC pipe
				II	0.37-0.55	0.18	Brown	10YR 4/3	Clay	Compacted	< 10% limestone gravel	Distinct/wavy	Alluvium	Intact	-
				III	0.55-0.95+	0.4+	Dark gray	10YR 4/1	Gley	Sticky, plastic	-	-	Anaerobic Alluvial	Intact	-
E-20-5	5.60	0.95	Decomposing limestone bedrock	I	0.0-0.65	0.65	Brown	10YR 4/3	Sand	Fine, single grain	95% crushed basalt (1-inch)	Abrupt/smooth	Fill	Secondary deposit	Basalt aggregate
				II	0.65-0.95	0.30	Dark grayish brown	10YR 4/2	Sandy clay loam	Fine friable crumb	10% limestone gravel and pebbles	Abrupt/smooth	Alluvium	Intact- upper surface possibly truncated	-
				III	0.95+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-20-6	5.80	1.66	Water table	I	0.0-0.13	0.13	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	Roots; 20% organic material; 20% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	-
				II	0.13-0.93	0.80	Dark brown	7.5YR 3/3	Clay loam	Fine friable crumb	20% limestone gravel and pebbles; 10% basalt boulders; humic soil at interface between Layers II & III	Abrupt/smooth	Fill	Redeposited	-
				III	0.93-1.48	0.55	Pinkish white	7.5YR 8/2	Limestone	Weathered	100% decomposing limestone	Abrupt/smooth	Bedrock over void	Intact	-
				IV	1.48-1.66+	0.18+	Dark gray	10YR 4/1	Gley	Non-sticky, non-plastic	-	-	Anaerobic Alluvial fill in void	Intact	-
E-20-7	5.60	1.04	Decomposing limestone bedrock & Water table	I	0.0-0.28	0.28	Very dark grayish brown	10YR 3/2	Silty loam	Fine friable crumb, loose	Roots; < 5% limestone gravel	Abrupt/smooth	Fill- associated w/golf course	Redeposited	-
				II	0.28-0.7	0.42	Light brownish	10YR 6/2	Clay loam	Fine friable crumb	Roots	Distinct/smooth	Alluvium	Intact	-
				III	0.7-0.85	0.15	Dark gray	10YR 4/1	Gley	Non-sticky, plastic	-	Abrupt/smooth	Anaerobic Alluvial	Intact	-
				IV	0.85-1.04+	0.19+	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-21-1	5.90	0.95	Decomposing limestone bedrock	I	0.0-0.2	0.20	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	Roots; 15% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	-
				II	0.2-0.95	0.95	Dark grayish brown & Very dark grayish brown	Mottled 10YR 4/2 & 10YR 3/2	Silty clay loam	Fine friable crumb	Sparse roots; 20% limestone gravel and pebbles; recent trash at interface of Layers II & III	Abrupt/wavy	Fill	Redeposited	Recent trash: Budwiser beer can, melted glass, metal, plastic, fabric, 5-gal bucket lid, milled lumber
				III	0.95+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-21-2	6.20	0.90	Decomposing limestone bedrock & Water table	I	0.0-0.16	0.16	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	15% limestone gravel and pebbles	Distinct/wavy	Fill- road construction?	Redeposited	-
				II	0.10-0.35	0.19	Light gray	10YR 7/2	Limestone & Clay	Compacted	20% limestone cobbles, pebbles and	Abrupt/wavy	Fill-pipeline	Redeposited	pipeline
				III	0.35-0.45	0.10	Brown	10YR 5/3	Clay	Non-sticky, plastic	10% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				IV	0.42-0.9	0.48	Dark greenish gray	Gley1 10Y 4/1	Gley	Sticky, plastic	-	Abrupt/wavy	Anaerobic Alluvial	Intact	-
				V	0.90+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-21-3	6.00	1.40	Decomposing limestone bedrock & Water table	I	0.0-0.9	0.90	Brown & dark grayish brown	Mottled 10YR 4/3 & 10YR 4/2	Silty loam	Loose	70% limestone gravel and pebbles	Diffuse/wavy	Fill- associated w/sod farm	Redeposited	2" PVC pipe
				II	0.9-1.4	0.50	Light brownish gray & pale brown	10YR 6/2 & 10YR 6/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-21-4	6.80	1.70	Decomposing limestone bedrock & Water table	I	0.0-0.35	0.35	Dark reddish brown	5YR 3/4	Clay	Very fine friable crumb	< 10% limestone gravel and pebbles	Abrupt/smooth	Fill- associated w/golf course	Redeposited	-
				II	0.35-0.41	0.06	Brown & yellowish brown	10YR 4/3 & 10YR 5/4	Slightly clayey sand	Fine	10% limestone gravel and pebbles; sparse crushed basalt aggregate	Abrupt/wavy	Fill- associated w/golf course	Redeposited	Basalt aggregate
				III	0.41-0.71	0.30	Dark brown	7.5YR 3/3	Clay	Massive	-	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				IV	0.71-0.78	0.07	Very dark brown	10YR 2/2	Sandy clay	Very fine friable	10% limestone gravel and pebbles; crushed basalt aggregate (1-inch) at interface between Layers IV & V	Diffuse/wavy	Fill- associated w/golf course	Secondary deposit	Basalt aggregate
				V	0.78-0.83	0.10	Dark brown	10YR 3/3	Clay	Very fine friable crumb	Sparse limestone gravel	Diffuse/wavy	Alluvial	Intact	-
				VI	0.83-1.13	0.30	Light gray	10YR 7/2	Limestone	Weathered	100% decomposing limestone	Diffuse/wavy	Bedrock over void	Intact	-
				VII	1.13-1.4	0.27	Brown	10YR 4/3	Clay	Massive	-	Diffuse/wavy	Alluvial fill in void	Intact	-
				VIII	1.4-1.70+	0.30+	Pale brown	10YR 6/3	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-21-5	6.30	0.80	Decomposing limestone bedrock	I	0.0-0.11	0.11	Very dark grayish brown	10YR 3/2	Sandy loam	Very fine friable	50% organic material; 20% Limestone gravel & pebbles	Abrupt/wavy	Recent duff & Fill- associated w/sod farm	Redeposited	-
				II	0.11-0.27	0.16	Very pale brown	10YR 7/3	Limestone	Compacted	100% crushed limestone	Distinct/wavy	Fill- WW II barracks area Site 7275	Secondary deposit	-
				III	0.27-0.62	0.35	Dark yellowish brown	10YR 3/4	Sandy clay loam	Very fine friable	80% limestone cobbles, pebbles & gravel	Distinct/wavy	Fill- WW II barracks area Site 7275	Redeposited	-
				IV	0.62-0.8+	0.18+	Very pale brown	10YR 8/3	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-21-6	7.00	0.95	Decomposing limestone bedrock	I	0.0-0.12	0.12	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material; roots common	Distinct/wavy	Recent duff	Intact	-
				II	0.12-0.4	0.28	Brown	10YR 5/3	Sandy clay loam	Loose	70% limestone cobbles, pebbles & gravel	Abrupt/wavy	Fill	Redeposited	-
				III	0.4-0.95	0.55	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-22-1	5.40	0.75	Decomposing limestone bedrock	I	0.0-0.44	0.44	Very dusky red	2.5YR 2.5/2	Clay loam	Friable crumb	-	Abrupt/smooth	Fill-recent	Redeposited	Plastic garbage bags, corrugated plastic pipes
				II	0.44-0.54	0.10	Brown	10YR 4/3	Sandy loam	Loose	70% limestone cobble, pebbles and gravel	Diffuse/wavy	Fill- WW II barracks area Site 7275	Redeposited	-
				III	0.54-0.65	0.11	Dark brown	10YR 3/3	Sandy loam	Moderately Compacted	15% limestone pebbles & gravel	Distinct/wavy	Fill- WW II barracks area Site 7275	Redeposited	-
				IV	0.65-0.75	0.10	Brown	10YR 4/3	Silty clay loam	Compacted	10% limestone pebbles & gravel	Abrupt/wavy	Alluvial	Intact	-
				V	0.75+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-22-2	6.70	0.40	Decomposing limestone bedrock	I	0.0-0.15	0.15	Dark brown	7.5YR 3/2	Clay loam	Loose, unconsolidated	Sparse roots; < 10% limestone gravel and pebbles; limestone aggregate at interface between Layers I & II	Distinct/wavy	Fill- associated w/golf course	Secondary deposit	Limestone aggregate
				II	0.15-0.25	0.10	Brown	10YR 4/3	Sandy loam	Loose	20% limestone gravel and pebbles	Abrupt/wavy	Fill- associated w/golf course	Redeposited	-
				III	0.25-0.4	0.15	Very dark brown	7.5YR 2.5/2	Clay loam	Loose	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact- upper surface possibly truncated	-
				IV	0.4+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-
E-22-3	5.50	0.40	Decomposing limestone bedrock	I	0.0-0.08	0.08	Dark reddish	5YR 3/2	Clay loam	Loose	50% organic material; roots	Abrupt/smooth	Recent duff	Intact	-
				II	0.08-0.3	0.22	Brown	10YR 5/3	Sandy loam	Loose	Sparse roots; 80% limestone cobbles, pebbles & gravel	Distinct/wavy	Fill- associated w/sod farm or golf course	Disturbed	Marine shell, 20-penny nail
				III	0.3-0.4	0.10	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb, compacted	5% limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				IV	0.4+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Residual	Intact	-

