Draft
Archaeological Inventory Survey Report for the Block C West Project, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-3-001:005 (por.)

Prepared for
Howard Hughes Corporation

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(Job Code: KAKAAKO 120)

July 2014

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Management Summary

Reference	Archaeological Inventory Survey Report for the Block C West Project, Kakaʻako Ahupuaʻa, Honolulu (Kona) District, Oʻahu, TMK: [1] 2-3-001:005 (por.) (Sroat et al. 2014)
Date	July 2014
Project Number(s)	Cultural Surveys Hawaiʻi, Inc. (CSH) Job Code: KAKAAKO 120
Investigation Permit Number	CSH completed the archaeological inventory survey (AIS) investigation under archaeological permit # 14-04, issued by the Hawaiʻi State Historic Preservation Division (SHPD) per Hawaiʻi Administrative Rules (HAR) §13-13-282.
Project Location	The Block C West project is a discrete project within the larger Ward Neighborhood Master Plan project. The project area consists of the southern portion of the current Ward Warehouse commercial complex. The project area is bounded to the northeast by Auahi Street, to the southwest by Ala Moana Boulevard, to the southeast by a parking lot, and to the northwest by the Ward Warehouse complex. The project area is depicted on the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.
Land Jurisdiction	Private, Victoria Ward, Limited (VWL)
Project Funding	VWL
Project Description	The Block C West project is a discrete project of VWL's 60.5-acre (24.5-hectare) Ward Neighborhood Master Plan, a long-range development plan of 20-plus years. It follows guidelines set forth in the Mauka Area Plan of the Hawaiʻi Community Development Authority (HCDA). The Block C West project is part of the Ward Village Gateway project, which also includes the adjacent Block B East project area. The Ward Village Gateway project consists of a central plaza flanked on either side by low-rise villas, a residential tower, a parking structure, and ground level retail space. The Block C West project consists of the southern half of the Ward Village Gateway project. Ground disturbance associated with project construction includes demolition and removal of Ward Warehouse and at grade parking lot, borings related to foundation pile installation, and excavation related to the project area's development, including structural footings, utility installation, roadway and parking area installation, and landscaping.
Project Acreage	Approximately 2.2 acres (0.89 hectares)
Area of Potential Effect (APE)	The project's APE is defined as the entire approximately 2.2-acre project area. The project area's surrounding built environment is urban (paved streets and low rise and high rise buildings).

Historic Preservation Regulatory Context	The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation: Hawai‘i Revised Statutes (HRS) §343, HRS 6E-42, and Hawai‘i Administrative Rules (HAR) §13-284. As part of the historic preservation review process, a cultural impact assessment (CIA) (Cruz et al. 2012) and an archaeological literature review and predictive model study (O'Hare et al. 2012) of the entire Ward Neighborhood Master Plan project area were prepared and submitted to the SHPD on 20 July 2012. An AISP (Sroat et al. 2014) for this project was accepted in an SHPD §6E Historic Preservation Review (10 February 2014, LOG NO.: 2013.6922; DOC NO.: 1402SL11). This archaeological inventory survey report was prepared to address the Block C West component of the Ward Neighborhood Master Plan and was prepared in accordance with the requirements for an archaeological inventory survey report as stated in HAR §13-276-5.
Fieldwork Effort	Fieldwork was accomplished between 14 April 2014 and 5 June 2014. All fieldwork was conducted under the direction of the principal investigator, Matt McDermott, M.A. by Ena Sroat, B.A. (project director), Megan Hawkins, M.A., Michelle Pammer, B.A., Andrew Soltz, B.A., Kimi Matsushima, B.S., Scott Belluomini, B.A., Tim Zapor, B.A., Jessica Leger, M.Sc., Abbey Mierzejewski, B.A., Amanda Eggers, B.A., Jonas Madeus, B.A., James Thain, B.A., Laura Vollert, B.A., Nigel Kingsbury, B.A., Fred LaChance, B.A., Tara del Fierro, B.A., Tara Seaver, B.A., Pua Guanzon, B.A., and Leandra Medina, B.A.
Consultation	Consultation with the SHPD, the O‘ahu Island Burial Council (OIBC), and recognized cultural descendants was conducted both during the course of AIS fieldwork and following the completion of fieldwork on 5 June 2014. Consultation included presentation to the OIBC of preliminary AIS results, discussion with the SHPD and cultural descendants concerning testing results and proposed test location shifts, and a cultural descendants' consultation meeting following the completion of AIS fieldwork. A consultation letter was also forwarded to the Office of Hawaiian Affairs (OHA) presenting the results of the AIS testing program.

Number of Historic Properties Identified	Two historic properties were identified within the current project area: 1) State Inventory of Historic Properties (SIHP) # 50-80-14-7655, consists of subsurface historic salt pan remnants, documented as laminated organic material and associated man-made berms. The historic property reflects land-use activities related to historic salt production. 2) SIHP # 50-80-14-7658, consists of buried historic surfaces, including asphalt, concrete, coral and tar pavement, oil-rolled surfaces, and fence-lines associated with the historic development of the project area.
Historic Property Significance	1. SIHP # 50-80-14-7655, subsurface historic salt pan remnants, is assessed as significant under Hawaiʻi significance criteria "c" (embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value) and "d" (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR §13-284-6. 2. SIHP # 50-80-14-7658, buried historic surfaces, is assessed as significant under Hawaiʻi significance criterion "d" (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR §13-284-6.
Effect Recommendation	CSH's project specific effect recommendation is "effect, with proposed mitigation commitments." The recommended mitigation measures will reduce the project's effect on SIHP # 50-80-14-7655 SIHP # 50-80-14-7658, and any additional, as yet unidentified, cultural resources within the project area.

Mitigation Recommendations	This AIS documented the presence of subsurface historic salt pan remnants (SIHP # -7655) beneath early twentieth century land reclamation fill within the central and *mauka* portions of the project area. In consultation with the SHPD, it has been determined that an archaeological data recovery program is an appropriate mitigation measure for the salt pan remnants. This archaeological data recovery program would begin with an archaeological data recovery plan for the review and approval of the SHPD. The Block C West AIS also documented the presence of buried historic land surfaces associated with the mid-twentieth century historic development (SIHP # -7658) throughout the project area. In order to mitigate the potential impact to SIHP #s -7655 and -7658, or any as yet unidentified cultural resources within the project area, it is recommended that project construction proceed under an archaeological monitoring program. A program of on-site archaeological monitoring is recommended for all subsurface project construction activities within the Block C West project area. This monitoring program will facilitate the identification and proper treatment of any archaeological deposits disturbed by project construction, and will enable collection of additional samples and information related to the two identified historic properties. The archaeological monitoring program will include additional documentation, sampling, and analysis of SIHP #s -7655 and 7658. In addition, the natural marine sediments present in the *makai* portion of the project area will be fully recorded and closely examined for potential historic properties. Although the AIS identified largely disturbed marine sandy clay sediments in this area, the adjacent Block B East project area (refer to Pammer et al. 2014) did identify in situ Jaucas sands as well as isolated human skeletal remains (SIHP # -7656). The details of the monitoring program will be included in the project's archaeological monitoring plan to be reviewed and approved by the SHPD.

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Section 1 Introduction

1.1 Project Background

At the request of Victoria Ward, Limited (VWL) and the Howard Hughes Corporation (HHC), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this archaeological inventory survey report (AISR) for the Block C West project area, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu, TMK: [1] 2-3-001:005 (por.). The project area is located in the eastern portion of the Ward Warehouse commercial complex. It is bounded to the northeast by Auahi Street, to the southwest by Ala Moana Boulevard, to the southeast by a parking lot, and to the northwest by the Ward Warehouse complex. The project area is depicted on the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), a tax map plat (Figure 2), and a 2013 aerial photograph (Figure 3).

The proposed project is a discrete project within the larger VWL’s 60.5-acre (24.5-hectare) Ward Neighborhood Master Plan (General Growth Properties Inc., 2008), described as “a long-range development plan of 20-plus years that would evolve over time to fulfill the needs of the community.” It follows the guidelines set forth in the Mauka Area Plan of the Hawai‘i Community Development Authority (HCDA).

The 2.2-acre (0.89-hectare) Block C West project is part of the Ward Village Gateway project, which also includes the adjacent Block B East project area. The Ward Village Gateway project consists of a central plaza flanked on either side by low-rise villas, a residential tower, a parking structure, and ground level retail space (Figure 4). The Block C West project consists of the southern half of the Ward Village Gateway project. This is a private development owned and funded by HHC.

Ground disturbance associated with project construction will include demolition of Ward Warehouse and at-grade parking lot, borings related to foundation pile installation, and excavation related to the project area’s development, including structural footings, utility installation, roadway and parking area installation, and landscaping.

1.2 Historic Preservation Regulatory Context and Document Purpose

The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation: Hawai‘i Revised Statutes (HRS) §343 and HRS §6E-42, and Hawai‘i Administrative Rules (HAR) §13-284, respectively. As part of the historic preservation review process, a cultural impact assessment (CIA) (Cruz et al. 2012) and an archaeological literature review and predictive model study (O’Hare et al. 2012) of the entire Ward Neighborhood Master Plan project area were submitted to the SHPD on 20 July 2012. An archaeological inventory survey plan (Sroat et al. 2014) for this project was accepted by the SHPD in a letter dated 10 February 2014 (LOG NO.: 2013.6922, DOC. NO.: 1402SL11). This archaeological inventory survey report was prepared to address the Block C West component of the Ward Neighborhood Master Plan and was prepared in accordance with the requirements for an archaeological inventory survey report as stated in HAR §13-276-5.

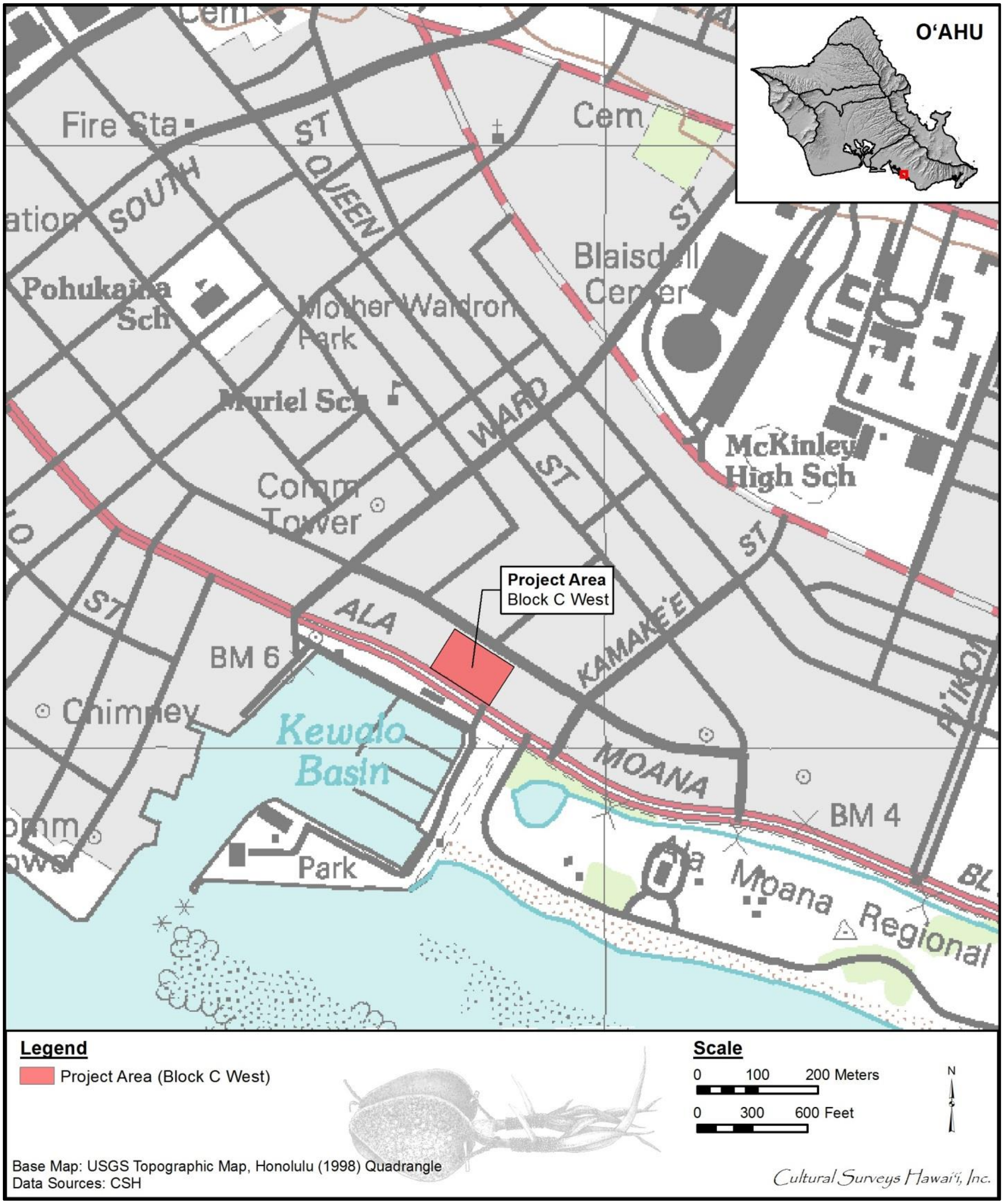

Figure 1. 1998 Honolulu USGS 7.5-minute topographic quadrangle depicting the location of the Block C West project area north of the intersection of Ala Moana Boulevard and Kamake'e Street

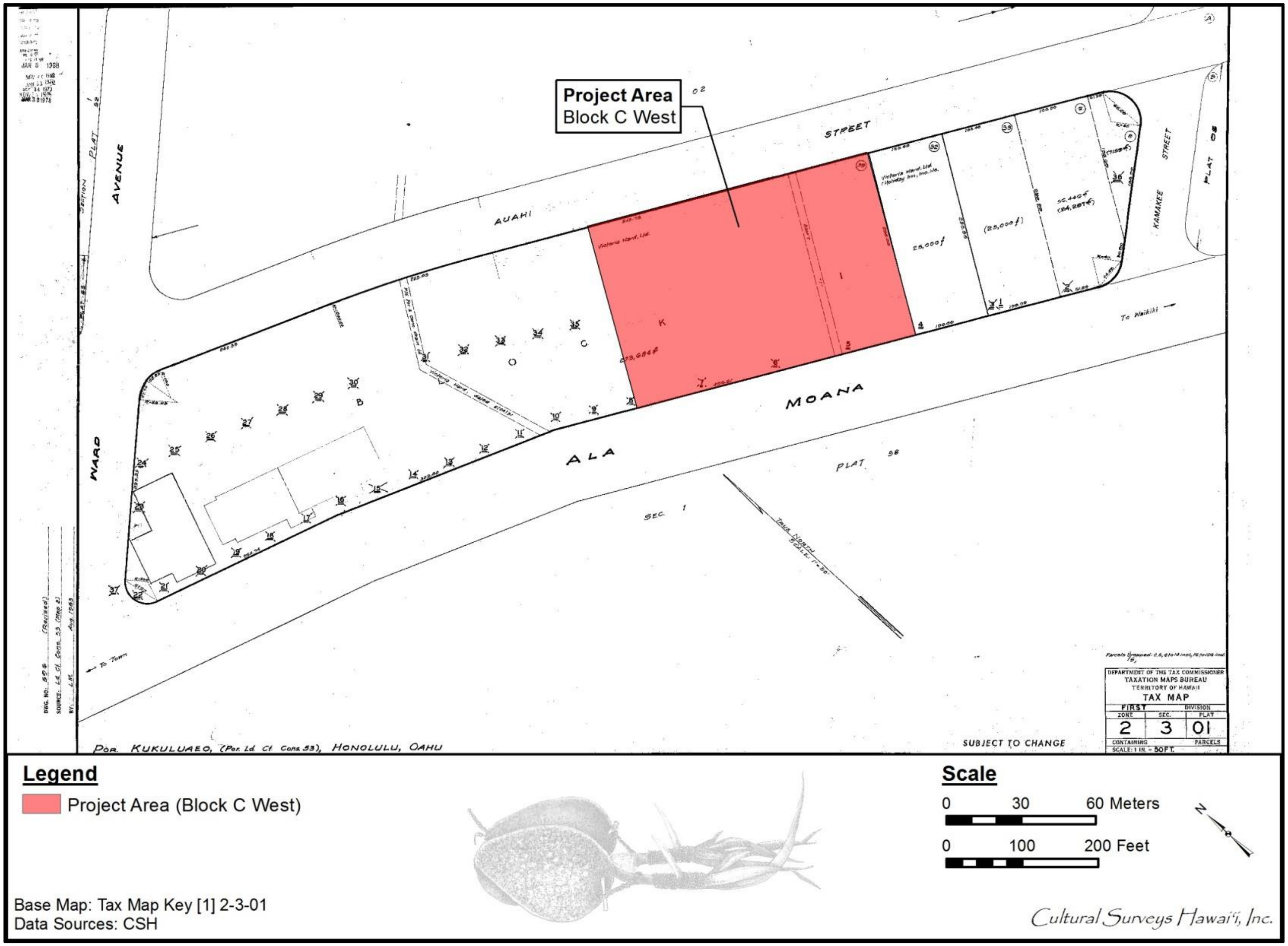

Figure 2. Tax map key (TMK): [1] 2-3-01, showing the location of the Block C West project area

Figure 3. Aerial photograph showing the location of the Block C West project area (base map: Google Earth 2013)

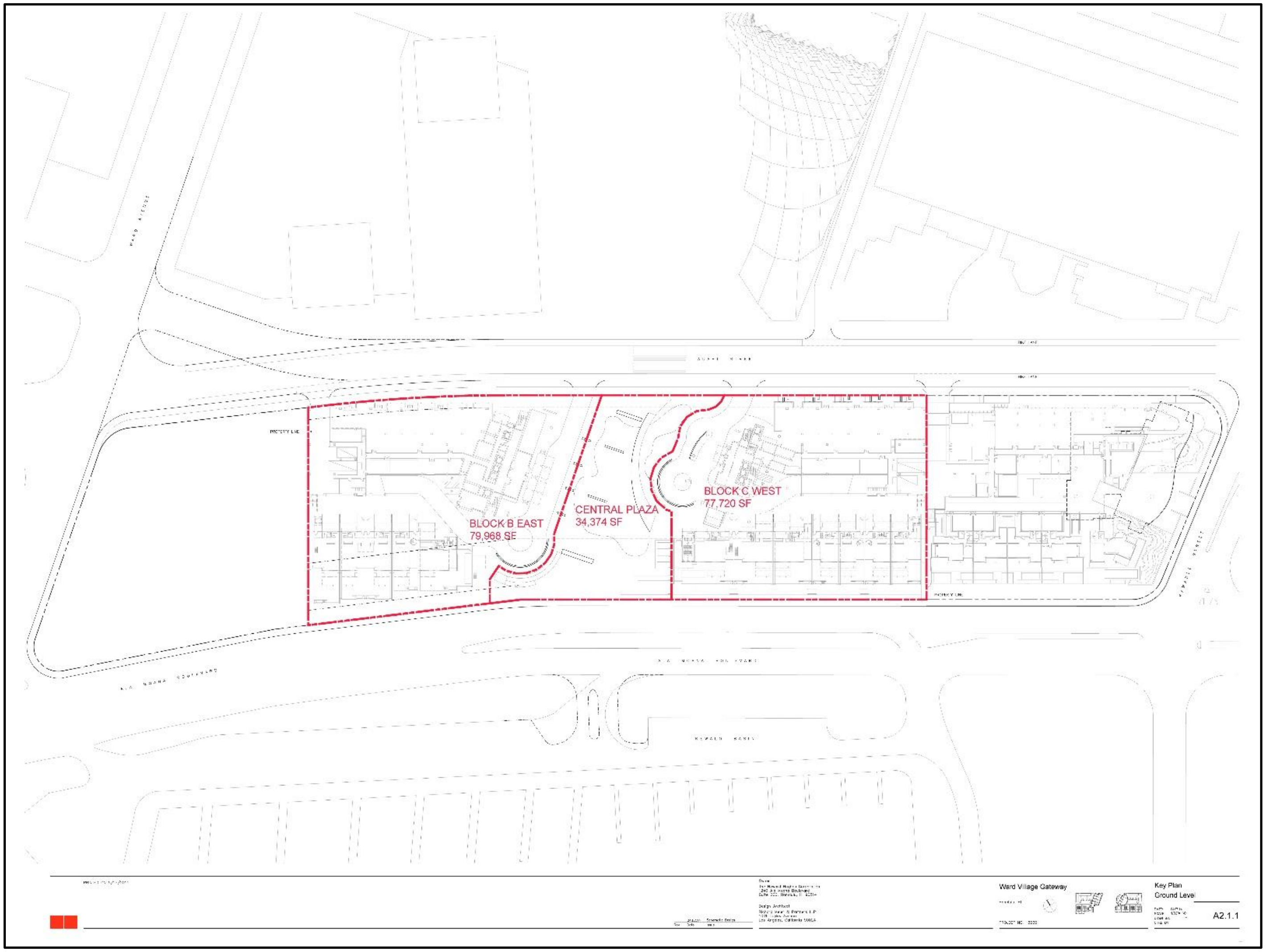

Figure 4. Project design showing the Ward Village Gateway building complex, straddling the Block B East and Block C West project areas, consisting of low-rise villas, residential towers, and commercial retail shops separated by a central plaza

1.3 Environmental Setting

1.3.1 Natural Environment

The Block C West project area is within a portion of O‘ahu called the Honolulu Plain, an area generally less than 4.5 m, or 15 ft, above sea level (Davis 1989:5). The Honolulu Plain is stratified with late-Pleistocene coral reef substrate overlaid with calcareous marine sand or terrigenous sediments, and stream-fed alluvial deposits (Armstrong 1983:36). The top soil stratum consists of Fill land (FL), containing areas filled with material dredged from the ocean and hauled from nearby areas (Foote et al. 1972).

The modern Hawaiian shoreline configuration is primarily the result of 1) rising sea level following the end of the Pleistocene (Stearns 1978; Macdonald et al. 1983); 2) the mid- to late Holocene approximately 1.5-2.0 m high-stand of the sea (see summary in Dye and Athens 2000:18-19); and 3) pre-Contact and post-Contact human landscape modification.

At the end of the Pleistocene, between approximately 20,000 and 5-6,000 years ago, water previously locked in glacial ice returned to the world’s oceans, and the sea level rose over 100 m to approximately its current level. In the vicinity of the Block B East project area, rising sea levels flooded the previously dry, earlier Pleistocene reef deposits, which had formed hundreds of thousands of years previously when sea level was comparable to modern levels. When sea levels reached approximately modern levels, the now coastal regions became depositional environments, where for tens of thousands of years previously, during the lower sea levels, they had been erosional environments.

A high stand of the sea for the Hawaiian Islands, approximately 1.5 to 2.0 m above present sea level, has been well documented between 4,500 and 2,000 years ago (Stearns 1978; Athens and Ward 1991; Fletcher and Jones 1996; Grossman and Fletcher 1998; Grossman et al. 1998; Harney et al. 2000). During this high stand, there appears to have been an increase in coral reef production and the production of detrital reef sediments. Littoral environments appear to have been augmented substantially by the deposition of marine sediments. “What this means is that the great shoreline sand berms must have developed around the islands at this time because this was when calcareous sand was being produced and delivered to the shorelines in large quantities” (Dye and Athens 2000:19).

The Honolulu coastline was likely greatly affected by the deposition of marine sediments during this elevated sea level. The subsequent drop in sea level to its present level, ca. 2,000 years ago, most likely created a slightly erosional regime that may have removed sediments deposited during the preceding period of deposition (Dye and Athens 2000:19). However, the net gain in sediments would have been substantial. In 1911, it was estimated that about one-third of the Honolulu Plain was a wetland (Nakamura 1979:65, citing a Hawaiian Territory Sanitary Commission report). Pre-Contact Hawaiians used the lagoonal/estuary environment of the Honolulu plain to construct fishponds. Fishpond walls served as sediment anchors for the accumulation of detrital reef sediments. They also likely affected along-shore sedimentary transport, resulting in new littoral deposition and erosion patterns. In the post-Western Contact period, when the fishponds were no longer utilized, they became obvious locations for the deposition of fill. These reclaimed areas provided valuable new land for expanding urban development near the heart of growing urban Honolulu.

Foote et al. (1972) show the study area as being fill (FL), as shown in Figure 5. The authors describe fill land as: “This land type occurs mostly near Pearl Harbor and in Honolulu, adjacent to the ocean. It consists of areas filled with material dredged from the ocean or hauled from nearby areas, garbage, and general material from other sources” (Foote et al. 1972:31).

While fill materials will likely be found throughout the project area, the coastal location of Block B East indicates natural Jaucas sand (JaC) may be encountered underneath portions of the Block B East project area. Foote et al. (1972) describe Jaucas sand as:

> In a representative profile the soil is single grain, pale brown to very pale brown, sandy, and more than 60 inches deep. In many places the surface layer is dark brown as a result of accumulation of organic matter and alluvium. The soil is neutral to moderately alkaline throughout the profile. [Foote et al. 1972:48]

In this area of the Honolulu District, rainfall averages less than 30 inches per year (Armstrong 1983:62). Northeasterly trade winds prevail throughout the year, although their frequency varies from more than 90% during the summer months to 50% in January; the average annual wind velocity is approximately 10 miles per hour (Wilson Okamoto 1998:2-1). Vegetation within the project area is limited to a few ornamental trees and shrubs along the project area margins.

1.3.2 Built Environment

The project area is located within central Honolulu, surrounded by modern urban development including commercial buildings, paved streets, sidewalks, utility infrastructure, and landscaped margins.

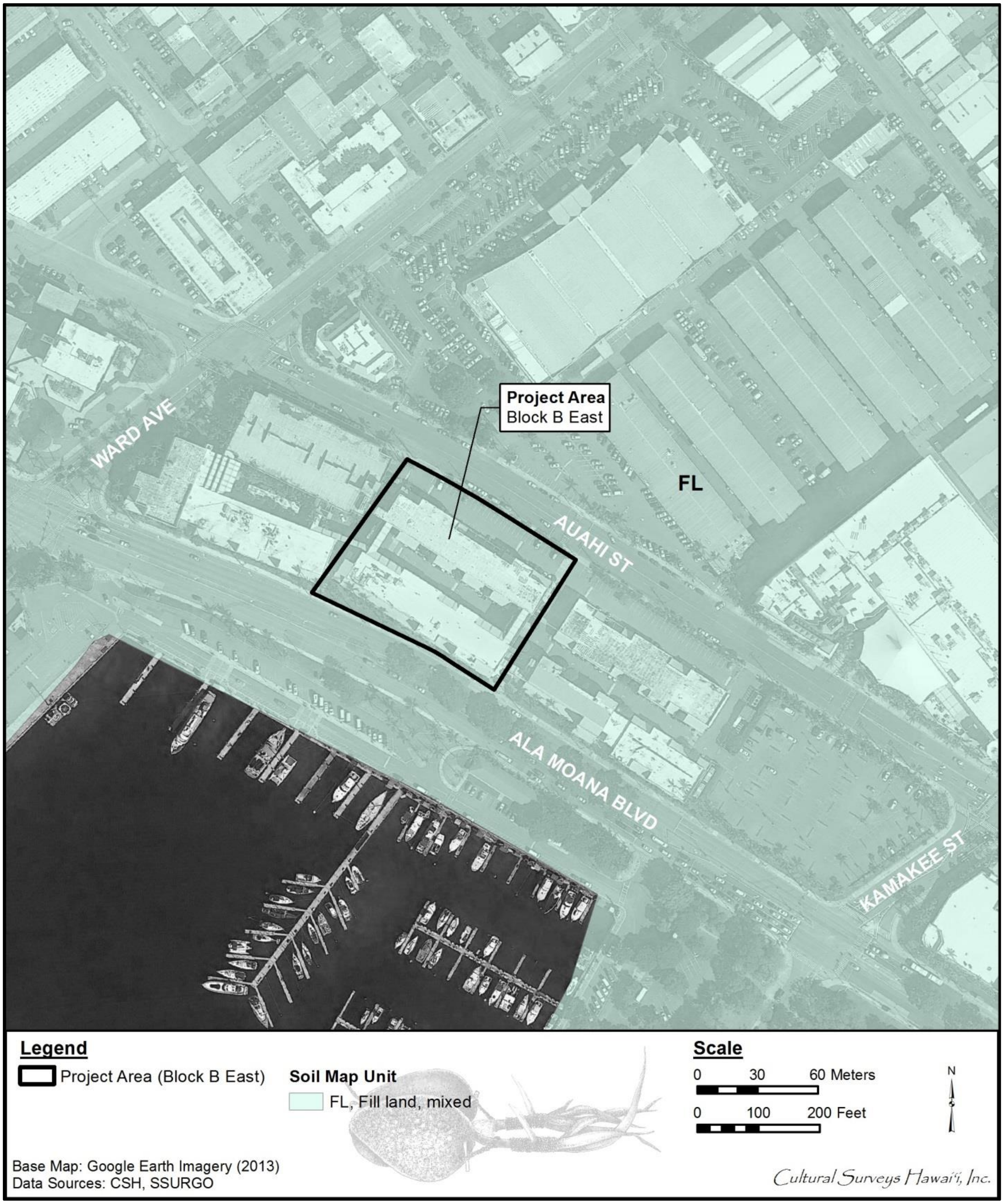

Figure 5. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), showing Fill lands (FL) within and surrounding the Block B East project area (base map: Google Earth 2013)

Section 2 Methods

2.1 Field Methods

This section details the research design and methods used by CSH personnel during fieldwork, laboratory analysis, and the preparation of this archaeological inventory survey report for the Block C West project. This research design (from the SHPD accepted AISP for this project) meets specifications for an archaeological inventory survey plan outlined in HAR §13-284-5.

2.2 Research Design

The research efforts described in the AISP (Sroat et al. 1014) are archaeological research activities, and as such, should be governed by a research design. A research design is essentially a plan that clearly identifies:

1) What is currently known about the research subject;
2) The research objective(s) and the methods that will be used to answer the research objective(s);
3) How the results of the investigation will be interpreted and evaluated.

The objective of this AISR is to identify, document, and assess any subsurface historic properties (non-burial and burial) encountered in the project area, and to make mitigation recommendations to address any project impacts on them.

2.3 Research Objectives

Based on historic background research and previous archaeological investigations (see Sections 3 and 4), three specific research objectives were formulated within the AISP for the Block C West project area:

1) The Block C project AIS investigation (Yucha et al 2014), located immediately adjacent to (south of) the current project area, documented a sand A horizon and Jaucas sand beneath the overlying fill layers in the majority of the project area; however, no cultural material or features were identified. Does similar stratigraphy exists within the Block C West project area, and if so, is there any evidence of traditional Hawaiian use of this coastal area (e.g. habitation, burials, fishing practices) or of early Western use? What might the presence, or absence, of cultural deposits indicate about cultural use of the Kakaʻako shoreline?
2) Is there evidence of salt pan deposition within the western portion of the project area? Can the southern boundary of the Kakaʻako salt pans be identified within the project area?
3) What evidence exists of the various reclamation projects within the Block C West project area and can any deposits be correlated with specific reclamation projects?

2.4 **Pedestrian Survey**

A 100 percent coverage pedestrian inspection was conducted within the project area in order to locate any surface historic properties. The pedestrian survey concluded that the entire project area has been mechanically modified as a result of development of the Ward Warehouse commercial complex, including significant elevation of the ground surface above the surrounding environment. No surface historic properties were identified within the project area. Accordingly, fieldwork within the project area focused on a program of subsurface testing to locate any buried cultural deposits that may be present beneath the modern land surface and to facilitate a thorough examination of stratigraphy within the project area.

2.5 **Subsurface Survey**

According to background research, potential archaeological cultural resources located within the project area include pre- and post-Contact cultural deposits and/or burials, a portion of the Kaka‘ako salt pans, remnants of twentieth century commercial development, and reclamation fill deposits, including historic trash layers or incinerated fill.

In order to locate and document these potential archaeological cultural resources, thirty-six test excavations were proposed for Block C West, distributed generally throughout the project area (Figure 6). Three of these test excavations (TE 1, TE 12, and TE 17), located along the northwest boundary, were specifically targeted by the AISP as areas of potential historic salt pan remnants, based on an 1883 Baldwin survey map (see Figure 18 within Section 3). During the AIS investigation, following the survey strategy provisions of the AISP, a certain number of test excavations required slight locational shifts (Figure 7). Trench location shifts were due largely to the presence of dense subsurface utility corridors. The main obstacle consisted of a complex of subsurface utilities identified within the central parking lot, running parallel in a northwest-southeast orientation. This utility nexus necessitated slight modifications in the location of TE 18, 19, 21, 23, and 26, which were shifted or angled to avoid the utilities. TE 17 required a more substantial relocation to the vicinity of TE 20 in order to avoid the utility corridor documented by Test Excavations 2 and 12.

Several of the interior test excavations were also shifted or relocated, due in part to logistical issues—the Ward Warehouse center is an active commercial complex with operational tenants, and in part to the results of the AIS exterior test excavations. The initial stage of the subsurface testing program concentrated on the exterior (parking lot and landscape) test excavations. These test excavations consistently documented similar stratigraphy throughout the paved areas of the project area, consisting of historic salt pan remnants. Based on these results, it was determined that the *mauka* Ward Warehouse commercial building was located within this very well documented stratigraphic zone; therefore Test Excavations 13 and 15 were relocated *makai*— TE 13 was relocated to the central parking lot and TE 15 was relocated to the *makai* project area boundary in an effort to provide additional coverage of the coastal zone and to determine whether Jaucas sands and/or traditional cultural activity could be found within this area. Within the *makai* Ward Warehouse commercial building, only one test excavation (TE 35) was shifted to the *makai* coastal edge, while two others (TE 28 and TE 33) were shifted slightly, but still remained within the building footprint in order to test for the boundary of the *mauka* historic salt pans and the natural coastal sediments. All significant shifts in test excavation locations were discussed with and

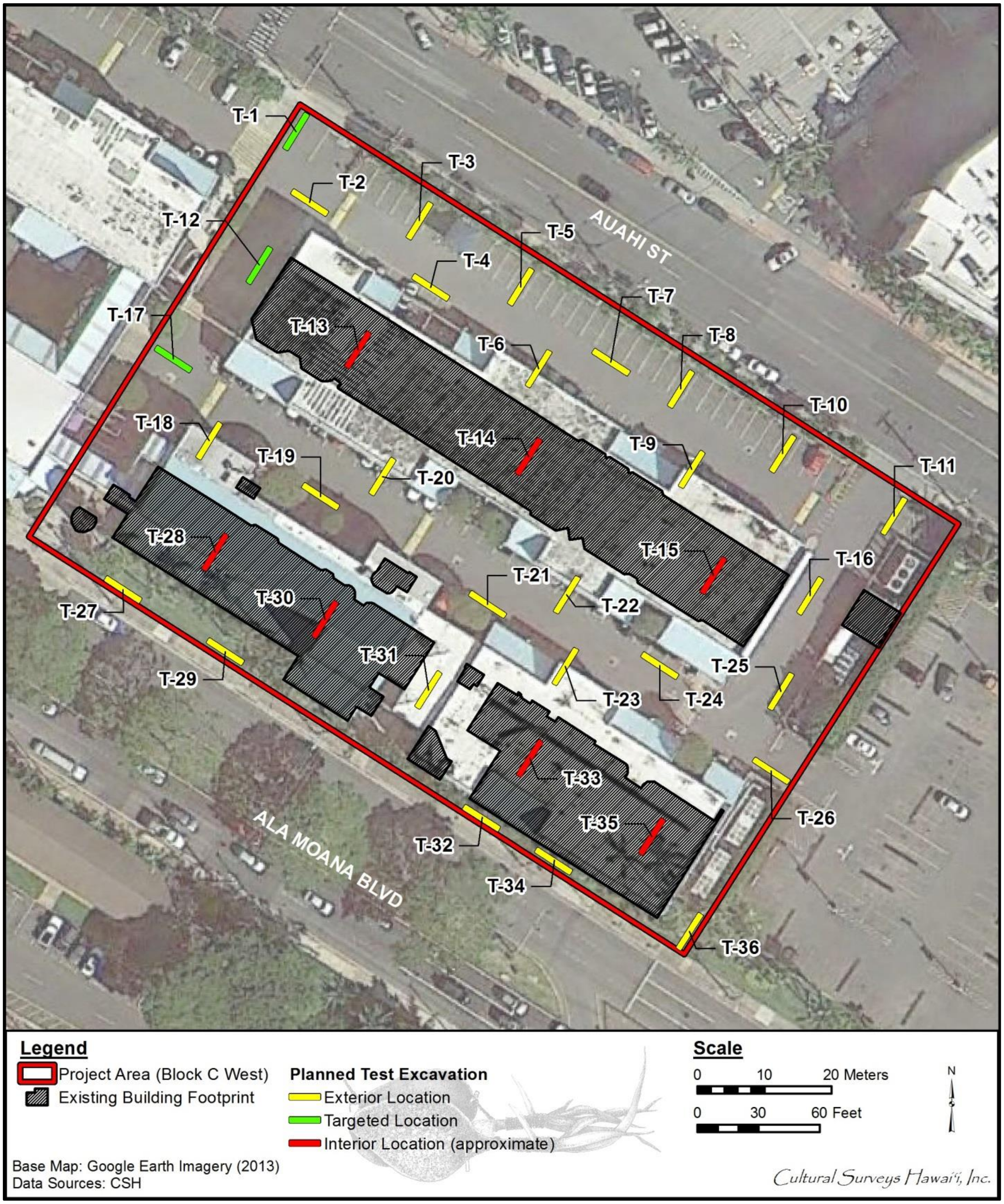

Figure 6. Aerial photograph showing the location of the AISP-proposed Block C West test excavations (base map: Google Earth 2013)

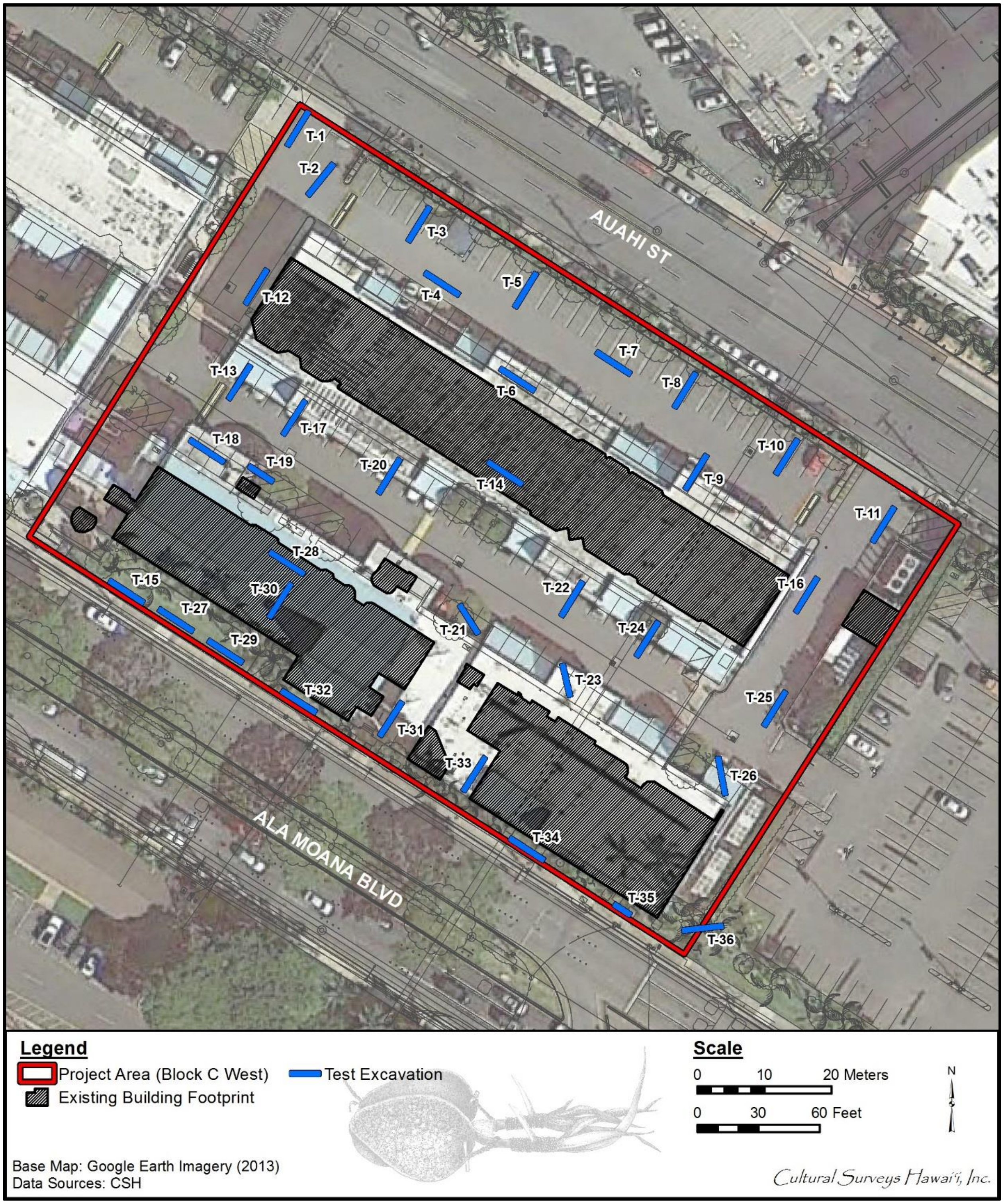

Figure 7. Aerial photograph showing the location of the adjusted Block C West project area AISR test excavations (base map: Google Earth 2013)

approved by the SHPD and the recognized cultural descendants participating as cultural monitors during the AIS investigation (see Section 2.10–Consultation Effort).