Test Area E Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
E-22-4	10.40	1.92	Decomposing limestone bedrock & Water table	I	0.0-0.35	0.13	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	Moderate roots	Abrupt/smooth	Recent duff & alluvium	Intact	
				II	0.12-0.68	0.40	Dark grayish brown & Dark brown	Mottled 10YR 4/2 & 10YR 3/3	Clay loam	Loose, unconsolidated	70% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill- associated w/sod farm	Redeposited	Copper wire
				IIIa	0.27-1.33	0.85	Dark grayish brown & dark brown	Mottled 10YR 4/2 & 10YR 3/3	Clay loam	Moderately Compacted	70% limestone gravel, pebbles and cobbles	Abrupt/smooth	Fill- WW II barracks area Site 7275	Redeposited	Copper wire, asphalt, concrete
				IIIb	0.81-1.25	0.35	Light yellowish brown	10YR 6/4	Sand	Loose, unconsolidated	80% limestone gravel, pebbles and cobbles	Abrupt/smooth- boundary w/Layer IV	Fill- WW II barracks area Site 7275	Intact	Limestone aggregate
				IV	1.22-1.62	0.16	Black	7.5YR 2.5/1	Clay loam	Fine friable crumb	15% limestone gravel & pebbles; waterworn marine shells	Abrupt/smooth	Cultural deposit; Alluvium-buried A horizon, Site 7296	Intact- upper surface possibly truncated by fill episode	2 basalt flakes; *Nerita picea* , *Trochus intextus* , Mytilidae & indeterminate bivalve shells; urchin, burned *kukui* nutshells, & abundant charcoal
				Hearth	1.2-1.36	0.16	Black	10YR 2/1	Clay loam	Fine friable crumb	-	Distinct	Cultural feature Site 7296	Intact	Charcoal
				V	1.36-1.59	0.27	Brown	7.5YR 4/4	Clay loam	Very fine friable crumb	< 5% limestone gravel	Abrupt/wavy	Oxidized alluvium- from burning cultural deposit	Intact	-
				VI	1.33-1.77	0.38	Very pale brown	10YR 7/3	Limestone	Weathered	100% fissured decomposing limestone	Abrupt/smooth	Bedrock over void	Intact	-
				VII	1.22-1.92	0.20	Brown	10YR 5/3	Clay	Non-sticky, plastic	-	-	Alluvial fill in void	Intact	-
				VIII	0.96-1.92+	-	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-
E-22-4b	6.10	1.75	Decomposing limestone bedrock & Water table	I	0.0-0.15	0.15	Dark brown	7.5YR 3/2	Clay loam	Fine friable crumb	Roots; sparse limestone gravel and	Abrupt/wavy	Alluvium	Intact	-
				II	0.15-0.8	0.65	Dark grayish brown	10YR 4/2	Sandy loam	Moderately Compacted	70% limestone gravel, pebbles, cobbles and boulders	Distinct/wavy	Fill- WW II barracks area Site 7275	Secondary deposit	Limestone aggregate
				III	0.8-1.8	1.00	Light brownish gray & Light yellowish brown	10YR 6/2 & 10YR 6/4	Limestone	Weathered	100% fissured decomposing limestone	Abrupt/wavy	Bedrock	Intact	-
				IV	1.05-1.45	0.40	Very dark grayish brown	10YR 3/2	Clay loam	Fine friable crumb	10% limestone gravel	Abrupt/wavy	Alluvial fill in void	Intact	-
				V	1.45-1.75	0.30	Dark grayish brown	10YR 4/2	Clay	Sticky, plastic	10% limestone pebbles & gravel	Abrupt/wavy	Alluvial fill in void	Intact	-
E-22-5	5.80	1.44	Decomposing limestone bedrock & Water table	I	0.0-0.19	0.19	Dark grayish brown	10YR 4/2	Clay loam	Loose	80% crushed basalt (1-inch)	Abrupt/wavy	Fill	Secondary deposit	Basalt aggregate
				II	0.19-0.4	0.21	Light yellowish brown	10YR 6/4	Clay loam	Loose	90% crushed limestone	Abrupt/smooth	Fill- WW II barracks area Site 7275	Secondary deposit	Limestone aggregate
				III	0.4-0.58	0.18	Dark grayish brown	10YR 4/2	Clay loam	Fine friable crumb	10% limestone gravel	Distinct/smooth	Alluvium	Intact	-
				IV	0.58-1.22	0.64	Brown	7.5YR 4/3	Clay loam	Massive	-	Abrupt/wavy	Alluvium	Intact	-
				V	1.22-1.44+	0.22+	-	-	Limestone	Weathered	100% decomposing limestone	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-1-1	5.00	0.40	Decomposing limestone bedrock	I	0.0-0.4	0.40	Very dark brown	7.5YR 2.5/2	Clay loam	Friable crumb	-	Abrupt	Alluvial	Intact	-
				II	0.4+	-	-	-	Limestone	-	100% weathered & decomposing limestone	-	Bedrock	Intact	-
F-1-2	5.00	0.48	Decomposing limestone bedrock	I	0.0-0.3	0.30	Dark brown	7.5YR 3/3	Clay loam	Unconsolidated	Roots	Abrupt/wavy	Alluvium	Intact	Glass bottle
				II	0.3-0.38	0.08	Black	5YR 2.5/1	Clay loam	Loose	Charcoal throughout; 20% burned limestone gravel and pebbles	Abrupt/smooth	Alluvial- burn event	Intact	-
				III	0.38-0.48	0.10	Brown	7.5YR 4/4	Clay loam	Friable crumb	-	Abrupt	Alluvial	Intact	-
				IV	0.38+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-1-3	5.00	0.50	Decomposing limestone bedrock	I	0.0-0.18	0.18	Dark brown	7.5YR 3/3	Clay loam	Unconsolidated	Roots; 30% subangular basalt gravel & pebbles (road base material)	Distinct	Alluvial	Intact	Basalt aggregate
				II	0.18-0.5	0.32	Dark brown	7.5YR 3/2	Clay	Blocky	50% limestone gravel and pebbles	Abrupt	Alluvial	Intact	-
				III	0.5+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-2-1	9.00	2.40	Water table	I	0.0-1.8	1.80	Dark brown	7.5YR 3/2	Clay loam	Loose	10% limestone gravel and pebbles	Diffuse/smooth	Fill	Redeposited	WWII structural concrete
				II	1.4-1.65	0.25	Black	7.5YR 2/1	Clay loam	Loose, friable	50% decomposing organic material	Abrupt w/III; Diffuse w/ IV	Alluvial	Intact	-
				III	1.65-1.8	0.15	Dark brown	7.5YR 3/3	Clay	Friable crumb	10% limestone gravel, pebbles and	Distinct/wavy	Alluvial	Intact	-
				IV	1.8-2.0	0.20	Very dark grayish brown	10YR 3/2	Clay	Fine, friable crumb	-	Diffuse	Alluvial	Intact	-
				V	2.0-2.4+	0.40	Dark gray	10YR 4/1	Gley	Non-sticky,	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-2-2	5.30	1.10	Water table	I	0.0-0.15	0.15	Very dark gray	7.5YR 3/1	Clay loam	Loose	decomposing organic material; roots	Distinct	Humus	Intact	-
				II	0.15-0.6	0.45	Brown	7.5YR 4/3	Clay	Fine, friable	Sparse roots	Abrupt/smooth	Alluvium	Intact	-
				III	0.6-0.8	0.20	Very dark gray	10YR 3/1	Clay	Fine	-	Abrupt/smooth	Alluvial	Intact	-
				IV	0.8-0.95	0.15	Gray	10YR 5/1	Gley	Non-sticky, super plastic	-	Abrupt/smooth	Anaerobic Alluvial	Intact	-
				V	0.95-1.1+	0.15	Very dark brown to very dark grayish brown	Mottled 10YR 2/2 and 10YR 3/2	Tropical peat	Vegetal mat	100% organic (partially decomposed reeds)	Unexcavated	Anaerobic Alluvial	Intact	-
F-2-3	5.00	1.04	Water table	I	0.0-0.1	0.10	Very dark gray	7.5YR 3/1	Clay loam	Loose	Roots	Distinct	Humus	Intact	-
				II	0.1-0.35	0.25	Brown	7.5YR 4/3	Clay	Fine, friable	Root layer between Layers II/III	Abrupt/wavy	Alluvium	Intact	-
				III	0.35-1.04	0.69+	Very dark gray	10YR 3/1	Gley	Non-sticky, super plastic	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-2-4	5.00	1.60	Water table	I	0.0-0.2	0.20	Very dark gray	7.5YR 3/1	Clay loam	Loose	-	Distinct/wavy	Humus	Intact	-
				II	0.2-0.45	0.25	Brown	7.5YR 4/4	Clayey sand (not marine)	Loose, coarse	-	Abrupt/wavy	Fill	Redeposited	-
				III	0.45-0.7	0.25	Brown	7.5YR 4/3	Clay	Friable	Sparse limestone	Abrupt/smooth	Alluvium	Intact	-
				IV	0.7-1.6	0.9+	Dark gray	10YR 4/1	Gley	Non-sticky, super plastic	-	-	Residual	Intact	-
F-2-5	5.80	1.50	Decomposing limestone bedrock	I	0.0-0.37	0.37	Very dark grayish brown	10YR 3/2	Clay loam	Very fine, friable crumb	20% limestone gravel and pebbles	Distinct/wavy	Alluvial	Redeposited	-
				II	0.37-0.6	0.23	Dark brown	7.5YR 3/2	Clay	Blocky	-	Abrupt/wavy	Alluvial	Intact	-
				III	0.6-1.5	0.90	Very pale brown	10YR 8/3 & 10YR 7/3	Limestone	Weathered, decomposing	100% weathered & decomposing limestone	-	Residual over bedrock	Intact	-
F-2-6	4.80	0.40	Decomposing limestone bedrock	I	0.0-0.33	0.33	Pale brown	10YR 6/3	Sand	Loose, single grain	50% crushed basalt	Abrupt/wavy	Road fill	Secondary Deposit	Basalt aggregate
				II	0.33+	-	-	-	Limestone	-	100% weathered & decomposing limestone	-	Bedrock	Intact	-
F-2-7	5.70	1.17	Decomposing limestone bedrock	I	0.0-0.49	0.49	Dark brown	7.5YR 3/3	Clay	Very fine, friable	20% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Redeposited	-
				II	0.15-0.64	0.40	Light brownish	10YR 6/2	Sand	Single grain	-	Abrupt/wavy	Pipe Trench Fill	Secondary Deposit	-
				III	0.57-0.75	0.18	Light brownish	10YR 6/2	Clay and sand	Single grain	-	Abrupt/wavy	Pipe Trench Fill	Secondary Deposit	-
				IV	0.7-1.17	0.47	Light brownish	10YR 6/2	Sand	Single grain	-	Abrupt/wavy	Pipe Trench Fill	Secondary Deposit	Copper pipe water line
				V	0.25-1.17+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-3-1	5.50	1.40	Decomposing limestone bedrock	I	0.0-1.07	1.07	Very dark brown	7.5YR 2.5/2	Clay loam	Loose	Roots & 10% weathered limestone gravel & pebbles	Distinct/wavy	Fill	Redeposited	Barbed wire
				II	1.0-1.4	0.40	Dark brown to dark gray	Mottled 7.5YR 3/2 & 10YR 4/1	Clay loam & Gley	Friable	10% limestone gravel and pebbles	Distinct/smooth	Mixed- alluvial & anaerobic	Disturbed	-
				III	1.35-1.5	0.15	Dark gray	10YR 4/1	Gley	Compact	-	Abrupt/wavy	Anaerobic Alluvial	Intact	-
				IV	0.55-1.4	0.85	Yellowish brown	10YR 5/4	Sand	Compact	70% weathered limestone gravel, pebbles & cobbles	Abrupt	Residual	Intact	-
				V	0.95+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-3-2	4.60	0.70	Decomposing limestone bedrock	I	0.0-0.3	0.30	Dark brown	7.5YR 3/2	Silty clay	Very fine crumb	Roots	Abrupt/wavy	Alluvium	Intact	-
				II	0.3-0.48	0.18	Reddish yellow	7.5YR 6/6	Sand	Loose	70% weathered limestone cobbles, pebbles and gravel	Distinct/wavy	Alluvial	Intact	-
				III	0.48-0.7	0.22	Dark brown	7.5YR 3/2	Clay loam	Very fine, friable crumb;	20% weathered limestone	Abrupt	Alluvial	Intact	-
				IV	0.70+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-3-3	5.20	0.70	Water table	I	0.0-0.05	0.05	Very dark gray	7.5YR 3/1	Clay loam	Loose	Roots, decomposing organic material	Distinct/wavy	Humus	Intact	Bottle glass
				II	0.05-0.4	0.35	Dark brown	Mottled 7.5YR 3/2 & 7.5YR 3/3	Clay loam	Fine, friable crumb	-	Distinct/smooth	Alluvium	Intact	-
				III	0.4-0.7	0.30	Dark gray	10YR 4/1	Gley	Non-sticky, super plastic	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-3-4	4.70	1.25	Immovable boulders at base of trench	I	0.0-0.1	0.10	Dark brown	7.5YR 3/2	Clay loam	Loose	Roots & 10% limestone gravel & pebbles	Gradual/wavy	Humus	Intact	-
				II	0.1-0.5	0.40	Dark brown	7.5YR 3/3	Clay	Loose	15% limestone pebbles and cobbles	Distinct/wavy	Tsunami? Push	Intact tsunami?	-
				III	0.5-1.25	0.75	Dark gray	7.5YR 4/1	Clay	Blocky	10% subrounded limestone boulders, cobbles and pebbles	Unexcavated	Tsunami (severe, violent)? Push	Intact tsunami? Redeposited fill?	-
F-3-5	4.60	0.46	Decomposing limestone bedrock	I	0.0-0.16	0.16	Very dark gray	7.5YR 3/1	Clay loam	Loose	Roots; 15% crushed basalt	Distinct/smooth	Humus	Intact	Basalt aggregate
				II	0.16-0.25	0.09	Gray	7.5YR 5/1	Silty sand	Coarse, unconsolidated	50% crushed basalt	Distinct/wavy	Fill (associated w/ Airfield?)	Redeposited	Basalt aggregate
				III	0.25-0.46	0.21	Dark brown	7.5YR 3/2	Clay	Fine, friable crumb	10% weathered limestone gravel and pebbles	Abrupt	Alluvial	Intact	-
				IV	0.46+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-3-6	5.10	0.24	Decomposing limestone bedrock	I	0.0-0.24	0.24	Yellowish brown & dark brown	10YR 5/4 & 10YR 3/3	Sandy loam	Very loose, unconsolidated	20% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Redeposited	-
				II	0.24+	-	-	-	Limestone	-	100% weathered & decomposing limestone	-	Bedrock	Intact	-
F-3-7	5.10	0.40	Decomposing limestone bedrock	I	0.0-0.3	0.30	Light yellowish brown & dark brown	10YR 6/4 & 10YR 3/3	Loamy sand	Very loose, unconsolidated	20% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Redeposited	-
				II	0.3+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-3-8	4.60	0.37	Decomposing limestone bedrock	I	0.0-0.33	0.33	Dark brown	10YR 3/3	Sandy loam	Loose, unconsolidated	2-inch crushed basalt; 20% limestone gravel and pebbles	Abrupt/smooth	Alluvial	Redeposited	Bottle glass, basalt & limestone aggregate
				II	0.33-0.37	0.04	Dark brown	7.5YR 3/3	Clay	Blocky	-	Abrupt/wavy	Alluvial	Intact	-
				III	0.37+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-3-9	5.30	1.00	Decomposing limestone bedrock	I	0.0-0.05	0.05	Dusky red	2.5YR 3/4	Sandy clay	Very fine, friable	-	Abrupt/wavy	Recent duff/fill	Redeposited	-
				II	0.05-0.09	0.04	Black	10YR 2/1	Disintegrating asphalt	Compacted	-	Abrupt/smooth	Asphalt pavement, Site	Intact	Asphalt
				III	0.09-0.55	0.46	Yellowish brown & very pale brown	10YR 5/4 & 10YR 7/4	Limestone	Massive	100% crushed limestone	Diffuse/smooth	OR&L RR bedding fill, Site 5791	Secondary Deposit	Limestone aggregate
				IV	0.55-0.91	0.36	Brown	7.5YR 4/3	Clay	Massive	-	Diffuse/wavy	Alluvial	Intact	-
				V	0.91+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-4-1	5.60	1.50	Water table	I	0.0-0.65	0.65	Brown to dark brown	Mottled 7.5YR 4/2 & 7.5YR 3/2	Clay loam	Fine, friable crumb	Roots & 25% limestone cobbles & pebbles	Abrupt/wavy	Fill	Redeposited (berm)	-
				I	0.45-1.45	1.00	Brown to light yellowish brown	Mottled 10YR 5/3 & 10YR 6/4	Sand	Loose, coarse	Roots & 50% limestone gravel, pebbles & cobbles	Diffuse/wavy	Alluvial	Intact	-
				III	1.3-1.5	0.2+	Dark gray	10YR 4/1	Gley	Non-sticky, super plastic	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-4-2	5.00	0.40	Decomposing limestone bedrock	I	0.0-0.3	0.30	Very dark gray	7.5YR 3/1	Clay loam	Fine, friable	Roots; 10% limestone cobbles & pebbles	Abrupt/wavy	Alluvium	Intact	-
				II	0.18-0.4	0.22	Brown	7.5YR 4/4	Clay	Single grain	30% limestone cobbles and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.4+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-3	5.30	0.95	Decomposing limestone bedrock	I	0.0-0.4	0.40	Dark brown	7.5YR 3/2	Clay loam	Loose, unconsolidated	Moderate roots; 10% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	-
				II	0.4-0.75	0.35	Brown	7.5YR 4/2	Clay loam	Friable crumb, moderately compacted	10% limestone gravel and pebbles	Distinct/smooth	Alluvial	Intact (upper possibly truncated)	-
				III	0.75-0.95	0.20	Yellowish brown	10YR 5/4	Clay	Fine, plastic, compacted	-	Abrupt/wavy	Alluvial	Intact	-
				IV	0.95+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-4	5.20	1.35	Decomposing limestone bedrock	I	0.0-0.64	0.64	Very dark grayish brown	10YR 3/2	Clay loam	Fine, friable crumb	Ironwood roots & 25% limestone cobbles, pebbles & gravel	Abrupt/wavy	Fill	Redeposited	-
				II	0.64-0.8	0.16	Very pale brown	10YR 8/2	Limestone	Weathered	100% weathered & decomposing	Abrupt/wavy	Bedrock over void	Intact	-
				III	0.8-0.95	0.15	Dark brown	7.5YR 3/3	Clay	Massive	Ironwood roots & 20% limestone pebbles & gravel	Diffuse/wavy	Alluvial fill in void	Intact	-
				IV	0.95-1.35	0.40	Very pale brown	10YR 7/3	Limestone	Decomposing	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-5	7.50	0.93	Decomposing limestone bedrock	I	0.0-0.1	0.10	Very dark brown	10YR 2/2	Vegetation	Structureless	100% organic material	Distinct/wavy	Recent duff	Intact	-
				II	0.1-0.62	0.55	Very dark grayish brown & very pale brown	10YR 3/2, 10YR 8/3 & 10YR 7/3	Beach sand w/clay loam pockets	Loose, single grain	Sparse limestone gravel, pebbles, cobbles	Abrupt/wavy	Tsunami? Fill?	Intact- tsunami? Redeposited- fill?	Fiberglass? Fabric
				III	0.62-0.93	0.38	Dark yellowish brown	10YR 3/4	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				IV	0.93+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-6	6.00	0.55	Decomposing limestone bedrock	I	0.0-0.14	0.14	Dark reddish brown to brown	Mottled 5YR 3/3 & 10YR 4/3	Sandy clay loam	Loose, unconsolidated	-	Distinct/wavy	Fill	Redeposited	-
				II	0.14-0.36	0.22	Dark brown	10YR 3/3	Clay loam	Massive	-	Abrupt/smooth	Alluvial	Intact	-
				III	0.36-0.55+	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-7	5.8	1.08	Decomposing limestone bedrock	I	0.0-0.08	0.08	-	-	Vegetation	Structureless	100% grasses	Distinct/wavy	Recent duff	Intact	-
				II	0.08-0.47	0.26	Very dark grayish brown, pale brown & very pale brown	10YR 3/2, 10YR 6/3 & 10YR 7/3	Sandy clay loam	Loose, unconsolidated	2-inch crushed basalt & 10% limestone gravel	Distinct/wavy	Fill	Redeposited	Asphalt fragments & basalt aggregate
				III	0.1-0.3	0.20	Black	10YR 2/1	Intact asphalt layer	-	-	Abrupt/smooth	Asphalt pavement, Site	Intact	Asphalt
				IV	0.2-0.54	0.34	Pale brown to very pale brown	Mottled 10YR 6/3 & 10YR 8/3	Limestone	-	Crushed gravel	Abrupt/wavy	Fill-bedding for OR&L RR grade	Intact	Limestone aggregate
				V	0.45-0.54	0.09	Grayish brown	10YR 5/2	Basalt	-	2-inch crushed gravel	Abrupt/wavy	Fill-bedding RR	Intact	Basalt aggregate
				VI	0.52-1.03	0.51	Dark brown	7.5YR 3/3	Clay	Massive	-	Abrupt	Alluvial	Intact	-
				VII	0.81-1.08	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-4-8	5.00	0.31	Decomposing limestone bedrock	I	0.0-0.25	0.25	Brown	10YR 4/3	Sandy loam	Very fine, friable; unconsolidated	20% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	Plastic garbage
				II	0.25-0.31	0.06	Dark yellowish brown	10YR 3/4	Clay	Very fine, friable	50% limestone gravel	Distinct/wavy	Alluvial	Intact	-
				III	0.31+	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-4-9	5.70	0.52	Decomposing limestone bedrock	I	0.0-0.36	0.36	Dark grayish brown	10YR 4/2	Sandy clay loam	Very fine, friable; unconsolidated	50% limestone gravel, pebbles and cobbles	Distinct/wavy	Push pile fill	Redeposited	Black sheet plastic fragments
				II	0.36-0.52	0.16	Dark yellowish brown	10YR 4/4	Clay	Massive	-	Distinct/wavy	Alluvial	Intact	-
				III	0.52+	-	-	-	Limestone	Weathered	-	-	Bedrock	Intact	-
F-5-1	5.20	1.65	Decomposing limestone bedrock	I	0.0-0.4	0.40	Dark brown	7.5YR 3/2	Clay loam	Loose, unconsolidated	Many roots; 10% limestone gravel and pebbles	Distinct/wavy	Recent duff	Intact	Plastic coated wire
				II	0.4-1.5	1.10	Dark brown to very dark brown	Mottled 7.5YR 3/2 & 7.5YR 2.5/2	Clay loam	Loose, unconsolidated	Few roots; 30% limestone cobbles, pebbles and gravel	Distinct/wavy	Push pile	Redeposited	-
				III	1.5-1.65	0.15	Dark brown	7.5YR 3/2	Clay	Massive, compacted	10% weathered limestone gravel	Abrupt/wavy	Alluvial	Intact	-
				IV	1.65+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-2	5.20	0.95	Decomposing limestone bedrock	I	0.0-0.6	0.60	Dark brown	7.5YR 3/2	Clay loam	Fine, friable crumb; loose, unconsolidated	Moderate roots; 15% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.6-0.95	0.35	Brown	7.5YR 4/2	Clay	Massive, compacted	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.95+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-3	5.00	1.10	Water table	I	0.0-0.4	0.40	Very dark gray	7.5YR 3/1	Clay loam	Very fine, friable crumb; unconsolidated	15% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact	-
				II	0.4-075	0.35	Brown	7.5YR 4/3	Clay loam	Very fine, friable crumb;	15% limestone gravel and pebbles	Abrupt/smooth	Alluvial	Intact	-
				III	0.75-1.1	0.35	Brown	10YR 5/3	Gley	Non-sticky,	-	-	Anaerobic Alluvial	Intact	-
F-5-4	5.50	1.30	Decomposing limestone bedrock	I	0.0-0.73	0.73	Very dark grayish brown & dark reddish brown	Mottled 10YR 3/2 & 5YR 3/3	Clay loam	Fine, friable crumb	25% limestone gravel, pebbles and cobbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.73-1.3	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-5	7.00	1.40	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	Ironwood detritus	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.25	0.18	Very pale brown	10YR 7/4 & 10YR 8/4	Beach Sand	Super fine, unconsolidated	-	Distinct/wavy	Fill? Tsunami?	Redeposited fill? Intact tsunami?	-
				III	0.25-0.42	17.00	Very dark grayish brown	10YR 3/2	Clay loam	Fine, friable crumb	Sparse limestone gravel and pebbles	Abrupt/wavy	Fill?	Redeposited?	-
				IV	0.42-1.4	0.96	Very pale brown & white	10YR 7/4 & 10YR 8/1	Limestone	Weathered	100% weathered & decomposing limestone	-	Bedrock	Intact	-
F-5-6	6.00	0.64	Decomposing limestone bedrock	I	0.0-0.09	0.09	-	-	Concrete slab	Rough concrete aggregate w/finished surface	-	Abrupt	Surface feature Site 7265	Intact	Concrete aggregate
				II	0.09-0.33	0.24	Pale brown	10YR 6/3	Limestone	-	100% crushed gravel	Abrupt/smooth	Fill-concrete bedding, Site 7265	Secondary Deposit	Limestone aggregate
				III	0.33-0.46	0.13	White	10YR 8/1	Limestone	Weathered	100% weathered & decomposing	Abrupt/smooth	Bedrock over void	Intact	-
				IV	0.46-0.64	0.18	Dark yellowish brown	10YR 3/4	Clay	Compacted, massive	-	Abrupt/wavy	Alluvial fill in void	Intact	-
				V	0.64+	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-7	6.20	0.52	Decomposing limestone bedrock	I	0.0-0.07	0.07	Very dark brown	7.5YR 2.5/2	Humus	Structureless	100% organic material & roots	Distinct/wavy	Recent duff	Intact	-
				II	0.07-0.35	0.28	Dark brown	10YR 3/3	Clay loam	Fine, friable	25% limestone gravel and pebbles	Distinct/smoot	Alluvial	Intact	-
				III	0.35-0.52	0.17	Dark yellowish brown	10YR 4/4	Clay	Massive	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				IV	0.52	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-8	4.80	0.60	Decomposing limestone bedrock	I	0.0-0.36	0.36	Dark grayish	10YR 4/2	Sandy clay loam	Unconsolidated	10% limestone gravel and pebbles	Distinct/wavy	Alluvium	Intact?	-
				II	0.36-0.55	0.19	Dark brown	7.5YR 3/3	Sandy clay loam	Massive	20% limestone gravel and pebbles	Distinct/wavy	Alluvial	Intact	-
				III	0.55-0.6	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-5-9	5.70	1.23	Decomposing limestone bedrock	I	0.0-0.54	0.54	Dark grayish	10YR 4/2	Sandy loam	Unconsolidated	10% limestone gravel and pebbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.54-0.74	0.20	Brown	10YR 4/3	Sandy clay loam	Fine, friable	60% limestone gravel and pebbles	Distinct/wavy	Fill	Redeposited	Amber bottle glass
				III	0.72-1.2	0.48	Brown to dark grayish brown	Mottled 10YR 4/2 to 10YR 4/3	Sandy loam & sandy clay loam (Mix of Layers I-II)	Fine, friable crumb; unconsolidated	60% limestone gravel and pebbles	Abrupt/smooth	Pipeline trench fill	Secondary Deposit	Bell junction cast iron sewage pipe
				IV	0.74-1.23	-	-	-	Limestone	Weathered	100% weathered & decomposing	-	Bedrock	Intact	-
F-5-10	7.50	1.15	Water table	I	0.0-0.13	0.13	Very dark gray	10YR 3/1	Humus	Structureless	Organic material; 1-in crushed basalt	Distinct/wavy	Recent duff	Intact	Modern trash; basalt
				II	0.13-0.4	0.27	Brown to dark yellowish brown	10YR 5/3 & 10YR 4/4	Limestone	Unconsolidated	100% crushed gravel	Distinct/wavy	Fill	Secondary Deposit	Steel wire bundle; limestone aggregate
				III	0.4-0.58	0.18	Very dark grayish brown & dark grayish brown	10YR 3/2 & 10YR 4/2	Clay loam	Fine, friable crumb	10% limestone gravel	Distinct/wavy	Alluvial	Intact	-
				IV	0.58-0.75	0.17	Light gray & grayish brown	10YR 7/2 & 10YR 5/2	Limestone	Weathered	100% weathered & decomposing limestone	Distinct/smooth	Bedrock over void	Intact	-
				V	0.75-0.9	0.15	Gray	10YR 5/1	Clay	Massive	-	Diffuse/smooth	Alluvial fill in void	Intact	-
				VI	0.9-1.15	0.25	Brown	10YR 4/3	Clay	Massive	-	Unexcavated	Alluvial fill in void	Intact	-
F-6-1	5.50	0.65	Decomposing limestone bedrock	I	0.0-0.3	0.30	Brown	7.5YR 4/2	Clay loam	Fine, friable	45% limestone gravel and pebbles	Diffuse/wavy	Road fill	Secondary Deposit	-
				II	0.3-0.65	0.35	Brown	10YR 5/3	Sand	Loose	20% weathered limestone gravel, pebbles & cobbles	Diffuse	Residual	Intact	-
				III	0.65+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-6-2	5.60	0.60	Decomposing limestone bedrock	I	0.0-0.25	0.25	Dark reddish brown to dark brown	Mottled 5YR 3/3 & 7.5YR 3/2	Clay loam	Loose	20% limestone gravel and pebbles and crushed basalt	Distinct/wavy	Road fill	Redeposited	Basalt aggregate
				II	0.25-0.6	0.35	Dark gray	7.5YR 4/1	Clay	Non-sticky,	10% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.6+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-7-1	5.00	0.55	Decomposing limestone bedrock	I	0.0-0.3	0.30	Dark brown	7.5YR 3/2	Clay loam	Loose	10% limestone gravel and pebbles	Gradual	Alluvial	Intact	-
				II	0.3-0.55	0.25	Gray	7.5YR 5/1	Gley	Non-sticky, super plastic	-	Abrupt	Anaerobic Alluvial	Intact	-
				III	0.55+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-7-2	5.00	1.25	Water table	I	0.0-0.3	0.30	Brown	7.5YR 4/4	Clay loam	Loose	Roots; 70% limestone boulders, cobbles, pebbles and gravel	Diffuse/wavy	Road disturbance	Redeposited	-
				II	0.3-0.4	0.10	Very dark gray	7.5YR 3/1	Clay loam	Fine, friable	10% limestone gravel and pebbles	Diffuse/wavy	Alluvial	Intact	-
				III	0.4-0.95	0.55	Brown	7.5YR 4/2	Clay	Super-plastic	Sparse limestone gravel	Gradual/wavy	Alluvial	Intact	-
				IV	0.95-1.25	0.3+	Light gray	7.5YR 7/1	Gley	Sticky, super-plastic	-	-	Anaerobic Alluvial	Intact	-
F-8-1	4.70	0.55	Decomposing limestone bedrock	I	0.0-0.35	0.35	Very dark gray	7.5YR 3/1	Clay loam humus	Unconsolidated	Moderate roots; 30% limestone cobbles, pebbles and gravel	Diffuse/wavy	Alluvium	Intact?	-
				II	0.35-0.55	0.20	Dark brown	7.5YR 3/3	Clay loam	Very fine friable crumb; unconsolidated	60% limestone cobbles and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.55+	-	-	-	Limestone	-	-	-	Bedrock	Intact	-
F-8-2	5.20	1.65	Water table	I	0.0-0.55	0.55	Dark brown	7.5YR 3/2	Clay loam	Loose	60% limestone cobbles, pebbles and	Abrupt/smooth	Berm fill	Redeposited	-
				II	0.55-0.85	0.30	Yellowish brown	10YR 5/4	Sandy loam	Loose	80% weathered limestone cobbles, pebbles and gravel	Diffuse/wavy	Fill	Redeposited	-
				III	0.85-1.65	0.80	Brown	7.5YR 4/3	Clay loam & small pockets of gley	Friable crumb; saturated & compacted	-	Unexcavated	Alluvial & Anaerobic Alluvial	Intact	-
F-9-1	5.00	0.45	Decomposing limestone bedrock	I	0.0-0.2	0.20	Very dark gray & brown	Mottled 7.5YR 3/1 & 7.5YR 4/4	Clay loam	Unconsolidated	70% limestone cobbles, pebbles and gravel	Diffuse/wavy	Fill associated w/ foundation, Site 7284, Feature A	Secondary Deposit	2-in threaded galvanized pipe
				II	0.2-0.45	0.25	Dark brown & light yellowish brown	7.5YR 3/2 (loam) & 10YR 6/4	Sandy clay loam & pockets of beach sand	Fine, friable crumb	1% crushed basalt	Abrupt/wavy	Pipeline trench fill; Site 7284 Feature A	Secondary Deposit	Basalt aggregate
				III	0.45+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-9-2	4.50	0.90	Decomposing limestone bedrock	I	0.0-0.7	0.70	Dark brown & dark reddish brown	Mottled 7.5YR 3/2 & 5YR 3/2	Clay loam	Unconsolidated, loose	1% limestone boulders, cobbles, pebbles and gravel	Distinct/wavy	Berm fill	Redeposited	Basalt aggregate
				II	0.7-0.9	0.20	Dark brown	7.5YR 3/2	Clay	Compacted	50% limestone gravel and pebbles	Abrupt/wavy	Alluvial	Intact	-
				III	0.9+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-10-1	4.30	0.60	Decomposing limestone bedrock	I	0.0-0.15	0.15	Very dark gray	7.5YR 3/1	Clay loam humus	Moderately compacted	10% limestone cobbles, pebbles and gravel	Distinct/wavy	Alluvium	Redeposited	Plastic switch cover, beer glass bottle
				II	0.15-0.6	0.45	Brown	10YR 5/3	Sandy clay loam	Unconsolidated	80% weathered limestone cobbles, pebbles and gravel	Abrupt/wavy	Imported fill for slab, Site 7284 Feature C	Secondary Deposit	-
				III	0.6+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-10-2	4.70	1.40	Water table	I	0.0-0.45	0.45	Dark brown & dark reddish brown	Mottled 7.5YR 3/2 & 5YR 3/3	Sandy clay loam	Unconsolidated	30% limestone gravel and pebbles	Diffuse/wavy	Fill	Redeposited	2" metal pipe (gate post)
				II	0.45-0.6	0.15	Yellowish brown & light yellowish brown	Mottled 10YR 5/4 & 10YR 6/4	Calcareous sand	Fine, single grain	-	Abrupt/wavy	Pipeline trench fill	Secondary Deposit	4" metal sewer pipe
				III	0.6-0.95	0.35	Dark brown	7.5YR 3/2	Clay	Compacted	10% weathered limestone gravel	Diffuse/wavy	Alluvial	Intact	-
				IV	0.95-1.4	0.45	Gray	10YR 5/1	Gley	Compacted	-	-	Anaerobic Alluvial	Intact	-
F-11-1	6.00	1.50	Water table	I	0.0-0.5	0.50	Dark brown	7.5YR 3/4	Clay loam	Loose	Roots; 50% limestone gravel, pebbles and cobbles	Distinct/wavy	Fill	Redeposited	-
				II	0.5-0.95	0.45	Dark brown	7.5YR 3/4	Clay loam	Fine, friable	25% limestone gravel and pebbles	Distinct/smoot	Waterline fill	Redeposited	Two 5" iron pipes
				III	0.95-1.5	0.55	Light yellowish brown	10YR 6/4	Sand	Coarse	100% weathered & decomposing limestone	Unexcavated	Residual	Intact	-
11-2	6.10	2.30	Water table	I	0.0-1.1	1.10	Dark reddish	5YR 3/3	Clay loam	Fine, friable	Roots; 10% limestone cobbles and	Abrupt/smooth	Push pile fill	Redeposited	Recent golf ball
				II	1.0-1.35	0.35	Brown & dark brown	Mottled 7.5YR 4/2 & 7.5YR 3/2	Sandy clay loam	Loose	20% limestone gravel and pebbles	Distinct/wavy	Push pile fill	Redeposited	Steel cable, plastic irrigation hose, tire
				III	1.25-1.77	0.52	Very dark brown	10YR 2/2	Sandy clay loam	Compacted, fine friable crumb	Light roots & < 10% limestone gravel	Diffuse/smooth	Alluvium	Intact	-
				IV	1.73-2.3	0.57	Dark gray & gray	Mottled 10YR 4/1 & 10YR 5/1	Gley	Non-sticky, super plastic	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-12-1	6.30	1.60	Decomposing limestone bedrock	I	0.0-0.05	0.05	Black	10YR 2/1	Intact asphalt layer	Compacted	-	Abrupt/smooth	Asphalt pavement, Site	Intact	asphalt aggregate
				II	0.05-0.3	0.25	Very pale brown & light yellowish brown	Mottled 10YR 7/4 & 10YR 6/4	Limestone	Weathered	Root mat; 100% limestone gravel & pebbles	Abrupt/smooth	Fill/bedding for asphalt surface, Site 5791	Secondary Deposit	-
				III	0.3-0.35	0.05	Dark grayish	10YR 4/2	Clay loam	Compact	30% limestone gravel and pebbles	Abrupt/wavy	Fill- Site 5791	Secondary Deposit	-
				IV	0.35-1.2	0.85	Very pale brown	10YR 7/4	Weathered limestone	Compact	100% limestone boulders, cobbles, pebbles, gravel	Abrupt/wavy	Limestone fill for OR&L RR Site 5791	Secondary Deposit	Railroad grade
				V	1.2-1.6	0.40	Dark gray	10YR 4/1	Gley	Compact	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-12-2	6.30	1.35	Water table	I	0.0-0.4	0.40	Dark brown	7.5YR 3/3	Clay loam	Fine, friable	Roots & 50% limestone gravel & pebbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.4-0.95	0.55	Dark brown	7.5YR 3/3	Clay loam	Fine, friable	-	Abrupt/wavy	Alluvial	Intact	-
				III	0.95-1.35	0.40	Dark gray	7.5YR 4/1	Gley	Compact, saturated	-	Unexcavated	Anaerobic Alluvial	Intact	-
F-13-1	6.50	0.12	Decomposing limestone bedrock	I	0.0-0.12	0.10	Very dark gray	7.5YR 3/1	Silty clay loam	Fine, friable crumb	25% limestone gravel & pebbles; roots & 50% decomposing organics	Abrupt/wavy	Alluvium	Intact	transfer printed ceramics, bottle glass
				II	0.12+	-	-	-	Limestone	-	-	-	Bedrock	Intact	-
F-13-2	6.00	2.13	Decomposing limestone bedrock	I	0.0-1.25	1.25	Dark brown	7.5YR 3/3	Clay loam	Loose, friable crumb	30% limestone gravel, pebbles and cobbles; roots	Distinct/wavy	Fill	Redeposited	-
				II	1.25-1.75	0.50	Dark reddish brown	5YR 3/3	Clay	Compacted, massive	-	Distinct/wavy	Alluvial	Intact	-
				III	1.75-2.13	0.38	Dark gray	10YR 4/1	Gley	Non-sticky,	-	Abrupt/smooth	Alluvial	Intact	-
				IV	2.13	-	-	-	Limestone	-	-	-	Bedrock	Intact	-