On average, the test excavations measured 0.6 by 6.1 m (2 by 20 ft), constituting 133.78 sq m (1,440 sq ft). In a limited number of cases, the trench excavations were shortened slightly in order to fit within narrow constraints (i.e. subsurface utilities and surface obstacles) (e.g. TE 19, TE 21, and TE 23) or because of safety concerns (e.g. TE 35). All test excavations extended to the coral shelf or to below the water table, unless obstructed by subsurface infrastructure.

Initial excavation methods consisted of saw cutting of the asphalt parking lot surface (exterior excavations) or commercial flooring (interior excavations). Removal of the underlying fill deposits was undertaken via backhoe (exterior) or via mini-excavator (interior). Fill deposits included various layers of base course material, imported fill sediments, and hydraulic fill. Archaeologists and project cultural monitors observed the excavation and removal of all fill sediments from the excavation.

Per the requirements of the AISP, all natural sand deposits underlying historic fill layers necessitated excavation by hand, while all other natural non-sand deposits allowed for slow removal via thin mechanized shovel scrapes. Natural marine sandy clay deposits were encountered only along the *makai* boundary of the project area; while no Jaucas sand deposits were identified in this area, these natural deposits were nevertheless hand excavated based on the potential for encountering traditional Hawaiian cultural deposits and/or burials in this zone. The remainder of the Block C West project area encountered non-sand deposits and was excavated by backhoe, with controlled pauses in which to enter the test excavations and investigate the stratigraphy.

All artifacts and historic pit features found in situ were mapped in plan or profile view and were excavated by hand if feasible. Large pit features containing rubble or historic material, were sampled using a combination of hand and mechanized excavation methods. Artifact assemblages in fill deposits and historic pit features primarily consisted of very small fragments not readily identifiable as diagnostic or construction debris; in most cases these historic fragments were photographed and documented in the field, reducing sample sizes collected for further analysis and curation. Photographs and analysis information pertaining to artifacts documented in the field were included in the report.

The stratigraphy in each test excavation was drawn and photographed. The sediments were described for each of the test excavations using USDA soil description observations and terminology. Sediment descriptions included Munsell color, texture, consistence, structure, plasticity, origin of sediments, descriptions of any inclusions such as cultural material and/or roots and rootlets, lower boundary distinctiveness and topography, and other general observations.

Photographs were taken of the general project area and in-progress work, recording on-the-job procedures, personnel, work conditions, and the area's natural and/or built environment. Additionally, overview and profile view photographs were taken of each trench showing stratigraphic sequence, the presence/absence of utilities, and any possible cultural or construction-related stratigraphic features. A photographic scale was included as appropriate, and the general orientation was noted for each photograph.

The location of the majority of the exterior test excavations was recorded using a Trimble Pro XH mapping grade GPS unit with real-time differential correction. This unit provides sub-meter horizontal accuracy in the field. GPS field data was post-processed, yielding horizontal accuracy between 0.5 and 0.3 m. GPS location information was converted into GIS shape files using Trimble's Pathfinder Office software, version 2.80, and graphically displayed using ESRI's ArcGIS 9.1. Interior test excavation locations, as well as exterior test excavations located in areas inaccessible to accurate GPS readings, were recorded using tape measurements and a project area footprint map and added to GIS data layers.

2.6 Sampling Methods

Sampling of potential archaeological cultural resources was conducted in an effort to characterize the deposits and to help establish the spatial extent and chronology of their deposition. As the project area primarily consisted of buried archaeosediments associated with historic salt pan remnants as well as underlying natural wetland and/or marine sediments, sampling consisted of a combination of bulk sediment samples and column samples.

Column samples targeting potential salt pan remnants were collected from cleaned test excavation sidewalls or from large multi-strata bulk samples collected in discrete chunks, which were later cleaned and processed within sterile laboratory conditions. Column samples included subsamples divided by stratigraphic layer (e.g., organic layer, natural wetland clay) in order to obtain the entire depositional sequence. Bulk samples were collected from archaeosediments throughout the project area (i.e. salt pan berm and salt pan bed sediments) as well as the natural underlying wetland sediments. These bulk samples were collected in order to better characterize and cross-compare within the CSH laboratory. Bulk samples were typically 1 to 5 liters in volume. All sediment sample collection locations were recorded on test excavation documents and the sediment samples were labeled with provenience information.

Historic artifacts, typically consisting of small fragments, and construction debris identified within historic pits were documented within test excavation forms and photographed. Larger diagnostic historic artifacts, including glass bottles as well as wooden post remnants found within historic post mold pits, were collected for further analysis in the laboratory.

2.7 Laboratory Methods

Materials collected during AIS fieldwork were identified and catalogued at CSH's laboratory facilities on Oʻahu. Analysis of collected materials was undertaken using standard archaeological laboratory techniques. Artifacts were washed, sorted, measured, weighed, described, photographed, and catalogued. In general, artifact analysis focused on establishing, to the greatest extent possible, material type, function, cultural affiliation, and location and age of manufacture.

2.7.1 Traditional Hawaiian Artifacts

No traditional Hawaiian artifacts were identified during the Block C West AIS investigation.

2.7.2 Historic Artifacts

Historic artifacts were identified using standard reference materials and resources available on the internet (e.g., Elliott and Gould 1988; Fike 1987; Kovel 1986; Lehner 1988; Lindsey 2010; Lockhart 2004-2010; Toulouse 1971; Whitten 2009; and Zumwalt 1980). Analyzed materials were tabulated and presented within Section 5 of this AISR. As noted above, the results of the historic artifact analysis were used to better characterize the age, function, and potentially the cultural affiliation of the associated archaeological deposits.

2.7.3 Bulk Sediment Samples

Bulk samples collected during the AIS investigation were analyzed within the CSH laboratory. The bulk samples consisted of archaeosediments and natural wetland and/or marine sediments, and were collected in order to further characterize and compare the samples. Additionally, close-up photographs were taken of collected salt pan bed organic sediments in order to help distinguish and document any distinctive traits.

2.7.4 Vertebrate Material

Non-human skeletal material was identified to the lowest possible taxa at the CSH laboratory using an in-house comparative collection and reference texts (e.g., Olsen 1964; Schmid 1972; and Sisson 1953).

2.7.5 Invertebrate Material

No invertebrate remains were collected during AIS fieldwork.

2.7.6 Wood Taxa Identification

No charcoal samples were identified or collected during AIS fieldwork.

2.7.7 Radiocarbon Dating

No appropriate samples were collected during AIS fieldwork.

2.7.8 EDXRF Analysis

No lithic artifacts were collected during AIS fieldwork.

2.7.9 Pollen/Micro Charcoal Particle Analysis

Five column sediment samples were collected during AIS fieldwork, prepared, weighed, and sent to PaleoResearch Institute of Golden, Colorado for pollen analysis and micro charcoal quantification. A chemical extraction technique based on flotation was used to remove pollen from the sediment matrix. After additional treatments, a light microscope was used to count and identify pollen grains within the sample.

2.8 Disposition of Collections

All collections, including samples and artifacts, resulting from the AIS process, are considered to be the property of the land owner, Victoria Ward, Limited. At the conclusion of the AIS investigation, all collected materials have been temporarily curated at the offices of Cultural Surveys Hawai‘i, Inc. in Waimanalo, O‘ahu, until a permanent curation facility can be decided upon, based on consultation with the landowner, the SHPD, and any other potential stakeholders.

2.9 Document Review

Background research included: a review of previous archaeological studies on file at the SHPD/DLNR library; review of historical documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public

Library, and the Archives of the Bernice Pauahi Bishop Museum; study of historic photographs at the Hawaiʻi State Archives and the Archives of the Bishop Museum; study of historic maps at the Hawaiʻi State Land Survey Division; and study of historic maps and photographs at the CSH library. This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources consulted were used to formulate a predictive model regarding the expected types and locations of historic properties that may be located in the project area

2.10 Consultation Effort

On July 10, 2012, as part of the Ward Neighborhood Master Plan Project consultation effort, the Howard Hughes Corporation (HHC) coordinated an informational meeting with recognized cultural descendants for the Ward Village Shops Project in order to introduce the Ward Neighborhood Master Plan Project, as well as present results of the recent supplemental archaeological inventory survey for the Ward Village Shops Phase II Project. Attendees included Kakaʻako cultural descendants (Kaʻanohi Kaleikini, Keala Norman, Kepoʻo Keliʻipaʻakaua, and Kahili Norman), Oʻahu Island Burial Council (OIBC) representative Hinaleimoana Wong-Kalu, HHC representatives (John Simon, David Striph, and Nick Vanderboom), CSH principal investigator Matt McDermott, and Kuʻiwalu cultural consultant Dawn Chang. Prior to this meeting, all cultural descendants were mailed a hard copy of the archaeological literature review and predictive model study (O'Hare et al. 2012) completed for the Ward Neighborhood Master Plan Project as part of its historic preservation review process and as a cultural and historical resource document. Cultural descendants were also mailed a copy of CSH's cultural impact assessment for the subject project (Cruz et al. 2012). A summary of the Ward Neighborhood Master Plan Project was provided by HHC Vice President of Development, Nick Vanderboom,, focusing on the upcoming initial portions of the project and development of archaeological inventory survey (AIS) plans for Blocks C, K, and O. Mr. Vanderboom also communicated HHC's desire to coordinate with the Office of Hawaiian Affairs (OHA) and Kamehameha Schools (KS), given their ownership of large tracts of land within Kakaʻako, and to develop cultural guidelines for the project. The cultural descendants were very supportive of the idea of incorporating *moʻolelo* (stories) of the area into the Hawaiian architecture and the use of native plants within the landscaping designs. They further suggested that resource gardens where Native Hawaiians could gather native plants could be established. In terms of the project's archaeological investigations, the cultural descendants were assured that AIS plans and AIS investigations would be prepared and conducted for each phase of the development and that the descendants would be kept informed of Master Plan developments and archaeological investigations.

Also invited to the July 10, 2012 meeting was Mr. Manny Kuloloio, a cultural descendant of the Honolulu and Kakaʻako area. Mr. Kuloloio called Ms. Chang the following day to express his regret at being unable to attend the meeting. As a follow-up, Mr. McDermott of CSH called Mr. Kuloloio to discuss any input he might have regarding development of the Ward Neighborhood Master Plan Project and AIS plans. Mr. Kuloloio acknowledged receipt of the archaeological literature review and predictive model document, but did not have any specific comments at this time.

On July 20, 2012, Nick Vanderboom of HHC and Matt McDermott of CSH met with the SHPD Administrator, Dr. Pua Aiu, and the SHPD Oʻahu Lead Archaeologist, Dr. Susan Lebo, to present an overview of the Ward Neighborhood Master Plan Project. Copies of the project’s background research studies, a draft cultural impact assessment (Cruz et al. 2012) and a draft archaeological literature review and predictive model study (O’Hare et al. 2012), were submitted to SHPD at the meeting. Mr. Vanderboom explained the documents’ requirement by the Hawai‘i Community Development Authority (HCDA) as part of the development approval process and their function as planning aides in the development of the project’s AIS plans. A brief presentation of the upcoming Blocks C, K, and O project areas was then followed by discussions regarding the limitations of AIS testing within in-use buildings and the proposed sampling strategy, including both within and outside existing structures.

SHPD agreed with the approach of using the predictive model study as the overarching background section for the Master Plan development, with individual AISPs for different construction phases/project areas which would focus on the specific footprint of each individual project area and refer to the predictive model for more general Kaka‘ako background information. Dr. Lebo stated the individual AISPs should clearly describe in the methodology section how historic artifacts would be treated and should include a discussion regarding the assignation of historic property numbers to historic fill layers that can be linked to specific deposition activities and events, such as the Kaka‘ako incinerator fill layer.

On November 6, 2013, an informational meeting concerning proposed AIS testing strategies for Blocks B East, C West, I, and M of the Ward Neighborhood Master Plan Project was held for recognized cultural descendants. Attendees included Kaka‘ako cultural descendants (Keala Norman, Ka‘anohi Kaleikini and *‘ohana* members), OIBC representative Hinaleimoana Wong-Kalu, HHC representatives (David Striph, Race Randle, and Nick Vanderboom), CSH principal investigator Matt McDermott, and Ku‘iwalu cultural consultant Dawn Chang. Mr. McDermott reviewed the Ward Neighborhood Master Plan Project context, the historic background of the four project parcels, and previous archaeological studies within the vicinity. The archaeological testing strategy for each block project area was then presented, including the constraints imposed by testing within active commercial centers. The OIBC representative and cultural descendants expressed support for the proposed testing strategies and the extent of archaeological testing. Discussion also included the possibility of commencing limited AIS work within Blocks I and M prior to the SHPD approval of the AISPs. At the present moment, a percentage of the interior commercial space within the project areas is unoccupied by tenants and thus more easily accessible for archaeological excavation. Given the difficulties of excavating within in-use commercial space, the cultural descendants and OIBC representative were amenable in this particular case to limited excavation prior to approval of the AISPs. It was resolved that the SHPD would be consulted regarding possible early testing within these project areas.

Prior to the cultural descendants’ meeting, Matt McDermott of CSH contacted Edward Halealoha Ayau and Kihei Nahalea of Hui Mālama I Nā Kūpuna O Hawai‘i Nei in order to provide notification of the upcoming projects and the scheduled consultation meeting as well as to inquire whether a representative of Hui Mālama would be interested in participating in upcoming consultation meetings. On November 5, 2013, Mr. Ayau responded that attendance at the consultation meetings would not be necessary and that alternative forms of communication would be sufficient (e.g. email, telephone, mail, Skype). On November 15, 2013, Mr. Nahalea confirmed that Mr. Ayau should continue to be the point of contact for Hui Mālama.

On November 8, 2013, consultation letters concerning the four upcoming projects (Blocks B East, C West, I, and M), as well as three additional upcoming projects (Blocks B West, G, and N East), and the proposed testing strategies were mailed to the Office of Hawaiian Affairs (OHA), Hui Mālama I Nā Kūpuna O Hawai‘i Nei, the OIBC, and the SHPD (History and Culture Branch).

At the November 13, 2013 OIBC monthly meeting, Mr. Vanderboom of HHC introduced the the four proposed projects (Blocks B East, C West, I, and M) to the OIBC and Mr. McDermott provided a PowerPoint presentation of the historical and archaeological background of the project parcels and the proposed AISP testing strategies. No public comment was received.

On November 18, 2013, an additional cultural descendants' consultation meeting was held. Dr. Susan Lebo of the SHPD was present for this meeting as well as cultural descendants (Mana Caceres, Kekaimalino Kaopio, JR Williams, Keala Norman, Ka‘anohi Kaleikini, and Kalā Kaleikini), OIBC Kona representatives (Hinaleimoana Wong-Kalu and Jonathan Scheuer), HHC representatives (Nick Vanderboom, Race Randle, John Simons, and David Striph), CSH principal investigator Matt McDermott), and Ku‘iwalu cultural consultant Dawn Chang. Following a brief PowerPoint presentation by Mr. McDermott describing the four project areas, background research, and the proposed archaeological testing strategy, the cultural descendants reaffirmed their approval of the proposed AIS testing strategy. The cultural descendants also reaffirmed acceptance of limited AIS testing within vacant interior commercial space prior to SHPD approval of the AISPs, with the understanding that this would not set a precedent for future projects. Following discussion regarding this matter, it was agreed that in this particular circumstance, in which the AISPs were prepared as part of the Ward Neighborhood Master Plan Project's settlement agreement and not at the request of the SHPD, it would be acceptable for limited AIS fieldwork to proceed while the AISPs were still under SHPD review. It was understood that the final SHPD-approved AISPs may require revisions to the testing strategy; however, any revisions would likely not affect the need to excavate the proposed interior test excavations.

A follow-up email was sent by Matt McDermott on November 21, 2013 to Dr. Lebo summarizing the November 18, 2013 consultation meeting and the agreement of meeting participants to allow limited interior space test excavations within the project areas prior to the SHPD-approval of the AISPs.

AIS fieldwork for the Block C West project area commenced on 14 April 2014. Following completion of the exterior test excavations, Matt McDermott met with Dr. Susan Lebo of the SHPD in order to provide a brief outline of preliminary results and to discuss the shifting or relocation of several interior test excavations. As discussed within Section 2.5, five interior test excavations were proposed to be shifted or relocated based on the AIS results and logistical difficulties. Based on the preliminary AIS results, which documented a large area of buried historic salt pan remnants within the majority of the project area, Dr. Lebo agreed that two of the interior excavations (TE 15 and TE 35) could be relocated to the *makai* edge of the project area in order to provide more testing in areas potentially containing traditional Hawaiian cultural deposits and/or burials; two test excavations (TE 28 and TE 33) could be shifted laterally within the *makai* Ward Warehouse building to alleviate access issues; and one test excavation (TE 13), believed to be solidly located within the salt pan boundary, could be shifted to the parking lot. The proposed relocations and rationale were also discussed with recognized cultural descendant and project area cultural monitor, Ka‘anohi Kaleikini, who agreed to the relocations/shifts.

On 14 May 2014, Matt McDermott also presented an overview of the Ward Neighborhood Master Plan Project’s ongoing AIS fieldwork, including the Blocks B East, C West, and I project areas. The discussion focused on a summary of the *iwi kūpuna* (human skeletal remains) finds documented within Block I and Block B East.

On 16 June 2014, a follow-up meeting was held with the project area’s recognized cultural descendants. Attendees included CSH principal investigator Matt McDermott, Kaka‘ako cultural descendants (Keala Norman, Mana Caceres, Ka‘anohi Kaleikini and *‘ohana* members), OIBC representatives Hinaleimoana Wong-Kalu and Jonathan Scheuer, and HHC representatives (David Striph, Race Randle, Nick Vanderboom, and John Simons). Matt McDermott provided a summary of the recently completed test excavation results from both Block B East and Block C West, as well as of the ongoing AIS excavations within Block I. The discussion and cultural descendants’ concerns focused on the burial finds within Block I. There were no concerns expressed regarding the Block C West AIS testing or findings.

Following completion of the Blocks B East and C West AIS fieldwork on 10 June 2014, a consultation letter was mailed to the Office of Hawaiian Affairs (OHA) on 20 June 2014 (see Appendix D). The major findings of the two AIS investigations were provided and any comments and/or concerns requested from OHA. The consultation letter specifically noted the presence of a disturbed, isolated cranial fragment within the *makai* portion of Block B East.

Section 3 Background Research

3.1 Traditional and Historical Background

3.1.1 Explanation of Place Names

As noted in the introduction, the project area is within the Kaka‘ako Community Development District. However, the boundary of this development district is not the same as the ancient boundary of Kaka‘ako. The development district is comprised of the *‘ili* (land section) of Kaka‘ako and lands once known as Ka‘ākaukukui, Kukuluāe‘o, and Kewalo, and even smaller areas—portions of *‘ili*—called Kawaiaha‘o, Honuakaha, Ka‘ala‘a, ‘Āpua, ‘Auwaiolimu, Pualoalo, Pu‘unui, and Kolowalu. The Block C West project area is within the ‘*ili* of Kukuluāe‘o (Figure 8).

The land called Kukuluāe‘o was named for the Hawaiian stilt bird (*Himantopus himantopus*), also called *kukuluāe‘o,* which means “to walk on stilts.” The area was described as having contained “marshes, salt ponds, and small fishponds,” an environment well suited for this type of bird (Griffin et al. 1987:36). Kekahuna (1958:4) described it as “the land on the upland side of Ka‘ākaukukui. Salt was formerly made there.”

John Papa ‘Ī‘ī mentions some of these lands while discussing early nineteenth century trails in the Honolulu/Waikīkī area (Figure 9). The fact that the trail traversed this region—characterized by ponds, marshlands and *lo‘i* (irrigated fields)—suggests the trail, especially as it neared the coastline at Kālia, must have run on a sand berm raised above surrounding wetlands and coral flats. On this inland trail (probably close to the current alignment of Queen Street), walking from Waikīkī to Honolulu, “The trail from Kalia led to Kukuluaeo, then along the graves of those who died in the smallpox epidemic of 1853, and into the center of the coconut grove of Honuakaha” (‘Ī‘ī 1959:89).

The smallpox epidemic graves referred to are within the Honuakaha Cemetery, designated State Inventory of Historic Properties (SIHP) # 50-80-14-3712, near the corner of Halekauwila and South Streets, *makai* (seaward) of Kawaiaha‘o Church. Honuakaha was a settlement located generally between Punchbowl and South Streets, on the *makai* side of Queen Street.

3.2 Legendary Accounts

The Block C West project area is located in an area called Kukuluāe‘o on historic maps. The place name Kaka‘ako is found in various legends and traditions, but Kukuluāe‘o does not appear in any sources referenced in the *Hawaiian Island Legends Index* (Gotanda 1989) or in the index to *Fornander’s Collection of Hawaiian Antiquities and Folklore* (Fornander 1916-1920).

However, a *heiau* (place of worship) called Pu‘ukea may have once been located in Kukuluāe‘o. This *heiau* is mentioned in a *mele* (chant) to the chief Huanuikalala‘ila‘i, who was born in Kewalo, the land section north and adjacent to Kukuluāe‘o.

‘O Hua-a-Kamapau ke ‘li‘i	Hua-a-Kamapau the chief
O Honolulu o Waikīkī	Of Honolulu, of Waikīkī
I hanau no la i kahua la i ***Kewalo****,*	Was born at **Kewalo**,
‘O Kālia la kahua	Kālia was the place [the site]

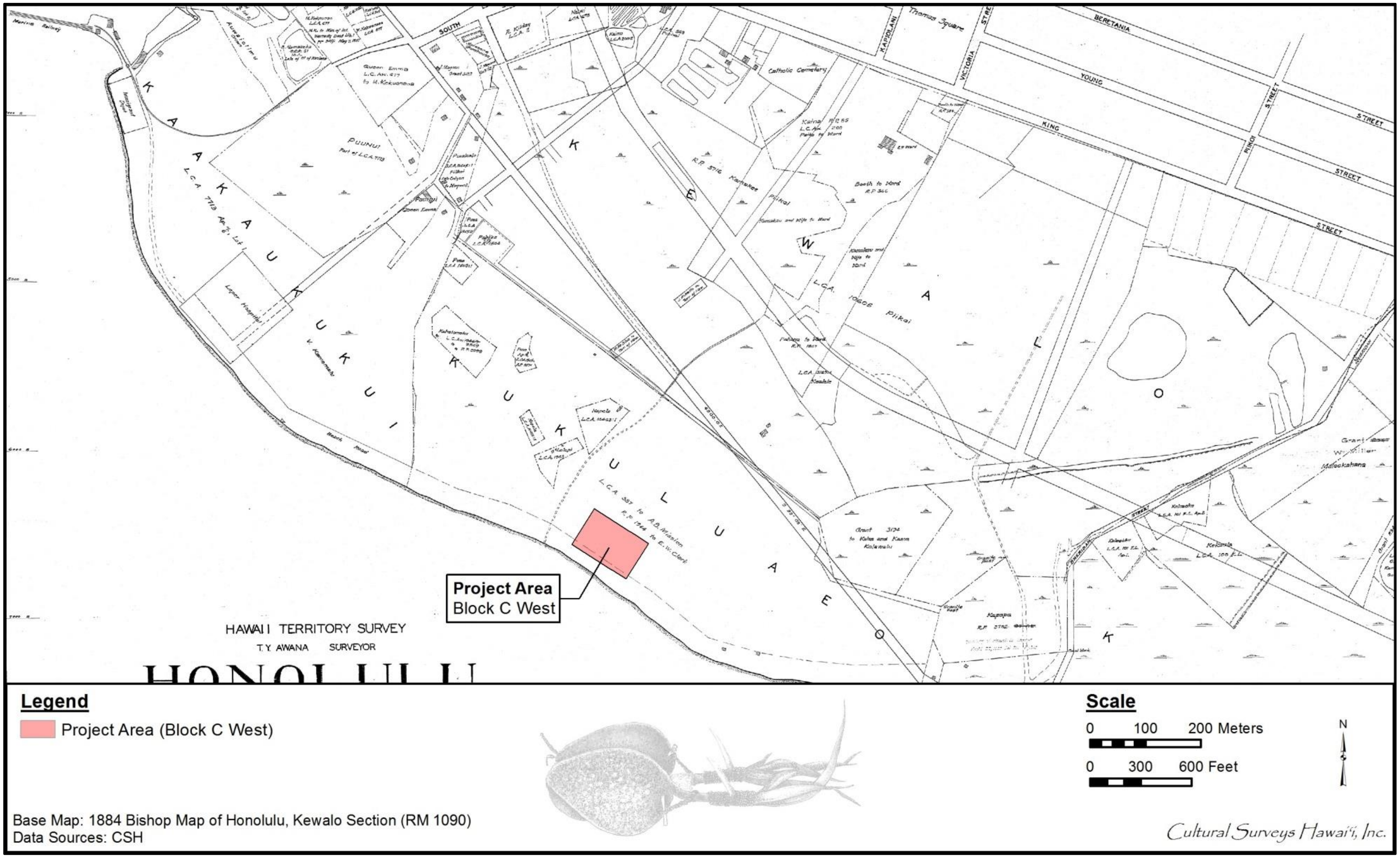

Figure 8. 1884 map of Honolulu, Kewalo Section (portion), by S.E. Bishop, showing place names and Land Commission Award (LCA) locations near the project area (Hawai‘i Land Survey Division, Registered Map 1090)

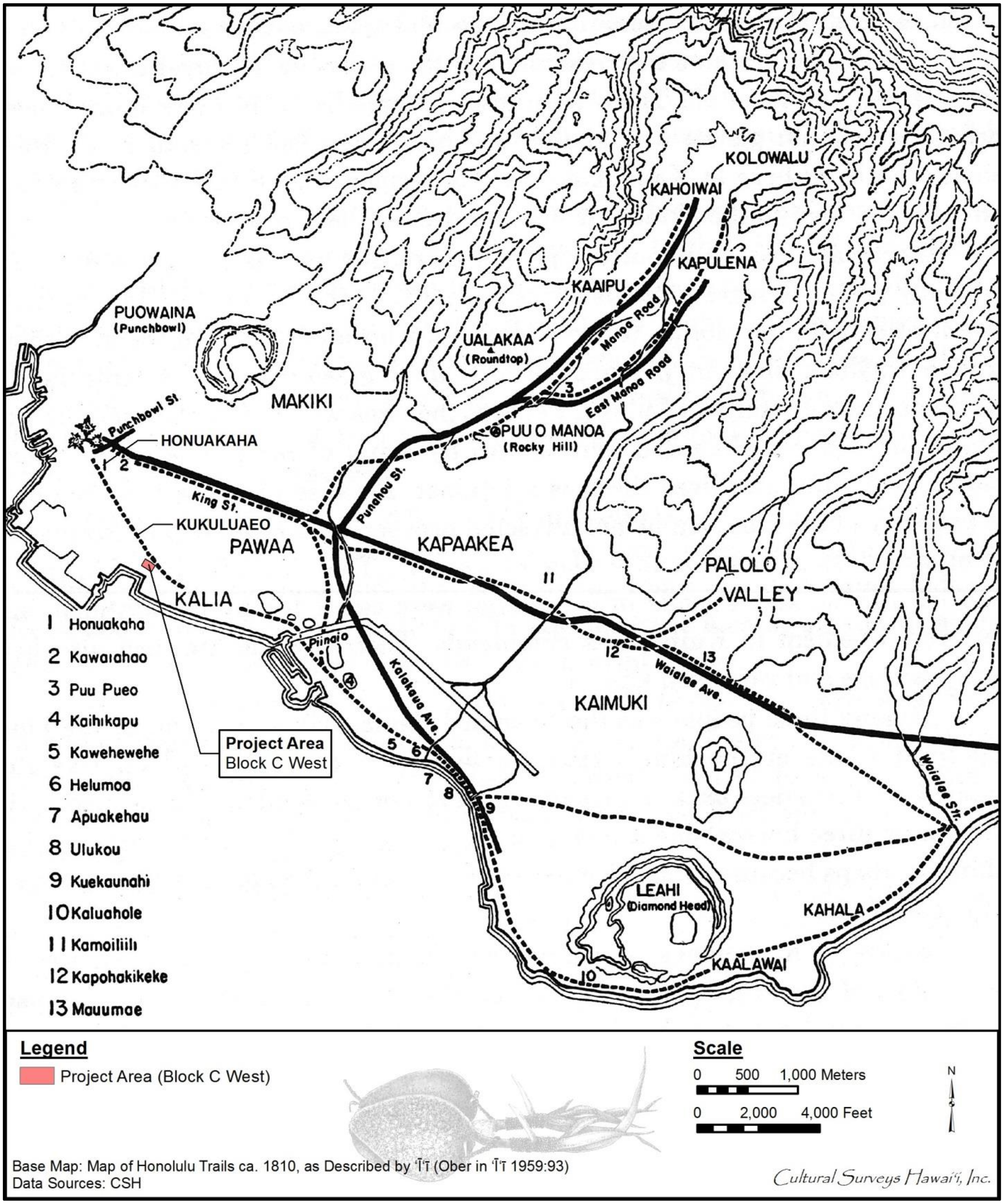

Figure 9. Early nineteenth century (ca. 1810) trails on the southwest coast of Oʻahu (illustration by Gerald Ober from ʻĪʻī 1959:93), showing the location of Honuakaha, Kukuluāeʻo, and Kālia

O Makiki la ke ēwe,	At Makiki the placenta,
I Kānelāʻau i Kahehuna ke piko,	At Kānelāʻau at Kahehuna the navel cord,
I Kalo i Pauoa ka ʻaʻa;	At Kalo at Pauoa the caul;
I uka i Kahoʻiwai i	Upland at Kahoʻiwai, at
Kanaloahoʻokau . . .	Kanaloahoʻokau . . .
[Kamakau 1991:24]	

The chief Hua was famous for his love of cultivation and his care for the people. His *heiau*, Puʻukea, is mentioned in a traditional *wānana* (prophecy) recorded by Kamakau (1991:24-25) as follows:

[*Ka makaua ua kahi o ʻEwa*]	[The increasing "first rain" of ʻEwa]
Ua puni ka iʻa o Mokumoa,	Overcomes the fish of Mokumoa,
Ua kau iʻa ka nene;	Washes up fish to the nene plants;
Ua haʻa kalo haʻa nu;	Lays low the taro as it patters down;
Haʻa ka iʻa o kewalo,	Lays low the fish of Kewalo,
Haʻa na ʻualu o Pahua,	Lays low the sweet potatoes of Pahua,
Haʻa ka mahiki i ***Puʻukea****,*	Lays low the mahiki grass at **Puʻukea**,
Haʻa ka unuunu i Peleʻula,	Lays low the growing things at Peleʻula
Haʻa Makaaho i ke ala.	Lays low Makaaho [Makāho] in its path
E Kū e, ma ke kaha ka ua, e Kū,	O Kū, the rain goes along the edge [of the island], O Kū
[*I ʻai ʻna ka iʻa o Maunalua*] . . .	[Eating the fish of Maunalua] . . .

The chant mentions the *mahiki* grass of Puʻukea Heiau. The Hawaiian term *mahiki* means "to peel off" (Andrews 2003:369). The word was also used to describe a rite to exorcise an evil spirit, as the skilled *kahuna* (priest) "peeled" the malicious spirit from the afflicted. Used in the ritual was a shrimp called *mahiki* or a native grass called *mahiki*. *Mahiki*, or ʻ*akiʻaki*, is a tufted rush (*Sporobolos* sp.) found near the seashore. The ethnologist Mary Kawena Pukui states that even during her youth, parents put "*ti* leaves, or *hala*, or *ʻakiʻaki* grass, in a little sea-salt water and [would] have the child drink it" (Pukui et al. 1972:163) to rid them of badly-behaving spirits. The use of this grass in a ritual may explain its association with a ceremonial *heiau*, or it may simply be that the Kukuluāeʻo coast was a good habitat and thus a favored place for healers to collect this type of grass. The literal meaning of Puʻukea is "white hill" (Pukui et al. 1974:199), although it may have alternate meanings. Puʻukea is also the name of a small land division within the ʻ*ili* of Kukuluāeʻo, mentioned in at least two Land Commission Awards, LCA 1502 (not awarded) and 1504. LCA 1504 was located near the junction of Halekauwila Street and Cooke Street.

It is fairly common for a *heiau* to have the same name as the ʻ*ili* it is located within, so it is possible that Puʻukea Heiau was also near the junction of Halekauwila and Cooke streets. The majority of the house sites in the mid-nineteenth century in Kukuluāeʻo were located near Halekauwila Street and Queen Street, *mauka* (inland) of the low-lying coastal swamplands on higher dry ground. It is possible that the *heiau* platform or the area that it was built on was one of the few "high spots" in the flat, low-lying swamp that surrounded it, and thus gained the name *puʻu kea* (white hill).

From these legendary accounts it can be seen that Kukuluāeʻo was traditionally noted for its fishponds and salt pans, for the marsh lands where *pili* grass and other plants could be collected, for ceremonial sites such as Puʻukea Heiau, and for the trails that allowed transport between the more populated areas of Waikīkī and Honolulu. Important chiefs were born in the area and conducted religious rites, and commoners traveled to the area to procure food and other resources; some commoners probably also lived in the area, possibly adjacent to the ponds and trails.

3.3 Early Post-Contact History and Population Centers

Kukuluāe‘o is between two centers of population, Kou and Waikīkī, on the southern shore of pre-Contact O‘ahu. In Waikīkī, a system of taro *lo‘i* (irrigated terrace) fed by streams descending from Makiki, Mānoa, and Pālolo valleys blanketed the plain, and networks of fish ponds dotted the shoreline. Similarly, Kou—the area of downtown Honolulu surrounding the harbor—possessed shoreward fishponds and irrigated fields watered by ample streams descending from Nu‘uanu and Pauoa Valleys. The pre-Contact population and land use patterns of Kukuluāe‘o may have derived from its relationship to these two densely populated areas; this population may have participated in some of the activities associated with them. Thus, the attempt to reconstruct the Kukuluāe‘o region (and the present study area)—as it existed for the Hawaiians during the centuries before Western Contact and the modern urbanization that has reconfigured the landscape—must begin with accounts of Kou and Waikīkī.

Waikīkī is actually the name of a large *ahupua‘a* (traditional land division) encompassing lands stretching from Honolulu to Maunalua Bay. Within that *ahupua‘a*, by the time of the arrival of Europeans during the late eighteenth century, the area today known as Waikīkī had long been a center of population and political power on O‘ahu. According to Martha Beckwith (1940:383), by the end of the fourteenth century, Waikīkī had become “the ruling seat of the chiefs of O‘ahu.” The pre-eminence of Waikīkī continued into the eighteenth century and is confirmed by the decision of Kamehameha, in the midst of unifying control of the islands, to reside there after winning control of O‘ahu by defeating the island’s chief, Kalanikūpule. The nineteenth century Hawaiian historian John Papa ‘Ī‘ī, himself a member of the *ali‘i* (chiefly class), described the king’s Waikīkī residence:

> Kamehameha’s houses were at Puaaliilii, makai [seaward] of the old road, and extended as far as the west side of the sands of Apuakehau. Within it was Helumoa where Kaahumanu ma went to while away the time. The king built a stone house there, enclosed by a fence; . . . [‘Ī‘ī 1959:17]

‘Ī‘ī (1959:17) further noted that the “place had long been a residence of chiefs. It is said that it had been Kekuapoi’s home, through her husband Kahahana, since the time of Kahekili.”

Chiefly residences were only one element of a complex of features sustaining a large population that characterized Waikīkī up through the pre-Contact period. Beginning at least by the fifteenth century, a vast system of irrigated taro fields was constructed, extending across the littoral plain from Waikīkī to lower Mānoa and Pālolo valleys. This field system, an impressive feat of engineering, the design of which is traditionally attributed to the chief Kalamakua, took advantage of streams descending from Makiki, Mānoa, and Pālolo Valleys, which also provided ample fresh water for the Hawaiians living in the *ahupua‘a*. Water was also available from springs in nearby Mō‘ili‘ili and Punahou. Closer to the Waikīkī shoreline, coconut groves and fishponds dotted the landscape. A continuous zone of population and cultivation, from the shoreline of present day Waikīkī Beach, extended north well into Mānoa Valley. The western and eastern bounds of this zone are less clear, and there are no specific references to Waikīkī’s abundance reaching into the Kewalo region.

A basic description of Honolulu and Kou, up to Western Contact, is given by E.S. Craighill and Elizabeth Handy:

> What is now Honolulu was originally that flatland area between the lower ends of Nuʻuanu and Pauoa Valleys and the harbor. [W.D.] Westervelt . . . wrote that ʻHonolulu was probably a name given to a very rich district of farm land near what is now . . . the junction of Liliha and School Streets, because its chief was Honolulu, one of the high chiefs at the time of Kakuhihewa'. . . . It is probable that the chief referred to by Westervelt took his name from the harbor and adjoining land. The original name of the land where the town grew when the harbor became a haven for foreign ships was Kou. . . . The number of *heiau* in this area indicates that it was a place of first importance before the era of foreign contact. [Handy and Handy 1972:479]

Rev. Hiram Bingham, arriving in Honolulu in 1820, described a still predominantly Native Hawaiian environment—still a "village"—on the brink of western-induced transformations:

> We can anchor in the roadstead abreast of Honolulu village, on the south side of the island, about 17 miles from the eastern extremity. . . . Passing through the irregular village of some thousands of inhabitants, whose grass thatched habitations were mostly small and mean, while some were more spacious, we walked about a mile northwardly to the opening of the valley of Pauoa, then turning southeasterly, ascending to the top of Punchbowl Hill, an extinguished crater, whose base bounds the northeast part of the village or town. . . . Below us, on the south and west, spread the plain of Honolulu, having its fishponds and salt making pools along the seashore, the village and fort between us and the harbor, and the valley stretching a few miles north into the interior, which presented its scattered habitations and numerous beds of kalo (arum esculentum) in its various stages of growth, with its large green leaves, beautifully embossed on the silvery water, in which it flourishes. [Bingham 1847:92-93]

The Kukuluāeʻo region would have been in Bingham's view as he stood atop "Punchbowl Hill" looking toward Waikīkī to the south; it would have comprised part of the area he describes as the "plain of Honolulu" with its "fishponds and salt making pools along the seashore."

Another visitor to Honolulu in the 1820s, Captain Jacobus Boelen, hints at the possible pre-Contact character of Honolulu and its environs, including the Kukuluāeʻo area:

> It would be difficult to say much about Honoruru. On its southern side is the harbor or the basin of that name (which as a result of variations in pronunciation [*sic*] is also written as Honolulu, and on some maps, Honoonoono). The landlocked side in the northwest consists mostly of tarro fields. More to the north there are some sugar plantations and a sugar mill, worked by a team of mules. From the north toward the east, where the beach forms the bight of Whytetee, the soil around the village is less fertile, or at least not greatly cultivated. [Boelen 1988:62]

Boelen's description implies that the Kukuluāeʻo region and the present study area are within a "not greatly cultivated" region of Honolulu perhaps extending from Pūowaina (Punchbowl Crater) at the north through Kakaʻako to the Kālia portion of Waikīkī in the east.

An early, somewhat generalized depiction of the pre-Contact Native Hawaiian shaping of Waikīkī, Honolulu, and the Kukuluāe‘o region is given on an 1817 map by Otto von Kotzebue (1821), commander of the Russian ship *Rurick*, who had visited O‘ahu the previous year. The map (Figure 10) shows taro *lo‘i* (the rectangles, representing irrigated fields) massed around the streams descending from Nu‘uanu and Mānoa valleys. The depicted areas of population and habitation concentration (illustrated by the trapezoids) probably reflect distortions caused by the post-Contact shift of Hawaiians to the area around Honolulu harbor—the only sheltered landing on O‘ahu and the center of increasing trade with visiting foreign vessels. Kamehameha himself had moved from Waikīkī to Honolulu in 1809.

Kotzebue’s map illustrates that the land between Pūowaina (Punchbowl Crater) and the shoreline—which would include the Kukuluāe‘o area—formed a “break” between the heavily populated and cultivated centers of Honolulu and Waikīkī; the area is only characterized by fishponds, salt ponds, trails connecting Honolulu and Waikīkī, and occasional taro *lo‘i* and habitation sites.

A clearer picture of Kukuluāe‘o and the present project area develops with accounts of other visitors to and settlers of Honolulu during the first half of the nineteenth century. Gorman D. Gilman, who arrived in Honolulu in 1841, recalled in a memoir the limits of Honolulu during the early 1840s:

> The boundaries of the old town may be said to have been, on the *makai* [seaward] side, the waters of the harbor; on the *mauka* [inland] side, Beretania street; on the Waikīkī side [i.e. the area just beyond Punchbowl Street], the barren and dusty plain, and on the Ewa [west] side, the Nuuanu Stream. [Gilman 1903:97]

Gilman further describes the “barren and dusty plain” beyond (east of) Punchbowl Street:

> The next and last street running parallel [he had been describing the streets running *mauka-makai*, or from the mountains to the shore] was that known as Punchbowl Street. There was on the entire length of this street, from the *makai* side to the slopes of Punchbowl, but one residence, the two-story house of Mr. Henry Diamond, *mauka* of King Street. Beyond the street was the old Kawaiahao church and burying ground. A more forsaken, desolate looking place than the latter can scarcely be imagined. One, to see it in its present attractiveness of fences, trees and shrubbery, can hardly believe its former desolation, when without enclosure, horses and cattle had free access to the whole place. [Gilman 1903:89]

That the environs of the missionary enclave and Kawaiaha‘o Church were indeed “forsaken” and “desolate looking” in the 1820s when the missionaries first settled there is confirmed in the memoirs of the American missionary C.S. Stewart who, arriving on Maui after living at the mission, declared Lahaina to be “like the delights of an Eden” after “four weeks residence on the dreary plain of Honoruru” (Stewart 1970:177). It is likely these descriptions of the Honolulu plain also include—at least for western sensibilities—the Kukuluāe‘o region. The barrenness of the Kukuluāe‘o area is illustrated in two sketches, one made in 1834 (Figure 11) when Kawaiaha‘o Church was still a long grass-thatched building and one made in 1853 (Figure 12) after the grass hut had been replaced by a large coral stone structure with a steeple. Between Kawaiaha‘o Church and the sea are only a few scattered huts along the shore and aligned along the inland trail, (now

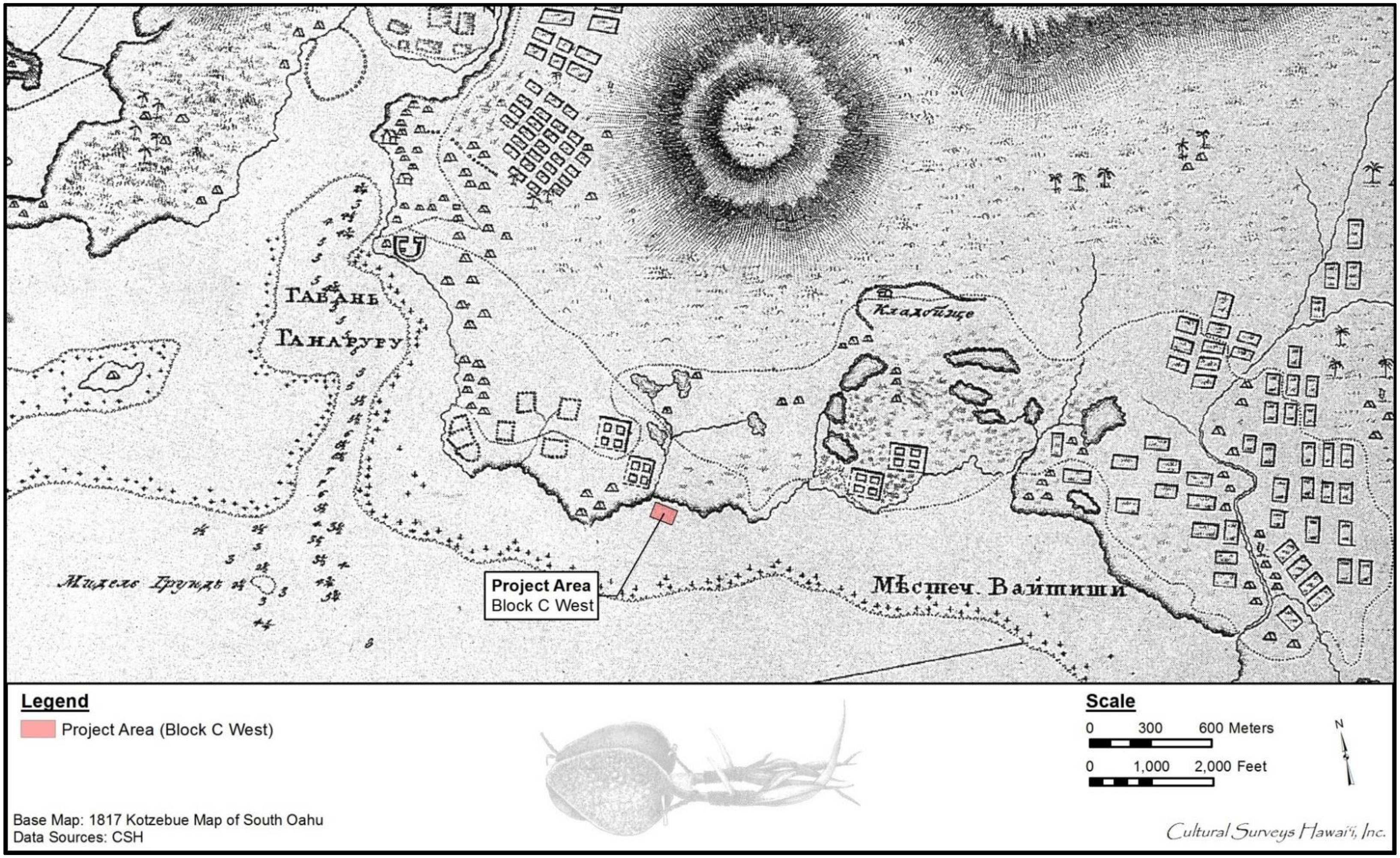

Figure 10. The 1817 map by Otto von Kotzebue of the Russian ship *Rurick* shows taro *lo'i*, fishponds, and salt pans in Honolulu and Waikīkī; few habitations are depicted along much of the shoreline portions near the project area (map reprinted in Fitzpatrick 1986:48-49). (Note: Although geo-referencing in this map places the project area offshore, in historic times the block was always back from the shore)

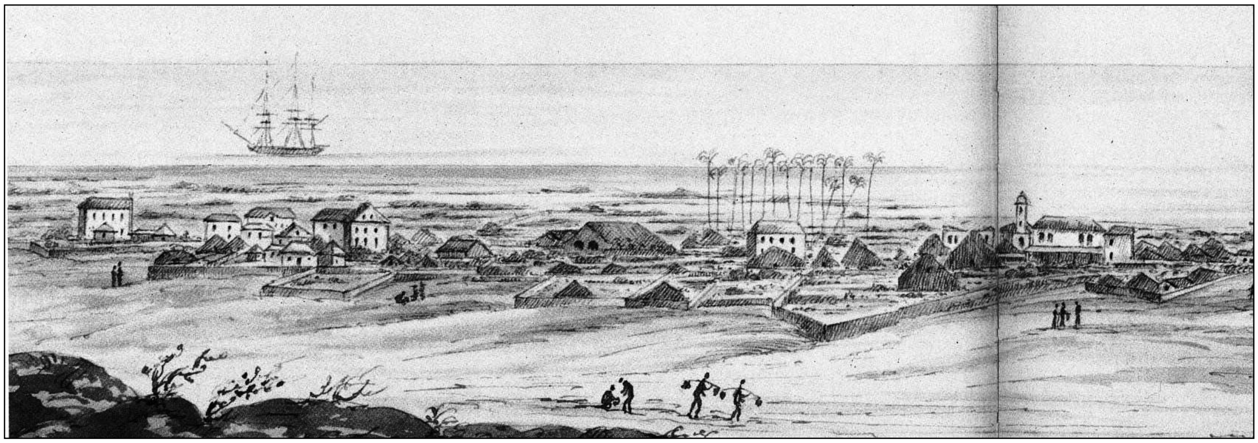

Figure 11. "Town of Honolulu: Island of Woahoo: Sandwich Islands," portion of 1834 sketch by anonymous illustrator; the project area is west and south (left and back) of Kawaiahaʻo Church, the long thatched structure in the center of the sketch (original sketch at Bernice Pauahi Bishop Museum; reprinted in Grant 2000:64-65)

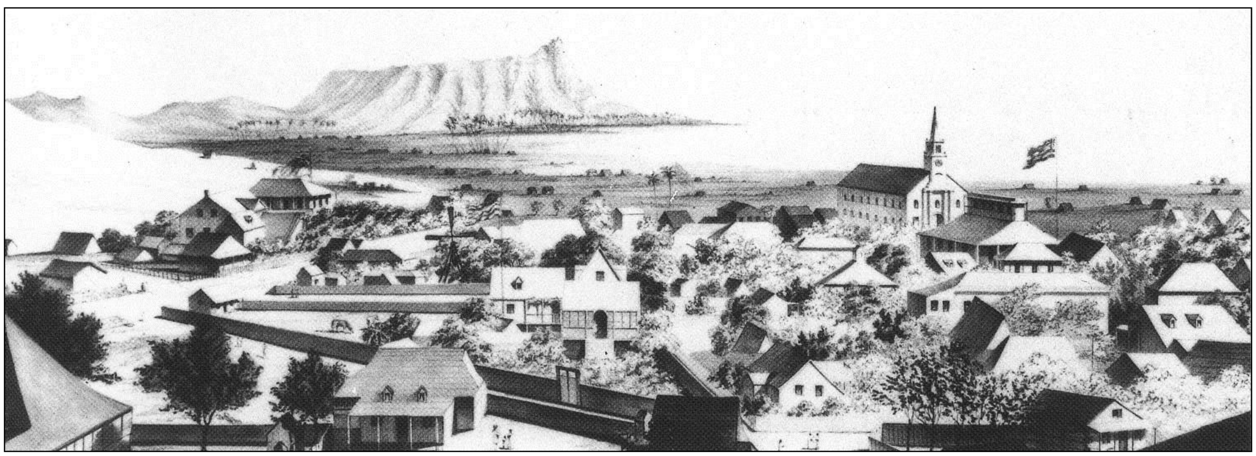

Figure 12. "View of Honolulu from the Catholic Church No. 2," central panel of sketch by Paul Emmert ca. 1853; the project area is west and south (left and back) of the coral-block Kawaiahaʻo Church (structure with steeple completed in 1842) (original sketch at Hawaiian Historical Society; reprinted in Grant 2000:5)

covered by King Street). The project area would be *makai* and left (east) of the church along the shore. An 1887 photograph (Figure 13, Figure 14) of the area also shows the marshy nature of the area, with only scattered houses near the ponds or near the shore *makai* of Kawaiahaʻo Church. The missionary families grazed their cows in the lands *makai* of the mission houses, possibly on lands within the project area (*Paradise of the Pacific* 1950:21).

3.4 Mid-Nineteenth Century and the Māhele

In 1845, the Board of Commissioners to Quiet Land Titles, also called the Land Commission, was established "for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property" (Chinen 1958:8). This led to the Māhele, the division of lands between the king of Hawaiʻi, the *aliʻi,* and the common people, which introduced the concept of private property into Hawaiian society. In 1848, Kamehameha III divided the land into four divisions: certain lands to be reserved for himself and the royal house were known as Crown Lands; lands set aside to generate revenue for the government were known as Government Lands; lands claimed by *aliʻi* and their *konohiki* (supervisors) were called Konohiki Lands; and habitation and agricultural plots claimed by the common people were called *kuleana* (Chinen 1958:8-15). The common people presented their claim, several witnesses confirmed that the person lived on or used the land, the parcel was surveyed, and the claimant was presented with the award.

The *ʻili* of Kukuluāeʻo (LCA 387) was awarded to the American Board of Commissioners for Foreign Missions (ABCFM). The claim (in English) with witness testimony and the award (in Hawaiian) with a map of the surveyed lot are presented in Appendix B. Initially this land was associated with Punahou School in Makiki and Mānoa Valley, as Chief Boki gave the Punahou lands to Hiram Bingham, pastor of Kawaiahaʻo Church in 1829 (DeLeon 1978:3), as stated in the LCA testimony:

> The boundaries of that part which lies on the sea shore we cannot define so definitely, but presume there will be no difficulty in determining them as it is commonly known as pertaining to Punahou. This part embraces fishing grounds, coral flats & salt beds. [Land Commission Award 387; see Appendix B]

In the Māhele, however, this sea land became "detached" from the Mānoa award and was instead given to the pastor of the Kawaiahaʻo Church, as noted in Punahou School history:

> There belonged in former times, as an appurtenance to the land known as Kapunahou, a valuable tract of salt-ponds, on the sea-side to the east-ward of Honolulu harbor, called Kukuluaeo, and including an area of seventy-seven acres. At the time of the settlement of land claims before the Land Commission, application was made for it by the successor of Mr. Bingham in the pastorate of Kawaiahao Church—he believing it to be a glebe land for the support of that church. His claim was resisted by the then Principal of Punahou School, but without success, and a Royal Patent was issued, severing it from the Punahou estate, and awarding it to the applicant as his private property. [Punahou School and Oahu College 1866]

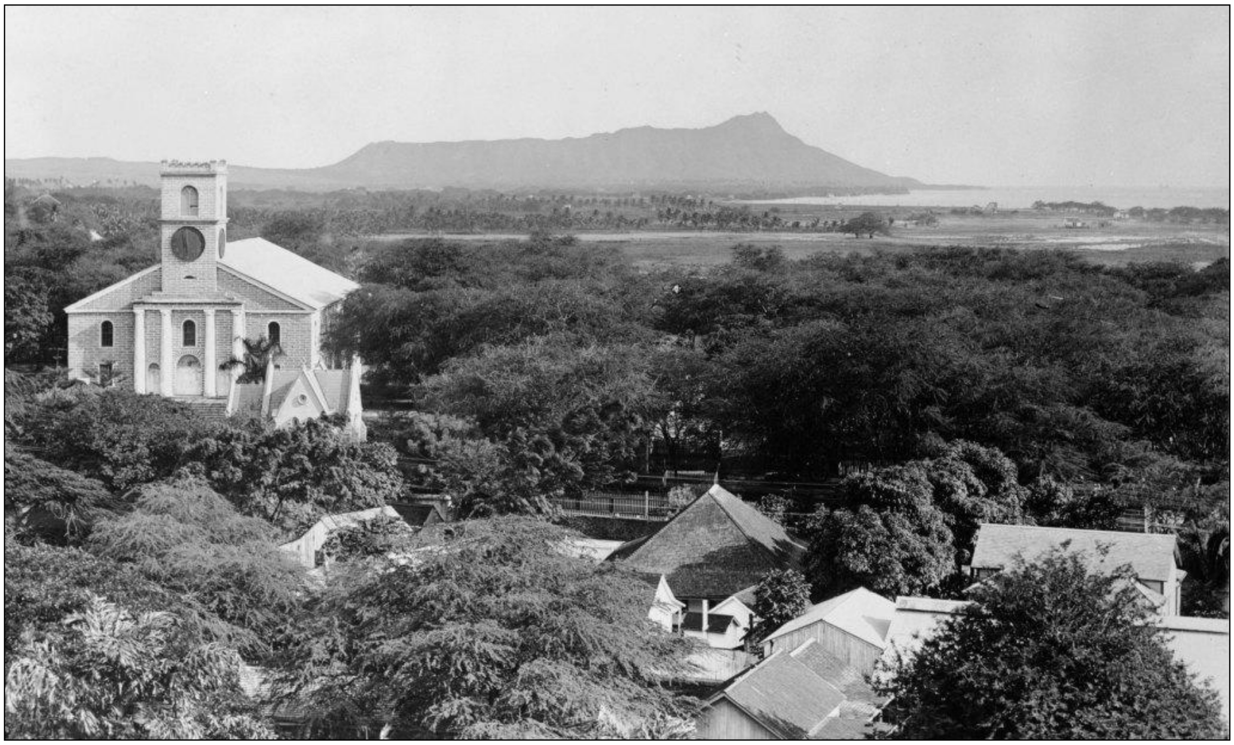

Figure 13. Kawaiahaʻo Church and Honuakaha Village, ca. 1887 photograph; the Ward's House roof cupola, on the mauka end of Old Plantation, can be seen to the left of the church steeple; the project area is within the marshlands in the right upper background (Hawaiʻi State Archives, Henry L. Chase Collection; reprinted in Stone 1983:84-85)

Figure 14. Kakaʻako area, portion of a ca. 1887 (see Figure 13 above), close-up of right upper background area, showing marshlands and scattered huts along the coast

Within this larger award were eight ‘*āpana* (lots) of five *kuleana* awards to commoners: LCA 1503 (*‘Āpana* 1, 2, and 3), LCA 1504, LCA 1903 (*‘Āpana* 2), LCA 9549, and LCA 10463 (*‘Āpana* 1 and 2). The 1884 map by Sereno Bishop shows the location of these LCA parcels, and other parcels outside the project area. This figure (Figure 15) is color-coded to match the description of lands indicated in the LCA testimonies, blue for fishponds, yellow for salt ponds or salt lands, and orange for house lots. As can be seen, the salt lands are mainly along the coast, the fishponds are usually located *mauka* of Queen Street, and the house lots are clustered around established roads, especially Queen and King Streets.

The nearest LCA parcel to the Block C West project area was LCA 1903 to Lolohi. The claim and award documents for this award are presented in full in Appendix C. In his claim, he mentions the parcel contained two salt beds, two *ho‘oliu* (salt water drainage ditch), two *poho kai* (depression where salt is gathered), and one salt *kula* (dryland). The land was given to his father “when Haaliho had returned from Briton. Lolohi’s parents had received it during the lifetime of Kinau . . .” Kīna‘u was the daughter of Kamehameha I and sister of Kamehameha III. She was the *kuhina nui* (generally analogous to a prime minister) to her brother from 1832 to his death in 1854 (Day 1984:78). Timothy Ha‘alilio was the private secretary to Kamehameha III who made a trip in 1842 to Washington, London, and Paris to get agreement on political independence for the Hawaiian Islands. He died in 1842 on the ship carrying his party back to Hawai‘i (Day 1984:47). Thus Lolohi’s family was given the land sometime between 1842 and 1854 (after Ha‘alilio’s death and before Kamehameha III’s death). Lolohi also claimed a second ‘*āpana*, a farm with taro patches in Kaliu, an *‘ili* of Honolulu. This *‘ili* is located near the corner of Liliha and Kuakini Streets in lower Nu‘uanu Valley.

3.5 Nineteenth Century Land Use in Kukuluāe‘o

3.5.1 Salt-Making

In the testimony for LCA 1903, four separate types of salt features are mentioned—the ponds near the shore that fill with salt water at high tide (*ālia*), the drains (*ho‘oliu*) where salt water is transferred to smaller clay-lined or leaf-lined channels, the natural depressions (or modified depressions) in the rocks along the shore where salt formed naturally (*poho kai*), and the salt *kula*, which was waste land, land that could probably not be used for agriculture as it was impregnated with salt. Lolohi did not live near his salt lands, but Pahiha, claimant of LCA 1504, did have a house near his fish pond and salt bed. The house was probably a simple grass hut, similar to those shown on an 1838 sketch entitled “Honolulu Salt Pans, Near Kakaako” and the one shown on an 1845 sketch of Kawaiaha‘o Church viewed from the “Old Salt Pans” (Figure 16 and Figure 17).

Salt was traditionally made by these methods before Western Contact for local use, but when Westerners began to land at the islands, salt became an important export commodity. In the next years after the discovery of the islands by Captain Cook in 1778, most visitors to the islands were British and American fur-traders, who stopped at Hawai‘i on their way to China. One reason for their visit was to stock up on food and water, but another purpose was to buy or trade for salt, which was used to cure seal and mammal pelts collected from the Northwest Coast.

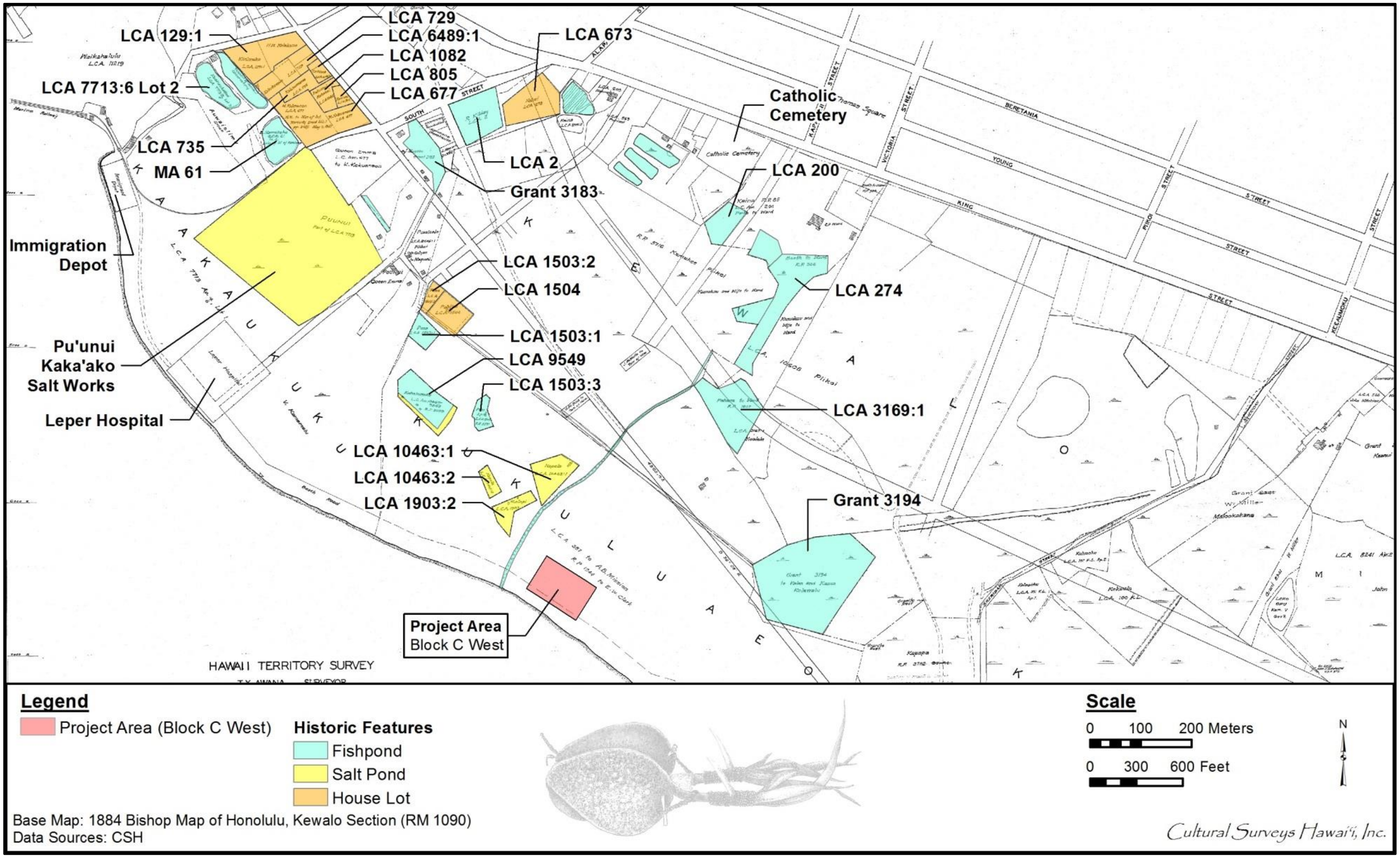

Figure 15. 1884 map of Honolulu, Kewalo Section (portion), by Sereno Bishop (Hawai‘i Land Survey Division, Registered Map 1090), showing the locations of LCA parcels, fishponds, salt lands, and house lots surrounding the project area

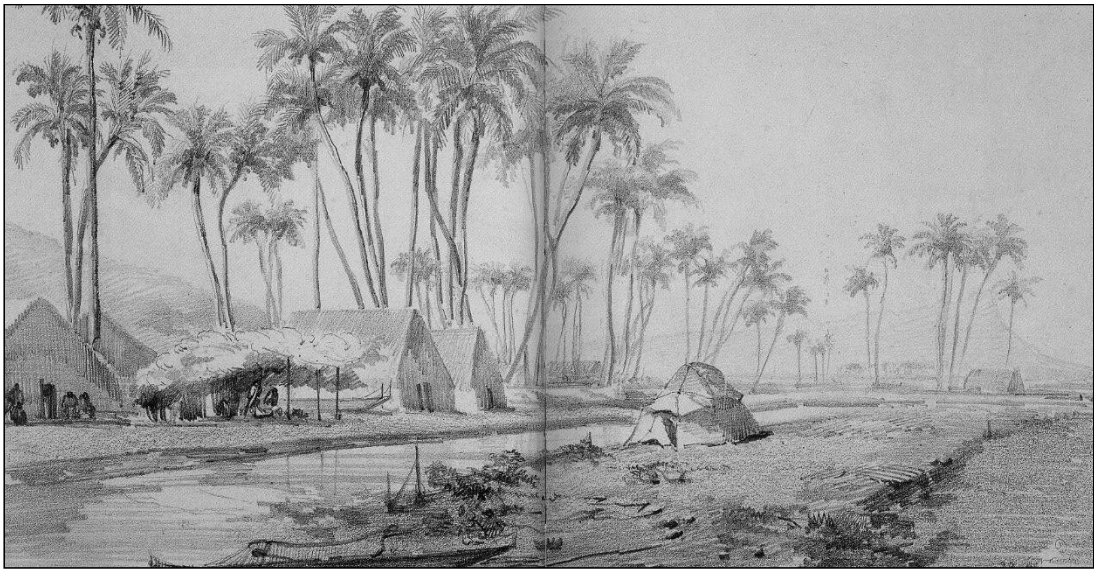

Figure 16. "Honolulu Salt Pan, near Kakaʻako," 1838 sketch drawn by a French visitor, Auguste Borget (original sketch at Peabody Essex Museum, Salem, Massachusetts; reprinted in Grant 2000:64-65)

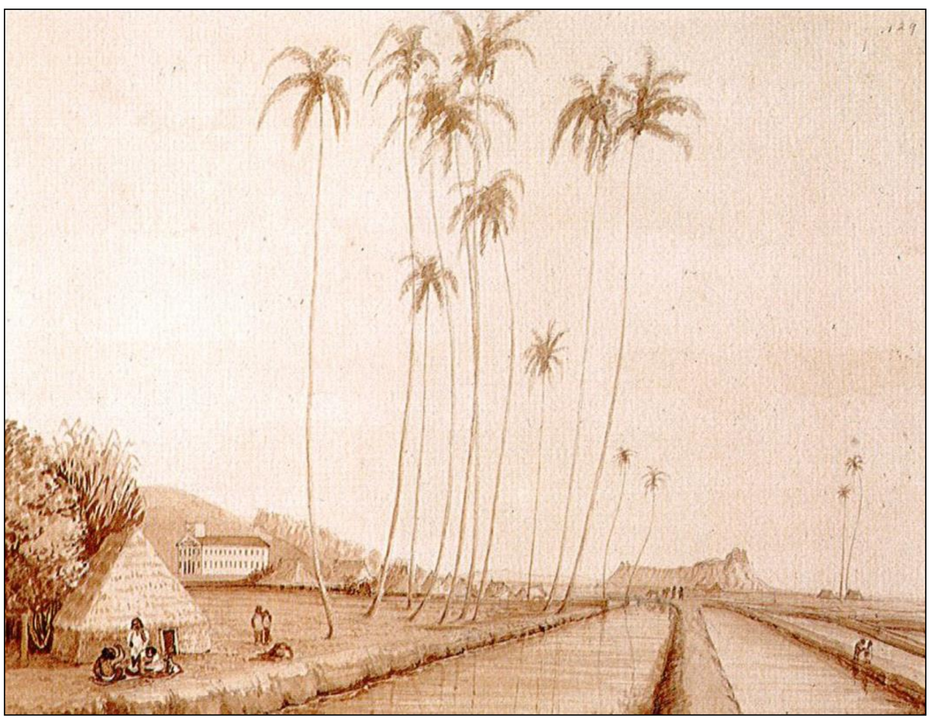

Figure 17. "Native Church [Kawaiahaʻo Church], Oahu, from the Old Salt Pans," 1845 sketch drawn by John B. Dale, from the U.S. Exploring Expedition led by Lt. Charles Wilkes (J. Welles Henderson Collection, reprinted in Forbes 1992:126); the sketch is probably from the salt pans in Kaʻākaukukui, west of the project area

During Kotzebue's visit in 1816 and 1817, he noted that "Salt and sandalwood were the chief items of export" (Thrum 1905:50).

> The journals of none mention the object of call other than for refreshments, though one, 3 some years later, records the scarcity and high price of salt at the several points touched at, with which to serve them in the curing of furs obtained on the coast. In all probability salt was the first article of export trade of the islands and an object, if not the object, of these pioneer fur-traders' call. [Thrum 1905:45]

In an article on Hawaiian salt works, Thomas Thrum (1924:112-117) discusses the large salt works at Ālia Paʻakai (Salt Lake in Moanalua) and at Puʻuloa on the western loch of Pearl Harbor. Kamakau (1961:409) reported "The king and Isaac of Puʻuloa are getting rich by running the salt water into patches and trading salt with other islands." The salt was sent to Russian settlements in the Pacific Northwest, where it was used to pack salmon and other fish (Thrum 1924:115, 117). Thrum also mentions a salt works in Kakaʻako.

> Honolulu had another salt-making section in early days, known as the Kakaako salt works, the property of Kamehameha IV, but leased to and conducted by E.O. Hall, and subsequently E.O. Hall & Son, until comparatively recent years. This enterprise was carried on very much after the ancient method of earth saltpans as described by Cook and Ellis. [Thrum 1924:116]

The Kakaʻako salt works shown on historic maps extended into the Block C West project area (Figure 18). This historic salt works consisted of grids of square salt evaporation pans, generally attended by Chinese workers.

The Chinese were involved in salt production, usually in concert with their management of fishponds. One son of a Chinese resident remembered (for ca. 1900) the Chinese form of salt production from salt pans bordering the sea, fed continually with seawater by the tides.

> Both the natural tides and the Chinese method of peddling a wooden wheel that transported water upward, helped to keep the salt beds damp with about three inches of water. After a few months, the senior Mau would drain off the remaining water and use a wooden rake with deep prongs to break up the salt. When the bed was dry a flat rake was used to flatten and smooth out the salt. Later it was raked into piles, packed in cloth bags and distributed. [Chong 1998:108]

3.5.2 The Ward Estate

The *mauka* portion of the Ward Estate (north of Queen Street) is within the *ʻili* of Kewalo, and was part of LCA 272 to Joseph Booth. Joseph Booth was an early English resident of the Hawaiian Islands who operated a saloon and hotel in Honolulu, known at the time of the Māhele as the Eagle Tavern (Greer 1994:54). He was granted lands in downtown Honolulu (where the tavern was located), in Kewalo Uka (Pacific Heights area), in the *ʻili* of Kapuni, and in an area with "Three fish ponds, and a part of the plain near the road leading to Waikiki." Little information on these three fishponds is given in the LCA testimony, but the Royal Patent No. 306 for these lands, mentions one known as "the large fishpond" or "long fishpond" (*loko ia nui*), which had two huts beside it. This pond would later be modified into the "lagoon" on the Ward estate.

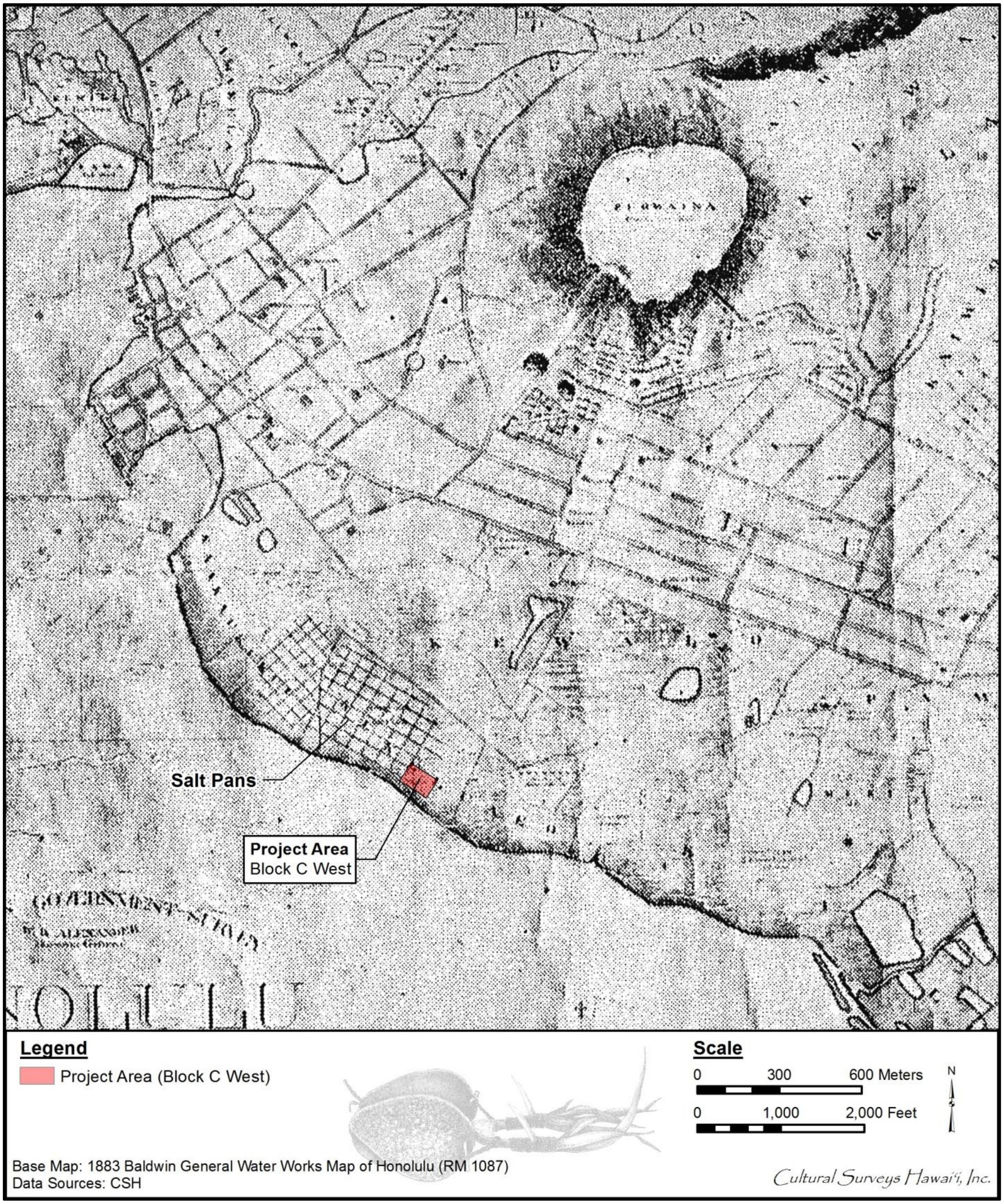

Figure 18. 1883 map of the Honolulu Water Works System by E.D. Baldwin (1883) (Hawaiʻi Land Survey Division, Registered Map 1087); the grid symbol extending into the project area represents salt pans

Curtis Perry Ward, a native of Kentucky, came to the Hawaiian Islands in 1853, and soon established a livery and draying business, moving goods from the harbor to Honolulu town and loading goods at the docks for the whaling and shipping industries. In 1865, he married Victoria Robinson, who was descended from the Hawaiian *ali‘i* and early French and British residents (Hustace 2000:21-29). For his new family, Ward purchased at auction the 12-acre estate of Joseph Booth, Royal Patent 306 and additional contiguous lands in the Kō‘ula area in 1870. This constituted the *mauka* portion of the "Old Plantation," from Thomas Square on King Street to the *makai* border at Waimanu Street. A few years later (before 1875), Ward added to his property with the purchase of 77 acres and 3,000 ft of ocean frontage in the *‘ili* of Kukuluāe‘o, *makai* of Queen Street (Hustace 2000:37-38) (Figure 19). The Wards had a permanent easement for the *‘auwai* (ditch) that extended from the long fishpond to the sea through the Kukuluāe‘o section (Figure 20). *Makaloa* grass, used to make mats and hats, grew along this *‘auwai* and was one source of income for the family (Hustace 2000:7-55). The alignment of this ditch is shown on Figure 21; today it is between the alignments of Ward Avenue and Cummins Street.

Workers were hired to clear the fishponds and ditches, plant taro in the fishponds, fence in pastures for the horse, plant 6,000 coconut trees, plant *kiawe* trees for firewood, and restore the *kāhaka* (salt pans) near the shore (Hustace 2000:41). A house in the southern style was built at the *mauka* end near King Street, and the fishponds were modified into a long "lagoon". An article in the *Pacific Commercial Advertiser* reported:

> In taking a drive out on the Kulaokahua continuation of King street, attention is attracted to the premises just beyond the Catholic cemetery, the property of Mr. C.P. Ward. The lot consists of some thirty acres, and is thickly planted with algaroba and, in rows, there are some seven thousand thrifty young cocoanut trees. . . . The algarobas will certainly be valuable as firewood, and the cocoanuts alone will in a few years produce a handsome income. The property is well watered by means of pumps driven by windmills, there being an inexhaustible supply of water a few feet below the surface of the plains. [*Pacific Commercial Advertiser*, 4 September 1875:3]

Income from the 111-acre estate was also generated by leasing the rights to the Kukuluāe‘o fishery, which was part of the Kukuluāe‘o LCA 387 award. After the death of her husband in 1882, Victoria Ward derived much of her income from "eggs, bananas, firewood, *‘awa*, taro leaf, *makaloa* grass, chickens, fish, hay, pigs, salt, white sand, *mānienie* grass, hides, butter, squid, and horses" (Hustace 2000:47) collected from the estate. On this estate, Victoria Ward raised her seven daughters, Mary (Mrs. Ernest Hay Wodehouse), Keakealani (Mrs. Robert Booth), Annie (Mrs. Wade Armstrong), Mele Elizabeth (Mrs. Frank Hustace, Sr.), and three unmarried daughters, Kathleen, Lucy, and Kulumanu Ward.

By 1901, most of the fishponds and salt pans *makai* of Queen Street were reported as abandoned. In that year, the Hawaii First Legislature Assembly (1901:185) proposed to build a ditch to drain away the "foul and filthy water that overflows that district at the present time."