Test Area F Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
F-14-1	6.00	0.10	Decomposing limestone bedrock	I	0.0-0.10	0.10	Dark brown	7.5YR 3/2	Clay loam	Fine, friable crumb	20% limestone gravel & pebbles; roots & 20% decomposing organics	Abrupt/smooth	Alluvium	Intact	-
				II	0.10+	-	-	-	Limestone	-	100% weathered & decomposing limestone	-	Bedrock	Intact	-
F-14-2	4.60	0.63	Decomposing limestone bedrock	I	0.0-0.18	0.18	Dark reddish	5YR 3/3	Clay loam	Fine, friable	20% limestone gravel and pebbles	Abrupt/wavy	Push pile fill	Redeposited	-
				II	0.18-0.45	0.27	Yellowish brown	10YR 5/4	Sandy loam	Loose	80% limestone gravel and pebbles	Distinct/wavy	Push pile fill	Redeposited	-
				III	0.45-0.63	0.18	Very dark grayish brown	10YR 3/2	Sandy loam	Loose	30% limestone gravel and pebbles	Abrupt/wavy	Push pile fill	Redeposited	Asphalt fragments, bottle glass
				IV	0.63+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-15-1	6.40	0.61	Decomposing limestone bedrock	I	0.0-0.13	0.12	Black	7.5YR 2.5/1	Clay loam	Loose	roots; 50% organic material	Clear/wavy	Alluvium	Intact	-
				II	0.12-0.55	0.41	Dark grayish	10YR 4/2	Clay loam	Fine, friable	10% limestone gravel and pebbles	Clear/wavy	Alluvial	Intact	-
				Pipe Trench	0.06-0.55	0.50	Very pale brown	10YR 7/3	Beach Sand	Loose	-	Abrupt/wavy	Pipe trench fill	Secondary Deposit	8-inch iron pipeline
				III	0.37-0.61	0.10	Dark gray	10YR 4/1	Gley	Non-sticky,	-	-	Anaerobic Alluvial	Intact	-
				IV	0.61+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-
F-15-2	5.00	1.20	Decomposing limestone bedrock	I	0.0-0.3	0.30	Dark brown	7.5YR 3/3	Silty loam	Fine, friable	10% limestone gravel and pebbles	Abrupt/wavy	Fill	Redeposited	-
				II	0.3-0.75	0.45	Pale brown to brown	Mottled 10YR 6/3 & 10YR 4/3	Limestone	Crushed	100% crushed gravel, pebbels & cobbles	Distinct/wavy	Fill	Secondary Deposit	Limestone aggregate; concrete fragments
				III	0.75-0.87	0.12	Yellowish brown	10YR 5/4	Silty sand	Single grain	70% limestone gravel and pebbles	Distinct/wavy	Fill	Secondary Deposit	-
				IV	0.87-1.2	0.33	Dark reddish	5YR 3/3	Clay	Blocky	-	Abrupt/wavy	Alluvial	Intact	-
				V	1.2+	-	-	-	Limestone	-	100% weathered & decomposing	-	Bedrock	Intact	-

Test Area G Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
G-2-1	5.00	2.30	Subsoil	I	0.0-0.5	0.50	Dark brown	7.5YR 3/2	Clay loam	Loose	weathered organic debris; dense roots	Diffuse/wavy	Reworked	Plow zone	-
				II	0.5-0.86	0.35	Dark brown	7.5YR 3/3	Clay	Blocky	< 5% weathered limestone gravel	Smooth/abrupt	Alluvial	Intact	-
				IIIa	0.86-0.98	0.12	Dark brown	7.5YR 3/2	Clay loam	Compacted	< 5% weathered limestone gravel	Smooth/abrupt	Alluvial	Intact	-
				IIIb	0.93-0.98	0.05	Dark brown	7.5YR 3/3	Gravelly clay loam	Compacted	50% weathered limestone gravel; lens	Smooth/abrupt	Alluvial	Intact	-
				IV	0.98-2.3	1.32	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	-	Unexcavated	Alluvial	Intact	-
G-2-2	5.00	2.70	Subsoil	I	0.0-0.45	0.45	Very dark brown	7.5YR 2.5/2	Clay loam	Loose	Roots common	Diffuse/wavy	Reworked	Plow zone	-
				II	0.45-0.78	0.33	Dark brown	7.5YR 3/2	Clay	Blocky	< 5% limestone gravel, pebbles; few	Diffuse/wavy	Alluvial	Intact	-
				III	0.78-2.7	1.92	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	speckled w/ weathered limestone fragments	Unexcavated	Alluvial	Intact	-
G-2-3	4.50	2.20	Subsoil	I	0.0-0.4	0.40	Very dark brown	7.5YR 2.5/2	Clay loam	Loose	Few roots, basalt crushed gravel	Distinct/wavy	Reworked	Plow zone	Basalt aggregate, Marconi Rd
				II	0.4-1.0	0.60	Dark brown	7.5YR 3/4	Clay	Blocky	-	Distinct/wavy	Alluvial	Intact	-
				III	1.0-2.2	1.20	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	sparse weathered limestone fragments	Unexcavated	Alluvial	Intact	-
G-3-1	5.20	2.20	Subsoil	I	0.0-0.4	0.40	Dark brown	7.5YR 3/3	Clay loam	Loose	Roots common	Abrupt/wavy	Reworked	Plow zone	-
				II	0.4-0.46	0.60	Dark brown	7.5YR 3/4	Clay	Compacted	< 5% weathered limestone gravel	Abrupt/smooth	Alluvial	Intact	-
				III	0.46-0.65	0.19	Dark brown	7.5YR 3/3	Clay loam	Loose	-	Abrupt/wavy	Reworked	Plow zone	-
				IV	0.65-2.2	1.55	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	-	Unexcavated	Alluvial	Intact	-
G-3-2	5.00	2.35	Subsoil	I	0.0-0.4	0.40	Very dark brown	7.5YR 2.5/2	Clay loam	Loose	-	Diffuse/wavy	Reworked Alluvium	Plow zone	-
				II	0.4-2.35	1.95	Dark brown	7.5YR 3/4	Clay	Massive	-	Unexcavated	Alluvial	Intact	-
G-4-1	5.90	2.30	Decomposing limestone bedrock	I	0.0-0.55	0.55	Dark brown	7.5YR 3/3	Clay loam	Loose	> 5% sparse weathered limestone, roots	Diffuse/wavy	Reworked	Plow zone	-
				II	0.55-0.95	0.40	Dark brown	Mottled 7.5YR 3/3 and 7.5YR	Clay loam	Blocky	-	Abrupt/wavy	Alluvial	Possible plow zone	-
				III	0.95-2.3	1.35	Dark brown	7.5YR 3/3	Clay	Compacted, Massive	1% very sparse limestone	Abrupt/wavy	Alluvial	Intact	-
				IV	2.3+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-
G-4-2	6.40	2.00	Decomposing limestone bedrock	I	0.0-0.6	0.60	Mottled Dark brown & Dark reddish brown	5YR 3/3 and 7.5YR 3/4	Clay loam	Loose	10% weathered limestone; roots	Abrupt/wavy	Reworked Alluvium	Plow zone	-
				II	0.6-2.0	1.40	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	-	Abrupt	Alluvial	Intact	-
				III	2.0+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-
G-4-3	5.20	1.50	Subsoil	I	0.0-0.4	0.40	Dark brown	7.5YR 3/3	Clay loam	Loose	-	Abrupt/wavy	Reworked	Plow zone	Modern debris
				II	0.4-1.45	1.05	Dark brown	7.5YR 3/3	Clay	Massive	-	Abrupt/wavy	Alluvial	Intact	-
				III	1.45-1.5	0.05	Yellowish red	5YR 4/6	Sand	Very Friable, coarse	100% decomposing limestone	-	Residual	Intact	-
				IV	1.5+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-
G-5-1	5.90	2.30	Decomposing limestone bedrock	I	0.0-0.35	0.35	Dark reddish	5YR 3/3	Silty clay loam	Loose	< 5% limestone, roots common	Diffuse	Reworked	Plow zone	-
				II	0.35-0.95	0.60	Dark reddish	5YR 3/2	Clay loam	Compacted	10% weathered limestone	Diffuse	Alluvial	Intact	-
				III	0.95-1.55	0.60	Dark reddish brown	5YR 3/3	Clay	Compacted, Massive	< 5% weathered limestone	Distinct	Alluvial	Intact	-
				IV	1.55-2.3	0.75	Brown	Mottled 7.5YR 4/4 & 7.5YR 5/4	Clay	Moderately Compacted	30% weathered limestone	Alluvial	Alluvial	Intact	-
				V	2.3+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-