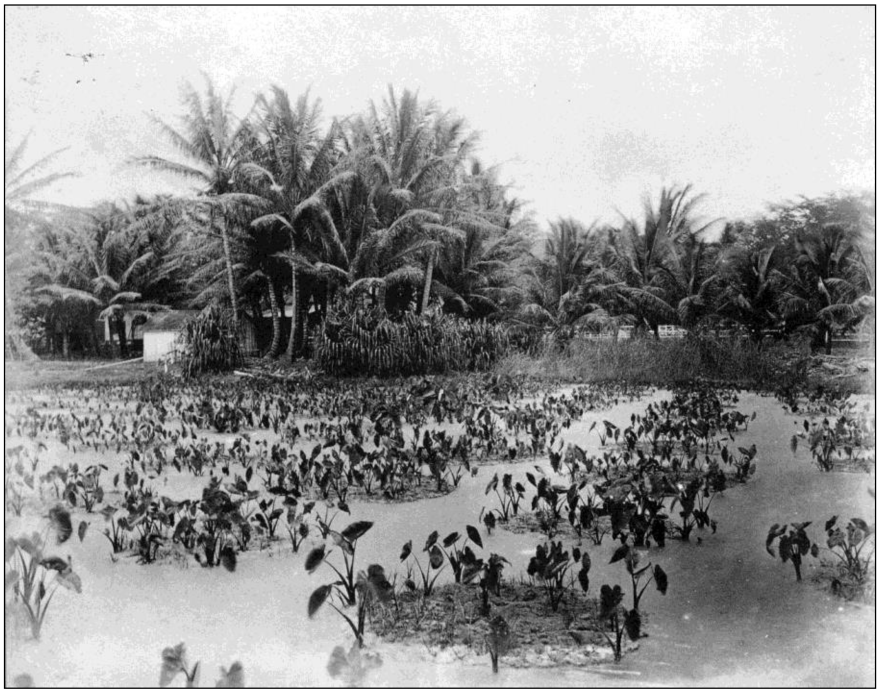

Figure 19. The Kukuluāeʻo portion of the Ward Estate, nineteenth century photograph (reprinted in Hustace 2000:49)

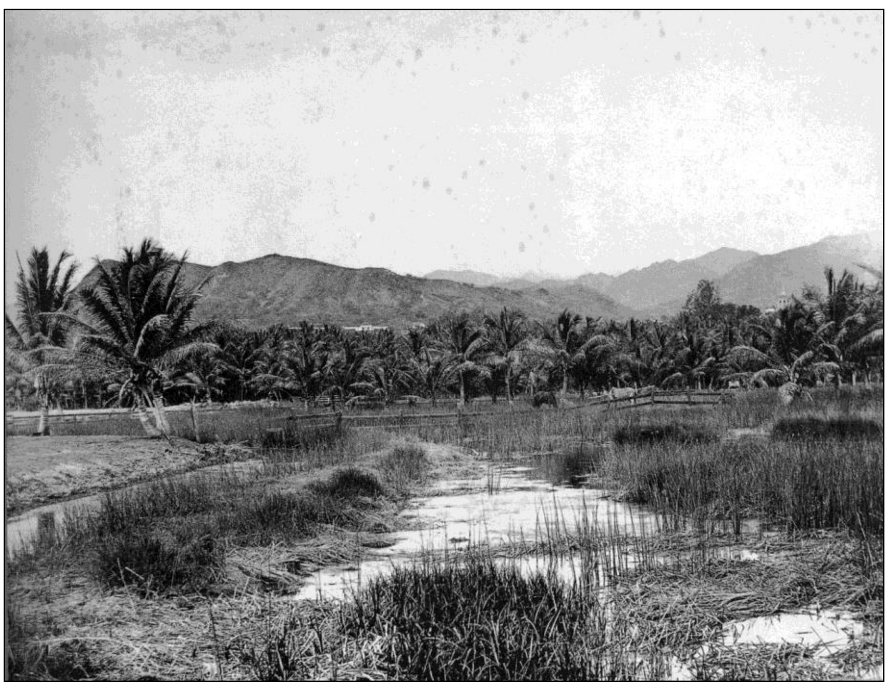

Figure 20. The Old Plantation *ʻauwai*, extending from the sea to the *mauka* "lagoon" of the Ward Estate, nineteenth century photograph, view north toward Punchbowl (Hustace 2000:51)

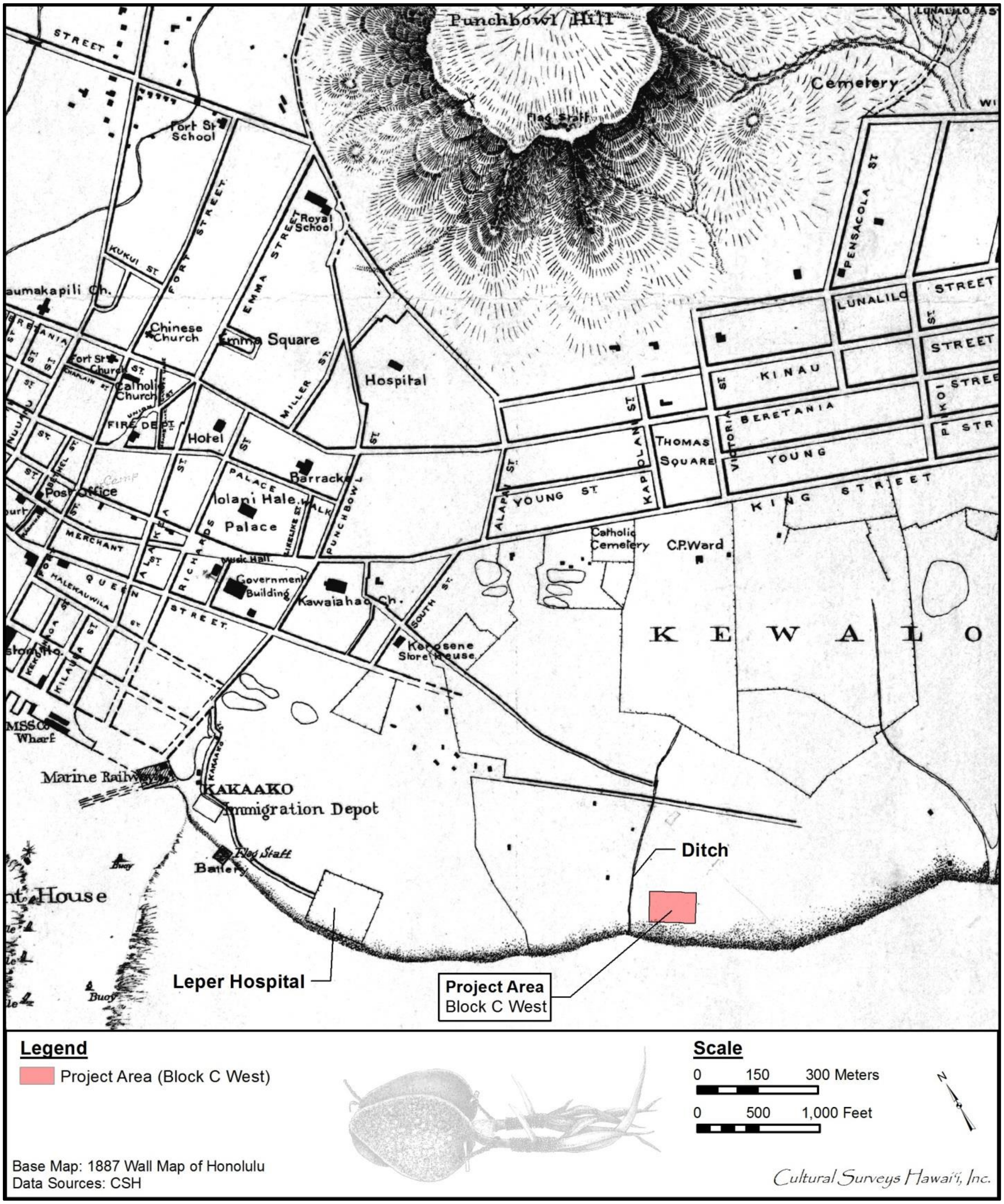

Figure 21. 1887 map of Honolulu (portion), by W.A. Wall (copy at Library of Congress, Geography and Map Division), showing the project area located to the east of the Ward Estate *ʻauwai*

> The district makai of King St. and the Catholic Cemetery, Ewa of Mrs. Ward's (the Old Plantation), mauka of Clayton St., and Waikiki of the land from King St., leading to the Hoomananaauao Church, consists of six large abandoned fish ponds and a large number of smaller ones, all in filthy condition, fed by springs and flowing into Peck's ditches. Just makai of these ponds, at the end of Clayton street, next to Mr. Ward's, is Peck's place. An artesian well flushing the wash houses flows into two foul ditches, thence to the big pond which is Waikiki of what used to be Cyclomere and next to Mrs. Ward's line [ditch] extending down to Waimanu St.
>
> The rear portion of Mrs. Ward's property down to Waimanu St. used to be fish ponds all connecting to the sea by a ditch which is fed by an artesian well. These ponds, with the exception of three, are abandoned. [Hawaii First Legislature Assembly 1901:185]

In 1930, Victoria Ward incorporated Victoria Ward, Limited to manage the estate. In 1957, the City and County of Honolulu purchased the *mauka* portion of the estate to construct the new Blaisdell Civic Center (Hustace 2000:67, 77).

3.6 **Twentieth Century Land Use**

3.6.1 Trash Burning and the Kaka‘ako and Kewalo Incinerators

In the early years of garbage disposal, all trash was dumped into low-lying ground or landfills, or burned in an open area. To reduce the volume of waste, plans were made to build incinerators, where "putrescible" (mainly animal and fish waste) trash could be burned in incinerators, while non-animal material, called "combustible" waste was still disposed of in the earlier method (Young 2005). Thomas Thrum reported on the first incinerator in the Kaka‘ako area in 1905:

> Early in the year was completed the long projected garbage crematory for the disposal, daily, of the city's refuse by a patent and sanitary process. It is located on the shore of Kakaako, adjoining the sewer pumping station; is two stories in height and built of brick. [Thrum 1906:177]
>
> The dredging of Honolulu harbor and its channel is completed as far as planned for the present, and excavations for the *Alakea* and *Kinau* slips finished, the material therefrom being used to fill in a large area of Kakaako and the flats in the vicinity of the sewer pumping station and garbage crematory. The amount of material removed by the Federal dredging was a million and a half cubic yards. [Thrum 1907:148–149]

For the incinerator, Thrum noted:

> The new station is built on piles on reclaimed land that is being filled in from the coral dredgings that is going on, and is gradually taking on a tropical appearance. . . . Adjoining its premises on the mauka side is the new building designed for the Planters's Association for their labor bureau. [Thrum 1907:148–149]

In the early 1920s, trash was burned in the open at the Ala Moana Dump (landfill area *makai* of Ala Moana Boulevard) (Figure 22). The Hawaii Public Works recommended that an incinerator

Figure 22. Open-air burning of trash in area between Kewalo Basin and Ala Moana Park, 1921 photograph (Hill 1921, reprinted in Scott 1968:578)

should be built for the burning of "putrescible" waste. The Kewalo Incinerator (Incinerator Number 1) was built in the Italianate-style, at the intersection of Ahui and Olomehana Streets in1930 by the City and County of Honolulu. The facility was built to dispose of waste from the Ala Moana dump and use the ash to fill the seawall in Kaʻākaukukui in the late 1940s to create 29 additional acres of land, adjacent to Fort Armstrong (Figure 23). It ceased operations in 1945 when a new incinerator was built on Ohe Street. The second incinerator, built on Ohe Street in 1946–1948 was used for waste burning until 1997 (Mason Architects 2002).

3.6.2 Kakaʻako Reclamation

The first efforts to deepen Honolulu Harbor were made in the 1840s. The idea to use this dredged material, composed of sand and crushed coral, to fill in low-lying lands, was quickly adopted. Between 1857 and 1870, the "Esplanade" between Fort and Alakea streets was created on 22 acres of filled-in former reef and tideland. By 1874, Sand (Quarantine) Island, site of the first immigration station, had been created over "reclaimed" land on reefs (Hawaiʻi Department of Transportation, Harbors Division 2007:3).

By the 1880s, filling-in of the mud flats, marshes, salt ponds in the Kakaʻako and Kewalo areas had begun. This filling was pushed by three separate but overlapping improvement justifications. The first directive or justification was for the construction of new roads and raising the grade of older roads so improvements would not be washed away by flooding during heavy rains. A report by the Hawaii Board of Health (1908) noted:

> I beg to call attention to the built-up section of Kewalo, 'Kakaʻako,' where extensive street improvements, filling and grading have been done. This, no doubt, is greatly appreciated and desirable to the property owners of that locality, but from

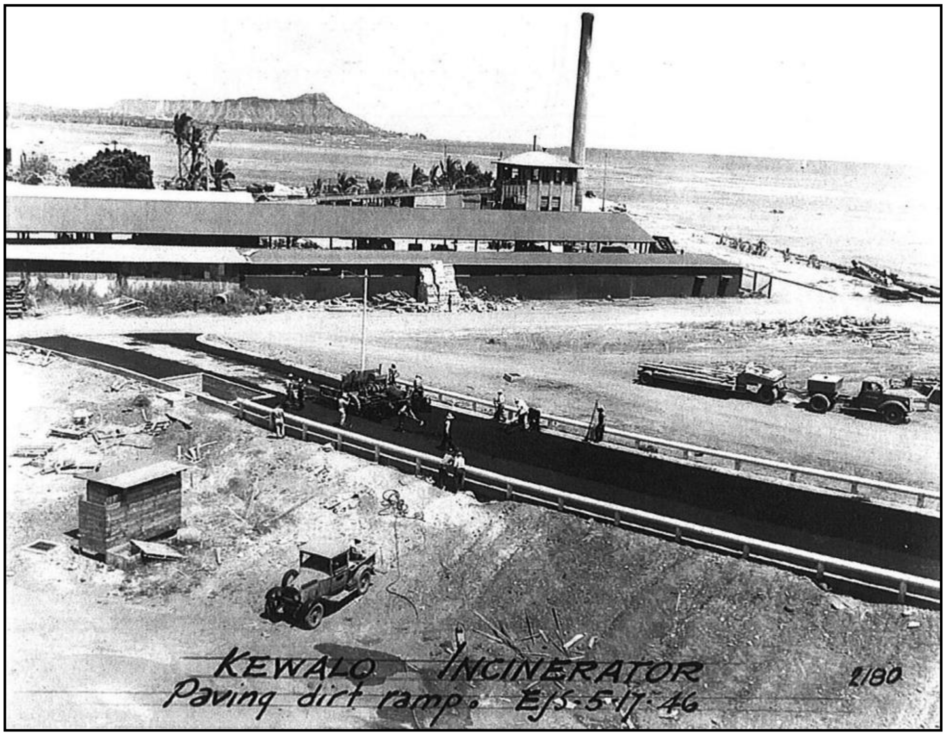

Figure 23. 1946 photograph of the Kewalo Incinerator No. 1, west side of Kewalo Harbor (Mason Architects 2002)

> a sanitary point of view is dangerous, inasmuch as no provision has been made to drain the improved section, on which have been erected neat cottages occupied for the greater part by Hawaiian and Portuguese families, now being from one to three feet below the street surface, and which will be entirely flooded during the rainy season. Unless this is remedied this locality will be susceptible to an outbreak [of cholera] such as we experienced in the past. [Hawaii Board of Health 1908:80]

As mentioned in the above section, the justification most frequently cited was public health and sanitation, the desire to clean up rivers and ponds that were reservoirs for diseases such as cholera and that acted as breeding places for rats and mosquitoes. Thus as early as 1902, it is reported that:

> The Board [of Health] has paid a great deal of attention to low-lying stagnant ponds in different parts of the city, and has condemned a number of them. The Superintendent of Public Works has given great assistance to seeing that the ponds condemned by the Board are filled. In September a pond on South Street was condemned as deleterious to the public health. [Hawaii Board of Health 1902:80]

The first areas to be filled were those closest to Honolulu town, then areas moving outwards to Kaka‘ako (Griffin et al. 1987:13). The first fill material may have been set down for the Kaka‘ako Leper Branch Hospital (between Coral and Keawe Streets), which had been built on a salt marsh. Laborers were hired to “haul in wagonloads of rubble and earth to fill up that end of the marsh” (Hanley and Bushnell 1980:113). In 1903, five more lots in Kewalo, on Laniwai, Queen, and Cooke Streets, were condemned and order to be filled (Hawaii Board of Health 1903:6).

A main concern in this area was the Kaka‘ako Ditch, which originated from the large fishponds in the *mauka* portion of the Ward Estate and extended to the sea. A Hawaii legislature report of 1901 asked for an appropriation to build a new drainage ditch through the Kewalo district to address problems with older ditches:

> The district makai of King St. and the Catholic Cemetery, Ewa of Mrs. Ward’s (the Old Plantation) . . . consists of six large abandoned fish ponds and a large number of smaller ones, all in filthy condition, fed by springs and flowing into Peck’s ditches. . . . The rear portion of Mrs. Ward’s property down to Waimanu St. used to be fish ponds all connecting to the sea by a ditch which is fed by an artesian well. These ponds, with the exception of three, are abandoned.
>
> When Desky opened Kewalo for settlement he dug a ditch from the pond on Peck’s place along Waimanu St. to Mrs. Ward’s ditch, and drained all the above described property. A law suit ensued, as the foul water drove away the fish, and the connecting ditch was torn out . . . and a dyke wall was built between Mr. Ward’s and Peck’s.
>
> The result was that as the Kakaako ditch, at the point of juncture with Peck’s ditch, was too high, the water in Peck’s ditch rose and backed up . . . and as it must necessarily go somewhere, it overflowed its banks and at present Ward avenue from end to end is a big pond with no footing for pedestrians, and a carriage driven through the other day sank to the body of the same in water and mud. [Hawaii First Legislative Assembly 1901:186]

Although public health and safety were prominently cited, according to Nakamura (1979), the main desire (and third justification) to fill in Honolulu, Kewalo, and then Waikīkī lands was to provide more room for residential subdivisions, industrial areas, and finally tourist resorts. In the early part of the twentieth century, Kaka‘ako was becoming a prime spot for large industrial complexes, such as iron works, lumber yards, and draying companies, which needed large spaces for their stables, feed lots, and wagon sheds. In 1900 (Thrum 1901:172), the Honolulu Iron Works, which produced most of the large equipment for the Hawaiian plantation sugar mills, moved from their old location at Queen and Merchant Streets near downtown Honolulu to the shore at Kaka‘ako, on land that had been filled from dredged material during the deepening of Honolulu Harbor. Other businesses soon followed. Thrum (1902) noted:

> The Union Feed Co. is another concern whose business has outgrown the limits of its old location, corner of Queen and Edinburgh streets. Like the Iron Works Co. they have secured spacious premises at Kakaako, erecting buildings specially adapted to the needs of their extensive business at the corner of Ala Moana (Ocean Road) and South Street. [Thrum 1902:168]

Private enterprises were not the only new occupants of Kaka‘ako. A sewer pumping station, an immigrant station, and a garbage incinerator were also built on “reclaimed land.” For the incinerator, Thrum noted:

> The new station is built on piles on reclaimed land that is being filled in from the coral dredgings that is going on, and is gradually taking on a tropical appearance. .

> . . Adjoining its premises on the mauka side is the new building designed for the Planters's Association for their labor bureau. [Thrum 1907:148–149]

The new immigration station had seven large rooms for dormitories, surrounded by a breezy, open *lanai*, where immigrant workers would stay while waiting for clearance to go to their new work places on the sugar plantations. Adjacent to the dormitory was a hospital, which was used to check the new immigrants for any "loathsome or dangerous contagious disease" (Hawaii Governor 1905:77). The hospital was also used during epidemics to isolate contagious patients suffering from diseases such as smallpox, cholera, or plague.

In 1900, a pond surrounded by a bicycle racing track, called the Cyclomere (built in 1897), in the Kewalo area was filled. This was located on the *makai* side of Kapiʻolani Avenue between Cooke Street and Ward Avenue. In 1904, the area around South Street from King to Queen Streets was filled in. The Hawaii Department of Public Works (1904:7) reported "considerable filling [was] required" for the extension of Queen Street, from South Street to Ward Avenue, which would "greatly relieve the district of Kewalo in the wet season."

3.6.3 Kewalo Reclamation Project

Although the Board of Health could condemn a property and the Department of Public Works could then fill in the land, the process was rather arbitrary and piecemeal. In 1910, after an epidemic of bubonic plague, the Board of Health condemned a large section of Kewalo, consisting of 140 land parcels, (including areas once known as Kukuluāeʻo and Kaʻākaukukui), which had numerous ponds (Hawaii Department of Public Works 1914:196).

In 1914, the entire

> . . . locality bounded by King street, Ward avenue, Ala Moana and South street, comprising a total area of about two hundred acres, had been found by the board of health of the Territory to be deleterious to the public health in consequence of being low and below 'the established grades of the street nearest thereto' and at times covered or partly covered by water and improperly drained and incapable by reasonable expenditure of effectual drainage, and that said lands were in an insanitary and dangerous condition. [Hawaii Reports 1915:329]

The superintendent then sent a letter to all of the property owners, informing them that they must fill in the lands to the grade of the street level within sixty days. Only a few of the land owners complied, filling their land with a variety of materials. Most of the land owners did not comply with this notice, and in 1912 the bid to fill in the land was given to Lord-Young Engineering Company to fill in the land with "sand, coral and material dredged from the harbor or reef and the depositing of the same upon the land by the hydraulic method" (Hawaii Reports1915:331). The recalcitrant land owners sued to stop the work, and in the suit, the method of hydraulic filling is described:

> By this [hydraulic] method the material dredged is carried in suspension or by the influence of water which is forced through large pipes and laid upon the lands and intervening streets, and afterwards is distributed and leveled, the water having drained off through ditches provided for the purpose. The work is done in large sections around which bulkheads have been constructed. A section can be filled in about thirty days, the dredger working about fifteen hours per day. And in about

> two months after a section has been filled the ground will have dried out so as to be fit for use as before. . . . The character of the material varies from very fine sand to coarse bits of coral . . .
>
> It appears in evidence that though the method employed the finest of the material which is carried upon the land settles when the water which transports it becomes quiet and as the water runs off a sludge or mud remains which forms a strata more or less impervious to water. This strata, however, is covered by the coarser and more porous material. . . . it appears that by mixing in to a depth of a few inches ordinary soil small plants will grow without difficulty. . . . The character of the locality must be considered. It is not adapted to agriculture, but is suited more particularly to such business purposes as it is now partly used for, such as stables, laundries, warehouses, mills, etc., and for cottages with small yards for the accommodation of laborers engaged in connection therewith. Upon the whole, we are of the opinion that the material proposed to be used in the fill-in of the lands of the complainants is not of a character as should be held to be improper for any of the reasons urged. [Hawaii Reports 1914:351]

The first land to be filled in was the portion of the Ward Estate Kukuluāeʻo property west of Ward Avenue, which was completely filled in by June 1913. In July "25,000 cubic yards of sand and ground-up coral were deposited on the Bishop Estate in the vicinity of Ala Moana and Keawe street, the reason for shifting operations to this part of the district being that the Hawaiian Sugar Planter's Association had erected a reinforced concrete building there and wished to have the lot brought to grade" (Hawaii Department of Public Works 1914:198). By August, the rest of the Ward Kukuluāeʻo lands west of Ward Avenue had been completely filled and by February 1914, all of the land from South Street to Ward Street, and from Ala Moana to Queen Street had been filled.

Legal proceedings in 1914 did manage to shut down operations planned for the area from Ward Street to Waikīkī but the filling in was eventually completed (Thrum 1916:159-160). This land was mainly owned by the Bishop Estate, which leased the land to small farmers growing taro and rice and raising ducks in the ponds. In 1916, the Bishop Estate announced that as soon as their present tenant leases expired, they planned to fill the lands and divide them into residence and business lots (Larrison 1917:148-149). In 1919, a portion of the coastal section of the Bishop Estate lands was secured by the government in order to expand Kewalo Basin (Thrum 1920:148).

3.6.4 Kewalo Basin Dredging

Prior to dredging, Kewalo Basin was a natural deep pocket in the reef seaward of Ala Moana Boulevard between Ward Avenue and Kamakeʻe Street. It had been used as a canoe landing in pre-Contact times. In 1919, the Hawaii Government appropriated $130,000 to improve the small harbor of Kewalo for the aim of "harbor extension in that it will be made to serve the fishing and other small craft, to the relief of Honolulu harbor proper" (Thrum 1920:147). As the area chosen for the harbor area was adjacent to several lumber yards, the basin was initially made to provide docking for lumber schooners, but by the time the wharf was completed in 1926, this import business had faded, so the harbor was used mainly by commercial fishermen. The dredged material from the basin was used to fill a portion of the Bishop Estate on the western edge of Waikīkī and some of the Ward Estate in the coastal area east of Ward Avenue (U. S. Department of Interior

1920:52). The new basin and the coral fill, used to fill inland areas and make new land offshore, can be seen in a 1933 oblique aerial photograph of Kaka‘ako and Waikīkī (Figure 24). In 1941, the basin was dredged and expanded to its current 55 acres. In 1955, dredged material was placed along the *makai* side to form an 8-acre land section protected by a revetment, now part of the Kewalo Basin Park (Kewalo Basin Harbor 2013).

3.6.5 Waikīkī Reclamation Project

It was during the 1920s that southeast O’ahu would be transformed when the construction of the Ala Wai Drainage Canal—begun in 1921 and completed eight years later—resulted in the draining and filling in of the remaining ponds and irrigated fields of Honolulu and Waikīkī. The canal was one element of a plan to urbanize Waikīkī and the surrounding districts, first conceived in 1906. Dredging for the Ala Wai Canal began in 1921 and was completed seven years later. The final result was a “canal three miles long, with an average depth of twenty-five feet and a breadth of two hundred fifty feet” (*Honolulu Advertiser,* 17 October 1928:2:16).

The land surface of modern Honolulu and Waikīkī is situated on the result of this decade-long dredging and fill project of which the creation of the Ala Wai Canal was part. In Nakamura’s (1979:113) *The Story of Waikīkī and the Reclamation Project*, he writes that this land “reclamation” program, under the subterfuge of “drainage” and “sanitation,” changed the ecology of Waikīkī from a once viable and important agriculture and aquaculture center. Many of the original property owners lost their land or had serious damage to their property as a result of the reclamation activities and/or the costly expense for the mandatory filling in of their properties.

3.7 Twentieth Century Commercial and Residential Development

Subsequent maps show the future development of the Kukuluāe‘o area in a grid of streets extending from Honolulu town towards Waikīkī. Other maps and documents generated during the last decades of the nineteenth century and first decades of the twentieth century reveal the disappearance of the traditional Hawaiian landscape of Kukuluāe‘o, including the conversion of taro *lo‘i* to rice fields. The urban development of the area is shown on a series of late nineteenth and twentieth century maps and aerial photographs from 1897 to 1978 (Figure 25 through Figure 35).

The 1884 Bishop map (see Figure 8) shows the nascent traces of the future development in the grid of roads stretching *mauka* of the project area. Kaka‘ako was considered outside the Honolulu town boundary and was used in the mid- to late nineteenth century as a place for cemeteries, burial grounds, and for the quarantine of contagious patients. Then in the beginning of the twentieth century, the area was used as a place for sewage treatment and garbage burning, finally becoming an area for cheap housing, and commercial industries (Griffin et al. 1987:13).

Figure 24. Honolulu and Waikīkī from Fort Armstrong (lower right) to Diamond Head, 1933 oblique aerial photograph (Hawai‘i State Archives); new lands of coral fill are shown as white patches in inland areas, along Kapi‘olani Boulevard, and offshore for the new Ala Moana Park; Kewalo Basin is at the western (lower) end of the offshore fill area

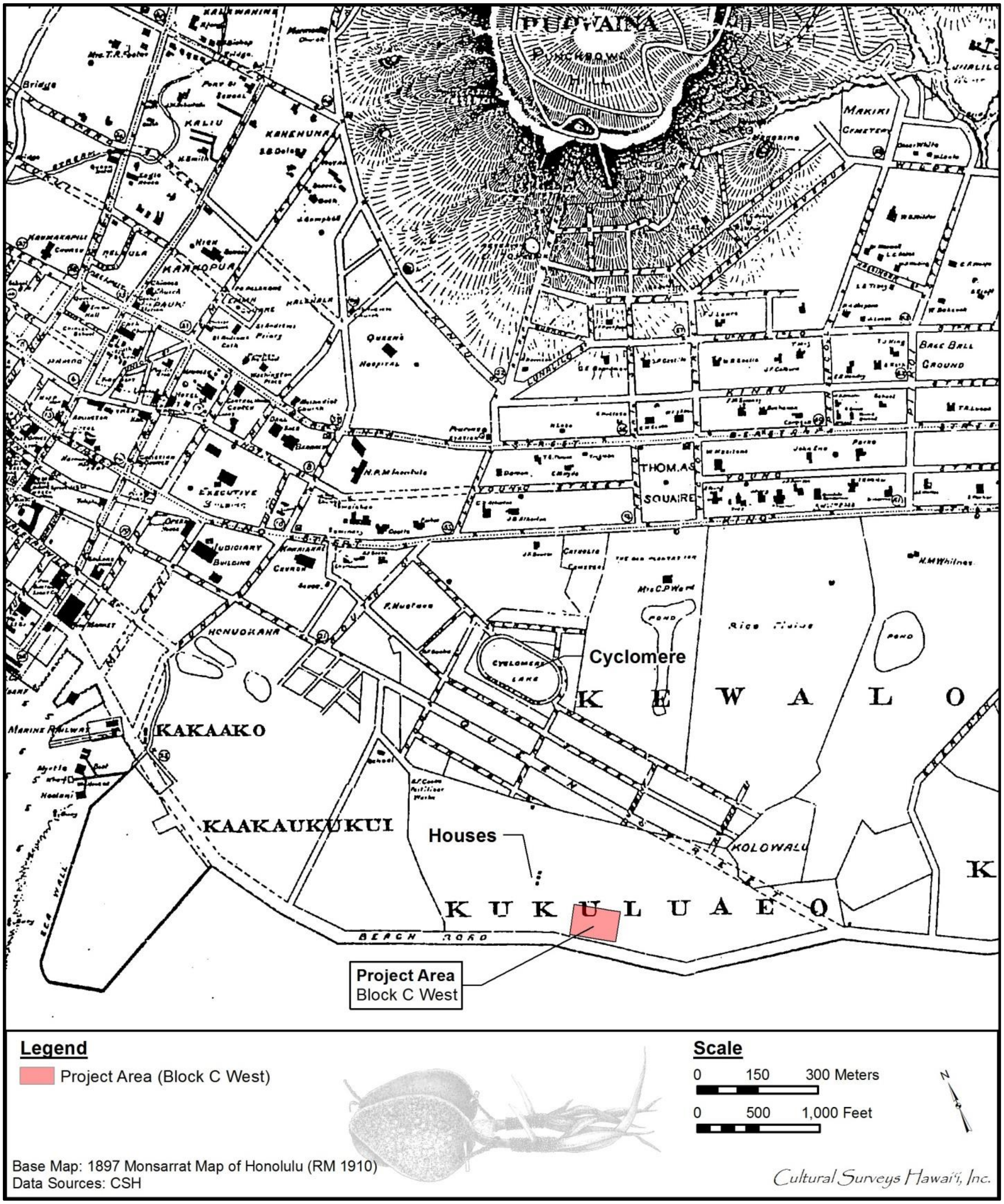

Figure 25. 1897 map of Honolulu by M.D. Monsarrat (Hawai'i Land Survey Division, Registered Map 1910), showing the location of the project area; the map also shows the location of the "Cyclomere"

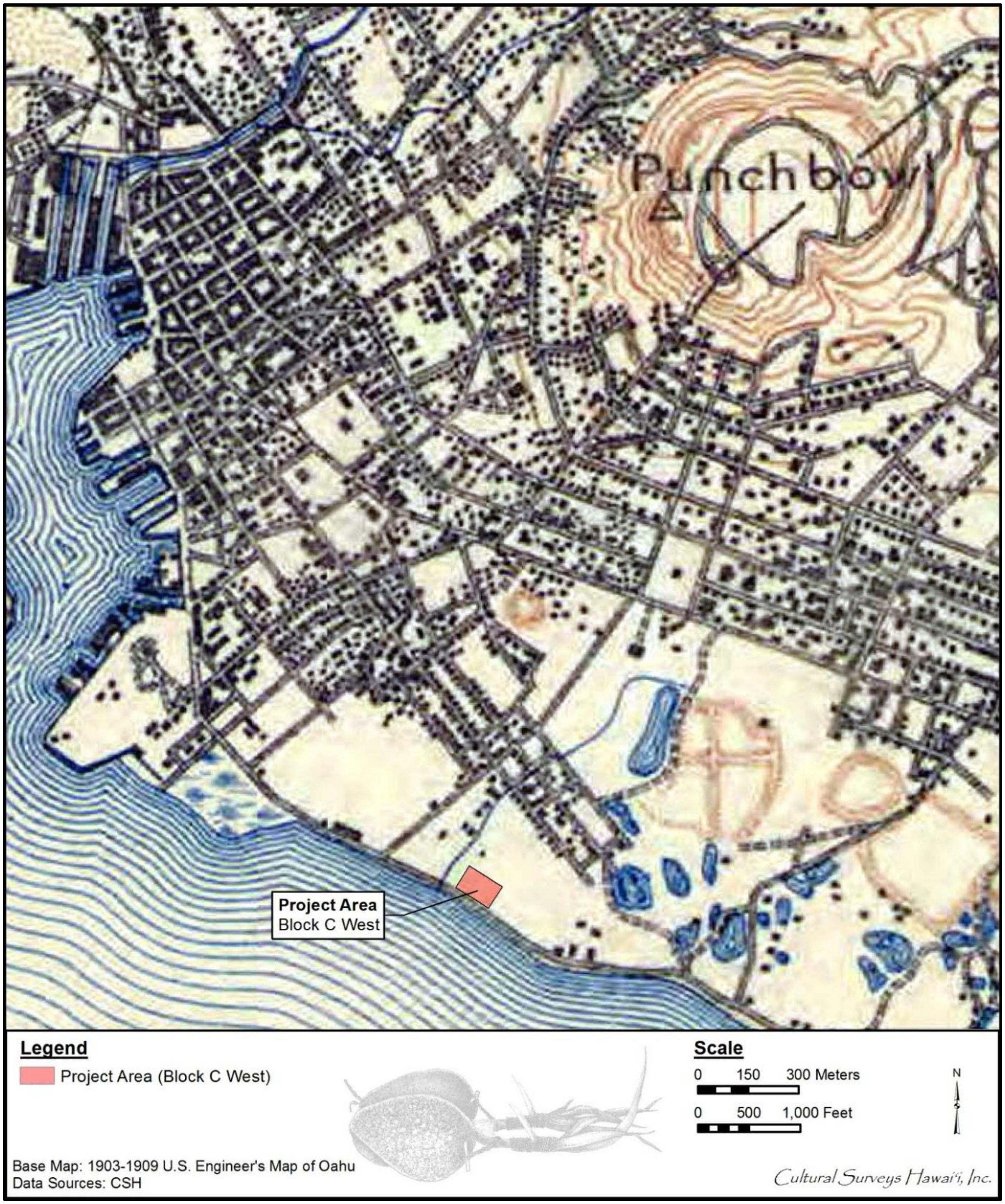

Figure 26. 1903-1909 (published 1917) U.S. Engineer's map of Oʻahu (portion) depicting Kakaʻako; many ponds, including Kolowalu and the Ward Estate "Long Lagoon," are still open and unfilled at the eastern terminus of the northwest-southeast aligned Queen Street

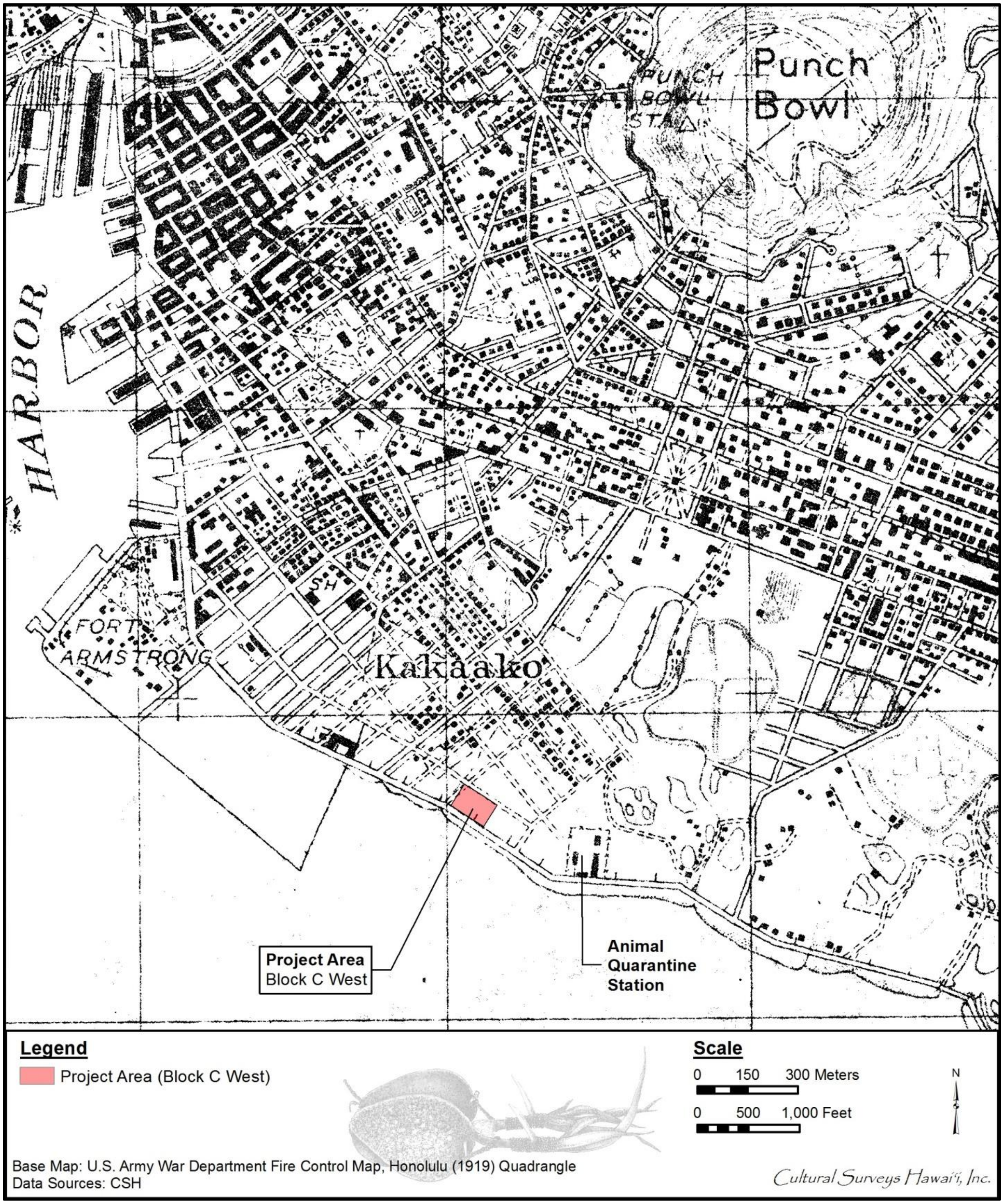

Figure 27. 1919 U.S. Army War Department Fire Control map of Oʻahu, Honolulu Quadrangle, showing the location of the project area within a grid of streets; solid lines denote paved streets, while dotted lines represent unpaved streets or planned streets

Figure 28. 1927 USGS aerial photograph of the Kaka‘ako area (USGS; mosaic of photograph sheets from Hawai‘i Coastal Geology Group)

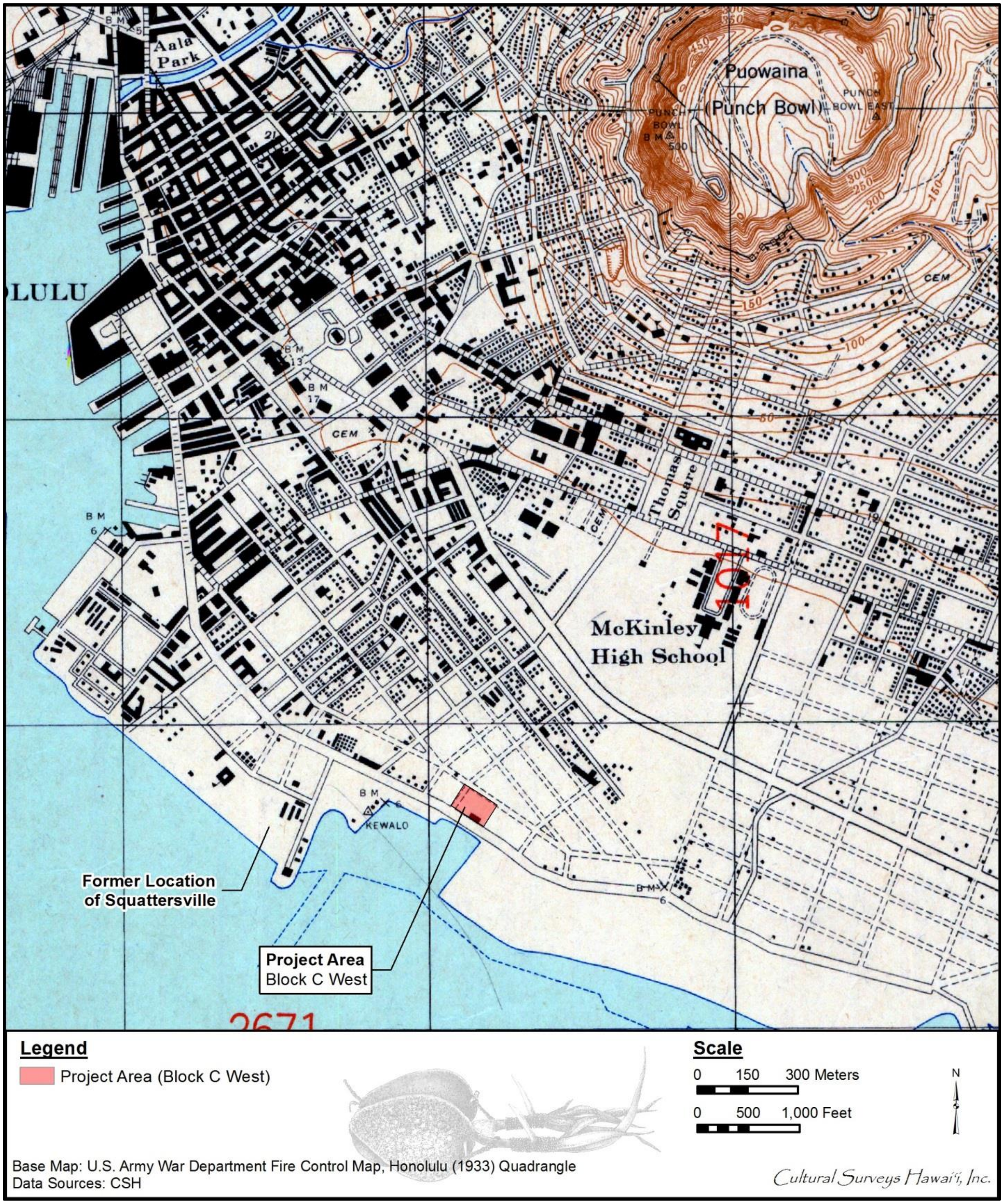

Figure 29. 1927-28 (published 1933) U.S. Army War Department Fire Control map of Oʻahu, Honolulu Quadrangle, showing the project area within a grid of streets; note the former location of Squattersville, adjacent to Kewalo Basin and east of Fort Armstrong

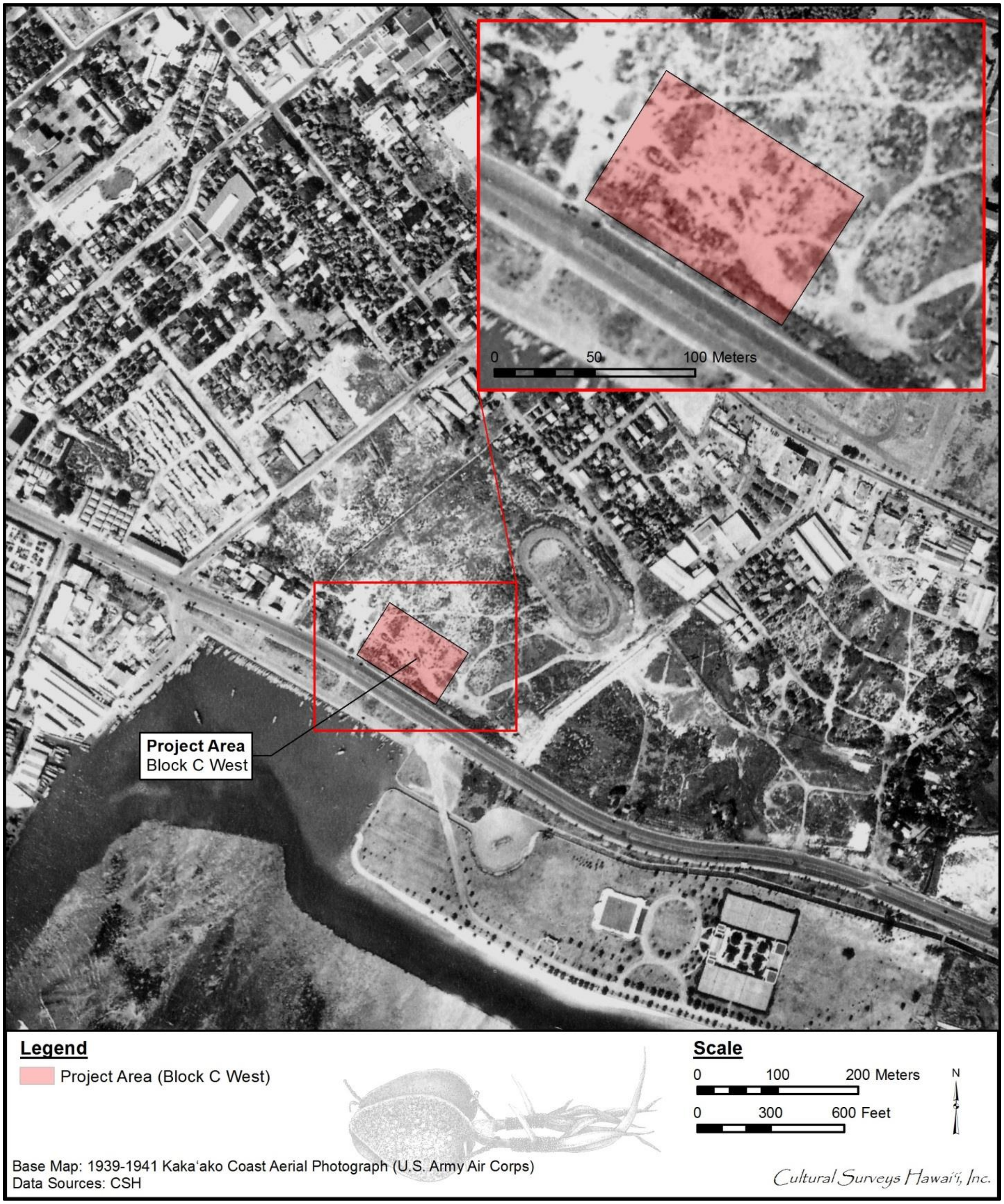

Figure 30. 1939-1941 aerial photograph (U.S. Army Air Corps) of Kakaʻako; note the completion of Kewalo Harbor to the west and the construction of Ala Moana Park to the east along the shore

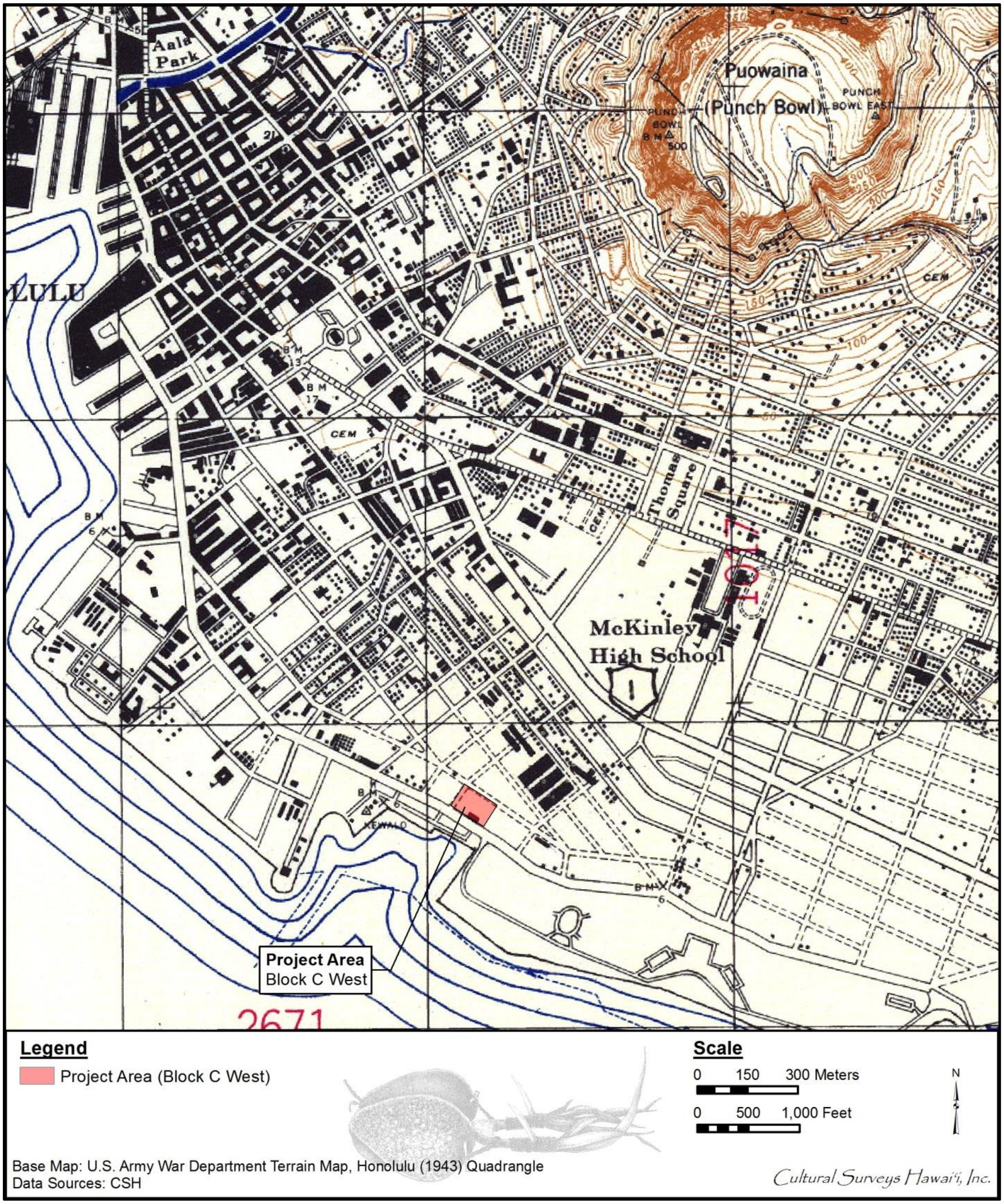

Figure 31. 1943 U.S. Army War Department Fire Control map of O'ahu, Honolulu Quadrangle; note the location of a structure along Ala Moana Boulevard within Block C West

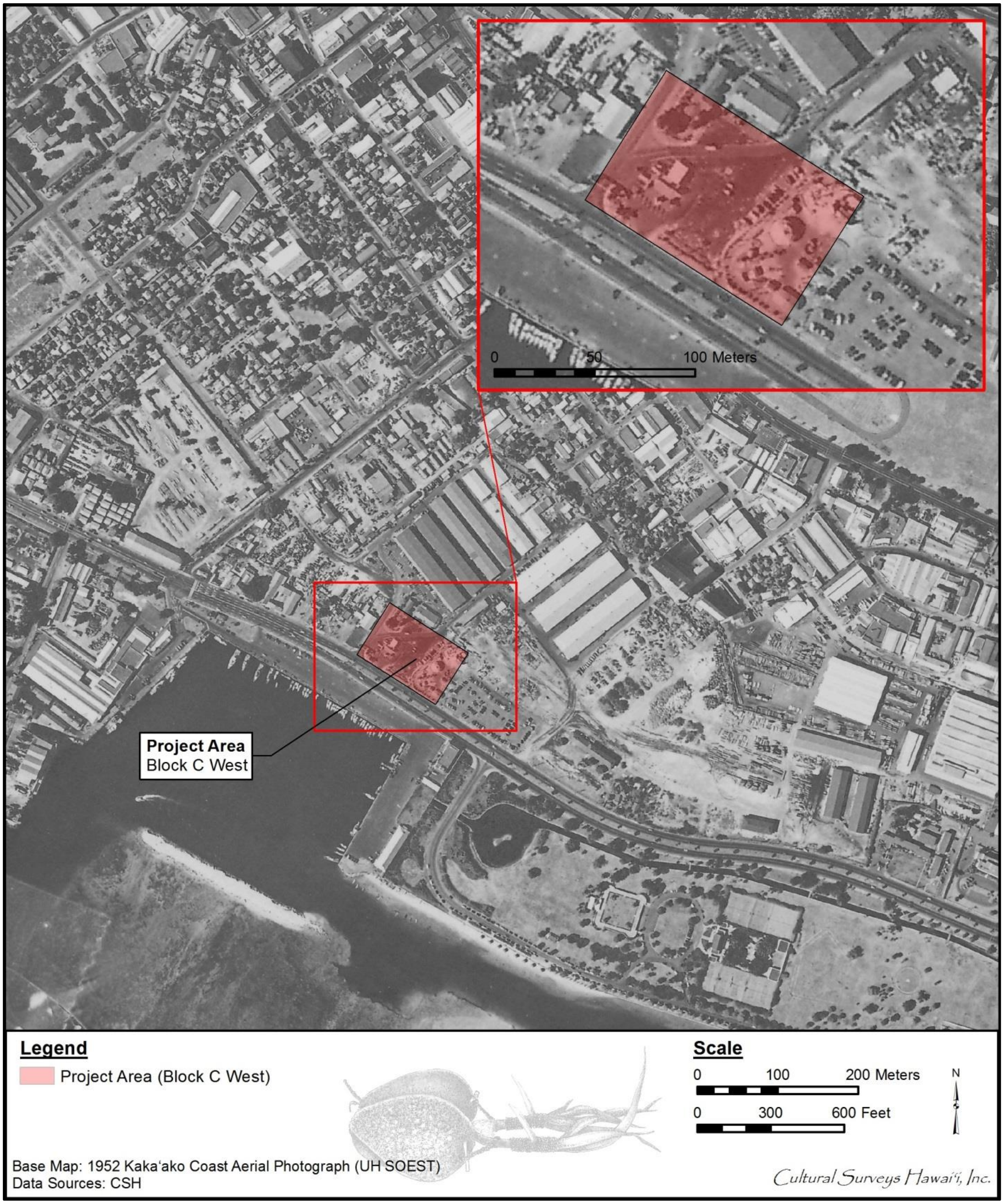

Figure 32. 1952 aerial photograph (U.S. Army Air Corps, mosaic of sheets from Hawaiʻi Coastal Geology Group)

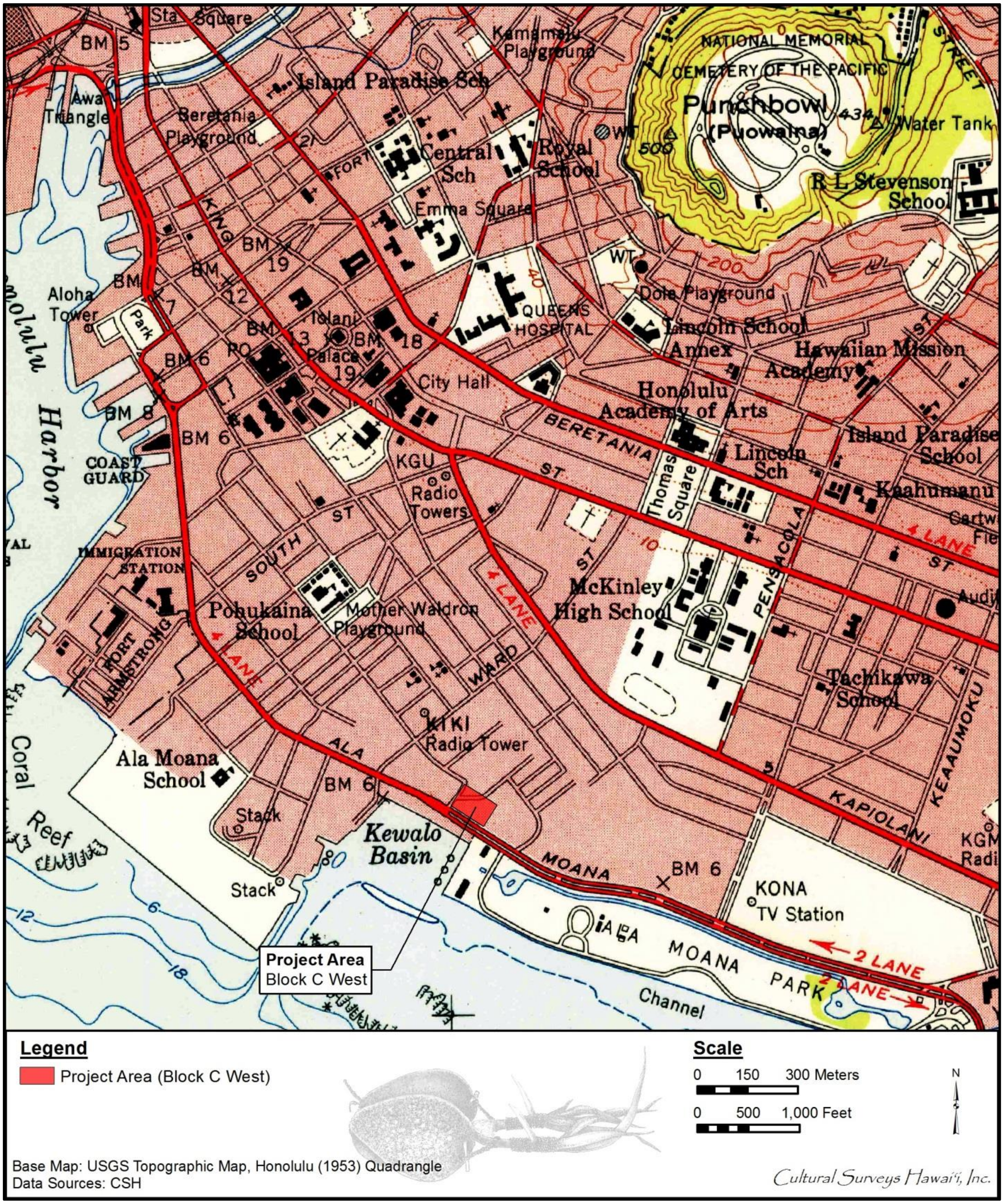

Figure 33. 1953 Army Mapping Service topographic map of Oʻahu, Honolulu Quadrangle, showing project area within an improved street grid

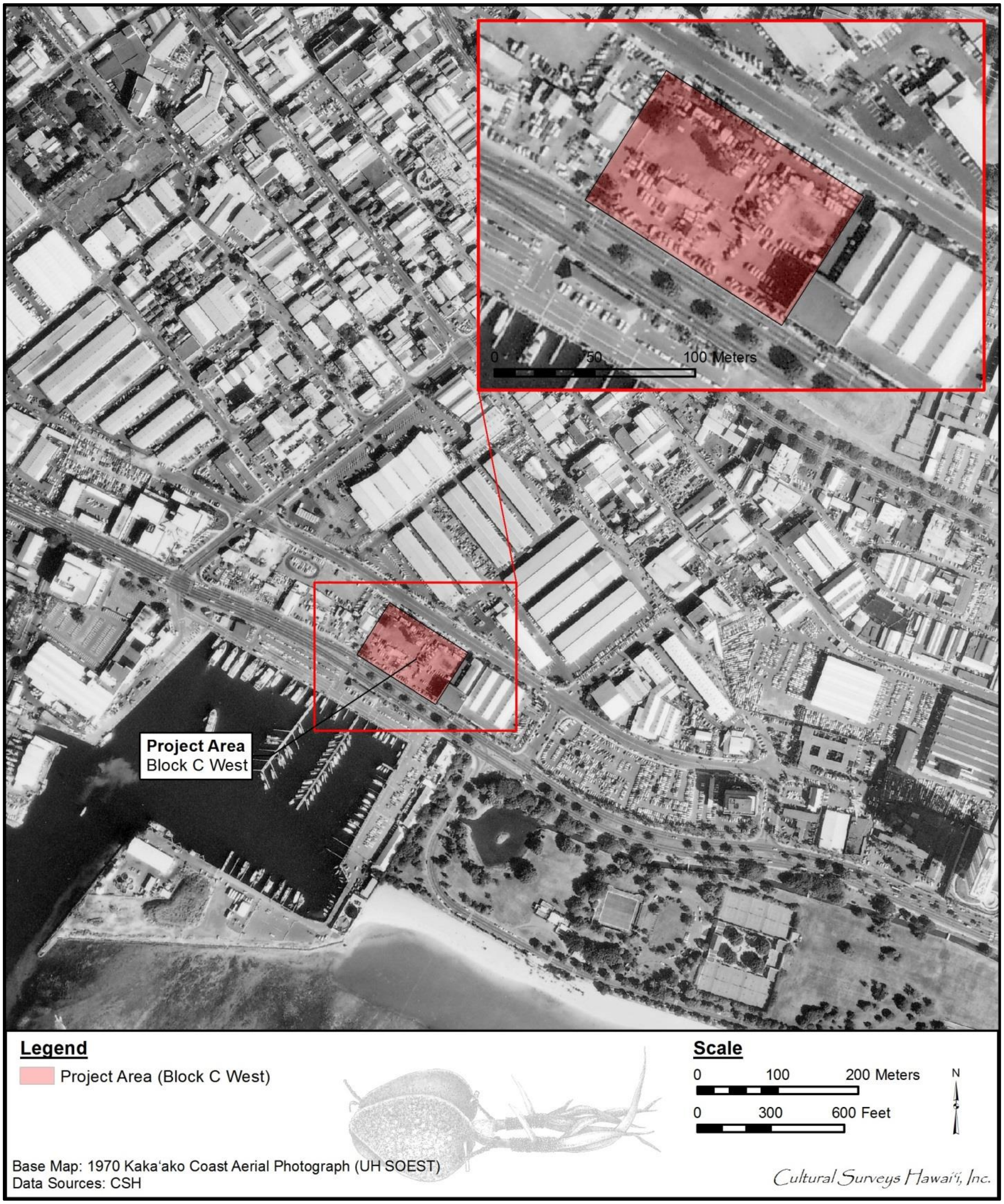

Figure 34. 1970 aerial photograph (R.M. Towill), showing the project area

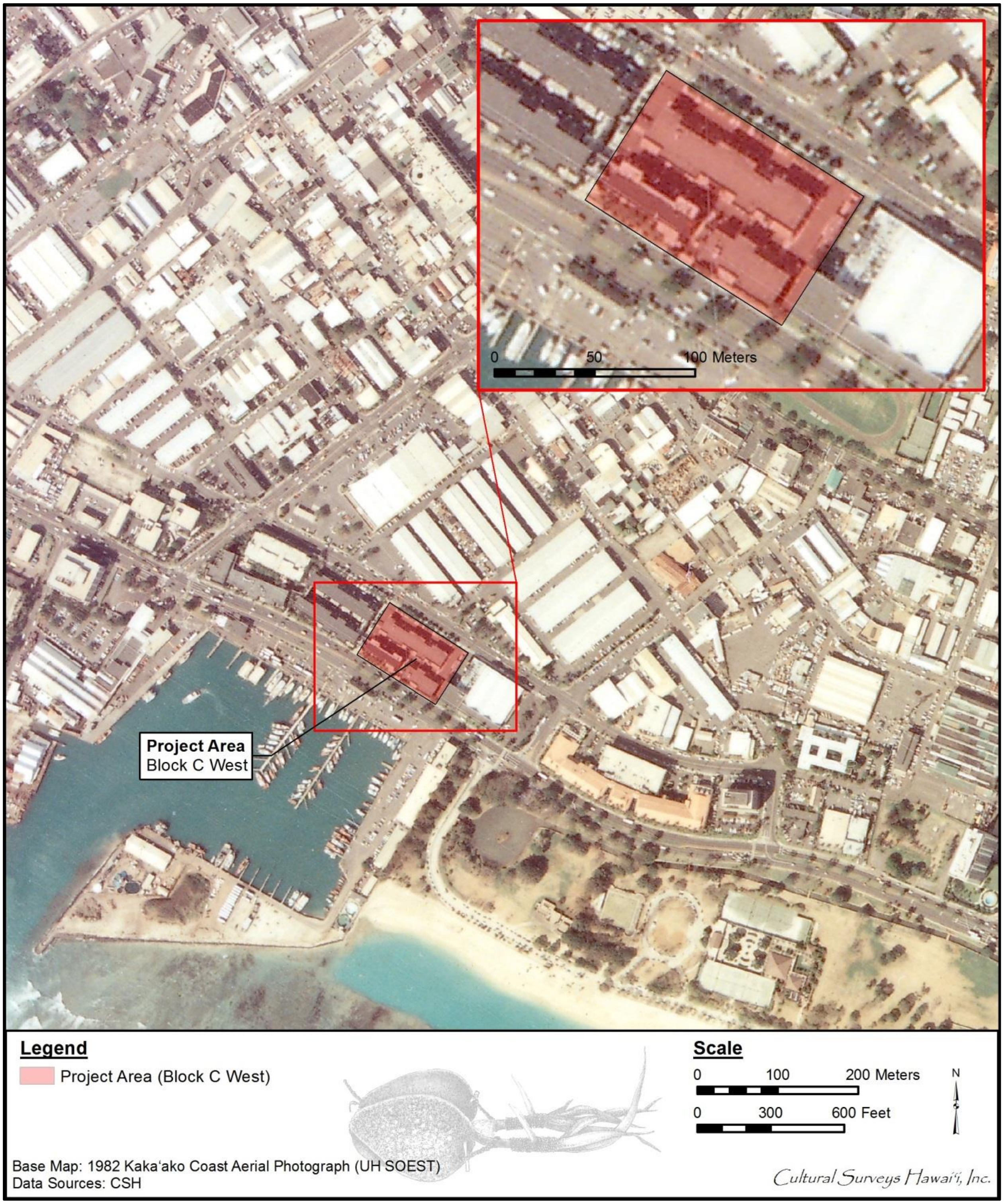

Figure 35. 1982 USGS aerial photograph, depicting large warehouses throughout Kakaʻako and Ward Warehouse within the project area

Other maps, photographs, and documents generated from the last decades of the nineteenth century up to the present reveal further characteristics of the original character of the Kewalo lands and the disappearance of that landscape.

An 1897 map (Figure 25) by M.D. Monsarrat shows Thomas Square and the Old Plantation, and makes evident the urbanization of the landscape of Honolulu that had taken place near the end of the nineteenth century. The map clearly displays the development occurring *mauka* and ‘Ewa (westward) of the project area, and the “arm” of streets projecting from downtown Honolulu into Kaka‘ako and Kewalo. It is on this map that Kamake‘e Street first appears, running from Queen Street and dead-ending *mauka* of Waimanu Street towards where Kapi‘olani Boulevard would eventually be constructed. A large portion of Kaka‘ako, however, remains open and the map reveals that the area adjacent (east) of the Old Plantation and *mauka* of the project area has become “Rice Fields.” The 1897 map shows the Cyclomere, a pond surrounded by a bicycle racing track in the Kewalo area. This was located on the *makai* side of Kapi‘olani Avenue between Cooke Street and Ward Avenue.

A 1903-1909 U.S. Engineer’s map (Figure 26) depicts houses clustered around the few paved roads, with a scatter of houses along the Ward Estate *‘auwai* and along the shore. There is no indication on this map of the deep water channel east of Fort Armstrong that will later be dredged to create Kewalo Basin. Numerous ponds are shown to the east of the project area, especially Kolowalu Pond at the eastern terminus of Queen Street, and the “Long Lagoon” of the Ward Estate, north of the Queen Street terminus.

The 1919 U.S. Army War Department Fire Control map (Figure 27) shows residences clustered around Queen Street and Ward Avenue. There are still many ponds east of the project area, in the area northeast later to be part of McKinley High School, and the area east along the coast, which will be developed into Ala Moana Shopping Center and Park. Poor people, mainly Native Hawaiians, inhabited the area. In the 1920s, on the east side of Kewalo Basin they congregated at a camp named “Blue Pond,” named after a large and deep pond near the shore. On the west side of the basin, in the Ka‘ākaukukui area (shortened to ‘Ākaukukui), they lived in shacks and sturdy houses in an area called “Squattersville,” named because they lived without authorization on government land. This camp was generally around Olomehani Street near the shore, protected from the waves by a long sea wall. There were around 700 Hawaiians and part-Hawaiians living in these two camps in the mid-1920s, but by 1926 they were all gone. The government evicted the families and razed the houses (Clark 1977:64).

A 1927 aerial photograph (Figure 28) shows the development of dredging and filling projects in Kaka‘ako. Areas west of Ward Avenue and *makai* of Ala Moana Boulevard are filled and developed, while the areas *mauka* and east, including Block B East, have only been recently filled (indicated by bare white coral fill areas) or are still open marsh/rice lands, such as *makai* of the new McKinley High School, the long lagoon of the Ward Estate, and the Kolowalu Pond. Kewalo Basin is an ill-defined dredged area of deep water east of Fort Armstrong directly *makai* of Block B East.

A 1933 U.S. Army War Department Fire Control map (Figure 29) shows the first buildings of the new McKinley High School campus and also illustrates that the eastern portion of Kaka‘ako is still undeveloped, with dotted lines showing unimproved or proposed streets, including within the area of Block B East. However, the land was more inhabited than is evident from this map. The Ward family leased to the Japanese lands for camps, schools, playground, temples and shrines

(University of Hawai‘i 1978:847). Kaka‘ako was one of the first residential areas for working class families, housing people working at the laundries, the harbor, the Honolulu Iron Works, the Honolulu Brewery, and truck drivers, seamen, and fishermen. In 1940, Kaka‘ako had over 5,000 residents. Hawaiians, Portuguese, Chinese, and Japanese settled in camps based on their ethnic origins. The residents all came together for social and community functions.

On a 1939-1941 aerial photograph (Figure 30), Ala Moana Park, on new land created with dredged fill, is depicted with a deep-water channel meant to allow boats to sail from Kewalo Basin to the Ala Moana Yacht Harbor. Kewalo Harbor has been completed and ships line the shoreline. The former white coral areas east of Ward Avenue now have some vegetation, but they are still not greatly developed past the stage shown on the 1927 aerial photograph. One exception is the McKinley High School grounds, which have been completely filled in and leveled, and covered with several new campus buildings. The long lagoon of the Ward Estate is still unfilled. Block B East is still largely undeveloped, although small structures now occupy the western/*makai* corner.

On a 1943 U.S. Army War Department Fire Control map (Figure 31), this eastern section of Kaka‘ako is an area of open lumber yards and large warehouses. After World War II, Kaka‘ako became increasingly industrialized, and residents moved out to the newer subdivisions away from the central Honolulu area. The 1943 map depicts the docks for Kewalo Basin. The McFarlane Tuna Company (now Hawaiian Tuna Packers) built a shipyard at the basin in 1929 for their fishermen’s “sampan fleet.” A new tuna cannery was built at the basin in 1933 and operated successfully. However, the entire cannery was taken over in 1941 by the military after the attack on Pearl Harbor. The cannery was converted to military use and used to make airplane gas tanks. Land in Kaka‘ako taken by the military was not returned until 1946 (Clark 1977:64; Gessler 1938:182-185).

A 1952 aerial photograph (Figure 32) shows major development in the eastern section of Kaka‘ako, with parking lots and small buildings within Block B East. Coral fill has been placed to create the substrate for the new Ala Moana Shopping Center to the east of the project area, and new land has been created on the *makai* side of the former Fort Armstrong, west of Kewalo Basin. The dredged strip along the coast still extends from Kewalo Basin to Ala Moana Yacht Harbor and the western end of the Ala Wai Canal. A 1953 topographic map (Figure 33), less detailed than earlier maps, does indicate many of the improved or proposed roads in the eastern section of Kaka‘ako are now paved and improved.

In 1964, new land along the western boundary of the Ala Wai Yacht Club was created to make a peninsula called “Magic Island,” later renamed ‘Āina Moana State Recreation Area. The construction of this peninsula cut off access for boats between the Kewalo and Ala Moana boat docks, and the function of the channel along Ala Moana Beach Park was changed into a safe swimming area (Clark 1977:60-63). On a 1970 aerial photograph (Figure 34) of the eastern section of Kaka‘ako, the new Ala Moana Shopping Center is completed and the Blaisdell Civic Center has replaced the grounds, house, and lagoon of the Ward Estate. Small commercial structures are largely clustered on the *makai* half of the Block B East project area.

In 1975, it was estimated there were 990 firms operating in Kaka‘ako and approximately 30% of the neighborhood residents also worked in the area (University of Hawai‘i 1978:A-116-117). In the 1970s to 1990s, portions of eastern Kaka‘ako were used for various small businesses that existed in warehouses and parking lots, as shown on a 1982 aerial photograph (Figure 36). Many of these warehouses were roofed, open-sided storage sheds for large lumber yards. Ward

Warehouse was built in 1975 (Daysong 1997) and the shopping center can be seen as several adjacent structures on the 1982 aerial photograph. The Block B East project area is located within the central portion of the Ward Warehouse complex.

In summary, the project area was apparently outside the two most intensely populated and cultivated areas—Waikīkī and Honolulu (or Kou)—along this portion of O‘ahu’s southern shore during the pre-Contact period. The area of Kaka‘ako was nonetheless well utilized by Hawaiians for activities appropriate to the specific environment, salt making and farming of fishponds, along with some wetland agriculture. The eastern portion of Kaka‘ako, including the project area, was also among the last areas of urban Honolulu to be built on and developed, with many of the roads in the area not developed until World War II.

3.8 Previous Archaeological Research

3.8.1 Geological Study of Kaka‘ako and Kewalo

For his doctoral dissertation in Geology and Geophysics, Charles C. Ferrall (1976) synthesized all data from subsurface boring logs excavated in the Honolulu and Waikīkī areas to that time. The data were compiled from 800 borings made by the Hawai‘i Public Works, Board of Water Supply, and other state/city engineering departments.

Most of the coastal plain of Honolulu formed during the Pleistocene, during several sea level fluctuations related to the advance and retreat of glaciers. These fluctuations produced reef deposits at various levels, some above the present sea level. The Kaka‘ako area coral shelf was mainly formed during the Waimanalo High Sea Stand, about 120,000 years ago, which reached a maximum of 25 ft above the present sea level. The Waimanalo Sea Stand was preceded by the Waipio Low and was followed by the Mamala Low. During the Mamala Low when the sea receded as much as 300 ft below present levels, deep alluvial channels dissected the former reefs, including one which Ferrall called the HIC Channel. This channel was found in borings made within the Honolulu International Center (now called the Blaisdell Center), thus the name of the channel. Due to the scattered locations of the 800 borings, the exact path of this channel as it traverses *makai* to the ocean could not be determined; however, Ferrall postulated that the channel extends through the area in which Land Blocks 1 and 2 of the Ward Neighborhood Master Plan are located. (Ferrall (1976:53) cautions “given the sinuous course of this channel in the area where control is available, it could be expected to meander considerably from the direct route to the sea which is shown.” This carved channel contains alluvium with lenses of sand and volcanic cinder overlain by swamp deposits. The sediments overlying the channel are similar to the surrounding areas (i.e. above the general coral shelf).

For bores excavated in the Kaka‘ako area, the coral shelf is found at three different levels, at +5 ft above sea level and at -15 and -30 ft below sea level. The +5, -15, and -30 coral ledges were all formed during the Waimanalo High Sea Stand (Figure 36). Ferrall notes extensive coral “growth occurred during the Waimanalo High Sea Stand, probably as a result of the warmer climate of the interglacial stage” (Ferrall 1976:116). As the sea receded from a previous high of +25, it paused at +5 ft, long enough for the growth of corals that favor a high-energy reef flat environment. This reef developed in about 20 ft of water. The -15 ft ledge probably developed after this during a regression of the sea from the Waimanalo High Stand to the Mamala Low Stand. The -15 coral shelf also developed within a high-energy zone, but was formed in a more shallow

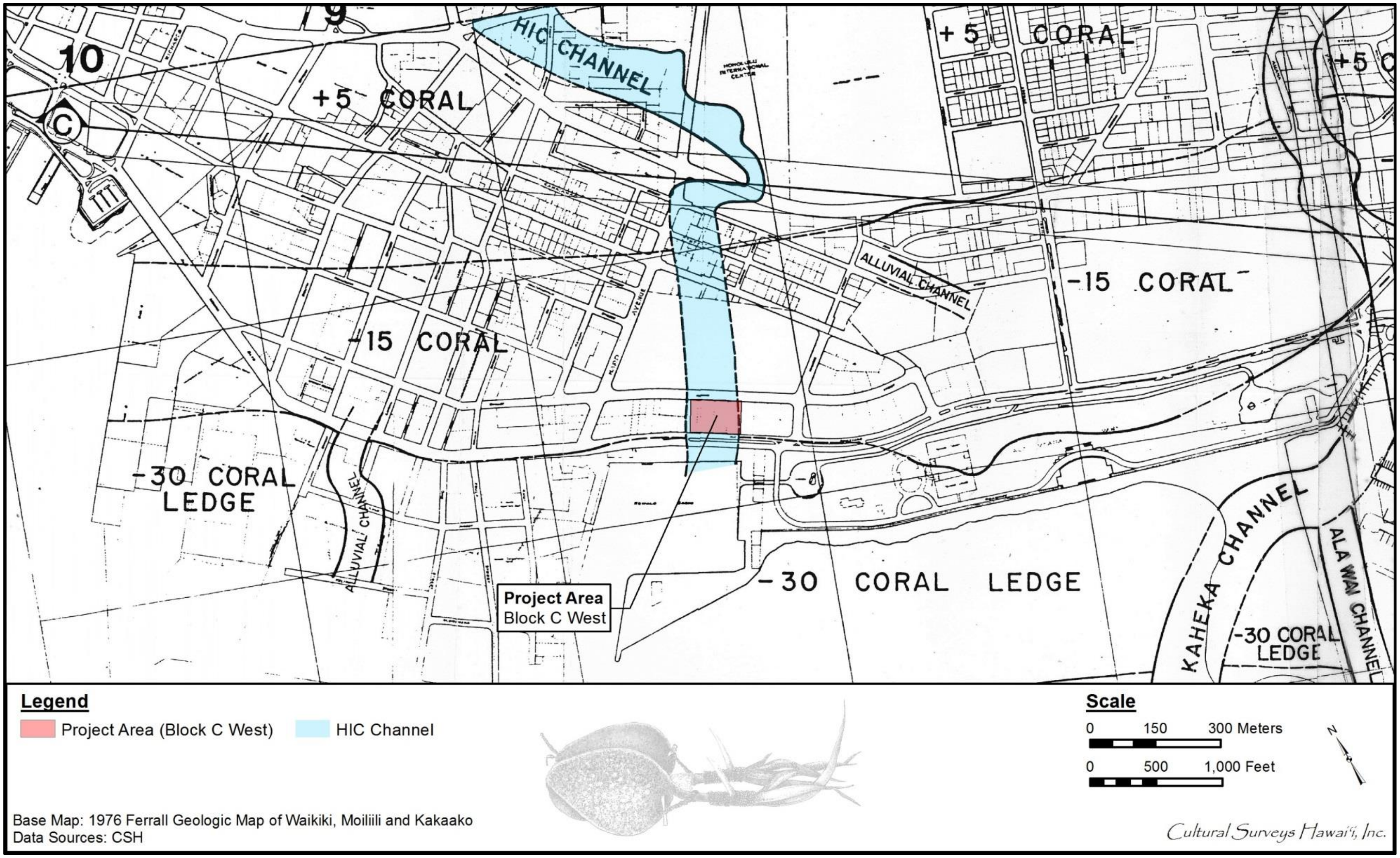

Figure 36. Coral shelf depth (+/- feet above or below sea level) and possible location of HIC channel through the Block C West project area (modified figure of outsize map in Ferrall 1976)

water environment, in only a few feet of water. The -30 coral shelf was composed of coral that grows in low-energy lagoonal environments. It may represent the "seaward (forereef) reflection" of one of the +5 or -15 coral ledges rather than a separate time period (Ferrall 1976:125).

Ferrall (1976) remarks on the area with the +5, -15, and -30 coral ledges:

> . . . lagoonal deposits are widespread . . . overlying the -30 and -15 ledges, the alluvial channels, and the lower, seaward edge of the +5 ledge. In general, any area that was not above existing sea level prior to the [Mamala] transgression to the modern sea level became covered with lagoonal deposits. . . . After the sea more or less stabilized at its present level, the lagoon filled up and became a swamp. Swamp deposits, with peat layers are found from just below existing sea level, on top of the lagoonal deposits, to just above sea level. Even into historical time, much of the area seaward of the +5 ledge was dominated by swamp conditions. [Ferrall 1976:135]

According to Ferrall's work, the current project area is within the -15 coral ledge zone, *makai* of the +5 coral ledge and *mauka* of the -30 coral ledge.

The current project area falls within Quad B-8 of Ferrall's study. The closest boring within this quad was at the intersection of Ward Avenue and Auahi Street. The coral ledge was 15-22 ft below the surface overlain with lagoonal deposits and 3 ft of fill.