Test Area G Trench Stratigraphy

Backhoe Trench	Trench length (m)	Max. Trench Depth (m)	Reason for termination	Layer	Depth of Layer (m bs)	Average thickness of layer (m)	Soil color	Munsell	Matrix	Structure	Inclusions	Lower boundary	Deposit type	Integrity	Cultural material
G-5-2	5.30	2.10	Decomposing limestone bedrock	I	0.0-0.5	0.50	Dark brown	7.5YR 3/3	Clay loam	Loose	10% limestone gravel	Abrupt/smooth	Reworked	Plow zone	-
				II	0.5-0.85	0.35	Very dark brown	7.5YR 2.5/2	Clay loam	Compact	-	Abrupt/smooth	Alluvial	Intact	-
				III	0.85-1.95	1.10	Reddish brown	5YR 3/3	Clay	Compact	5% limestone gravel	Distinct/wavy	Alluvial	Intact	-
				IV	1.95-2.1	0.15	Brown	Mottled 7.5YR 4/4 & 7.5YR 5/4	Clay	Compact	30% weathered limestone	Abrupt/wavy	Alluvial, Residual	Intact	-
				V	2.1+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-
G-5-3	5.60	2.40	Decomposing limestone bedrock & Water table	I	0.0-0.5	0.50	Dark brown	7.5YR 3/3	Clay loam	Loose	sparse weathered organic material	Gradual/wavy	Reworked	Plow zone	-
				II	0.5-1.3	0.80	Dark brown	7.5YR 3/4	Clay	Compacted, Massive	< 10% weathered limestone pebbles	Gradual/wavy	Alluvial	Intact	-
				III	1.3-1.6	0.30	Brown	7.5YR 4/4	Slity clay loam	Compacted	50% weathered subangular basalt pebbles & cobbles	Distinct	Alluvial	Intact	-
				IV	1.6-2.0	0.40	Dark brown	7.5YR 3/3	Clayey silt	Moderately Compacted	< 5% limestone pebbles	Distinct	Alluvial	Intact	-
				V	2.0-2.4	0.40	Reddish yellow	7.5YR 6/6	Clay	Loose	50% weathered subangular limestone	Abrupt/wavy	Alluvial, Residual	Intact	-
				VI	2.4+	-	-	-	Limestone	-	100% decomposing limestone	-	Bedrock	Intact	-
G-6-1	5.15	2.10	Subsoil	I	0.0-0.38	0.38	Dark reddish	5YR 3/3	Silty loam	Unconsolidated	15% weathered limestone; few roots	Diffuse/wavy	Reworked	Plow zone	steel cable, wine bottle
				II	0.38-0.9	0.52	Dark reddish brown and reddish brown	Mottled 5YR 3/3 & 5YR 4/4	Silty clay loam	Slightly consolidated	30% weathered limestone	Gradual/wavy	Alluvial	Intact	-
				III	0.9-1.43	0.53	Dark reddish	5YR 3/3	Clay	Compacted	sparse weathered limestone	Diffuse/wavy	Alluvial	Intact	-
				IV	1.43-2.1	0.67	Brown & Dark brown	7.5YR 4/4 & 7.5YR 3/4	Clay	Coarse	20% weathered limestone	Unexcavated	Alluvial	Intact	-

APPENDIX D - Accession Record for Haun & Associates TBR SAIS

HAUN & ASSOCIATES ACCESSION RECORD FOR TBR SAIS

Acc.No.	SIHP Site No.	Test Area	Transect	Trench	Layer	Depth cm below surface	Specimen	Material	TNF	Weight (grams)	Comment	Recorder	Date
1.001		A	1	2	II	80-125	Core	Volcanic Glass	1	1.7	multidirectional; L=15.4mm, W=12.0mm, T=11.4mm	JK	1/27/2012
2.001		A	5	1	IV	110-156	Handle	Metal	1	97.6	chromed handle of indeterminate type, could be historic or modern; L=78.2mm, W=39.5mm, T=27.0mm	JK	1/30/2012
3.001		C	Sand Pit 1	Profile 2	II	5-240+	*Felis catus*	Bone	7	13.5	tibia, radius, 2 vertebrae, 3 phalanges	JK	1/4/2012
4.001		C	7	1	III	6-40	Unidentified Mammal	Bone	1	1.2	probable *Sus scrofa*	TG	1/17/2012
4.002		C	7	1	III	6-40	Poritidae *Porites* sp. pebble	Coral	1	0.4	manuport	TG	1/17/2012
5.001		C	8	1	Pit- IIIa	16-53	Charred Wood	Charcoal	3	0.3		TG	1/17/2012
6.001		C	8	2	IV a	84-117	Conidae *Conus* sp.	Gastropod Shell	1	1.1	waterworn	TG	1/19/2012
6.002		C	8	2	IV a	84-117	Neritidae *Nerita picea*	Gastropod Shell	2	0.4	waterworn	TG	1/19/2012
6.003		C	8	2	IV a	84-117	Indeterminate Gastropod	Gastropod Shell	2	0.8	waterworn	TG	1/19/2012
6.004		C	8	2	IV a	84-117	*Heterocentrotus mammillatus*	Urchin Spine	1	0.4	waterworn	TG	1/19/2012
7.001	4488	C	Sand Pit 6	Profile 1	II	36-180	Earthenware Vessel Fragments	Ceramic	3	6.8	light green slip	TG	1/17/2012
7.002	4488	C	Sand Pit 6	Profile 1	II	36-180	Avian	Bone	1	0.1		TG	1/17/2012
7.003	4488	C	Sand Pit 6	Profile 1	II	36-180	Unidentified Mammal	Bone	2	109.9	probable *Sus scrofa* , *Bos taurus* or *Equus ferus*	TG	1/17/2012
7.004	4488	C	Sand Pit 6	Profile 1	II	36-180	Charred Wood	Charcoal	1	0.1		TG	1/17/2012
8.001		D	9	3	IV	118-200	Indeterminate Bivalve	Bivalve Shell	1	< 0.1		TG	1/16/2012
8.002		D	9	3	IV	118-200	Crustacea	Exoskeleton	1	0.3	crab claw	TG	1/16/2012
9.001		D	8	3	I	0-65	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	2	0.5		JK	1/11/2012
9.002		D	8	3	I	0-65	Mytilidae	Bivalve Shell	1	0.1		JK	1/11/2012
9.003		D	8	3	I	0-65	Echinometridae	Exoskeleton	1	0.1		JK	1/11/2012
9.004		D	8	3	I	0-65	Crustacea	Exoskeleton	1	0.1	crab claw	JK	1/11/2012
9.005		D	8	3	I	0-65	Waterworn Marine Shell	Mixed	9	3.0		JK	1/11/2012
10.001	7289	D	2	1	III	38-45	Debitage	Basalt	4	5.6		JK	1/10/2012
10.002	7289	D	2	1	III	38-45	Patellidae *Cellana* sp.	Gastropod Shell	1	1.1		JK	1/10/2012
11.001	7289	D	2	1B	III	30-54	Neritidae *Nerita polita*	Gastropod Shell	1	1.8		JK	1/20/2012
11.002	7289	D	2	1B	III	30-54	Crustacea	Exoskeleton	1	0.1	crab claw	JK	1/20/2012
11.003	7289	D	2	1B	III	30-54	Waterworn Marine Shell	Gastropod Shell	1	0.1		JK	1/20/2012
12.001	7289	D	2	1B	III	30-54	Conidae *Conus* sp.	Gastropod Shell	1	0.4		JK	1/20/2012
12.002	7289	D	2	1B	III	30-54	Indeterminate Bivalve	Bivalve Shell	5	0.6		JK	1/20/2012
12.003	7289	D	2	1B	III	30-54	Echinometridae	Exoskeleton	1	0.1		JK	1/20/2012
12.004	7289	D	2	1B	III	30-54	Unidentified Mammal	Bone	2	0.6		JK	1/20/2012
12.005	7289	D	2	1B	III	30-54	*Aluerites moluccana*	Nutshell	1	0.1	*Kukui* , burned	JK	1/20/2012
12.006	7289	D	2	1B	III	30-54	Charred Wood	Charcoal	74	8.7		JK	1/20/2012
12.007	7289	D	2	1B	III	30-54	Waterworn Marine Shell	Gastropod Shell	7	1		JK	1/20/2012
13.001	7289	D	2	1D	IV	56-80	*Sus scrofa*	Bone	15	19.5	juvenile pig	TG	1/23/2012
13.002	7289	D	2	1D	IV	56-80	Charred Wood	Charcoal	1	0.1		TG	1/23/2012
14.001	7290	D	5	1	IV	35-53	Charred Wood	Charcoal	1	0.1		TG	1/10/2012
14.002	7290	D	5	1	IV	35-53	Waterworn Marine Shell	Mixed	12	3.4		TG	1/10/2012
15.001	7290	D	5	1	VI	42-90	Core	Volcanic Glass	1	3.1	multidirectional; L=20.2mm, W=16.6mm, T=12.3mm	TG	1/10/2012
15.002	7290	D	5	1	VI	42-90	Trochidae *Trochus intextus*	Gastropod Shell	1	2.3		TG	1/10/2012
15.003	7290	D	5	1	VI	42-90	Charred Wood	Charcoal	3	0.2		TG	1/10/2012
15.004	7290	D	5	1	VI	42-90	Waterworn Marine Shell	Mixed	8	2.2		TG	1/10/2012
16.001	7290	D	6	1	II	17-43	Conidae *Conus* sp.	Gastropod Shell	1	0.7		JK	1/10/2012
16.002	7290	D	6	1	II	17-43	Tellinidae *Tellina palatam*	Bivalve Shell	2	0.6		JK	1/10/2012
16.003	7290	D	6	1	II	17-43	Indeterminate Bivalve	Bivalve Shell	1	0.6		JK	1/10/2012
16.004	7290	D	6	1	II	17-43	Charred Wood	Charcoal	3	0.1		JK	1/10/2012
17.001	7290	D	6	1	IV	46-86	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	1	1.6		JK	1/10/2012
17.002	7290	D	6	1	IV	46-86	Charred Wood	Charcoal	1	0.5		JK	1/10/2012
17.003	7290	D	6	1	IV	46-86	Waterworn Marine Shell	Mixed	2	0.6		JK	1/10/2012
18.001	7290	D	7	1	IV	33-85	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	1	2.7		JK	1/11/2012
18.002	7290	D	7	1	IV	33-85	Indeterminate Faunal	Bone	3	0.5	probable avian	JK	1/11/2012
18.003	7290	D	7	1	IV	33-85	Waterworn Marine Shell	Mixed	2	1.4		JK	1/11/2012
19.001		D	10	3	III	48-77	Waterworn Marine Shell	Gastropod Shell	1	0.2		TG	1/13/2012
20.001	7291	D	12	2	II	38-105	Conidae *Conus abbreviatus*	Gastropod Shell	1	0.2		TG	1/13/2012
20.002	7291	D	12	2	II	38-105	Neritidae *Nerita picea*	Gastropod Shell	1	0.7		TG	1/13/2012
20.003	7291	D	12	2	II	38-105	*Aluerites moluccana*	Nutshell	4	2.8	*Kukui* , not burned	TG	1/13/2012
20.004	7291	D	12	2	II	38-105	Charred Wood	Charcoal	4	0.6		TG	1/13/2012
20.005	7291	D	12	2	II	38-105	Poritidae *Porites* sp. pebble	Coral	1	3.2	manuport	TG	1/13/2012
20.006	7291	D	12	2	II	38-105	Waterworn Marine Shell	Mixed	32	17.4		TG	1/13/2012
21.001	7291	D	12	2	Pit--III	73-117	Neritidae *Nerita picea*	Gastropod Shell	2	1.6		TG	1/13/2012
21.002	7291	D	12	2	Pit--III	73-117	Charred Wood	Charcoal	8	0.7		TG	1/13/2012
21.003	7291	D	12	2	Pit--III	73-117	Waterworn Marine Shell	Mixed	15	7.1		TG	1/13/2012