3.8.2 Archaeological Background

Most traditional Hawaiian surface structures had been demolished in the Kakaʻako area by the time of the first scientific archaeological surveys (e.g., Griffin 1987). In his report on the survey of Oʻahu sites conducted in the early 1930s, McAllister (1933:80) says of Honolulu, "Information regarding former sites within the present limits of Honolulu must come entirely from literary sources." He mentions Pākākā Heiau, once the main royal temple in Honolulu. This *heiau* would have been located around the foot (*makai* end) of Fort Street. He does not list Puʻukea Heiau (discussed in Section 2.2), which Kamakau (1991:24-25) placed in Kukuluāeʻo, but he does note that Peter Corney, a visitor to the island in 1819, saw several *heiau* (*morai*) along the Honolulu shore:

> There are several morais, or churches in the village, and at new moon the priests, chiefs and hikanees (aikane) [counselors] enter them with offerings of hogs, plantains, and cocoanuts, which they set before the wooden images. The place is fenced in, and have pieces of white flags flying on the fences. [Corney 1896:101]

Although no previous archaeological investigations have been conducted within the Block B East project area, several archaeological studies have been conducted in parcels and on road alignments within the vicinity; the most relevant investigations are summarized in Table 1 and the following text. Figure 37 shows the locations of previous archaeological investigations and recorded profiles. Figure 38 shows the location of documented historic properties and burials.

3.8.3 Kakaʻako Improvement District 6 (ID-6)

The Kakaʻako Improvement District 6 (ID-6) was an area bounded by Ala Moana Boulevard (*mauka*), ʻĀhui Street, Kewalo Basin, and extending approximately 200 ft seaward of Ilalo Street.

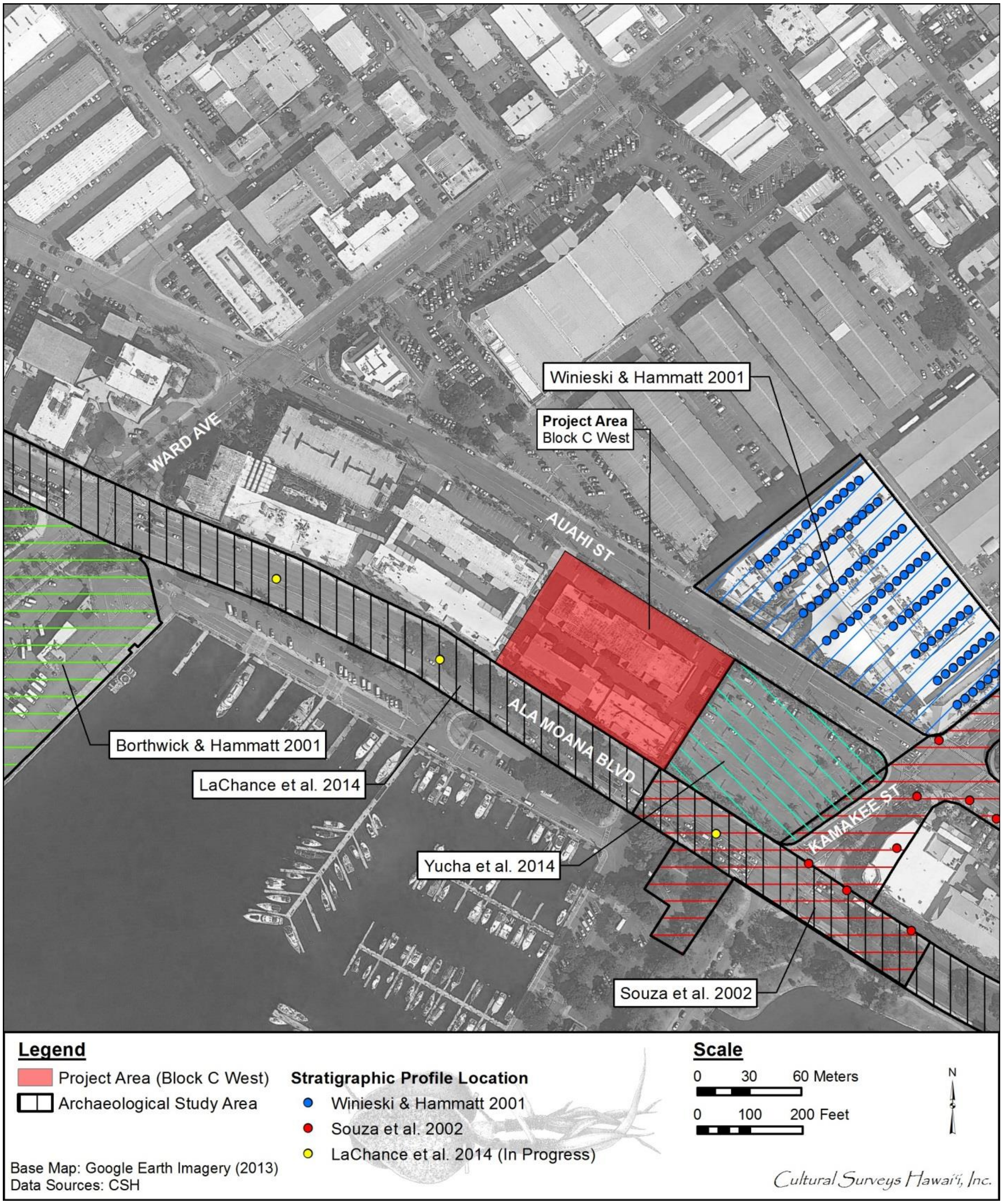

Figure 37. Previous archaeological studies within the vicinity the project area, archaeological monitoring profile locations are indicated by colored dots (base map: Google Earth 2013)

Figure 38. Aerial photograph showing the location of documented historic properties and burials within the vicinity of the project area (base map: Google Earth 2013)

Table 1. Previous Archaeological Studies within the Vicinity of the Block C West Project Area

Reference	Project Name	Type of Study	Results
Borthwick and Hammatt 2001	Kakaʻako ID-6	Archaeological monitoring	No cultural materials found during monitoring; fill material found over old tidal flats
Winieski and Hammatt 2001	Ward Theaters	Archaeological monitoring	No burials or cultural deposits found; buried A horizon found in pile caps in NW and SE corners
Souza et al. 2002	Kakaʻako ID-7	Archaeological monitoring	Three disturbed pre-Contact burials recorded (SIHP #s -6376, -6377, -6378); old A horizon found in seven of ten profiles
Yucha et al. 2014	Ward Neighborhood Block C Project	Archaeological inventory survey	Burned trash layer (SIHP # -7422) identified; majority of project area contained sand or peat A horizon and Jaucas sand beneath reclamation fill layers; no cultural material or features observed
LaChance et al. 2014	Ala Moana Blvd./Nimitz Hwy. Resurfacing & Highway Lighting Replacement Project	Archaeological monitoring	No finds within the vicinity of the current project area; Jaucas sand found in profiles *makai* of the current project area

The project provided an extension of Ward Avenue *makai* of Ala Moana Boulevard, connecting to ‘Āhui Street. The street extension was accompanied by improvements to drainage, water, sewer, and utility systems, as well as the construction of a parking lot and landscaping involving relocation of existing trees and the addition of new vegetation.

The project area lay seaward of the pre-Contact and early historic shoreline; therefore, it was highly unlikely that intact or in situ cultural materials or burials were present. It was considered possible that scattered cultural materials, partial burials, and historic trash could have been transported to the area during the period when fill materials were placed in this area. No burials, traditional Hawaiian or early historic cultural layers, or large historic to modern trash pits were observed. It is possible that scattered cultural materials, partial burials, and historic trash could have been transported to the area during the period when fill materials were placed in this area. No burials, traditional Hawaiian or early historic cultural layers, or large historic to modern trash pits were observed during archaeological monitoring (Borthwick and Hammatt 2001). The finds were, as anticipated, fill materials over tidal flats strata.

3.8.4 Ward Village Phase II (Ward Theaters)

In 2000, Cultural Surveys Hawai‘i performed archaeological monitoring for Victoria Ward, Ltd. at the site of the Ward Village Phase II (Ward Theaters) construction project in Kaka‘ako (Winieski and Hammatt 2001). This project area is bound by Auahi Street on the southwest and Kamake‘e Street to the southeast. The commercial building does not have extensive footing or any subsurface structures (i.e. underground parking, businesses, storage, etc.); instead, the structure is supported by numerous drive piles. The open cut excavation component of the pile installation involved excavation of typically 4 by 4 meter trenches, 130 cm deep, to accommodate pile caps. Open cut trenching was also required for installation of underground utilities. These were typically less than a meter in depth. No pre-Contact materials, historic cultural materials, or human burials were encountered.

Approximately 90% of the pile cap excavations exhibited nearly identical stratigraphic sequences. Beneath what had previously been asphalt parking surfaces or building slabs was a 40 cm thick crushed coral fill layer. Beneath this layer was hydraulic (i.e. pumped dredged material) clay fill, usually light gray. However, in some instances a brownish yellow clay hydraulic fill overlay the gray layer, evidence of different hydraulic fill episodes. Beneath the hydraulic fill layers, decomposing coral shelf occurred.

At the northwest corner of the buildings’ foot print, a few of the pile cap excavations exposed an old A horizon beneath fill materials, shown in a profile and a photograph (Figure 39 and Figure 40). Underlying the silty sand A horizon was light brownish gray sandy clay, which was interpreted as old pond sediments. This old A horizon was also present above a sterile calcareous sand layer in a 50-m long shallow trench dug for telephone cable conduits behind Nordstrom Rack, just *mauka* of the project area. In this trench the old A horizon and sand layer were continuous, apparently not disturbed by previous construction.

At the southeast corner of the project area, near the intersection of Auahi and Kamake‘e Streets, the old A horizon and sand layer were present, however they were discontinuous, having been disturbed by previous construction activities and replaced with backfill. It is near this area that a human burial (SIHP # 50-80-14-6377) was encountered within the sand matrix during the adjacent Kakaʻako Improvement District 7 Project.

3.8.5 Kakaʻako Improvement District 7 (ID-7)

The Kakaʻako Improvement District 7 (ID-7) project constructed improvements to drainage, water, sewer, and utility systems on Kamakeʻe Street between Queen Street and Ala Moana Boulevard, and also extended the drain system from Ala Moana Boulevard to Kewalo Basin (Souza et al. 2002). The project also included realignment of the existing Kamakeʻe Street between Auahi Street and Ala Moana Boulevard.

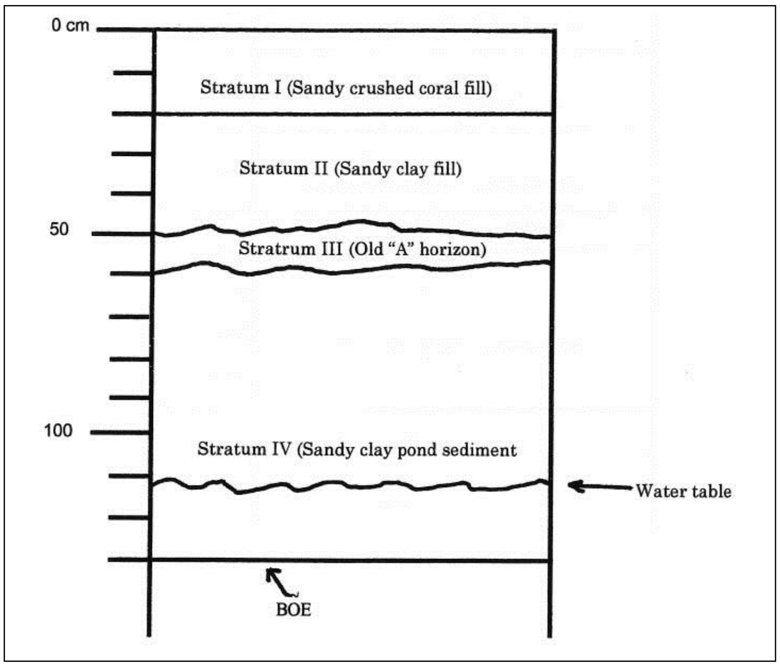

Figure 39. Profile of pile cap excavation in northeast corner of the Ward Village Phase II footprint (Ward Theaters) showing old A horizon and pond sediment (Winieski and Hammatt 2001)

Figure 40. Photograph of pile cap trench showing old A horizon (dark stratum) capping sandy clay pond sediments (Winieski and Hammatt 2001)

During excavation activities associated with the Kakaʻako Improvement District 7 Construction Project, three human burials were encountered (see Figure 38). Burial 1 (SIHP # -6376), a single cranium, was inadvertently discovered by construction personnel in the base yard back dirt pile. The back dirt pile was derived from a trench on Ala Moana Boulevard and Kamakeʻe Street. Burial 2 (SIHP # -6377), an adult individual, was encountered by an archaeologist during backhoe excavations for a box drain on Kamakeʻe Street. The burial was within an undisturbed sand deposit. Burial 3 (SIHP # -6378), consisting of a femur and several rib fragments, was recovered in the construction base yard. The original location of the burial could not be determined.

Ten profiles were described and drawn along Kamakeʻe Street between Queen Street and Ala Moana Boulevard. Most of the excavations occurred in previously-disturbed fill material. As expected, the land comprising Ala Moana Beach Park and the Kewalo Basin consists totally of fill material, since the areas were seaward of the shoreline in the pre-Contact and early historic periods. Natural discontinuous deposits were exposed most frequently along the ʻEwa (west) and Diamond Head (southeast) sides of Kamakeʻe Street extending down to Ala Moana Boulevard. An old A horizon was observed in seven profiles.

3.8.6 Ward Neighborhood Block C Project

Between December 2012 and January 2013, CSH conducted an archaeological inventory survey of the Ward Neighborhood Block C project, a component of the Ward Neighborhood Master Plan area, located immediately adjacent to (southeast of) the current project area at the intersection of Ala Moana Boulevard and Kamakeʻe Street (Yucha et al. 2014). Forty-one test excavations were distributed across the project area. Only one historic property was identified, a burned trash layer (SIHP # 50-80-14-7422) located near the corner of Kamakeʻe and Auahi Streets (see Figure 38). Stratigraphy within the project area was largely consistent. A deposit of hydraulic fill associated with the reclamation infilling of Kakaʻako during the 1913–1930 period was found within the north, west, and south portions of the project area (Figure 41). Beneath the fill layers, a coarse sand A horizon was documented within 25 test excavations throughout the project area, while a peat A horizon was found within three excavations within the northern portion of the project area (Figure 42). A majority of the project area (35 test excavations) contained Jaucas sand (Figure 43). No cultural material or features were observed within the test excavations or within screened and bulk sediment samples. A representative profile showing the sand A horizon is illustrated in Figure 44.

3.8.7 Ala Moana Boulevard/Nimitz Highway Resurfacing and Highway Lighting Replacement Project

From March 2011 through the present, CSH has performed archaeological monitoring for the Ala Moana Boulevard/Nimitz Highway Resurfacing and Highway Lighting Replacement project, located between Fort Street and Kalākaua Avenue (LaChance et al. 2014). The majority of the project-related subsurface impacts were due to the installation of subsurface utilities. The project was divided into five phases, with Phase 3 located in the immediate vicinity of the current project area.

Within Phase 3, two representative profiles (Profiles 6 and 7) were drawn of stratigraphy just *makai* of the Block C West project area along Ala Moana Boulevard (see Figure 37). Profile 7 is located approximately 30 m west of the current project area. The stratigraphy of Profile 7 consisted of the asphalt roadway and basalt gravel base course overlying natural Jaucas sand and the coral shelf (Figure 45). Profile 6 contained similar stratigraphy. In both profiles the upper boundary of the Jaucas sand was located at 40 cm below surface. No human burials were found within the vicinity of the Block C West project area.

Figure 41. Aerial photograph depicting the Ward Neighborhood Block C project, showing where hydraulic fill deposits were encountered (Google Earth 2008)

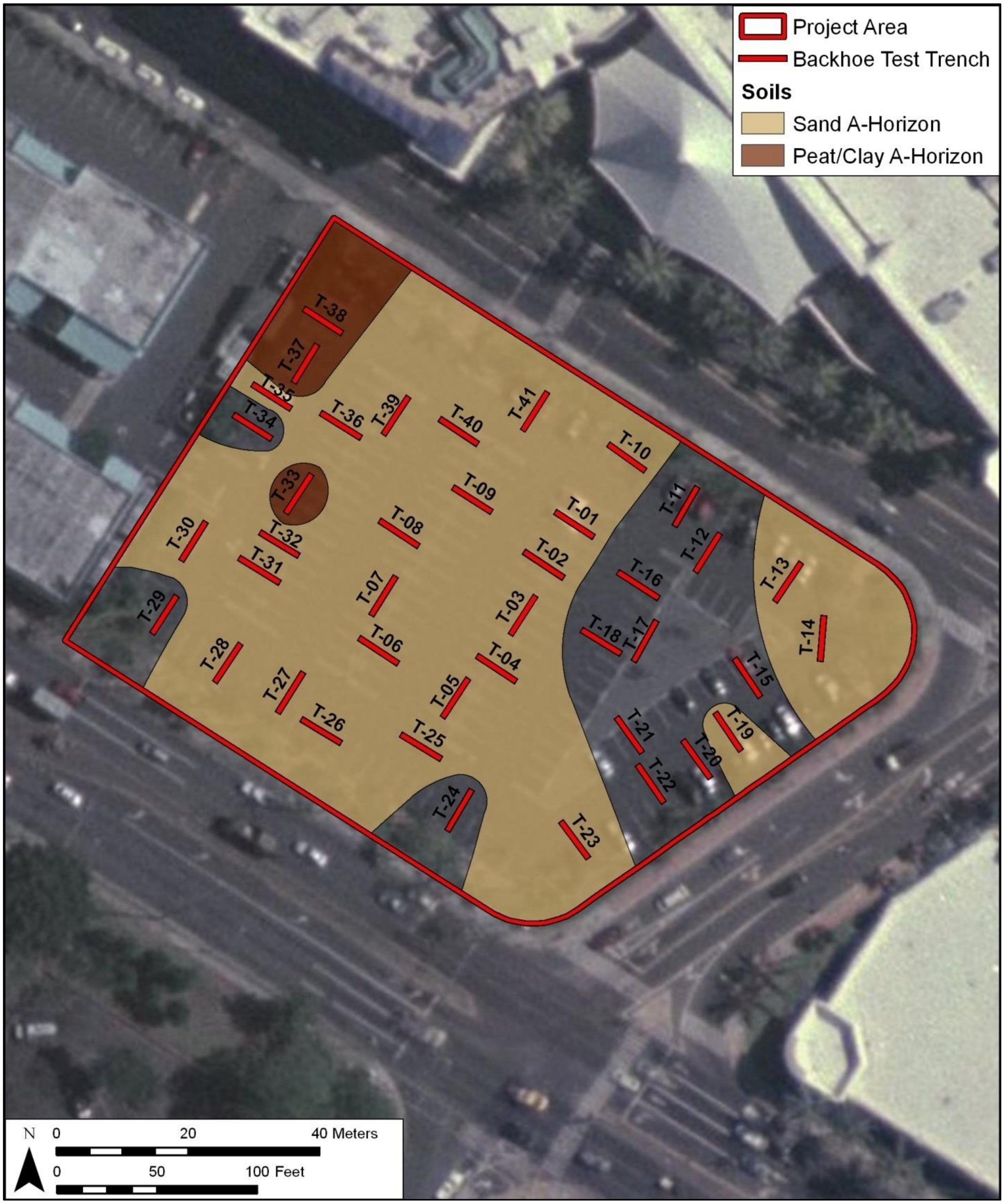

Figure 42. Aerial photograph depicting the Ward Neighborhood Block C project, showing where a buried A horizon was encountered (Google Earth 2008)

Figure 43. Aerial photograph depicting the Ward Neighborhood Block C project, showing where Jaucas sand deposits were encountered (Google Earth 2008)

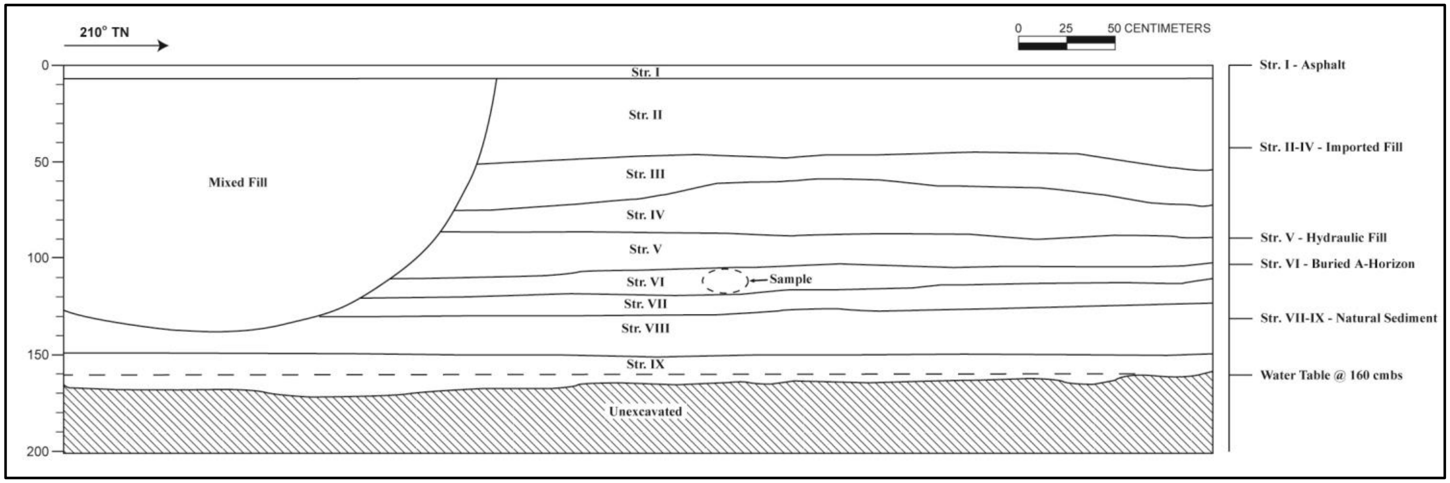

Figure 44. Ward Block C project AIS, Trench 30, profile of southeast sidewall (Yucha et al. 2014)

Stratigraphic Description

I	Asphalt
II	Fill; 10YR 3/4 (dark yellowish brown); very gravelly loamy sand
III	Fill; 10YR 3/4 (dark yellowish brown mottled with 30% medium 2.5YR 4/6 red); gravelly clay loam
IV	Fill; 10YR 7/2 (light gray); coarse sand; crushed coral fill
V	Hydraulic Fill; 10YR 8/2 (very pale brown); very fine sandy clay; land-reclamation fill
VI	A Horizon; 10YR 5/1 (gray); medium sand; truncated and compacted former land surface
VII	Natural; 10YR 8/3 (very pale brown); medium sand; natural marine sand
VIII	Natural; 10YR 7/2 (light gray); sandy clay;
IX	Natural; 5BG 6/1 (greenish gray); sandy clay; natural lagoon sediment

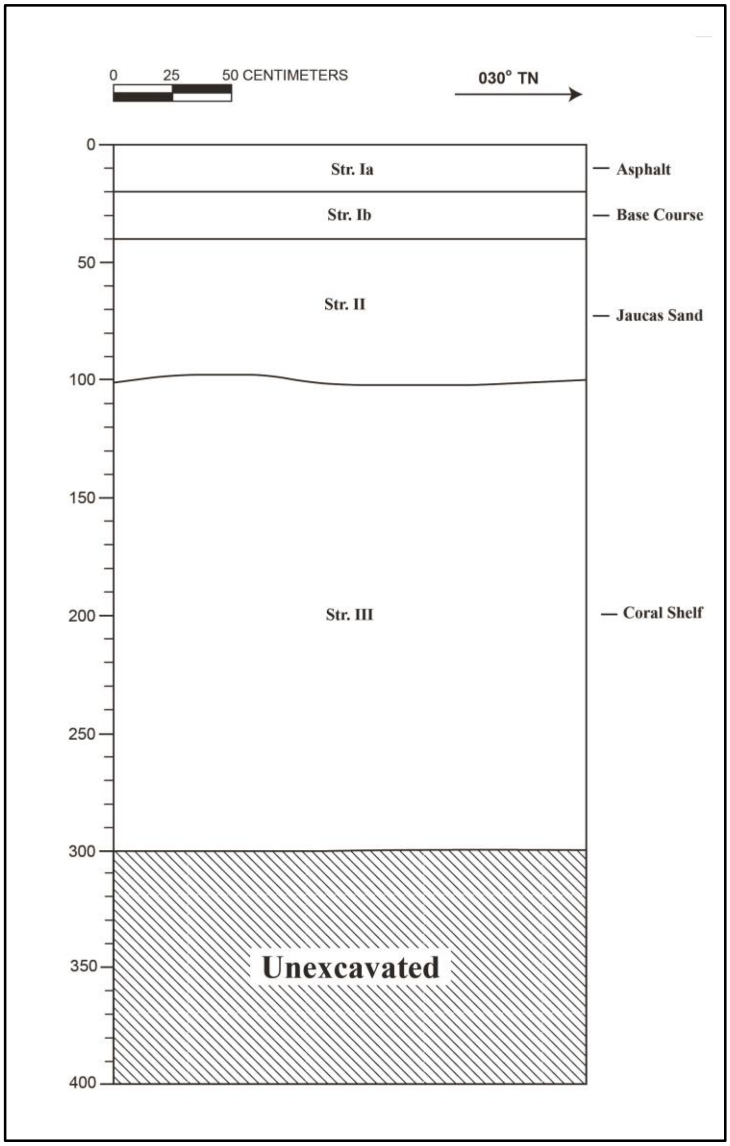

Figure 45. Ala Moana Boulevard/Nimitz Highway Resurfacing and Highway Lighting Replacement project, Profile 7, showing Jaucas sand (Stratum II) directly beneath the roadway pavement and base course (LaChance et al. 2014)

3.9 **Summary of Kaka‘ako Stratigraphy**

The Kukuluāe‘o area has been heavily modified over the last 150 years due to filling of the area for land reclamation. However, much of the cultural and natural deposits and land forms of the area (low-land marshes, sand deposits, coral reef flats, and fishponds) survived below this fill. There are the following three major stratigraphic zones in the Kaka‘ako Development District area:

Zone 1

Zone 1 consists of two types of historic fill. The first type was deposited during the various land reclamation projects in Kaka‘ako, when fishponds and other low-lying areas were filled. Using dredged material from Honolulu Harbor and the reef flats fronting the Kaka‘ako area, large amounts of trash and refuse from the town dump, and soil and sand from various locations on the island, the Kaka‘ako area west of Ward Avenue was largely filled over the course of 40 years from 1875 to 1915. The area east of Ward Avenue was filled in the 1920s and 1930s during the Kewalo Basin and Waikīkī Reclamation projects. The second type of fill consists of layers of material used to bring the various roads in the Kaka‘ako area up to grade and to make them passable during the wetter part of the year. The road fill layers in Kaka‘ako were made up primarily of crushed coral, soil, and crushed basalt gravel.

Zone 2

Zone 2 consists of the natural and cultural strata of the land prior to the historic filling of the area including fishpond deposits, traditional pre-Contact and early historic Hawaiian cultural layers, human burials, and the buried A horizon of the pre-fill land surface. Most archaeological features encountered include historic refuse pits, building foundations, scattered historic and pre-Contact artifacts, pre-Contact refuse pits and cultural deposits, fishponds, and both historic and pre-Contact burials. Fishpond deposits are often distinguished as layers of gleyed marine sediments containing marine shell and decaying organic matter. Based on archaeological research completed in Kaka‘ako to date, it has become apparent the vast majority of pre-Contact Hawaiian burials in Kaka‘ako are buried in natural sand layers associated with the pre-Contact intertidal shoreline. These sand layers have been extensively disturbed in some areas, but many undisturbed pockets remain.

Zone 3

Zone 3 is the geologic non-cultural and pre-cultural stratigraphy of the Kaka‘ako area including sterile coralline sand deposits, cinder deposits from the Tantalus/Sugarloaf eruptions, and a coral reef shelf/deposit from the last interglacial period. The Tantalus eruptions are thought to have taken place only 6,000 to 10,000 years ago, making them by far the most recent eruptions of O‘ahu (Farrell 1976). The Tantalus eruptions are relatively unique to O‘ahu in terms of the type of well-sorted cinder produced. The eruption of the cinder predates human occupation in Hawai‘i by thousands of years. The cinder layer provides a very clear demarcation between the underlying sterile geologic stratigraphy and the layers contemporaneous with cultural activity. This cinder is found only on the inland portion of the Kaka‘ako area, northwest of the project area (generally west of Cooke and *mauka* of Halekauwila Streets). On the coastal section, the lowest stratum is of sterile sand. Below both is a coral shelf deposited during the last interglacial period, the Waimanalo Stand, at 122,000 +/- 7,000 years before present.

Section 4 Results of Fieldwork

The fieldwork component of this archaeological inventory survey was conducted between 14 April 2014 and 5 June 2014. CSH archaeological field personnel consisted of Ena Sroat, B.A. (project director), Megan Hawkins, M.A., Michelle Pammer, B.A., Andrew Soltz, B.A., Kimi Matsushima, B.S., Scott Belluomini, B.A., Tim Zapor, B.A., Jessica Leger, M.Sc., Abbey Mierzejewski, B.A., Amanda Eggers, B.A., Jonas Madeus, B.A., James Thain, B.A., Laura Vollert, B.A., Nigel Kingsbury, B.A., Fred LaChance, B.A., Tara del Fierro, B.A., Tara Seaver, B.A., Pua Guanzon, B.A., and Leandra Medina, B.A. All fieldwork was conducted under the direction of the principal investigator, Matt McDermott, M.A.

Fieldwork consisted of an initial 100% coverage pedestrian inspection followed by a subsurface testing program. The pedestrian survey confirmed that there were no surface historic properties within the Block C West project area. The pedestrian survey concluded that the entire surface of the project area has been modified as a result of development of the Ward Warehouse commercial complex, including significant elevation of the ground surface above the surrounding environment (Figure 46, Figure 47). As there were no surface historic properties, the archaeological inventory survey focused on the program of subsurface testing to locate any buried cultural deposits and to facilitate a thorough examination of stratigraphy within the project area.

A total of 36 backhoe-assisted test excavations were completed, including both exterior (parking lot/courtyard) and interior (Ward Warehouse commercial space) test excavations (Figure 48). The test excavations were distributed throughout the project area in order provide comprehensive testing coverage. The entire length of each test excavation, measuring approximately 2 feet by 20 feet, was excavated to the upper boundary of the buried coral shelf or to below the water table. As discussed in Section 2, limiting factors that prohibited the complete excavation of each trench to depth included the presence of active utility lines, subsurface structural remnants, or safety concerns. In most cases, the complete excavation of the sediment underlying these foundations and utilities was not excavated due to the potential for damage or collapse during excavation and subsequent backfilling activities. All unexcavated areas beneath utilities lines or utility jackets are accurately represented on stratigraphic profile maps.

Significant findings of the inventory survey included identification of a large complex of buried historic salt pan structures and sediments within the central and mauka portions of the project area. The historic salt pan remnants, designated SIHP # -7655, consisted of a grid-like system of man-made berms enclosing low-lying, level salt pan beds. The berms consisted of anthropogenically altered local marine sandy clay modified into linear berm structures. The salt pan beds consisted of natural wetland sediment overlain with laminated organic material. For a complete description of SIHP # -7655, see Section 6.1.

Also identified within the project area, buried beneath modern fill episodes, were extensive remnants of previous twentieth century development of the Block C West and adjacent Block B East project areas, designated SIHP # -7658. The infrastructure remnants within Block C West consisted primarily of buried asphalt surfaces, but also included concrete and oil-rolled surfaces as well as milled wooden posts. Historic development of the project area began sometime between 1941 and 1952, as evidenced by aerial photographs (see Section 6.2), and continued until 1976, at which time the present Ward Warehouse commercial complex was constructed. For a complete

Figure 46. Photograph of Block C West, showing the significant elevation difference between the *mauka* parking lot and Auahi Street

Figure 47. Photograph of the *makai* Ward Warehouse commercial building within Block C West, showing the elevation difference between the building/courtyard and the *makai* edge of the project area along Ala Moana Boulevard

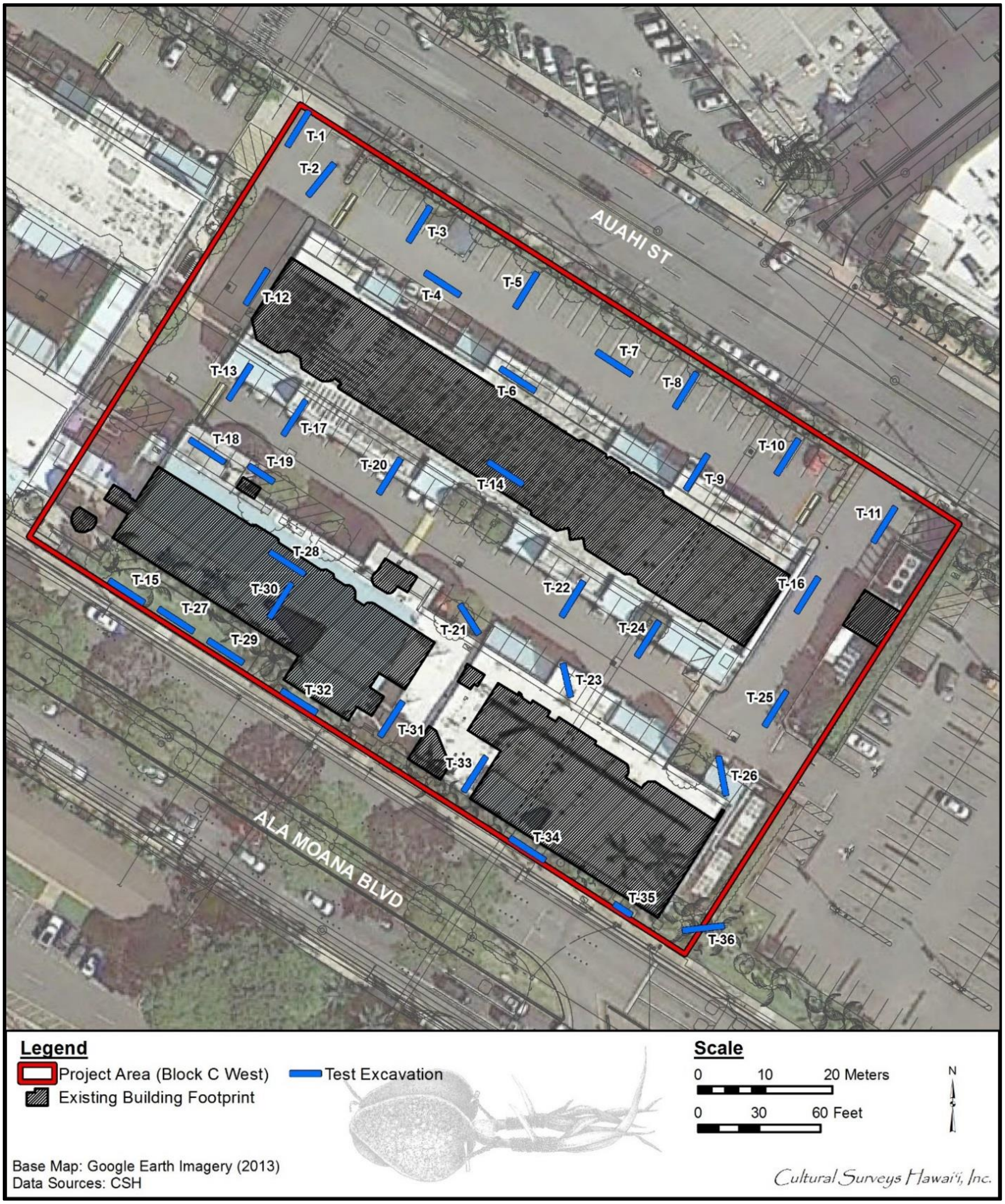

Figure 48. 2013 aerial photograph showing the location of AIS test excavations within the Block C West project area

description of SIHP # -7658, see Section 6.2.

4.1 Stratigraphic Summary

This section provides an overview of the stratigraphy observed within the 36 backhoe test trenches excavated within the Block C West project area. For detailed information regarding each of the test excavations, please refer to the trench profiles, sediment descriptions, and photographs which follow this summary section.

In general, the stratigraphic sequence within Block C West from the present land surface to the coral shelf included the modern developed land surface and variable layers of imported fill, overlying buried historic surfaces (SIHP # -7658) and associated grading fill, overlying crushed coral and hydraulic (dredge) reclamation fill, overlying historic salt pan remnants (SIHP # -7655) and/or natural wetland and marine sediments.

The modern developed land surface consisted of asphalt parking lot surfaces and concrete commercial floors associated with the present Ward Warehouse commercial complex, as well as various layers of fill. Beneath these modern layers, within 20 test excavations, were located previous twentieth century development land surfaces (SIHP # -7658), consisting of asphalt, concrete, and oil-rolled surfaces (see Figure 235). These buried surfaces were documented 20–105 cm below surface, with an average depth of 52 cm below surface.

Underlying the modern and historic surfaces and fill layers were extensive reclamation fill deposits, utilized to in-fill low-lying wetland areas and create a dry, level land surface. The reclamation fill deposits consisted of crushed coral and hydraulic-dredged marine clays and were documented 38–115 cm below surface, with an average depth of 73 cm below surface. A total of 28 test excavations contained reclamation fill, located almost ubiquitously throughout the project area, with the exception of the *makai* landscaped edge of the property (see Figure 264).

Background research indicates that land reclamation activity within the project area occurred sometime between 1919 and 1927, following allocation of territorial funds for the dredging of Kewalo Basin in 1919 and prior to a 1927 aerial photograph which shows a white coral deposit covering the project area (see Figure 268). The narrow date range of these reclamation fill deposits provided a clear dating tool, indicating that the strata underlying the reclamation fill could be considered older than 1919, and conversely, that the overlying strata could be considered later than 1927. For a complete analysis of the reclamation fill deposits, see Section 7.3.

The area of reclamation fill within Block C West aligned almost exactly with the area of underlying historic salt pan remnants (SIHP # -7655) (see Figure 184). This is consistent with the location of the historic salt pan remnants within areas of natural low-lying wetlands, which were converted to salt pan basins enclosed by man-made berm structures. The berm structures were comprised of archaeosediments, likely marine sandy clay deposits previously located within or in the immediate vicinity of the project area. The salt pan beds consisted of the natural underlying wetland sandy clay sediments covered with very thin organic laminations, likely associated with salt production methods.

Along the *makai* edge of the project area, the stratigraphy changed to coastal marine sandy clay sediments overlain by various fill deposits and crisscrossed by utility lines. Much of the disturbance to the natural sediments in this area appeared to be due to the installation of several large utilities at or near the coral shelf. The natural sandy clay marine deposits appeared very similar to the historic salt pan berm sediments and may represent the source of these archaeosediments.

Stratigraphy within the project area was designated using a Roman numeration system (Stratum I, II, III, etc.). All modern and historic fill deposits and surface layers were designated Stratum I and further divided into substrata (e.g., Strata Ia–Ig). Within the low-lying wetland areas, sediments associated with historic salt pan remnants were designated Stratum II (with substrata IIa and IIb), unless these sediments were absent, in which case the natural wetland sediments were identified as Stratum II (see Test Excavation 9). All underlying natural strata followed sequentially (e.g., Stratum III, IV, V). Along the *makai* boundary of the project area, Stratum II was used to designate disturbed natural marine sediment, followed by in situ natural marine sediments (Stratum III, IV, etc.). The hard coral shelf was reached at the base of excavation (BOE) within the majority of test excavations (32), but was not assigned a stratum designation.

4.1.1 Test Excavation 1 (TE 1)

Test Excavation 1 (TE 1), an exterior excavation located at the Ward Warehouse central entrance on Auahi Street, was oriented in a northeast-southwest direction, and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.58 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 1 consisted of asphalt surface (Stratum Ia), associated base coarse (Stratum Ib), and various fill layers consisting of gravelly loam (Stratum Ic), loam and asphalt mixed fill (Stratum Id/SIHP # -7658), two deposits of very gravelly sand (crushed coral) (Strata Ie and If), hydraulic sandy clay (Stratum Ig), and imported sand (Stratum Ih), overlying on the northwest sidewall a sandy clay man-made berm (Stratum IIa/SIHP # -7655) and natural sandy clay wetland sediments (Stratum III), and on the southeast sidewall laminated organic material (Stratum IIb/SIHP # -7655), sandy clay wetland sediment (Stratum IV), and gravelly clay sand marine sediment (Stratum V) (Figure 49 through Figure 54, Table 2).

Within TE 1, a discontinuous buried asphalt surface (Stratum Id) was determined to be a component of SIHP # -7658. The former land surface was observed primarily in the center of TE 1, with evidence of disturbance in the northeast and southwest ends and was observed 20 cm below surface, with a thickness of 15 cm. This buried asphalt surface overlies crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 1 also documented the presence of historic salt pan remnants, designated SIHP # -7655, consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum IIa) and a thin layer of laminated organic material (Stratum IIb) overlying natural wetland sediment (Stratum IV) utilized as a salt pan bed. TE 1 intersected a transition zone between the berm and salt pan bed, as indicated by the presence of the low berm on the northwest sidewall and the transition to a level laminated organic layer on the southeast sidewall. The maximum height of the berm was 45 cm above coral shelf. Due to the presence of a concrete jacket within the *mauka* portion of the test excavation, the full context of the berm to salt pan transition was unable to be documented.