HAUN & ASSOCIATES ACCESSION RECORD FOR TBR SAIS

Acc.No.	SIHP Site No.	Test Area	Transect	Trench	Layer	Depth cm below surface	Specimen	Material	TNF	Weight (grams)	Comment	Recorder	Date
1.001		A	1	2	II	80-125	Core	Volcanic Glass	1	1.7	multidirectional; L=15.4mm, W=12.0mm, T=11.4mm	JK	1/27/2012
2.001		A	5	1	IV	110-156	Handle	Metal	1	97.6	chromed handle of indeterminate type, could be historic or modern; L=78.2mm, W=39.5mm, T=27.0mm	JK	1/30/2012
3.001		C	Sand Pit 1	Profile 2	II	5-240+	*Felis catus*	Bone	7	13.5	tibia, radius, 2 vertebrae, 3 phalanges	JK	1/4/2012
4.001		C	7	1	III	6-40	Unidentified Mammal	Bone	1	1.2	probable *Sus scrofa*	TG	1/17/2012
4.002		C	7	1	III	6-40	Poritidae *Porites* sp. pebble	Coral	1	0.4	manuport	TG	1/17/2012
5.001		C	8	1	Pit- IIIa	16-53	Charred Wood	Charcoal	3	0.3		TG	1/17/2012
6.001		C	8	2	IV a	84-117	Conidae *Conus* sp.	Gastropod Shell	1	1.1	waterworn	TG	1/19/2012
6.002		C	8	2	IV a	84-117	Neritidae *Nerita picea*	Gastropod Shell	2	0.4	waterworn	TG	1/19/2012
6.003		C	8	2	IV a	84-117	Indeterminate Gastropod	Gastropod Shell	2	0.8	waterworn	TG	1/19/2012
6.004		C	8	2	IV a	84-117	*Heterocentrotus mammillatus*	Urchin Spine	1	0.4	waterworn	TG	1/19/2012
7.001	4488	C	Sand Pit 6	Profile 1	II	36-180	Earthenware Vessel Fragments	Ceramic	3	6.8	light green slip	TG	1/17/2012
7.002	4488	C	Sand Pit 6	Profile 1	II	36-180	Avian	Bone	1	0.1		TG	1/17/2012
7.003	4488	C	Sand Pit 6	Profile 1	II	36-180	Unidentified Mammal	Bone	2	109.9	probable *Sus scrofa* , *Bos taurus* or *Equus ferus*	TG	1/17/2012
7.004	4488	C	Sand Pit 6	Profile 1	II	36-180	Charred Wood	Charcoal	1	0.1		TG	1/17/2012
8.001		D	9	3	IV	118-200	Indeterminate Bivalve	Bivalve Shell	1	< 0.1		TG	1/16/2012
8.002		D	9	3	IV	118-200	Crustacea	Exoskeleton	1	0.3	crab claw	TG	1/16/2012
9.001		D	8	3	I	0-65	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	2	0.5		JK	1/11/2012
9.002		D	8	3	I	0-65	Mytilidae	Bivalve Shell	1	0.1		JK	1/11/2012
9.003		D	8	3	I	0-65	Echinometridae	Exoskeleton	1	0.1		JK	1/11/2012
9.004		D	8	3	I	0-65	Crustacea	Exoskeleton	1	0.1	crab claw	JK	1/11/2012
9.005		D	8	3	I	0-65	Waterworn Marine Shell	Mixed	9	3.0		JK	1/11/2012
10.001	7289	D	2	1	III	38-45	Debitage	Basalt	4	5.6		JK	1/10/2012
10.002	7289	D	2	1	III	38-45	Patellidae *Cellana* sp.	Gastropod Shell	1	1.1		JK	1/10/2012
11.001	7289	D	2	1B	III	30-54	Neritidae *Nerita polita*	Gastropod Shell	1	1.8		JK	1/20/2012
11.002	7289	D	2	1B	III	30-54	Crustacea	Exoskeleton	1	0.1	crab claw	JK	1/20/2012
11.003	7289	D	2	1B	III	30-54	Waterworn Marine Shell	Gastropod Shell	1	0.1		JK	1/20/2012
12.001	7289	D	2	1B	III	30-54	Conidae *Conus* sp.	Gastropod Shell	1	0.4		JK	1/20/2012
12.002	7289	D	2	1B	III	30-54	Indeterminate Bivalve	Bivalve Shell	5	0.6		JK	1/20/2012
12.003	7289	D	2	1B	III	30-54	Echinometridae	Exoskeleton	1	0.1		JK	1/20/2012
12.004	7289	D	2	1B	III	30-54	Unidentified Mammal	Bone	2	0.6		JK	1/20/2012
12.005	7289	D	2	1B	III	30-54	*Aluerites moluccana*	Nutshell	1	0.1	*Kukui* , burned	JK	1/20/2012
12.006	7289	D	2	1B	III	30-54	Charred Wood	Charcoal	74	8.7		JK	1/20/2012
12.007	7289	D	2	1B	III	30-54	Waterworn Marine Shell	Gastropod Shell	7	1		JK	1/20/2012
13.001	7289	D	2	1D	IV	56-80	*Sus scrofa*	Bone	15	19.5	juvenile pig	TG	1/23/2012
13.002	7289	D	2	1D	IV	56-80	Charred Wood	Charcoal	1	0.1		TG	1/23/2012
14.001	7290	D	5	1	IV	35-53	Charred Wood	Charcoal	1	0.1		TG	1/10/2012
14.002	7290	D	5	1	IV	35-53	Waterworn Marine Shell	Mixed	12	3.4		TG	1/10/2012
15.001	7290	D	5	1	VI	42-90	Core	Volcanic Glass	1	3.1	multidirectional; L=20.2mm, W=16.6mm, T=12.3mm	TG	1/10/2012
15.002	7290	D	5	1	VI	42-90	Trochidae *Trochus intextus*	Gastropod Shell	1	2.3		TG	1/10/2012
15.003	7290	D	5	1	VI	42-90	Charred Wood	Charcoal	3	0.2		TG	1/10/2012
15.004	7290	D	5	1	VI	42-90	Waterworn Marine Shell	Mixed	8	2.2		TG	1/10/2012
16.001	7290	D	6	1	II	17-43	Conidae *Conus* sp.	Gastropod Shell	1	0.7		JK	1/10/2012
16.002	7290	D	6	1	II	17-43	Tellinidae *Tellina palatam*	Bivalve Shell	2	0.6		JK	1/10/2012
16.003	7290	D	6	1	II	17-43	Indeterminate Bivalve	Bivalve Shell	1	0.6		JK	1/10/2012
16.004	7290	D	6	1	II	17-43	Charred Wood	Charcoal	3	0.1		JK	1/10/2012
17.001	7290	D	6	1	IV	46-86	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	1	1.6		JK	1/10/2012
17.002	7290	D	6	1	IV	46-86	Charred Wood	Charcoal	1	0.5		JK	1/10/2012
17.003	7290	D	6	1	IV	46-86	Waterworn Marine Shell	Mixed	2	0.6		JK	1/10/2012
18.001	7290	D	7	1	IV	33-85	Cypraeidae *Cypraea caputserpentis*	Gastropod Shell	1	2.7		JK	1/11/2012
18.002	7290	D	7	1	IV	33-85	Indeterminate Faunal	Bone	3	0.5	probable avian	JK	1/11/2012
18.003	7290	D	7	1	IV	33-85	Waterworn Marine Shell	Mixed	2	1.4		JK	1/11/2012
19.001		D	10	3	III	48-77	Waterworn Marine Shell	Gastropod Shell	1	0.2		TG	1/13/2012
20.001	7291	D	12	2	II	38-105	Conidae *Conus abbreviatus*	Gastropod Shell	1	0.2		TG	1/13/2012
20.002	7291	D	12	2	II	38-105	Neritidae *Nerita picea*	Gastropod Shell	1	0.7		TG	1/13/2012
20.003	7291	D	12	2	II	38-105	*Aluerites moluccana*	Nutshell	4	2.8	*Kukui* , not burned	TG	1/13/2012
20.004	7291	D	12	2	II	38-105	Charred Wood	Charcoal	4	0.6		TG	1/13/2012
20.005	7291	D	12	2	II	38-105	Poritidae *Porites* sp. pebble	Coral	1	3.2	manuport	TG	1/13/2012
20.006	7291	D	12	2	II	38-105	Waterworn Marine Shell	Mixed	32	17.4		TG	1/13/2012
21.001	7291	D	12	2	Pit--III	73-117	Neritidae *Nerita picea*	Gastropod Shell	2	1.6		TG	1/13/2012
21.002	7291	D	12	2	Pit--III	73-117	Charred Wood	Charcoal	8	0.7		TG	1/13/2012
21.003	7291	D	12	2	Pit--III	73-117	Waterworn Marine Shell	Mixed	15	7.1		TG	1/13/2012

B

APPENDIX B: (revised)

UNILATERAL AGREEMENT

RECORDATION REQUESTED BY:
Takeyama and Sullivan
1188 Bishop Street, Suite 3404
Honolulu, Hawaii 96813
Tel: (808)526-2416

BUREAU OF CONVEYANCES
AUG 12 1986
3:29

AFTER RECORDATION RETURN TO:
Takeyama and Sullivan
1188 Bishop Street, Suite 3404
Honolulu, Hawaii 96813
Tel: (808)526-2416

RETURN BY: MAIL( ) PICKUP (X)

Agreement No. 5532.00

UNILATERAL AGREEMENT AND
DECLARATION FOR CONDITIONAL ZONING

THIS INDENTURE, made this 12TH day of August 1986, by KUILIMA DEVELOPMENT COMPANY, whose principal place of business and post office address is 1001 Bishop Street, Pauahi Tower, Suite 1980, Honolulu, Hawaii 96813, hereinafter referred to as "Declarant" and the TRUSTEES UNDER THE WILL AND THE ESTATE OF JAMES CAMPBELL, DECEASED, acting in their fiduciary and not in their individual corporate capacities, whose principal place of business and post office address is 828 Fort Street, Honolulu, Hawaii 96813, the recorded owners of certain parcels of land situated in Kahuku, Koolauloa, Oahu and more particularly described in Exhibit I, attached hereto and incorporated herein.

W I T N E S S E T H:

WHEREAS, the City Council of the City and County of Honolulu, State of Hawaii, hereinafter referred to as "Council", pursuant to the provisions of Ordinance No. 4300, Bill No. 167 (1973), relating to conditional zoning, is considering a change in zoning from R-6 Residential, AG-1 Restricted Agricultural, P-1 Preservation, A-1 Low-Density Apartment and H-1 Resort Hotel Districts to P-1 Preservation, H-1 Resort Hotel and B-1 Neighborhood Business Districts. The subject lands are shown on the map marked Exhibit II, attached hereto and incorporated herein, and are described as Tax Map Keys 5-6-03: 37, Por. 40, Por. 41, Por. 42, 43, Por. 44; 5-7-01: 1, Por. 13, Por. 16, Por. 17, 20, Por. 22, 30, Por. 31, Por. 33; 5-7-03: 1-25, Por. 26, 27-35, 66, Por. 72, 73-75; 5-7-06: 1-17, 19, 21, as those lands are more particularly described in said Exhibit I; and

WHEREAS, a public hearing regarding the change in zoning was held by the Council on July 9, 1986; and

WHEREAS, Declarant has willingly, independently and concurrently agreed to the following conditions; and

WHEREAS, the Council recommended by its Planning and Zoning Committee Report that the said change in zoning be approved, subject to the following conditions:

1. The Declarant shall submit a plan for phasing the development of the water system for the resort to the Manager of the Board of Water Supply and the Director of the Department of Land Utilization for their approvals and shall receive those approvals prior to the issuance of subdivision approvals and building permits. Subject to the approval of the Board of Water Supply, this plan may be modified as necessary. The necessary water source, reservoir and distribution facilities shall be installed in conformance with the plan that has been approved by the Board of Water Supply, at the Declarant's cost.

2. Declarant shall submit a plan for phasing the development of the wastewater system for the resort to the Department of Public Works for its approval and receive its approval prior to the issuance of subdivision approvals and building permits. This plant shall be built to a capacity of a minimum of 1.3 million gallons per day and shall include any improvements that may be required to cause full compliance with all Federal, State and City and County of Honolulu laws, including any rules and regulations. Subject to the approval of the Department of Public Works, this plan may be modified as necessary. The wastewater system shall be installed pursuant to this plan, at Declarant's cost.

3. Development of the project shall generally be based on the submitted schedule, identified as Exhibit III, attached hereto and incorporated herein. Development may deviate from this schedule due to the occurrence of changed economic conditions, lawsuits, strikes or other unforseen circumstances. A minimum of fifty-one percent (51%) of the 4,000 resort units shall be operated as full service hotel units. The existing Turtle Bay Hilton containing 487 units is to be included in the 4,000 resort unit count.

4. The Declarant shall provide low-moderate income housing opportunities within or outside of the project site for residents living in the Koolauloa and North Shore region by constructing and offering for sale, in cooperation with the city Department of Housing and Community Development, a number of dwelling units equal to ten percent (10%) of the number of dwelling units not a

part of a full service hotel operation to be constructed on the property as a result of this zoning action. The sales units must be available to buyers earning less than eighty percent (80%) of the current median household income, adjusted for family size, for the City and County of Honolulu. The Declarant may work with the Department of Housing and Community Development in the expedited governmental approval process and planning waivers which may be permitted under City and State ordinances, laws and rules and regulations.

5. Declarant shall provide the following public amenities:

a. Four parks shall be provided - a four and eight-tenths (4.8) acre park fronting Kawela Bay (Park P-1 on Declarant's master plan); a thirty-seven (37) acre park located from Kahuku Point to the eastern boundary of Hanaka'ilo Beach (Park P-2 on Declarant's master plan); a six (6) acre park abutting Punahoolapa Marsh (Park P-3 on Declarant's master plan); and a two (2) acre park located in the area surrounding the outlet for East Main Drain (Park P-4 on Declarant's master plan). The shoreline park areas shall be linked, with the exception of the shoreline by the existing Turtle Bay Hilton, by a continuous shoreline easement, which will be linked to the five pedestrianway easements and the easement to Kalokoiki beach (Kuilima Cove), as set forth herein;

b. Public park sites shall be dedicated to the city in compliance with park dedication requirements. The park to be located at Kawela Bay shall be graded, grassed, and provided with a sprinkler system and all related off-site improvements. In addition to the minimum park dedication requirements, Declarant, at its cost, shall also provide public parking facilities and a comfort station containing restrooms and showers, at the Kawela Bay park site, in coordination with the Department of Parks and Recreation.

Upon Declarant's receipt of its first building permit for development of the first hotel to be built at the resort, Declarant shall record a document with the Bureau of Conveyances of the State of Hawaii which dedicates the Kawela Bay park site to the City and County of Honolulu. The document dedicating the park site shall provide that public use of the park area shall become effective, and improvement of the park, shall be completed, upon the issuance of a certificate of occupancy by the Building Department of the City and County of Honolulu for the first hotel to be constructed at the resort as a result of this zoning action; and shall reserve Declarant's right to manage and control the park site in the time period prior to issuance of the certificate of occupancy.

c. Upon Declarant's receipt of its first building permit for development of the first hotel to be built at the resort, Declarant shall record a document with the Bureau of Conveyances of the State of Hawaii which dedicates park P-2, said park being located at Kahuku Point as designated on Declarant's master plan, to the City and County of Honolulu. The document dedicating the park site shall provide that: (1) offsite improvements leading to the park will not be improved or provided until final subdivision approval for the condominiums to be built in Phase III is granted; (2) public use of this park site shall become effective upon said subdivision approval; and (3) Declarant reserves the right to control and manage the park site prior to said subdivision approval.

Prior to said subdivision approval Declarant shall also: (1) record a document with the Bureau of Conveyances of the State of Hawaii which provides permanent access for the public to park P-2. Declarant shall obtain and provide this access at its own cost; and (2) provide the following improvements for the park site - one full comfort station with shower facilities; full improvements up to the boundary of the park; a coral surface parking lot providing parking for a minimum of thirty automobiles.

d. The parks to be located adjacent to Punahoolapa Marsh and the East Main Drain outlet shall be privately-owned and maintained. These parks shall be open for use by the general public. Declarant will work with the U.S. Fish and Wildlife Service to implement improvements to the marsh that will enhance the marsh ecosystem. Improvements shall be made pursuant to a plan that has been approved by the U.S. Fish and Wildlife Service;

e. A series of publicly-owned and privately-maintained easements encompassing a minimum of twenty-six (26) acres of land shall be provided along and to the shoreline and shall be open to use by the general public. These easements shall be established in the public's favor, in perpetuity, in the following manner:

(1) Upon Declarant's receipt of its first building permit for development of the first hotel to be built at the resort, Declarant shall record a document with the Bureau of Conveyances

of the State of Hawaii which establishes easements in the public's favor, running with the land, covering: the land area extending one hundred (100) feet inland from the certified shoreline (hereinafter "shoreline easement area"), in the general areas designated on the map identified as Exhibit IV, attached hereto and incorporated herein; the right of way connecting a parking lot that will be located adjacent to the existing parking lot at the Turtle Bay Hilton to Kalokoiki beach (hereinafter "Kalokoiki easement"); and the right of way connecting Turtle Bay and Kaihalulu beach through the existing Turtle Bay Hilton site (hereinafter "Turtle Bay Hilton easement");

(2) Upon Declarant's receipt of its first building permit for major building development on a parcel that is adjacent to or that contains the following easements, Declarant shall record a document with the Bureau of Conveyances of the State of Hawaii which establishes easements in the public's favor, running with the land, covering: the five rights of way that extend from adjacent parking areas to the shoreline easement area, in the general locations designated on Exhibit IV, attached hereto, providing one pedestrianway to Kawela Bay, two pedestrianways to Turtle Bay, and two pedestrianways to Kaihalulu beach (Kuilima Bay) (hereinafter "pedestrianway easements");

(3) The document establishing the the shoreline easement area shall contain the following provision - "The one hundred (100) foot wide shoreline easement area is to maintain open space along the shoreline for the use and enjoyment of the general

public, guests at the resort and resort condominium owners. Management of the use of this area will make no distinctions between resort guests and resort condominium owners, and the general public, and shall at a minimum, allow sunbathing, picnicking, swimming and walking in this area, except where not permitted for safety purposes";

(4) The documents establishing the shoreline easement area and the pedestrianway easements shall provide that public use of each easement shall become effective, and improvement of each easement area shall be completed, upon the issuance of a certificate of occupancy by the Building Department of the City and County of Honolulu for a parcel that is adjacent to or that contains one of these easements;

(5) The documents establishing the Kalokoiki easement and the Turtle Bay Hilton easement shall provide that public use of these easement areas shall become effective, and improvement of these easement areas shall be completed, upon development of the portion of the resort's major internal roadway that fronts the Turtle Bay Hilton area;

(6) The documents establishing the easements referred to herein, shall also establish a means for Declarant, its successors and assigns, and subsequent grantees to maintain the easement areas encumbered therein, with said maintenance to be required at the time that public use of each of the easement areas becomes effective;

(7) The five pedestrianway easements shall be fifteen feet wide, and shall contain restroom and shower facilities. Each pedestrianway easement shall be located adjacent to a public

parking area containing eighteen (18) parking stalls, which shall provide parking free of charge to the public;

(8) Improvements in the easement areas shall accommodate public access, and signage shall be installed to facilitate such access.

f. Public parking at each of the parking areas for the public pedestrianway easements shall be free of charge. Employees shall be prohibited from parking in these public parking areas. Each of the hotel/condominium areas shall contain parking areas for its employees.

6. Historic and archaeological sites located within the subject property which are identified by the State and/or subsequent archaeological assessment shall be treated in accordance with recommendations made by the State Historic Preservation Officer of the Department of Land and Natural Resources.

Prior to the issuance of grading permits, the Declarant shall submit a Data Recovery Plan to the State Historic Preservation Officer, and shall obtain approval of the plan. The State Historic Preservation Officer shall also be made aware of sites not yet identified on the property, which may be discovered during grading and construction. The Officer shall determine whether these sites require preservation, relocation, mitigation, or further study.

Declarant shall submit its completed archaeological findings to the State Historic Preservation Officer for review and comment before commencing with the proposed development of the property.

Declarant shall comply with the State Historic Preservation Officer's recommendations in implementing Declarant's archaeological plan.

Above-ground archaeological features present within the project area will be relocated by the applicant to site(s) within the resort. Human remains that have been uncovered or that may be uncovered during the course of this project shall be disintered, relocated to an alternative site(s) within the resort, and reinterred in accordance with the relevant provisions of Chapter 338, Hawaii Revised Statutes, as amended, and in compliance with requirements of the State Department of Health.

7. A development implementation plan related to the proposed roadway modifications, shall be approved by the Director of the Department of Land Utilization in consultation with the City Department of Transportation and the State Department of Transportation, prior to tentative subdivision approval. Improvements which will be phased throughout the development of the entire project, and which will be implemented at the Declarant's cost, include the following items:

a) Channelizing the intersection of West Kuilima Drive and Kamehameha Highway;

b) Constructing left-turn storage and deceleration lanes on Kamehameha Highway at Kuilima and West Kuilima Drives;

c) Upgrading the intersection of Kamehameha Highway and Kahuku Airport Road (Marconi Road) with left-turn storage and deceleration lanes on Kamehameha Highway;

d) Signalizing Kamehameha Highway at Kahuku Airport Road and at West Kuilima Drive.

e) Providing a total of six bus turnouts along the portion of Kamehameha Highway fronting the resort. The bus turnouts shall be located near each of the entrances to the resort, on both sides of Kamehameha Highway.

All roadways and intersections within the Turtle Bay Resort expansion project to be dedicated to the City and County shall be designed in accordance with City and Federal standards for City roadways and State and Federal standards for improvements along Kamehameha Highway. All major roadways to be constructed by the Declarant, as reflected on Exhibit IV, whether private or public, shall be open to the public. Kahuku Airport Road (Marconi Road) shall be open to the public.

Declarant shall minimize the use of automobiles by visitors at the resort by implementing alternative transportation modes which may include the following: shuttle service between Honolulu International Airport and Waikiki to the resort area; shuttle service or expanded MTL operations to accommodate resort visitor trips to and from the Polynesian Cultural Center and Haleiwa; jitney service within the resort.

The Declarant and its successors or assigns, shall provide transportation services, at a reasonable cost to employees, for employees commuting to and from the resort. The employee transportation service shall pick up and drop off employees at specified points in the areas from Haleiwa to Kaaawa. This area of service may be modified by, and with the approval of, the State Department of Transportation, upon the request of Declarant, its successors or assigns. The employee transportation service shall be established at the completion of Phase II of the resort, set forth in Exhibit III attached hereto.

The resort association shall work, in conjunction with the State Department of Transportation, to coordinate the transportation needs of the guests and employees of the resort.

8. An overall urban design plan and landscape plan for the resort shall be submitted to and approved by the Department of Land Utilization prior to tentative subdivision approval or issuance of building permits. In addition, at each phase of development, the Declarant shall submit site plans and preliminary architectural drawings for the development to the Department of Land Utilization for review and approval to insure that the urban design objectives set forth herein, are adhered to.

Specific design standards that shall be complied with, but which shall not be applied to the existing Turtle Bay Hilton and the Kuilima East and West condominiums, include the following:

a. General height limits shall be as provided in Section 1.c. of the Koolauloa Development Plan, as amended (Ordinance 85-50).

b. All structures shall generally be set back a minimum distance of three hundred (300) feet inland from the certified shoreline. Structures located between one hundred (100) feet and three hundred (300) feet inland from the certified shoreline will be subject to design review and approval by the Department of Land Utilization.

c. No structure shall be located between the certified shoreline and one hundred (100) feet inland of the certified shoreline, with the following exceptions: pedestrian bridges, pedestrian walkways, or other access improvements; drainage-related improvements; park benches, showers or other structures that may be required by State or Federal agencies. In no event shall any concession or comfort station be located between the certified shoreline and one hundred (100) feet inland of the certified shoreline.

d. Structures in the parcels fronting Kawela Bay and Kawela Point fronting Turtle Bay over fifty (50) feet in height shall be set back a minimum distance of three hundred (300) feet inland from the certified shoreline.

e. For each increment fronting Kawela Bay and Kawela Point fronting Turtle Bay that is located between one hundred (100) feet and three hundred (300) feet from the shoreline, there shall be a maximum building to land coverage ratio of ten percent (10%) of the land area makai of the three hundred (300) foot line to the property line and buildings shall have staggered heights with a maximum height of fifty (50) feet. The percentage of any given section shall not be clustered.

9. General architectural and design goals that the resort will strive to achieve include following:

a. The general architectural character of the resort will be similar to that of a "kamaaina estate" - displaying hospitality and elegance, overlaid with fundamental simplicity and timelessness.

b. The resort will strive to implement extensive, lush landscaping to enhance the estate-like quality of the low density buildings, and to provide a sense of visual continuity throughout the resort. Existing ironwood trees, and other existing vegetation will be preserved and incorporated into the landscaping scheme where possible.

c. The public walkway that provides access throughout the shoreline easement area will be configured in an undulating line throughout the easement area.

d. Each of the public pedestrianways to the shoreline, with the exception of the pedestrianway to Kalokoiki beach, will be approximately fifteen (15) feet wide, and will contain a slightly undulating walkway to allow for plantings of coconut trees.

10. Declarant shall comply with all of the conditions set forth in the Findings of Fact, Conclusions of Law and Decision and Order of the State Land Use Commission, dated March 27, 1986, in relation to the approval of the district boundary amendment for Kuilima Development Company, as the same may be amended from time to time.

11. Declarant shall establish a child care center with applicable resources and/or service providers within the region, and shall dedicate approximately one-half acre of land within or outside of the project site to the North Shore Career Training Corporation for the purpose of establishing a child care center to service children of employees of the resort. Declarant's proposal for the child care center shall be reviewed and approved by the Kuilima North Shore Strategy Planning Committee and the City and County of Honolulu's Office of Human Resources prior to completion of the first hotel.

12. Declarant shall establish an employment program for residents of surrounding communities in coordination with applicable resources and/or service providers in the region. Declarant's proposed employment program shall be reviewed and approved by the Kuilima North Shore Strategy Planning Committee.

Declarant shall contribute a minimum of Five Hundred Thousand Dollars ($500,000.00) towards the establishment and implementation of the employment program that has been approved.