A sample of Stratum IIb, laminated organic material associated with the historic salt pans (SIHP # -7655) was submitted to PaleoResearch Institute, Inc. for pollen and microcharcoal analysis. The majority of the observed pollen consisted of *kolea* (*Myrsine*), an endemic Hawaiian tree. Cyperaceae pollen was documented, but not in a concentration indicative of a sedge marsh.

Pollen from introduced species included *kiawe* (*Prosopis*) and ironwood (*Casuarina*). This may indicate that the sample dates to the historic period, or that it may have been contaminated in recent of historic times. A small concentration of Poaceae pollen was identified, suggesting that grasses were growing in outlying areas. Sugarcane (*Saccharum*) and coconut (*Cocos nucifera*) pollen were present, suggesting that they may have been cultivated nearby.

Figure 49. Photograph of TE 1 northwest wall, view to west

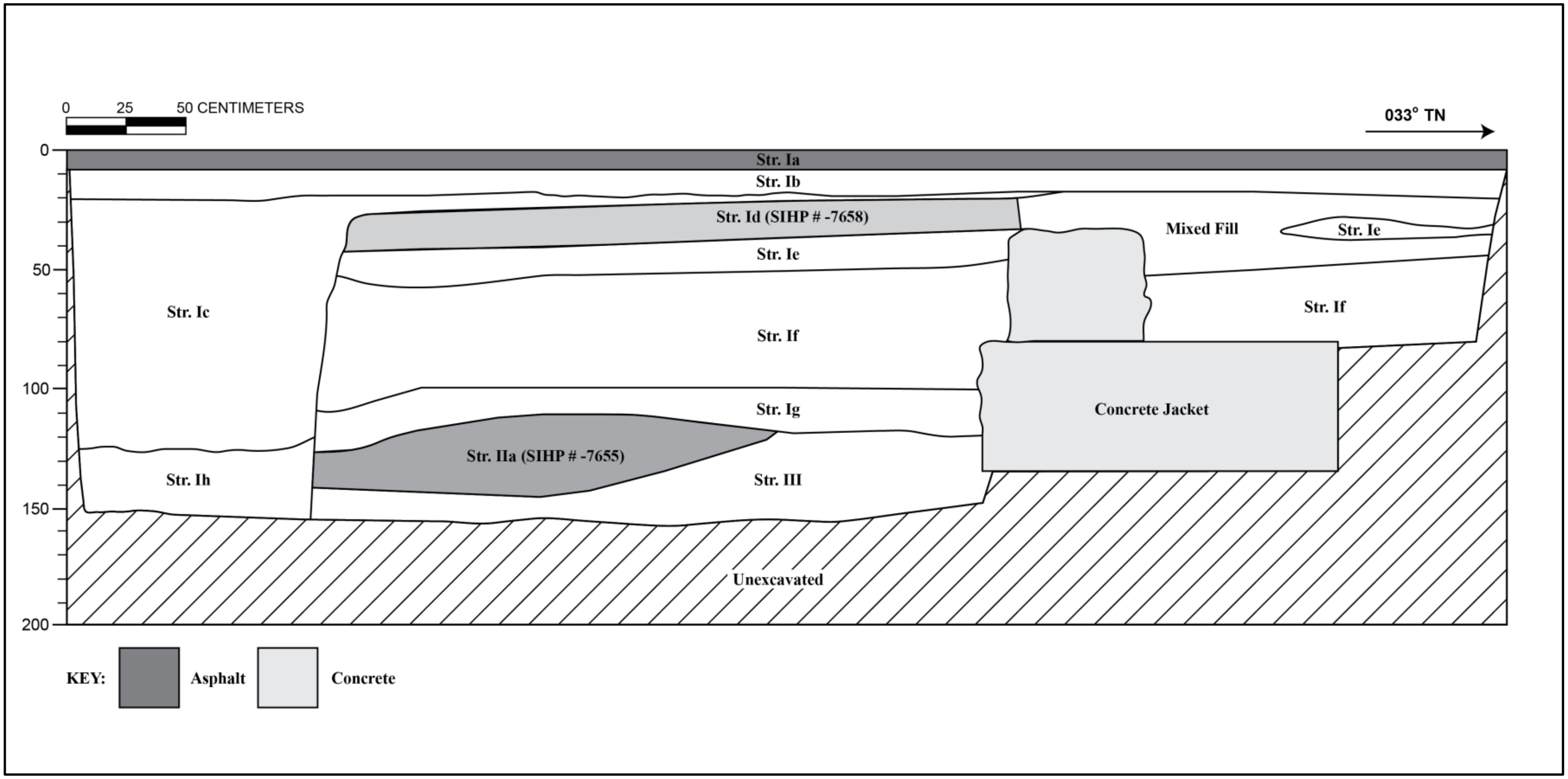

Figure 50. Profile of TE 1 northwest wall

Figure 51. Photograph of TE 1 southeast wall, view to south

Figure 52. Close-up of Stratum IIb (SIHP # -7655) overlying natural wetland sediments, view to southeast

Figure 53. Close-up of Stratum IIb, showing the laminated organic material

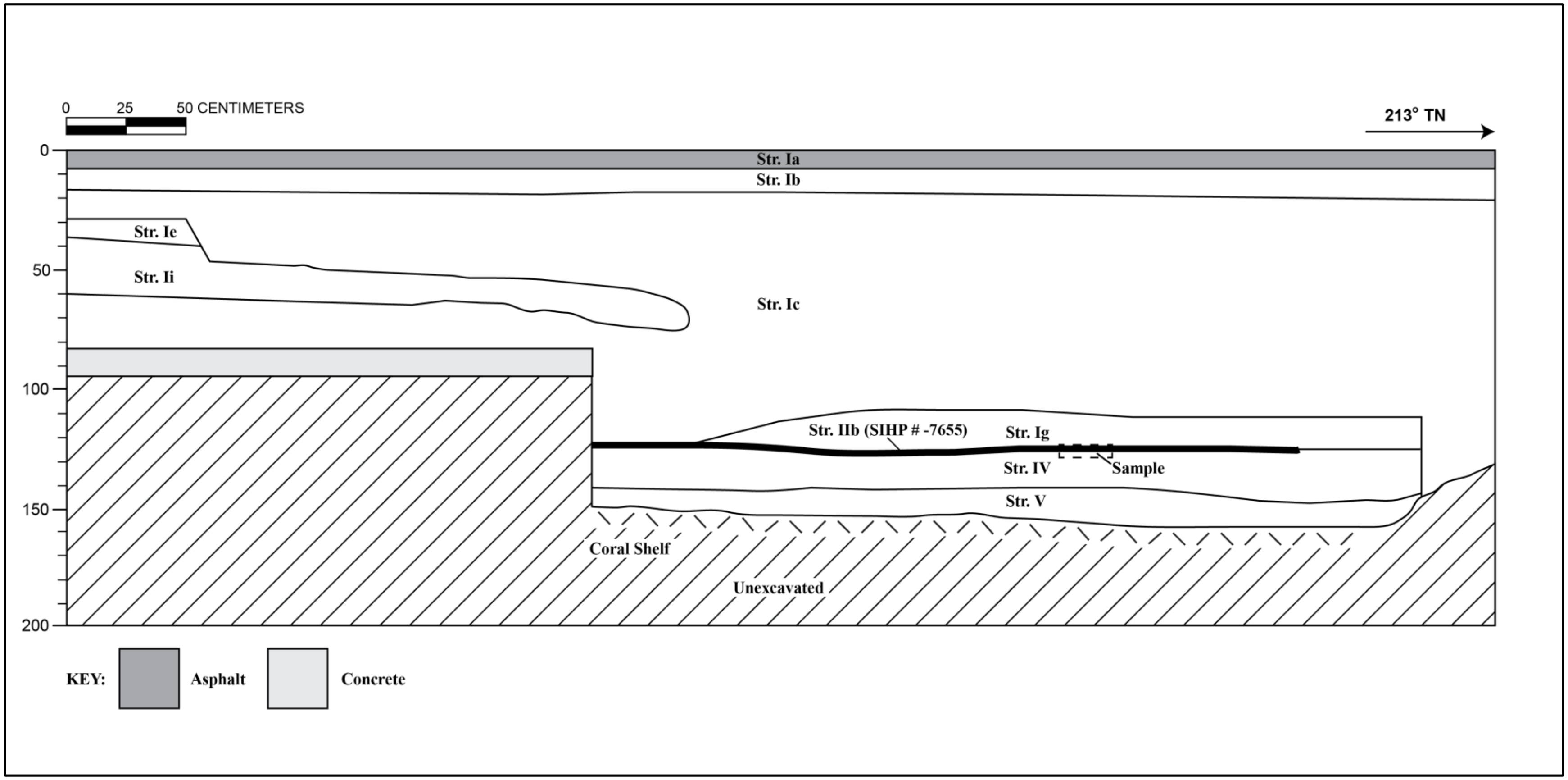

Figure 54. Profile of TE 1 southeast wall

Table 2. TE 1 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–8	Asphalt surface
Ib	8–20	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy loam; moist, loose consistency; non-plastic; abrupt, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	17–145	Fill; 10YR 5/3, brown; gravelly loam; weak, medium to coarse, crumb structure; moist, very friable consistency; non-plastic; mixed origin; abrupt, broken/discontinuous lower boundary; few, coarse roots; mixed fill containing coral gravel and historic trash
Id	20–42	SIHP # -7658; 10YR 3/2, very dark grayish brown; asphalt and loam; structureless (massive); non-plastic; abrupt, broken/discontinuous lower boundary; buried asphalt surface and associated grading layer; observed only within the northwest sidewall
Ie	30–40	Fill; 10YR 6/6, brownish yellow; very gravelly coarse sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; imported crushed coral fill
If	47–110	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic, marine origin; clear, smooth/discontinuous lower boundary; crushed coral fill associated with land reclamation events; observed only within the northwest sidewall
Ig	100–127	Fill; 10YR 7/2, light gray grading to 10Y 6/1, greenish gray; sandy clay; moderate, very fine, blocky structure; moist, firm consistency; plastic; marine origin; abrupt, wavy/discontinuous lower boundary; few, fine roots; hydraulic (dredge) fill associated with land reclamation events
Ih	120–155 (BOE)	Fill; 10YR 4/1, dark gray; loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; abrupt, broken/discontinuous lower boundary; observed only within the northwest sidewall
Ii	36–75	Fill; 10YR 6/3, pale brown; sandy loam; weak, fine, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; observed only within the southeast sidewall
IIa	110–145	SIHP # -7655; 10YR 6/2, light brownish gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, wavy/discontinuous lower boundary; man-made berm associated with salt pan remnants; observed only within the northwest sidewall
IIb	124–127	SIHP # -7655; organic laminations associated with salt pan remnants; observed only within the southeast sidewall

Stratum	Depth (cmbs)	Description
III	118–157 (BOE)	Natural; 10Y 6/1, greenish gray; sandy clay; moderate, medium, platy structure; wet, sticky consistency; plastic; marine origin, abrupt, smooth lower boundary; wetland sediment overlying coral shelf; observed only within the northwest sidewall
IV	125–147	Natural; 10GY 6/1, greenish gray; clay; structureless (massive); wet, slightly sticky consistency; plastic; marine origin; clear, smooth lower boundary; wetland sediment; observed only within the southeast sidewall
V	142–157 (BOE)	Natural; light gray; gravelly clay sand; weak, fine, granular structure; moist, friable consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; marine sediments containing marine shell and decomposing coral; observed only within the southeast sidewall

4.1.2 Test Excavation 2 (TE 2)

Test Excavation 2 (TE 2), an exterior excavation located at the Ward Warehouse central entrance on Auahi Street, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 0.9 mbs. The base of excavation was determined by the presence a concrete jacket. The stratigraphy of TE 2 consisted of asphalt surface (Stratum Ia), associated base coarse (Stratum Ib), and various fill layers consisting of gravelly loam (Stratum Ic), imported sand (Stratum Id), a buried asphalt surface and associated loam base course (Stratum Ie/SIHP # -7658), and very gravelly sand (crushed coral) (Stratum If) (Figure 55, Figure 56, Table 3).

Due to the complex of subsurface utilities within this portion of the project area, the placement of TE 2 was problematic. TE 2 was located within a narrow area believed to have the highest likelihood of avoiding subsurface utilities; however, the presence of a concrete jacket running diagonally through the majority of the test excavation floor prevented excavation to the natural stratigraphy and/or coral shelf.

Within TE 2, a buried asphalt surface was determined to be a component of SIHP # -7658 (Stratum Ie). The former land surface was observed 33 cm below surface, with an average thickness of 12 cm. This buried asphalt surface (SIHP # -7658) overlies a crushed coral fill associated with 1919-1926 land reclamation. Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

Figure 55. Photograph of TE 2 northwest wall, view to west

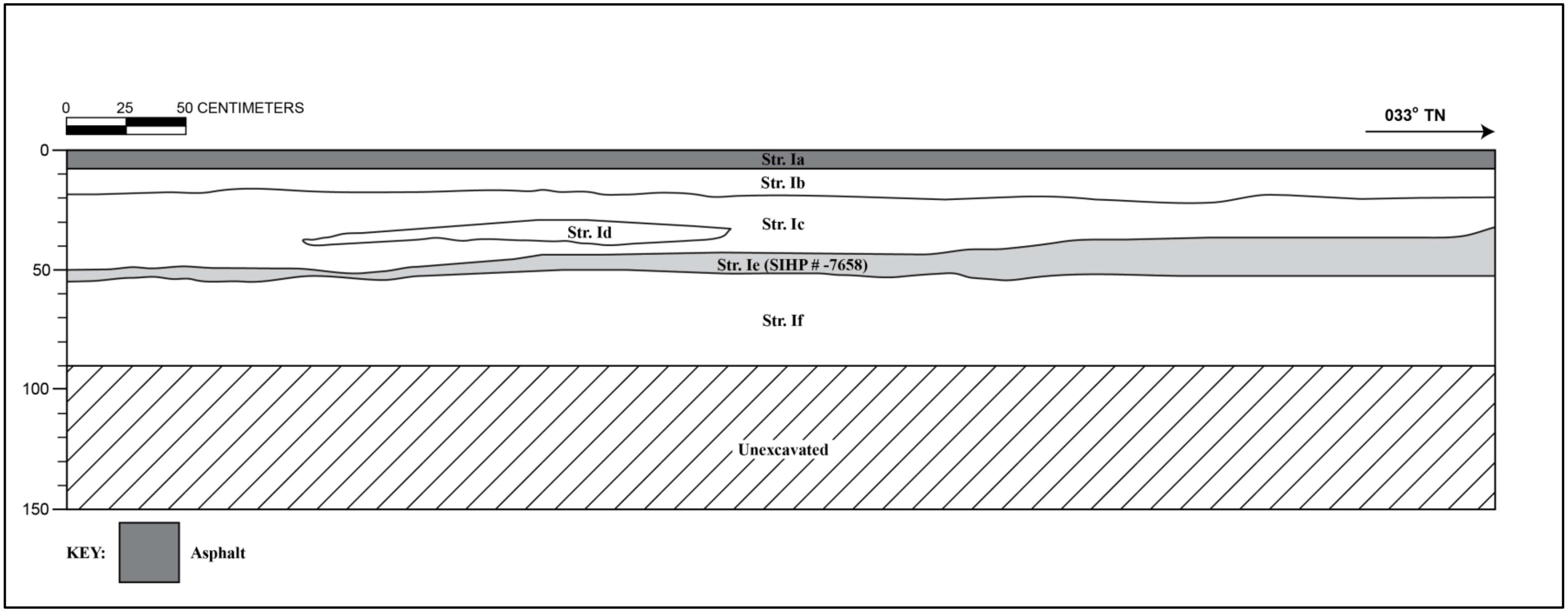

Figure 56. Profile of TE 2, northwest wall

Table 3. TE 2 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–9	Asphalt surface
Ib	9–20	Fill; 7.5YR 3/2, dark brown; extremely gravelly loam; moist, loose consistency; non-plastic; abrupt, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	17–50	Fill; 10YR 5/3, brown; gravelly loam; weak, medium to coarse, crumb structure; moist, very friable consistency; non-plastic; mixed origin; abrupt, smooth lower boundary; mixed fill containing coral gravel and historic trash
Id	30–40	Fill; 7.5YR 3/4, dark brown; medium sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken/discontinuous lower boundary; imported sand
Ie	33–55	SIHP # -7658; 10YR 3/2, very dark grayish brown; asphalt with loam base course; structureless (massive); abrupt, smooth lower boundary; buried asphalt surface with associated base course fill
If	60–90 (BOE)	Fill; 10YR 8/2, very pale brown; coarse, very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; abrupt, smooth lower boundary; crushed coral fill likely associated with land reclamation events

4.1.3 Test Excavation 3 (TE 3)

Test Excavation 3 (TE 3), an exterior excavation located in the northern portion of the project area, was oriented in a northeast-southwest direction, and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.76 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 3 consisted of asphalt surface (Stratum Ia), associated base coarse (Stratum Ib), and various fill layers consisting of very gravelly sandy loam (Stratum Ic), asphalt and very gravelly sandy clay (Stratum Id/SIHP # -7658), and very gravelly sand (crushed coral) (Stratum Ie), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) and clay wetland sediment (Stratum III) (Figure 57, Figure 58, Figure 60, Table 4).

A buried asphalt surface (Stratum Id/SIHP # -7658) was continuous throughout TE 3. The asphalt was observed 48 cm below surface, with an average thickness of 30 cm (including possibly associated base course). The buried asphalt surface overlies a crushed coral fill associated with land reclamation in this area from 1919-1926. Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 3 also documented the presence of historic salt pan remnants (SIHP # -7655), consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II), running lengthwise through the test excavation. The maximum height of the berm was 1.06 m above the coral shelf. Within the *makai* end of the trench, the berm material extended to the coral shelf, indicating removal of the natural wetland sediments in this area during construction of the berm. Faunal remains were observed and collected from the upper boundary of the berm, consisting of a butchered cow (*Bos taurus*) rib and pig (*Sus scrofa*) tibia (leg bone) fragment.

Several historic artifacts were also identified within Stratum Ic, consisting of rusted nails, clear glass fragments, and a glass marble (Figure 59).

Figure 57. Photograph of TE 3 northwest wall, view to southwest

Figure 58. Close-up photograph of TE 3, showing light gray sandy clay berm material (Stratum II), SIHP # -7655, overlying the gleyed clay wetland sediment (Stratum III) and coral shelf

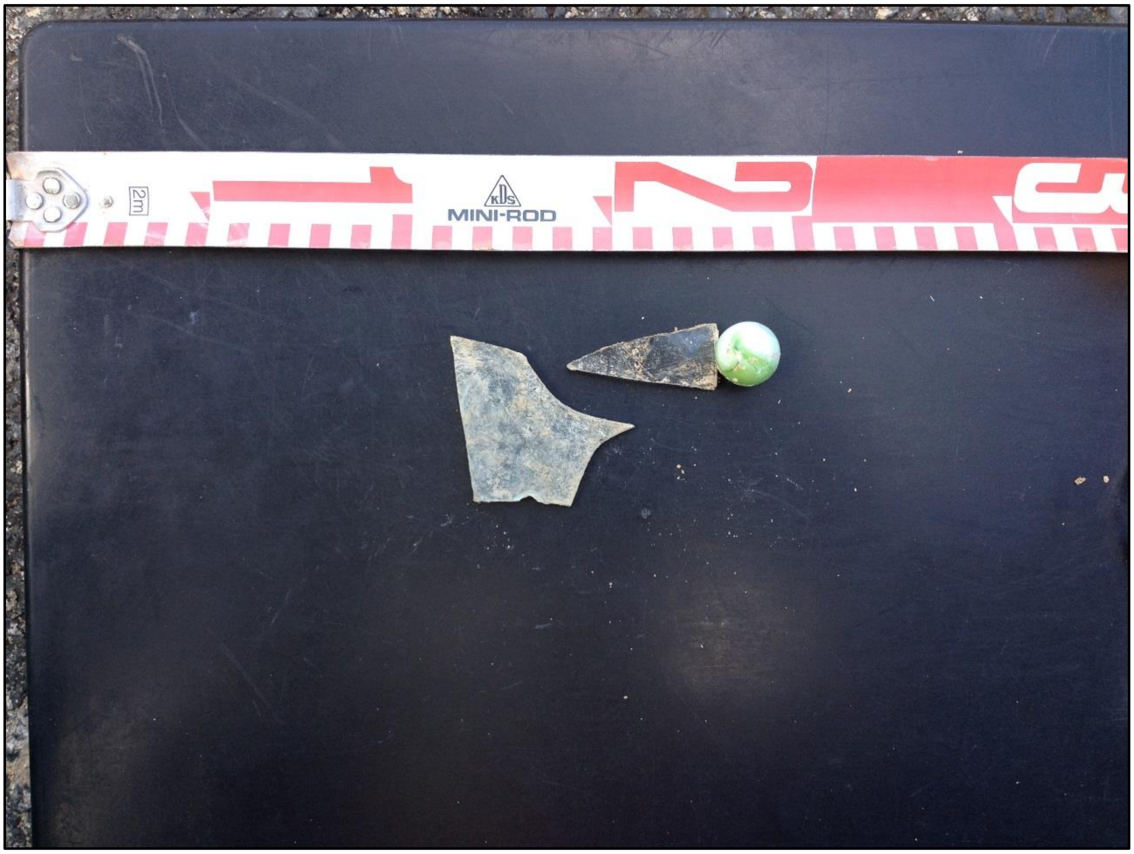

Figure 59. Photograph of glass marble and clear glass fragments identified within Stratum Ic

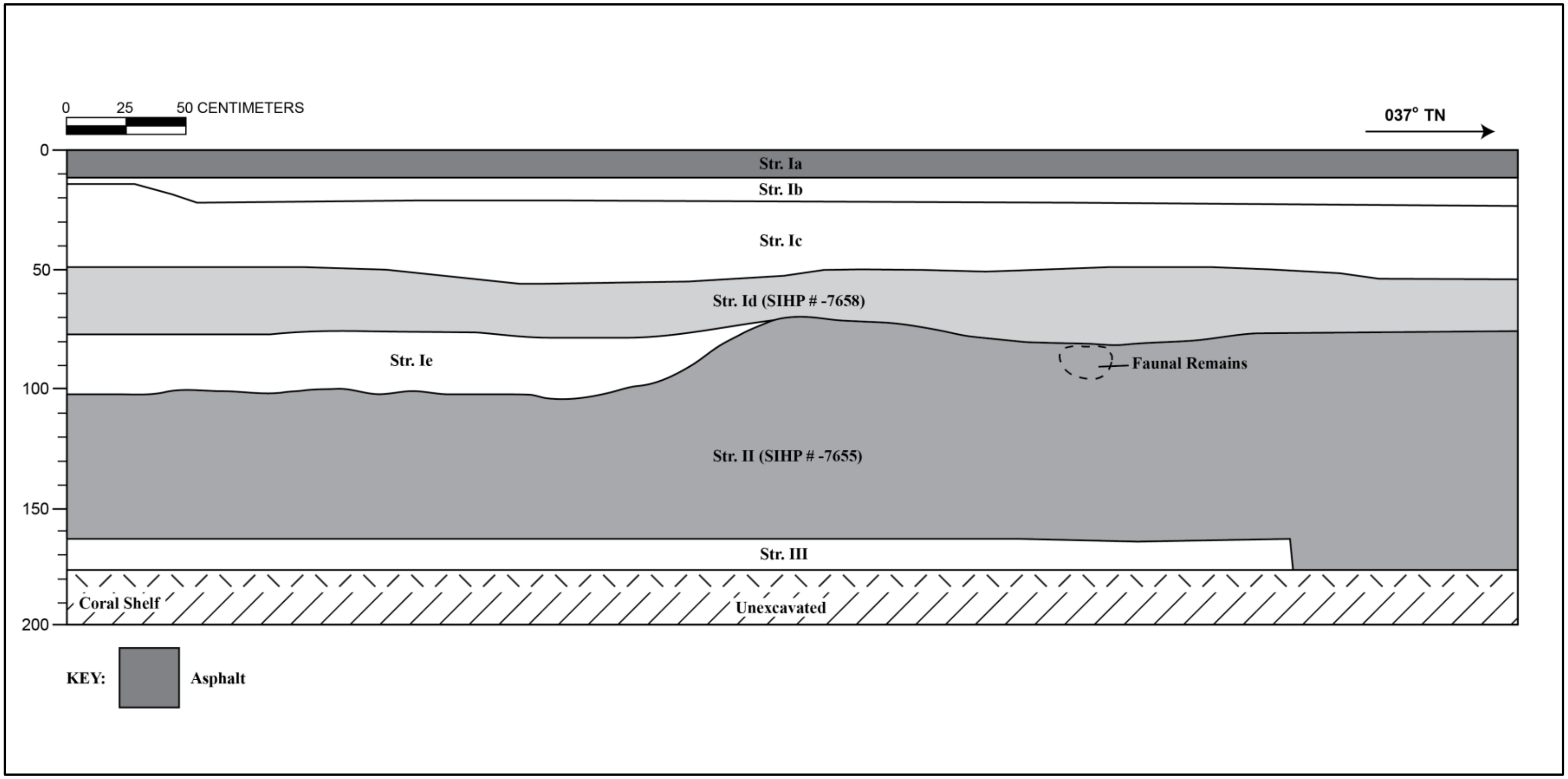

Figure 60. Profile of TE 3 northwest wall

Table 4. TE 3 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–12	Asphalt surface
Ib	12–22	Fill; 7.5YR 4/2, brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	22–56	Fill; 2.5YR 3/3, pale yellow; very gravelly sandy loam; weak, medium, granular structure; moist, very friable consistency; non-plastic; mixed origin; clear, smooth lower boundary; contained coral gravel, several glass fragments, rusted nails, and a glass marble (photographed, not collected)
Id	48–78	SIHP # -7658; 7.5YR 5/6, strong brown; very gravelly sandy loam; weak, crumb structure; moist, firm consistency; slightly plastic; terrigenous origin; irregular lower boundary; metal and glass observed; asphalt and sandy clay layer
Ie	73–101	Fill; 2.5Y 2/4, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken/discontinuous lower boundary; crushed coral fill associated with land reclamation events
II	70–122	SIHP # -7655; 2.5Y 7/4, pale yellow; sandy clay; fine, blocky structure; moist, firm consistency; plastic; marine origin; common, medium roots; berm associated with salt pan remnants; faunal skeletal remains collected from the upper boundary (cow and pig bone)
III	162–176 (BOE)	Natural; 10GY 8/1, light greenish gray; clay; structureless (massive); wet, very sticky consistency; marine origin; abrupt, smooth lower boundary; wetland sediment overlying coral shelf

4.1.4 Test Excavation 4 (TE 4)

Test Excavation 4 (TE 4), an exterior excavation located within the northern portion of the project area, was oriented in a northwest-southeast direction, and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.84 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 4 consisted of asphalt surface (Stratum Ia), associated base coarse (Stratum Ib), and various layers of fill consisting of gravelly sandy loam (Stratum Ic), gravelly sandy clay with disturbed asphalt along the lower boundary (Stratum Id/SIHP # -7658), gravelly sandy loam (utility pit fill), very gravelly sand (crushed coral) (Stratum Ie), and hydraulic silty clay (Stratum If), overlying a sandy clay man-made berm (Stratum IIa/SIHP # -7655), laminated organic material (Stratum IIb/SIHP # -7655), and natural sandy clay wetland sediments (Strata III and IV) (Figure 61, Figure 62, Figure 64, Table 4).

A buried asphalt surface (Stratum Id) observed in TE 4 was determined to be a component of SIHP # -7658. The asphalt was observed 57 cm below surface, with an average thickness of 24 cm. The asphalt surface overlies a crushed coral and hydraulic (dredge) fill associated with 1919-1926 land reclamation. Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 4 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum IIa) and a thin layer of laminated organic material (Stratum IIb), visible within both sidewalls. The man-made berm was observed within the Diamond Head portion of the test excavation, sloping toward the center of the trench and transitioning into a thin layer of organic laminations (Stratum IIb). A small pocket of berm sediment was also visible near the ‘Ewa portion of the test excavation; however, due to the presence of a subsurface utility, the extent of the berm material within the ‘Ewa portion was unable to be determined. Mixing between the berm material and the underlying natural wetland deposit (Stratum III) was observed and is most likely a result of disturbance caused by the creation of the berm. The maximum height of the berm was 39 cm above the coral shelf.

Several historic artifacts were also identified within Stratum Ic, consisting of asphalt pieces, wood, rusted metal, and glass fragments (Figure 63).

Figure 61. Photograph of TE 4 southwest wall, view to northwest

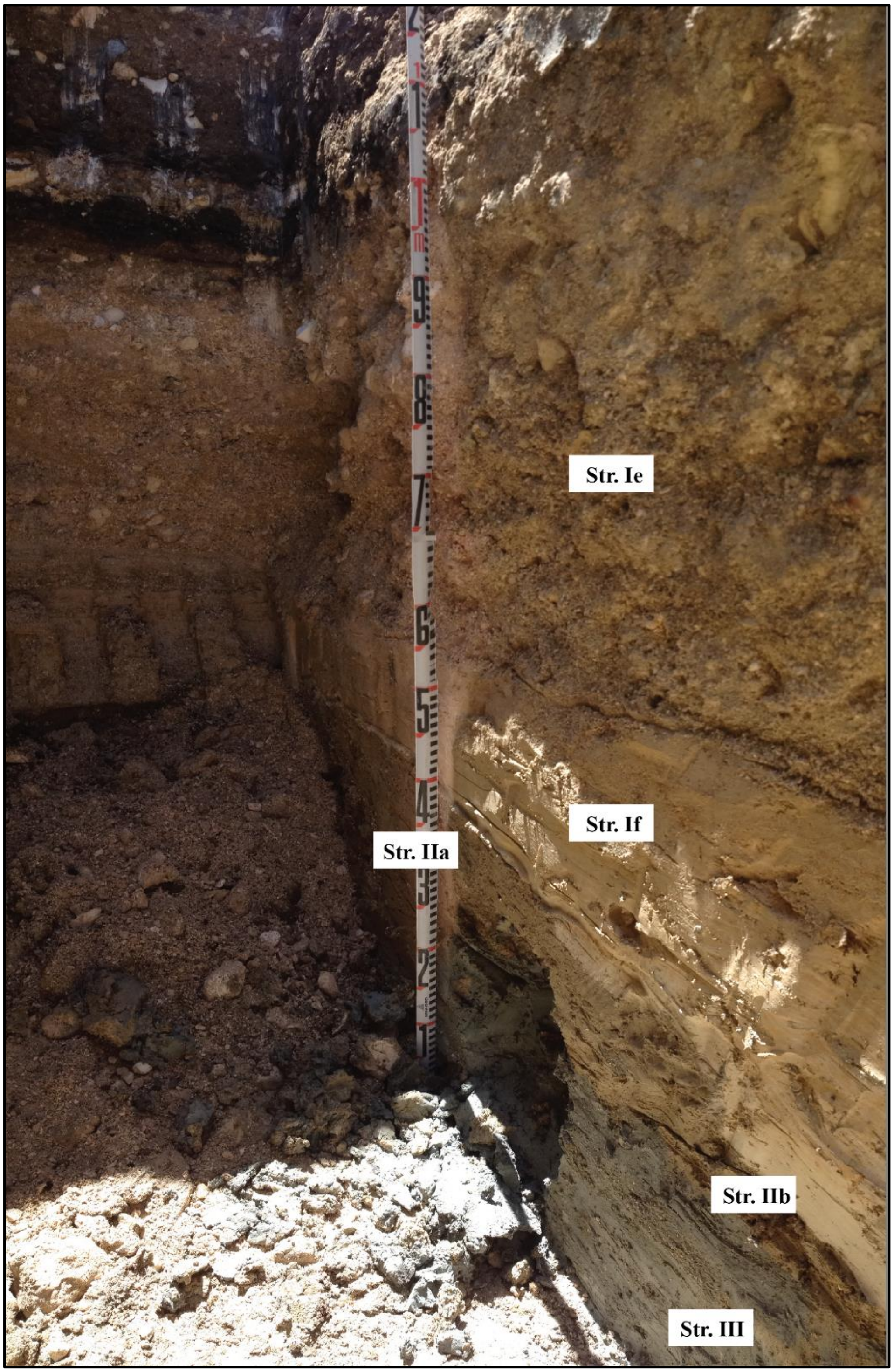

Figure 62. Close-up photograph of crushed coral (Stratum Ie) and light tan hydraulic fill (Stratum If) overlying the edge of a man-made berm (Stratum IIa/SIHP # -7655) transitioning to a thin dark layer of organic material (Stratum IIb/SIHP # -7655) overlying gleyed natural sandy clay (Stratum III)

Figure 63. Photograph of rusted metal pieces, nails, and wood identified within Stratum Ic

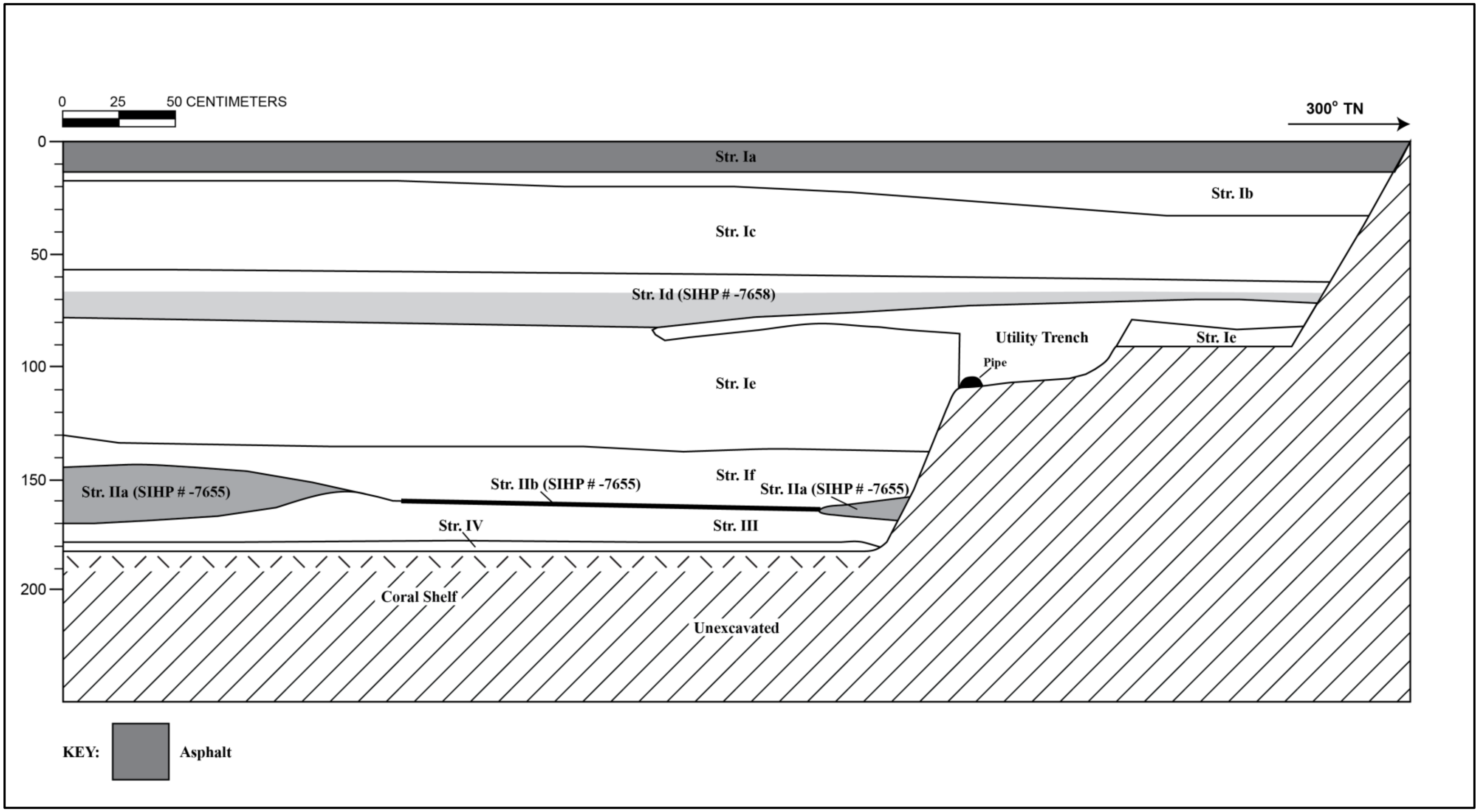

Figure 64. Profile of TE 4 west sidewall

Table 5. TE 4 Stratigraphy Description

Stratum	Depth (cmbs)	Description
Ia	0–12	Asphalt surface
Ib	12–31	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; common, fine roots observed; imported base course fill associated with the asphalt surface
Ic	19–61	Fill; 10YR 5/3, brown; gravelly sandy loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary; contained coral gravel, asphalt pieces, wood, rusted metal, and glass fragments (photographed, not collected)
Id	57–81	SIHP # -7658; 7.5YR 4/6, strong brown; gravelly sandy clay with asphalt; moderate, fine, blocky structure; moist, friable consistency; slightly plastic; terrigenous origin; abrupt, smooth lower boundary; imported alluvial clay with a disturbed asphalt layer at lower boundary
Utility Fill	70–108	Fill; 2.5Y 5/3, olive brown, gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; wavy, discontinuous lower boundary; fill associated with subsurface utility
Ie	79–136	Fill; 2.5Y 7/3, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coralline fill associated with land reclamation events
If	130–165	Fill; 10YR 7/4, very pale brown, grading to 10Y 7/1, light greenish gray; fine sandy clay to silty clay; structureless (massive); moist, firm consistency; very plastic; marine origin; abrupt, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	145–170	SIHP # -7655; 2.5Y 6/3, light yellowish brown; sandy clay; structureless (massive); moist, friable consistency; slightly plastic; marine origin; clear, broken/discontinuous lower boundary; common, fine roots; man-made berm associated with salt pan remnants
IIb	160–162	SIHP # -7655; organic laminations associated with salt pan remnants
III	160–177	Natural; 10Y 6/1, greenish gray; fine sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; fine, common roots; natural wetland sediment containing freshwater snails
IV	177–184 (BOE)	Natural; 10Y 7/1, light greenish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.5 Test Excavation 5 (TE 5)

Test Excavation 5 (TE 5), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northeast-southwest direction, and measured 6.1 m long by 0.7 m wide with a maximum depth of 1.77 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 5 consisted asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of gravelly sandy loam (Stratum Ic), very gravelly sand (crushed coral) (Stratum Id), and hydraulic silty clay (Stratum Ie), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) (Figure 65, Figure 66, Table 6)

TE 5 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a berm (Stratum II). The berm extended across the length of the test excavation, with the upper boundary roughly level and the base of the stratum resting directly on the coral shelf. Construction of the berm appeared to have removed any natural wetland sediment above the coral shelf. The maximum height of the berm was 32 cm above coral shelf.