Payments shall be made to a community-based non-profit, charitable corporation or association, or governmental body, as determined by Declarant and the Office of Human Resources. Payments shall be made in the following manner:

Annual payments in the amount of ONE HUNDRED TWENTY-FIVE THOUSAND DOLLARS ($125,000.00), payable in increments over the course of one year, for four (4) years, with the first payment to be made upon the granting of Declarant's requested zone change, and with subsequent payments payable on the first day of each successive year thereafter.

13. Declarant shall use its best efforts to perpetuate, work with, and obtain input from the Kuilima North Shore Strategy Planning Committee, throughout the development of the resort.

14. Declarant shall use its best efforts to promote the creation of a Marine Life Conservation District at Kawela Bay.

NOW, THEREFORE, Declarant hereby makes the following Declaration:

A. This Declaration is made pursuant to the provisions of Ordinance No. 4300, Bill No. 167 (1973), relating to conditional zoning. This Declaration shall become fully effective on the effective date of the zoning ordinance approving the change of zoning from R-6 Residential, AG-1 Restricted Agricultural, P-1 Preservation, A-1 Low-Density Apartment and H-1 Resort Hotel Districts to P-1 Preservation, H-1 Resort Hotel and B-1 Neighborhood Business Districts for the land described in said Exhibit I; and

B. Development of said parcels by Declarant shall conform to the aforesaid conditions with the understanding that, at the request of Declarant, and upon the satisfaction of the condition(s) set forth in this Unilateral Agreement, the Department of Land Utilization may fully or partially release any of the foregoing conditions that have been fulfilled; and

C. That the conditions imposed are reasonably conceived to fulfill public service demands created by the requested zoning and rationally relate to the objective of preserving the public health, safety and general welfare and the further imposition of the General Plan of the City and County of Honolulu.

AND IT IS EXPRESSLY UNDERSTOOD AND AGREED that the conditions imposed in this Declaration shall run with the land and shall bind and constitute notice to all subsequent lessees, grantees, mortgagees, lienors, successors and assigns, and any other persons who claim an interest in the land, and the City and

County of Honolulu of the State of Hawaii shall have the right to enforce this Declaration by appropriate action at law or suit in equity against all such persons. Changes or alterations of conditions shall be processed in the same manner as petitions for zone changes.

UNILATERAL AGREEMENT AND
DECLARATION FOR CONDITIONAL ZONING
for Kuilima Development Company

IN WITNESS WHEREOF, the parties hereto have executed this agreement on the day and year first above written.

KUILIMA DEVELOPMENT COMPANY,
a Hawaii general partnership
By: PIC Realty Corporation

By ______________________
Its:

By ______________________
Its:

Trustees Under the Will and
the Estate of James Campbell,
deceased, acting in their
fiduciary and not their
individual corporate capacities

P.R. CASSIDAY, INC.

By ______________________
Its:

H.C. CORNUELLE, INC.

By ______________________
Its:

[redacted]

(2) DP TG-283597

RECORDATION REQUESTED BY:

TITLE GUARANTY ESCROW SERVICES, INC.

AFTER RECORDATION, RETURN TO:

Title Guaranty Escrow

RETURN BY: MAIL ( ) PICKUP (X)

88-189713

STATE OF HAWAII
BUREAU OF CONVEYANCES
RECEIVED FOR RECORD

1988 DEC 30 AM 8:10

LIBER/P 22730 / 23

REGISTRAR

SPACE ABOVE THIS LINE FOR REGISTRAR'S USE

AMENDMENT TO UNILATERAL AGREEMENT

This Amendment to Unilateral Agreement ("Agreement") made this ___ day of December, 1988, by and between F. E. TROTTER, INC., W. H. McVAY, INC., P. R. CASSIDAY, INC. and H. C. CORNUELLE, INC., all Hawaii professional corporations, the duly appointed, qualified and acting TRUSTEES UNDER THE WILL AND OF THE ESTATE OF JAMES CAMPBELL, DECEASED, acting in their fiduciary and not in their individual corporate capacities, whose place of business and post office address is Suite 500, 828 Fort Street Mall, Honolulu, Hawaii 96813, ("Estate") and KUILIMA RESORT COMPANY, a Hawaii general partnership, whose place of business and post office address is 1001 Bishop Street, Suite 2000, Honolulu, Hawaii 96813, ("KRC");

X8875702

[redacted]

R E C I T A L S:

1. On or about August 12, 1986 and September 23, 1986, Kuilima Development Company, a Hawaii registered general partnership ("KDC"), as "Declarant", and Estate entered into that certain Unilateral Agreement and Declaration for Conditional Zoning ("Unilateral Agreement"), which Unilateral Agreement was recorded in the Bureau of Conveyances of the State of Hawaii in Liber 19756, Page 709 and filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii as Document No. 1402662.

2. Under the Unilateral Agreement, KDC made certain declarations relevant to certain lands located at Kuilima, Oahu, Hawaii ("Resort Lands").

3. KDC subsequently assigned its interests in the Resort Lands together with certain other interests to KRC.

4. KRC and Estate now desire to subject certain additional lands as more fully described on Exhibit A attached hereto and incorporated herein ("Additional Lands") to the Unilateral Agreement.

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which is mutually acknowledged, KRC and Estate do hereby acknowledge and agree that the

[redacted]

Additional Lands are and hereafter shall be subject to the Unilateral Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.

KUILIMA RESORT COMPANY,
a Hawaii general partnership

By Asahi Plaza Hawaii, Inc.,
a Hawaii corporation,
its General Partner

By Takaaki Sato
Its Vice President

By A.J. Plaza Hawaii Co., Ltd.,
a Hawaii corporation,
its General Partner

By Takaaki Sato
Its Vice President

"GRANTEE"

THE TRUSTEES UNDER THE WILL AND OF THE ESTATE OF JAMES CAMPBELL, DECEASED, acting in their fiduciary and not in their individual corporate capacities

F. E. TROTTER, INC.

By Fred E. Trotter
Its President

W. H. McVAY, INC.

By W H McVay
Its President

P. R. CASSIDAY, INC.

By PRCassiday
Its President

H. C. CORNUELLE, INC.

By ______
Its President

"GRANTORS"

[redacted]

22730 26

STATE OF HAWAII)
) SS:
CITY AND COUNTY OF HONOLULU)

On this 29th day of December, 1988 before me appeared F. E. TROTTER, W. H. McVAY, P. R. CASSIDAY and ~~H. C. CORNUELLE~~, to me personally known, who, being by me duly sworn, did say that F. E. TROTTER, W. H. McVAY, P. R. CASSIDAY and MVP ~~H. C. CORNUELLE~~ are President, sole shareholder and sole director of F. E. TROTTER, INC., W. H. McVAY, INC., P. R. CASSIDAY, INC. and ~~H. C. CORNUELLE, INC.~~, respectively, Hawaii professional corporations and Trustees under the Will and of the Estate of James Campbell, Deceased; that the foregoing instrument was signed by each of the persons listed as appearing before me in the respective capacity as President of a Hawaii professional corporation which is a Trustee; that said corporations are corporations without seals; that the President of each and every corporation which is a signatory hereto acknowledged that the aforesaid instrument was signed on behalf of said corporation with the authority of the sole shareholder and director and as the free act and deed of said corporation as such Trustee.

Margie von Berg
Notary Public
State of Hawaii

My Commission expires: 3/20/92

X8875702

[redacted]

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

On this 28th day of December, 1988 before me personally appeared Takaaki Sato, to me known, who, being by me duly sworn, did say that he is the Vice President of ASAHI PLAZA HAWAII, INC., a Hawaii corporation; that ASAHI PLAZA HAWAII, INC. is a general partner of KUILIMA RESORT COMPANY, a Hawaii registered general partnership; that the foregoing instrument was executed in the name of and on behalf of said corporation, as general partner of and on behalf of said partnership that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of the corporation by authority of its Board of Directors and that said officer acknowledged said instrument to be the free act and deed of said corporation, as said general partner of said partnership.

Lisa Simpkins
Notary Public, State of Hawaii

My Commission expires: 8-21-9

JS

[redacted]

22730 28

STATE OF HAWAII)
) SS.
CITY AND COUNTY OF HONOLULU)

On this 28th day of December, 1988 before me personally appeared Takeaki Sato, to me known, who, being by me duly sworn, did say that he is the Vice President of A. J. PLAZA HAWAII CO., LTD., a Hawaii corporation; that A. J. PLAZA HAWAII CO., LTD., is a general partner of KUILIMA RESORT COMPANY, a Hawaii registered general partnership; that the foregoing instrument was executed in the name of and on behalf of said corporation, as general partner of and on behalf of said partnership that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of the corporation by authority of its Board of Directors and that said officer acknowledged said instrument to be the free act and deed of said corporation, as said general partner of said partnership.

Notary Public, State of Hawaii

My Commission expires: 8-21-91

X8839173

[redacted]

EXHIBIT A

PARCEL 1

All of that certain parcel of land situate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, being Lot 298, area 0.200 acre, as shown on Map 24 filed in the Office of the Assistant Registrar of the Land Court of the State of Hawaii with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased, and as described in Transfer Certificate of Title No. 314,127 issued to Kuilima Resort Company, a registered general partnership.

Oahu TMK: 5-7-3-72

PARCEL 2

All of those certain parcels of land designated as the Sewage Treatment Plant Site on Schedule E attached to that certain indenture dated June 3, 1988, filed as Document No. 1555256, and recorded in Liber 22002, Page 457 (the "Fifth Amendment" of that certain Lease dated November 21, 1969, by and between the Trustees under the Will and of the Estate of James Campbell, deceased, as Lessor, and Del E. Webb Corporation, an Arizona corporation, and Pic Realty Corporation, a Delaware corporation, doing business as Inscon Development Company, a joint venture, as Lessee, filed as Document No. 492500, and recorded in Liber 6847, Page 322, and noted on Original Certificate of Title No. 17,854), and Well No. 338 on Schedule F attached to the Fifth Amendment, being portions of a parcel of land situate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, described as follows:

Lot 327-A, as shown on Map 69 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the lands described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-21

PARCEL 3 (Kuilima Estates East)

All of that certain parcel of land situate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, described as follows:

Lot 466, area 14.865 acres, as shown on Map 68 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-27

[redacted]

PARCEL 4 (Additional Hotel Property)

All of those certain parcels of land situate at Kahuku, District of Koolaupoko, City and County of Honolulu, State of Hawaii, described as follows:

(A) Lot 467, area 4.000 acres, and Lot 478, area 1.105 acres, as shown on Map 68 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-31

(B) Lot 468, area 0.616 acre, as shown on Map 68 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-28

(C) Lot 477, area 0.240 acre, as shown on Map 68 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-30

PARCEL 5 (Kuilima Estates West)

All of that certain parcel of land siuate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, being Lot 469, area 17.574 acres, as shown on Map 68 filed in said Office with 'and Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-29

PARCEL 6

All of that certain parcel of land designated as the Opana Well Site I on Schedule E attached to the Fifth Amendment, being a portion of a parcel of land situate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, described as follows:

[redacted]

Lot 987 as shown on Map 113 filed in said Office with Land Court Application No. 1095 of the Trustees under the Will and of the Estate of James Campbell, deceased. Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-2-1

PARCEL 7

All of those certain parcels of land situate at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, of the "RAILROAD TRACT SUBDIVISION" as shown on File Plan Number 1406, filed in the Bureau of Conveyances of the State of Hawaii, described as follows:

(A) Lot Number 7, area 0.235 acre, being a portion of the premises conveyed to Kuilima Resort Company, a registered Hawaii general partnership by Deed dated June 3, 1988, recorded in Liber 22002, Page 510.

Oahu TMK: 5-7-3-72

(B) Lot Number 18, area 0.080 acre, being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-31

PARCEL 8

All of that certain parcel of land (being portion of the land described in and covered by Royal Patent Number 516, Land Commission Award 2878, Apana 2 to Kekua), situate, lying and being at Kawela, District of Koolauloa, City and County of Honolulu, State of Hawaii, being a PORTION OF EXCLUSION 14, of Land Court Application No. 1095, and thus bounded and described as follows:

1.	S. 15° 30' E.	100.00	feet along the land of Paukoa;
2.	S. 74° 00' W.	52.80	feet along remnant of this award;
3.	N. 15° 30' W.	100.00	feet along Konohiki;
4.	N. 74° 00' E.	52.80	feet to the initial point and containing an area of 5,240 square feet, more or less.

Being the premises described in Limited Warranty Deed by and between T. G. Exchange, Inc., a Hawaii corporation, as Grantor, and Kuilima Resort

Company, a Hawaii general partnership, as Grantee, dated July 8, 1988, recorded in Liber 22174, Page 655.

5-7-6-18 (1)

PARCEL 9

All of that certain parcel of land (being all of the land described in and covered by Royal Patent Number 8000, Land Commission Award Number 2716, Apana 2 to Hoolae) situate, lying and being at Kahuku, District of Koolauloa, City and County of Honolulu, State of Hawaii, being EXCLUSION 17, and thus bounded and described:

Beginning at a pipe in concrete marked "79" at the Northeast corner of this piece of land, the true azimuth and distance from a pipe in concrete marked "DUNE" being 108° 24' 1,018.80 feet, the coordinates of said point of beginning referred to Government Survey Triangulation Station "PUUKI" being 12,311.70 feet North and 5,442.90 feet West, and running by true azimuths measured clockwise from South:

1.	10°	20'	104.30	feet to a pipe in concrete marked "80";
2.	100°	20'	104.30	feet to a pipe in concrete marked "81";
2.	190°	20'	104.30	feet to a pipe in concrete marked "78";
2.	280°	20'	104.30	feet to the point of beginning and containing an area of 0.25 acre, more or less.

Being a portion of the premises described in Original Certificate of Title No. 17,854 issued to the Trustees under the Will and of the Estate of James Campbell, deceased.

Oahu TMK: 5-7-1-13