Figure 65. Photograph of TE 5 southeast wall, view to northeast

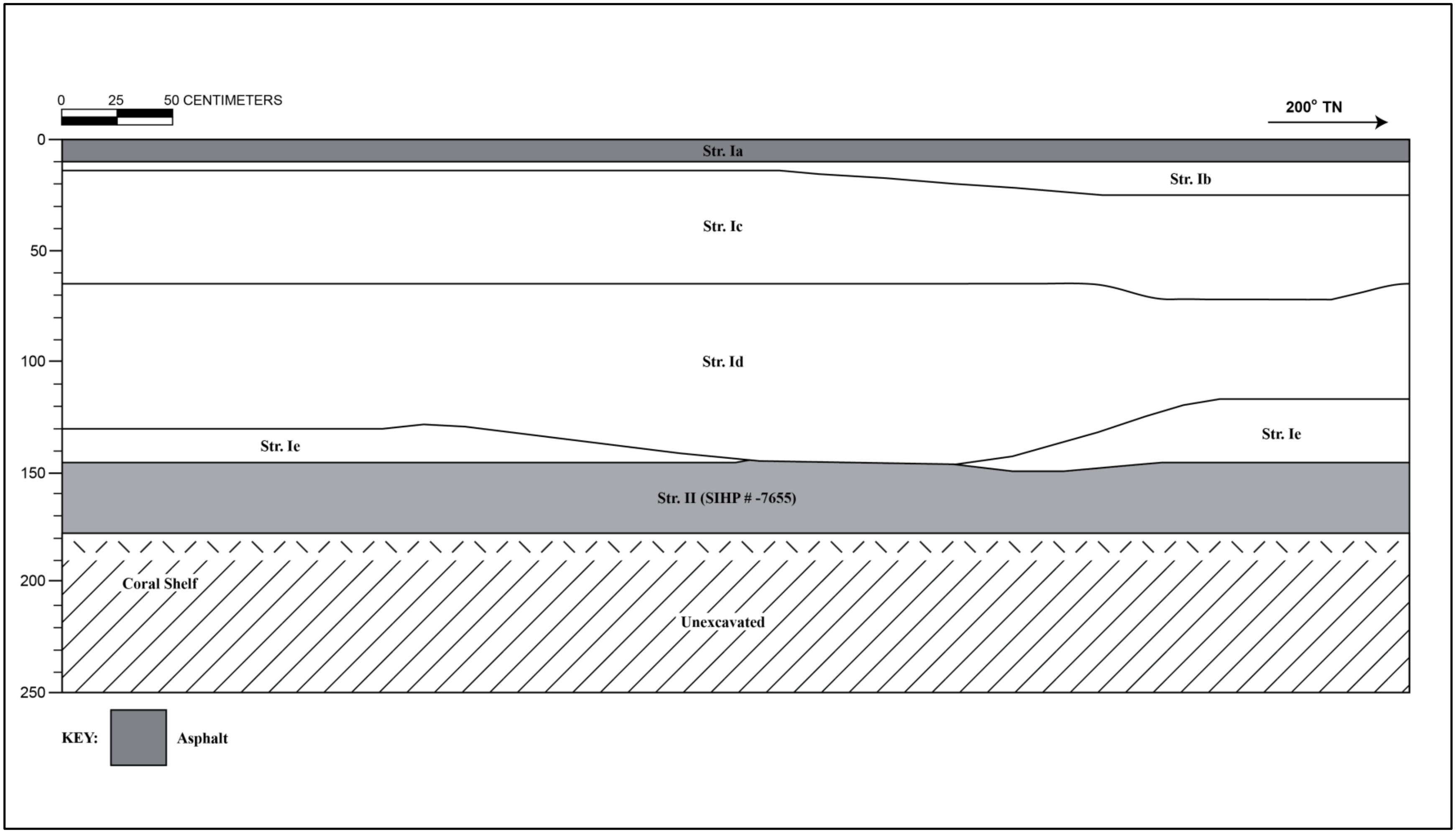

Figure 66. Profile of TE 5 southeast wall

Table 6. TE 5 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–25	Fill; 10YR 4/1, dark gray; very gravelly sandy loam; weak, fine to medium, crumb structure; moist, very friable to friable consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	15–71	Fill; 10YR 5/3, brown; gravelly sandy loam; weak, fine, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, discontinuous lower boundary; few, medium roots; contained glass bottle and ceramic fragments (not collected)
Id	65–146	Fill; 10YR 8/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill associated with land reclamation events
Ie	130–145	Fill; 10YR 7/1, light gray; silty clay; structureless (massive); moist, firm consistency; very plastic; marine origin; abrupt, smooth, discontinuous lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	145–177 (BOE)	SIHP # -7655; 10YR 6/3, pale brown; sandy clay; structureless (massive); moist, friable to firm consistency; plastic; marine origin; fine rootlets; abrupt, smooth lower boundary; man-made berm associated with salt pan remnants; overlying coral shelf

4.1.6 Test Excavation 6 (TE 6)

Test Excavation 6 (TE 6), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northwest-southeast direction, and measured 6.1 m long by 0.7 m wide with a maximum depth of 1.86 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 6 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of gravelly sandy loam associated with a sewer utility (Stratum Ic), very gravelly sandy loam (Stratum Id), a disturbed asphalt layer (Stratum Ie/SIHP # -7658), very gravelly sand (crushed coral) (Stratum If), and hydraulic silty clay (Stratum Ig), overlying laminated organic material (Stratum II/SIHP # -7655), and sandy clay wetland sediments (Strata III and IV) (Figure 67, Figure 70, Table 7).

Within TE 6, a disturbed buried asphalt surface (Stratum Ie) was determined to be a component of SIHP # -7658. The asphalt surface was striated with cement and was observed 65 cm below surface, with a thickness of 24 cm. The buried asphalt surface overlies crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photographs, the buried asphalt surface likely dates from 1939 to 1976.

TE 6 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of a thin layer of laminated organic material (Stratum II) overlying two strata of natural wetland sandy clay. The laminated organic layer was observed within both sidewalls. The presence of a sewer line within the ‘Ewa portion of the test excavation prevented documentation of what appeared to be gently rising sediments, possible indicating transition to a berm. As the nearby TE 5 documented berm material, this upslope may indicate this transition.

A sample of Stratum II, laminated organic material associated with the historic salt pans (SIHP # -7655), and the underlying wetland sediment (Stratum III) were submitted to PaleoResearch Institute, Inc. for pollen and microcharcoal analysis. The majority of the observed pollen consisted of *kolea* (*Myrsine*), an endemic Hawaiian tree. Cyperaceae pollen was documented in both samples, but not in a concentration indicative of a sedge marsh.

Pollen from introduced species was observed within both samples, including *kiawe* (*Prosopis*), *koa haole* (*Leucaena*), and ironwood (*Casuarina*). This may indicate that both samples date to the historic period. Alternatively, the alien species within the wetland sediments (Sample 9) may be a result of contamination during recent or historic times.

Small concentrations of ferns and grasses (Poaceae) were located within both samples, suggesting these plants were growing in outlying areas. Coconut were only documented in both samples (Samples 8 and 9). Potential cultigens include, sweet potato (*Ipomoea batatas*-type) from the laminated organic material (Sample 8) and rice (*Oryza*-type) from both samples (Samples 8 and 9). A larger variety of pollen was present in the wetland sample (Stratum III), while the laminated organic material (Stratum II) contained a higher pollen concentration value.

Several historic artifacts were also identified within Stratum Id, consisting of construction related debris, glass fragments, nails, ceramic fragments, wood pieces, brick fragments, and water worn rock (Figure 68, Figure 69).

Figure 67. Photograph of TE 6 northeast wall, view to northeast

Figure 68. Photograph of glass and ceramic fragments, brick, and a nail identified within Stratum Id

Figure 69. Photograph of rusted metal pieces identified within Stratum Id

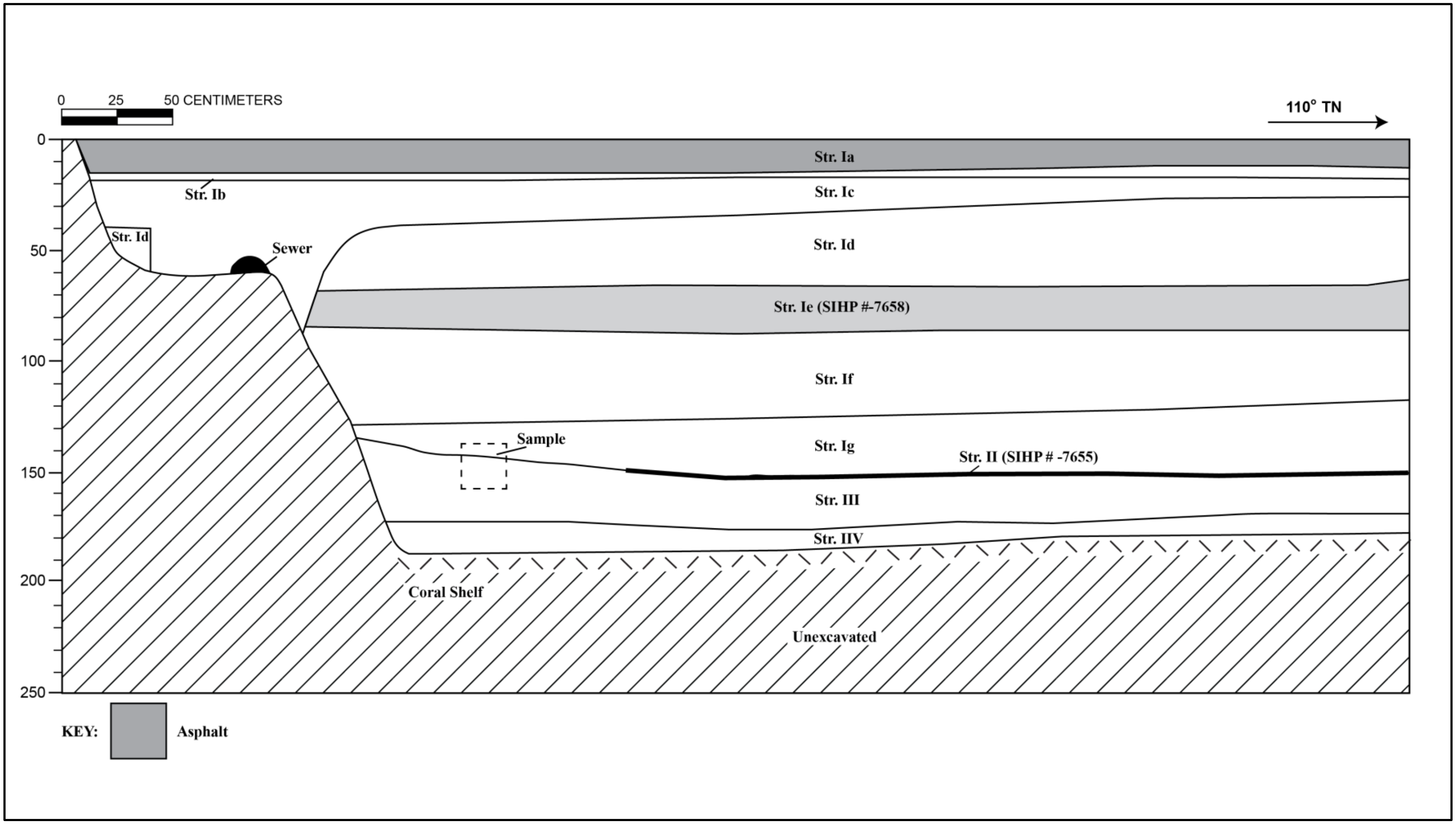

Figure 70. Profile of TE 6 northeast wall

Table 7. TE 6 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–15	Asphalt surface
Ib	12–18	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	18–70	Fill; 10YR 5/3, brown; gravelly sandy loam; moderate, medium, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, wavy lower boundary; few, fine roots; imported sediment associated with sewer line
Id	27–68	Fill; 10YR 4/3, brown, mottled with 10YR 2/1 (25%), black; very gravelly sandy loam; moderate, medium, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; contained coral gravel, construction related debris, glass fragments, nails, ceramic fragments, wood pieces, water worn rock (photographed, not collected)
Ie	65–89	SIHP # -7658; 10YR 2/1, black; gravelly loamy clay; moderate, medium, blocky structure; moist, very friable consistency; non-plastic; mixed origin; extremely compact layer of asphalt striated with cement; contained inclusions of sand, coral, gravel, hydraulic fill material
If	85–130	Fill; 2.5Y 8/3, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
Ig	120–152	Fill; 10YR 7/3, very pale brown grading to 10Y 7/1, light greenish gray; fine sandy clay to silty clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	153-155	SIHP # -7655; organic laminations associated with salt pan remnants; contained wood splinters and asphalt or slag pieces at upper boundary
III	135–177	Natural; 10Y 6/1, greenish gray; sandy loamy clay; structureless (massive); moist, friable consistency; plastic; marine origin; diffuse, smooth lower boundary; common, fine roots; natural wetland sediment
IV	172–187 (BOE)	Natural; 10Y 7/1, light greenish gray; sandy clay; structureless (massive); wet, slightly sticky consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.7 Test Excavation 7 (TE 7)

Test Excavation 7 (TE 7), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northwest-southeast direction, and measured 6.1 m long by 0.7 m wide with a maximum depth of 1.9 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 7 consisted of asphalt surface (Stratum Ia), associated base course fill (Stratum Ib), and various fill layers consisting of extremely gravelly loamy clay (Stratum Ic/SIHP # -7658), gravelly sandy loam (Stratum Id/SIHP # -7658), very gravelly sand (Stratum Ie), and hydraulic silty clay (Stratum If), overlying a sandy clay man-made berm (Stratum IIa/SIHP # -7655), laminated organic material (Stratum IIb/SIHP # -7655), and sandy clay wetland sediments (Strata III and IV) (Figure 71, Figure 72, Figure 73, Table 8).

Two continuous layers with buried asphalt chunks observed in TE 7 were determined to be a component of SIHP # -7658 (Strata Ic and Id). The layers were observed 28 to 80 cm below surface, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the layers with buried asphalt chunks likely date from 1939 to 1976.

TE 7 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a berm (Stratum IIa) and a thin layer of laminated organic material (Stratum IIb). The berm was located within the Diamond Head end of the test excavation, sloping down to the northwest and transitioning into salt pan laminations (Stratum IIb) overyling two natural wetland sediments. The maximum height of the berm was 80 cm above the coral shelf.

Figure 71. Photograph of TE 7 northeast wall, view to north

Figure 72. Close-up photograph of a man-made berm (light grayish brown) (Stratum IIa), SIHP # -7655, underlying crushed coral fill (Stratum Ie) and overlying gleyed natural wetland sediments (Strata III and IV)

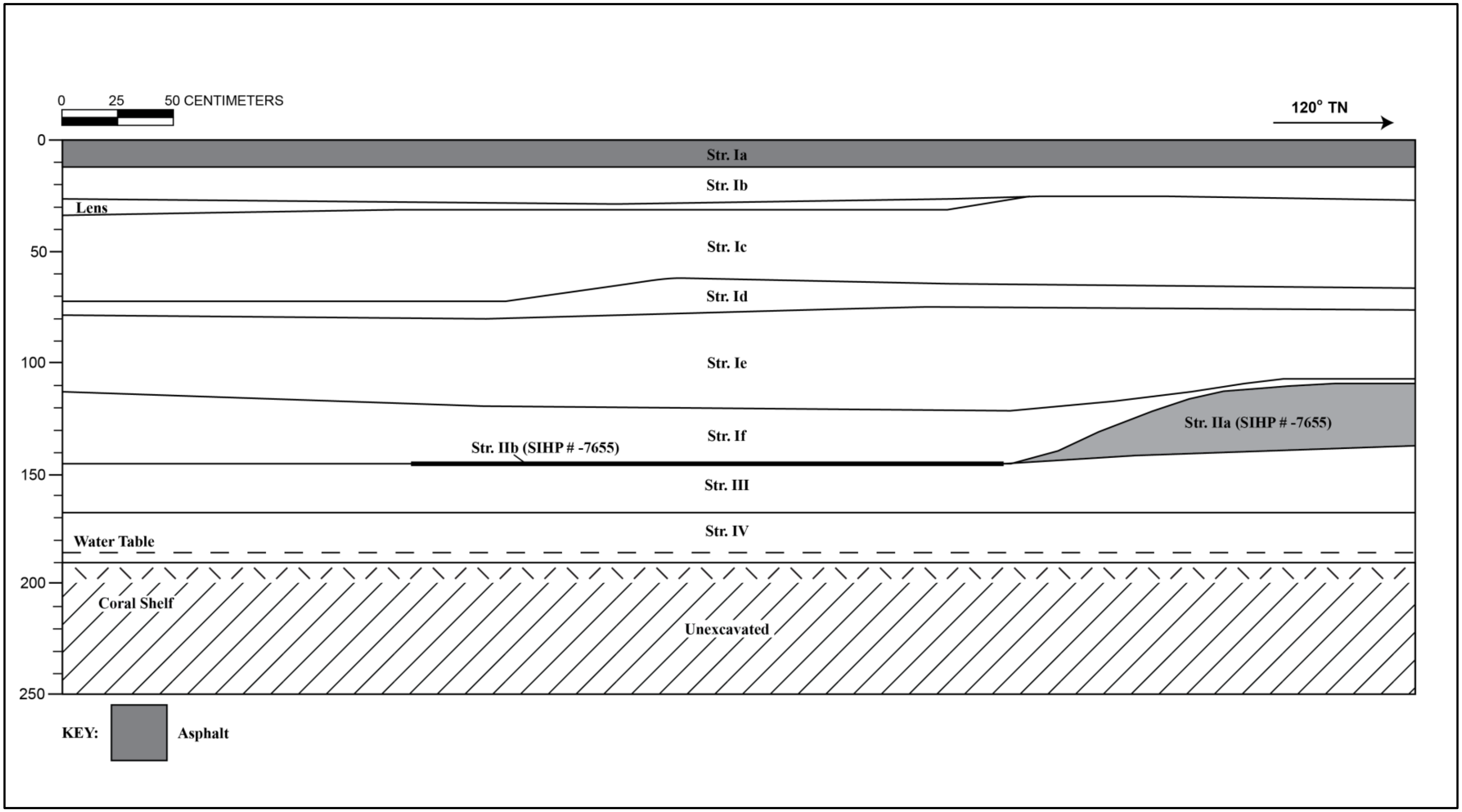

Figure 73. Profile of TE 7, northeast wall

Table 8. TE 7 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–12	Asphalt surface
Ib	12–28	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	28–74	Fill; 2.5Y 4/1, dark gray; extremely gravelly loamy clay; moderate, medium, crumb structure; wet, sticky consistency; non-plastic; mixed origin; clear, smooth lower boundary; few, medium roots; contained a gravelly sandy loam lens (10YR 4/3) along the upper boundary and asphalt pieces possibly from a previous surface (SIHP # -7658), wood, and metal
Id	61–80	Fill; 10YR 5/3, brown; gravelly sandy loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary; contained asphalt pieces possibly from a previous surface (SIHP # -7658)
Ie	75–121	Fill; 2.5Y 7/3, pale yellow; extremely gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
If	107–145	Fill; 10YR 7/4, very pale brown grading to 10Y 7/1, light greenish gray; fine sandy clay to silty clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	110–145	SIHP # -7655; 2.5Y 6/3, light yellowish brown; sandy clay; structureless (massive); moist, friable consistency; slightly plastic; marine origin; clear, broken/discontinuous lower boundary; common, fine roots; man-made berm associated with salt pan remnants
IIb	145–147	SIHP # -7655; organic laminations associated with salt pan remnants
III	137–168	Natural; 10Y 6/1, greenish gray; fine sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, smooth lower boundary; few, fine roots observed; natural wetland sediment
IV	168–190 (BOE)	Natural; 10Y 7/1, light greenish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.8 Test Excavation 8 (TE 8)

Test Excavation 8 (TE 8), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northeast-southwest direction, and measured 6.1 m long by 0.8 m wide with a maximum depth of 2.0 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 8 consisted of asphalt surface (Stratum Ia), associated base course fill (Stratum Ib), and various layers of fill consisting of extremely gravelly sandy loam (Stratum Ic), very gravelly sandy loam (historic pit fill); very gravelly sandy loam (Stratum Id), buried asphalt (Stratum Ie/SIHP # -7658), very gravelly sand (Stratum If), and hydraulic silty clay (Stratum Ig), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) intermingling with silty clay wetland sediment (Stratum III) over sandy clay wetland sediment (Stratum IV) (Figure 74, Figure 75, Figure 80, Table 9).

A buried asphalt surface (Stratum Ie) was disturbed by a historic pit in the south end of TE 8. The asphalt, determined to be a component of SIHP # -7658, was observed 60 cm below surface, with a thickness of 15 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 8 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a berm (Stratum II). The berm material intermixed with and disturbed the underlying natural, gleyed wetland sediment (Stratum III). The berm extended through the length of the test excavation along both sidewalls. The orientation is consistent with the berms documented within Test Excavations 3 and 5. The maximum height of the berm was 83 cm above coral shelf.

Several historic artifacts were also identified within the historic pit fill, consisting of wood pieces, rusted metal, a leather shoe, and ceramic fragments (Figure 76 through Figure 79).

Figure 74. Photograph of TE 8 southeast wall, view to southeast

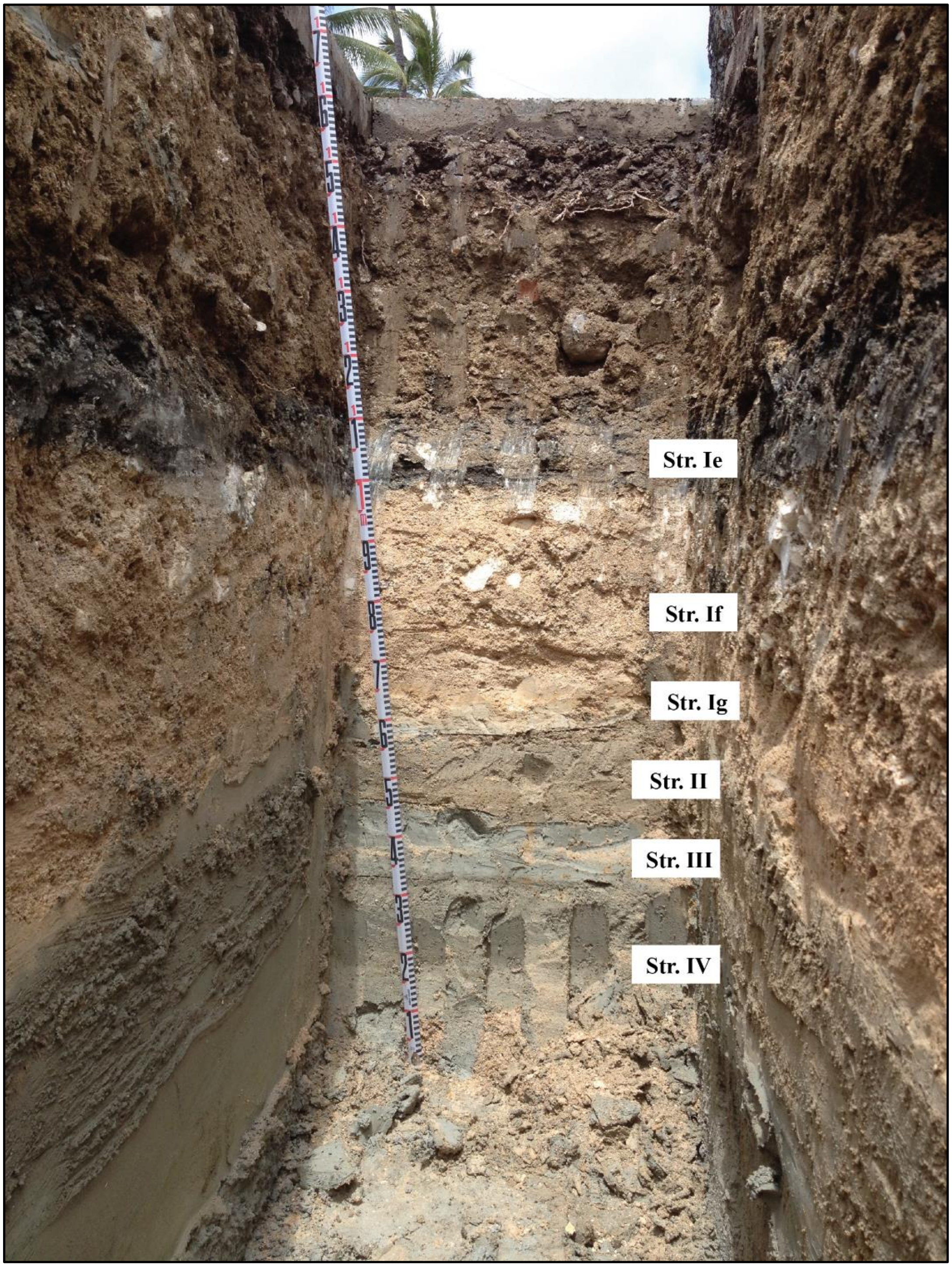

Figure 75. Photograph of *mauka* end of TE 8, showing a buried asphalt surface (Stratum Ie) overlying crushed coral (Stratum If), hydraulic fill (Stratum Ig), a man-made berm (Stratum II/SIHP # -7655), and natural wetland sediments (Strata III and IV)

Figure 76. Photograph of wood pieces identified within historic pit fill

Figure 77. Photograph of leather shoe identified within historic pit fill

Figure 78. Photograph of ceramic fragments identified within historic pit fill

Figure 79. Photograph of rusted metal pieces identified within historic pit fill

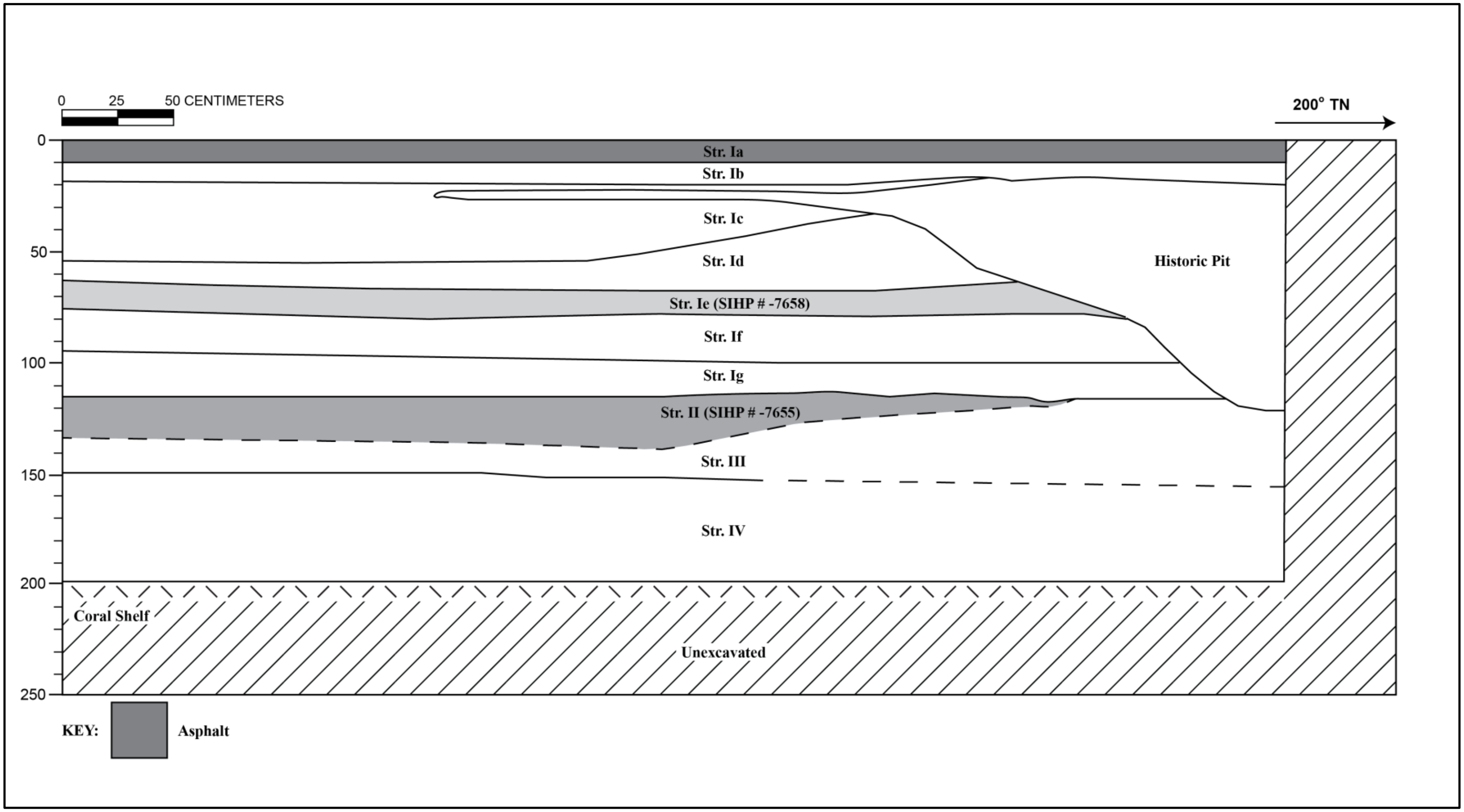

Figure 80. Profile of TE 8, southeast wall

Table 9. TE 8 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–20	Fill; 7.5YR 2.5/2, very dark brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	20–55	Fill; 10YR 5/3, brown; extremely gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistency; non-plastic; clear, smooth lower boundary; few, medium roots; contained brick and wood fragments; crushed coral fill containing mottles of hydraulic pump dredge
Historic pit	20–120	Fill; 10YR 5/1, gray; very gravelly sandy loam; weak, medium, crumb structure; moist, very friable consistency; non-plastic; terrigenous origin; clear, broken/discontinuous lower boundary; historic pit; contained metal, wood, charcoal, and a leather shoe sole (photographed, not collected)
Id	35–65	Fill; 10YR 4/3, brown; very gravelly sandy loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth, discontinuous lower boundary
Ie	60–75	SIHP # -7658; 10YR 2/1, black; buried asphalt; abrupt, smooth, discontinuous lower boundary; highly compacted
If	75–115	Fill; 2.5Y 8/3, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
Ig	95–115	Fill; 2.5Y 7/3, pale yellow grading to 10Y 7/1, light greenish gray; fine sandy clay to silty clay; moderate, fine, platy structure; moist, friable consistency; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	115–135	SIHP # -7655; 5Y 6/2, light olive gray; sandy clay; moderate, medium, crumb structure; moist, friable consistency; slightly plastic; marine origin; clear, wavy lower boundary; few, fine roots; man-made berm associated with salt pan remnants
III	115–150	Natural; 10Y 6/1, greenish gray; silty clay; structureless (massive); moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; wetland sediment
IV	150–198 (BOE)	Natural; 10Y 6/1, greenish gray; sandy clay; structureless (massive); wet, slightly sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; wetland sediment overlying coral shelf

4.1.9 Test Excavation 9 (TE 9)

Test Excavation 9 (TE 9), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northeast-southwest direction, and measured 6 m long by 0.77 m wide with a maximum depth of 1.95 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 9 consisted of asphalt surface (Stratum Ia), associated base course fill (Stratum Ib), and various layers of fill consisting of extremely gravelly sandy loam (Stratum Ic), loamy sand (Stratum Id), a buried asphalt layer (Stratum Ie/SIHP # -7658), loamy sand (Stratum If), and two strata of very gravelly sand (Strata Ig and Ih), overlying natural loamy clay (Stratum II) and sandy clay wetland sediments (Stratum III) (Figure 81, Figure 84, Table 10).

A buried asphalt surface (Stratum Ie), determined to be a component of SIHP # -7658, was disturbed by a utility trench in the northeast end of TE 9. The asphalt was observed 60 cm below surface, with a thickness of 23 cm. The buried asphalt surface overlies a loamy sand fill with historic trash, which overlies crushed coral and hydraulic (dredge) associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

While no evidence of historic salt pans was observed, it is likely that TE 9 previously contained a low-lying salt pan bed with organic laminations prior to land reclamation activity and disturbance to the area, based on the presence of man-made salt pan berms in the nearby test excavations (TE 8 and TE 10). Stratum If contained a concentration of historic trash, consisting of small glass and ceramic fragments, wood, charcoal, and rusted metal pieces (Figure 82, Figure 83).

Figure 81. Photograph of TE 9 northwest profile, view to southwest

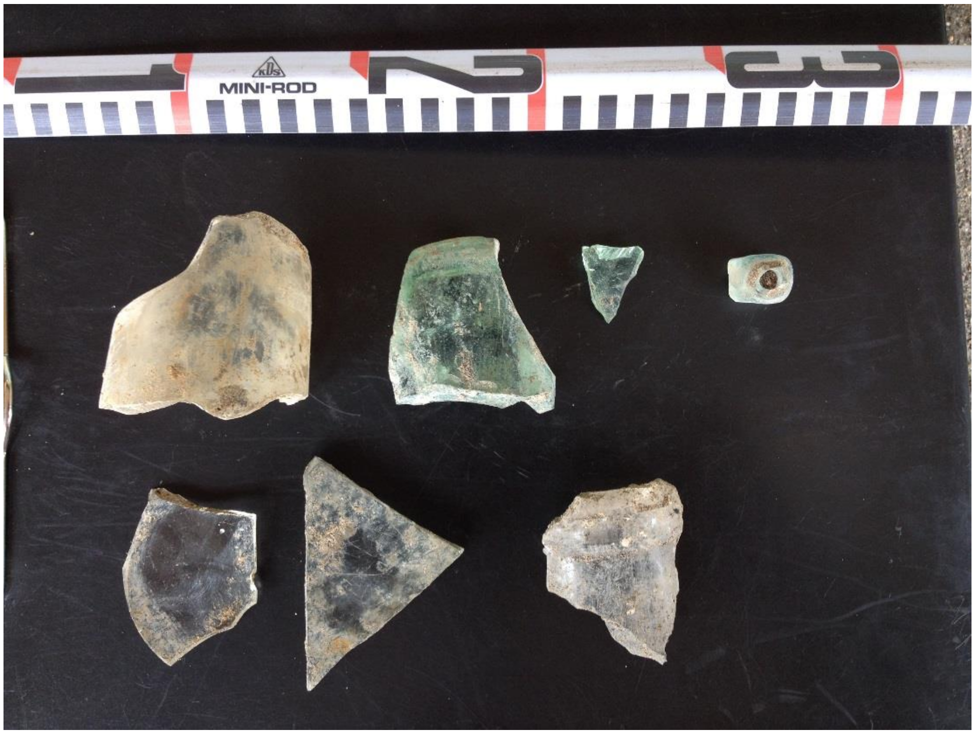

Figure 82. Photograph of glass bottle fragments identified within Stratum If

Figure 83. Photograph of wood and charcoal fragments identified within Stratum If

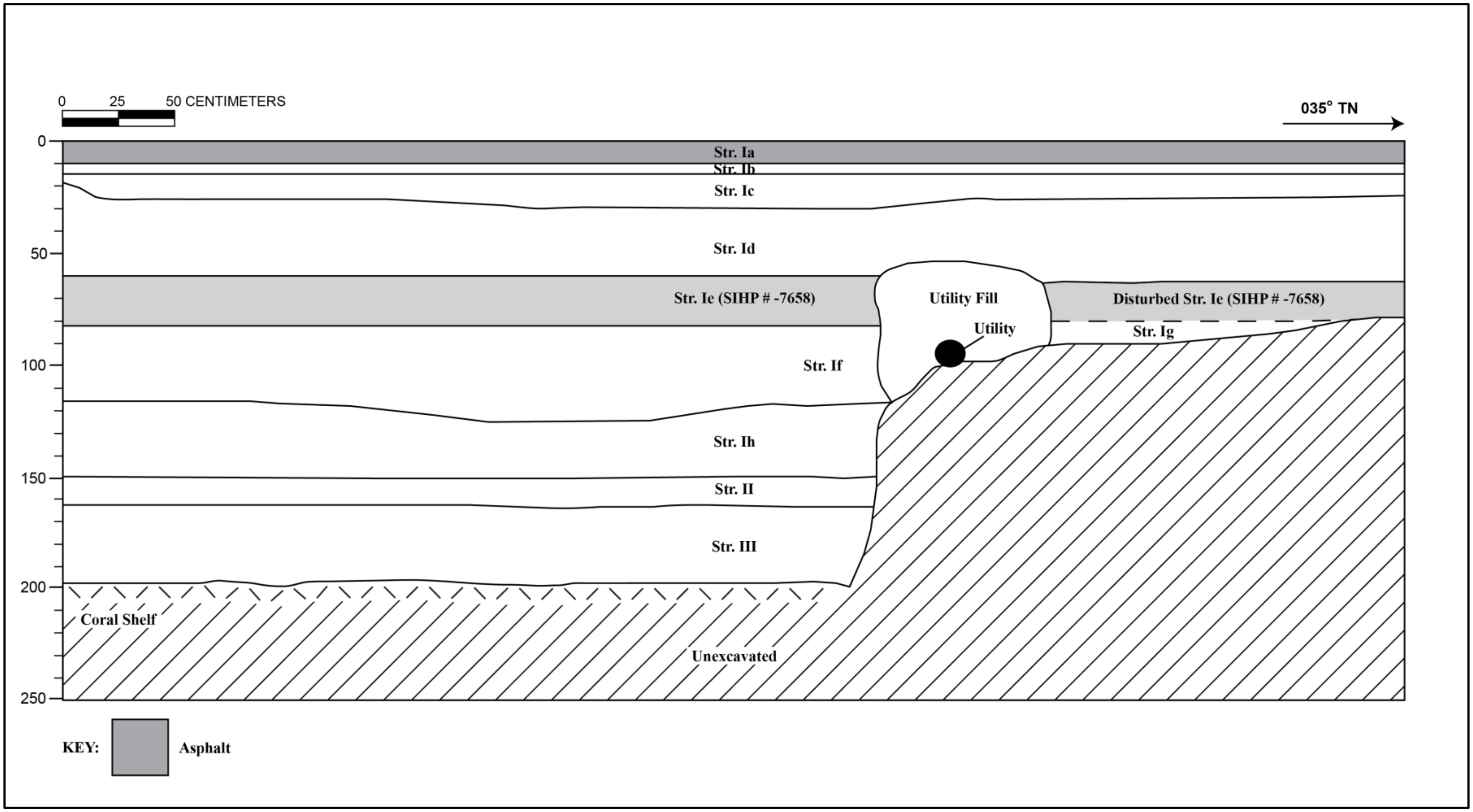

Figure 84. Profile of TE 9 northwest wall

Table 10. TE 9 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–15	Fill; 7.5YR 3/2, dark brown; extremely gravelly sandy clay loam; moderate, fine, crumb structure; moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	15–30	Fill; 10YR 6/4, light yellowish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, wavy lower boundary; crushed coralline layer
Id	25–-60	Fill; 10YR 3/2, very dark grayish brown; loamy sand; structureless (single-grain); moist, very friable consistency; non-plastic; terrigenous origin; clear, smooth lower boundary
Ie	60–83	SIHP # -7658; buried asphalt surface
If	83–125	Fill; 10YR 5/3, brown, mottled with 5YR 4/6, yellowish red; loamy sand; structureless (single-grain); moist, very friable consistency; non-plastic; terrigenous origin; diffuse and smooth lower boundary; contained a concentration of historic artifacts consisting of small glass and ceramic fragments, wood, charcoal, and rusted metal (photographed; not collected)
Ig	80–90	Fill; 10YR 3/4, very pale brown; very gravelly sand; stuctureless (single-grain); moist, very friable consistency; weak cementation; non-plastic; marine origin; lower boundary not visible; crushed coral
Ih	115–150	Fill; 10YR 3/4, very pale brown; very gravelly sand; stuctureless (single-grain); moist, very friable consistency; weak cementation; non-plastic; marine origin; diffuse and wavy lower boundary; crushed coral fill associated with land reclamation events
II	150–162	Natural; 2.5Y 7/1–7/2, light gray; loamy clay; structureless (massive); moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; wetland sediment; contained *Melampus sp*.
III	162–196 (BOE)	Natural; 10Y 8/1, light greenish gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; wetland sediment containing marine shell and *Melampus sp*.

4.1.10 Test Excavation 10 (TE 10)

Test Excavation 10 (TE 10), an exterior excavation located in the Ward Warehouse parking lot along Auahi Street, was oriented in a northeast-southwest direction, and measured 6.1 m long by 0.72 m wide with a maximum depth of 1.91 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 10 consisted of asphalt surface (Stratum Ia), associated base course fill (Stratum Ib), and various fill layers consisting of very gravelly loamy sand (Stratum Ic), a disturbed asphalt layer (Stratum Id/SIHP # -7658), and very gravelly sand (crushed coral) (Stratum Ie), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655), followed by a fine sandy clay A horizon (Stratum IIIa) and sandy clay wetland sediments (Strata IIIb and IV) (Figure 85, Figure 88, Table 11).

A layer with buried asphalt chunks (Stratum Id) observed in TE 10 was determined to be a component of SIHP # -7658. The buried layer was observed from 43 to 93 cm below surface, with a thin lens of asphalt along the upper boundary of a man-made berm. This historical property overlies a crushed coral fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the layer with buried asphalt chunks likely dates from 1939 to 1976.

TE 10 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II). The berm extended the length of the test excavation and was constructed over a natural wetland A horizon (Stratum IIIa) and sandy clay sediments (Strata IIIb and IV). These in situ natural sandy clay sediments closely resembled the berm material and may represent the type of local parent material utilized for the construction of the salt pan berm complex. The maximum height of the berm was 1.25 m above the coral shelf.

Several historic artifacts were also identified within Stratum Ic, consisting of brick and asphalt chunks, metal, small glass fragments, and wood (Figure 86, Figure 87).

Figure 85. Photograph of TE 10 southeast wall, view to east

Figure 86. Photograph of rusted metal pieces identified within Stratum Ic

Figure 87. Photograph of a glass bottle fragment and wood identified within Stratum Ic

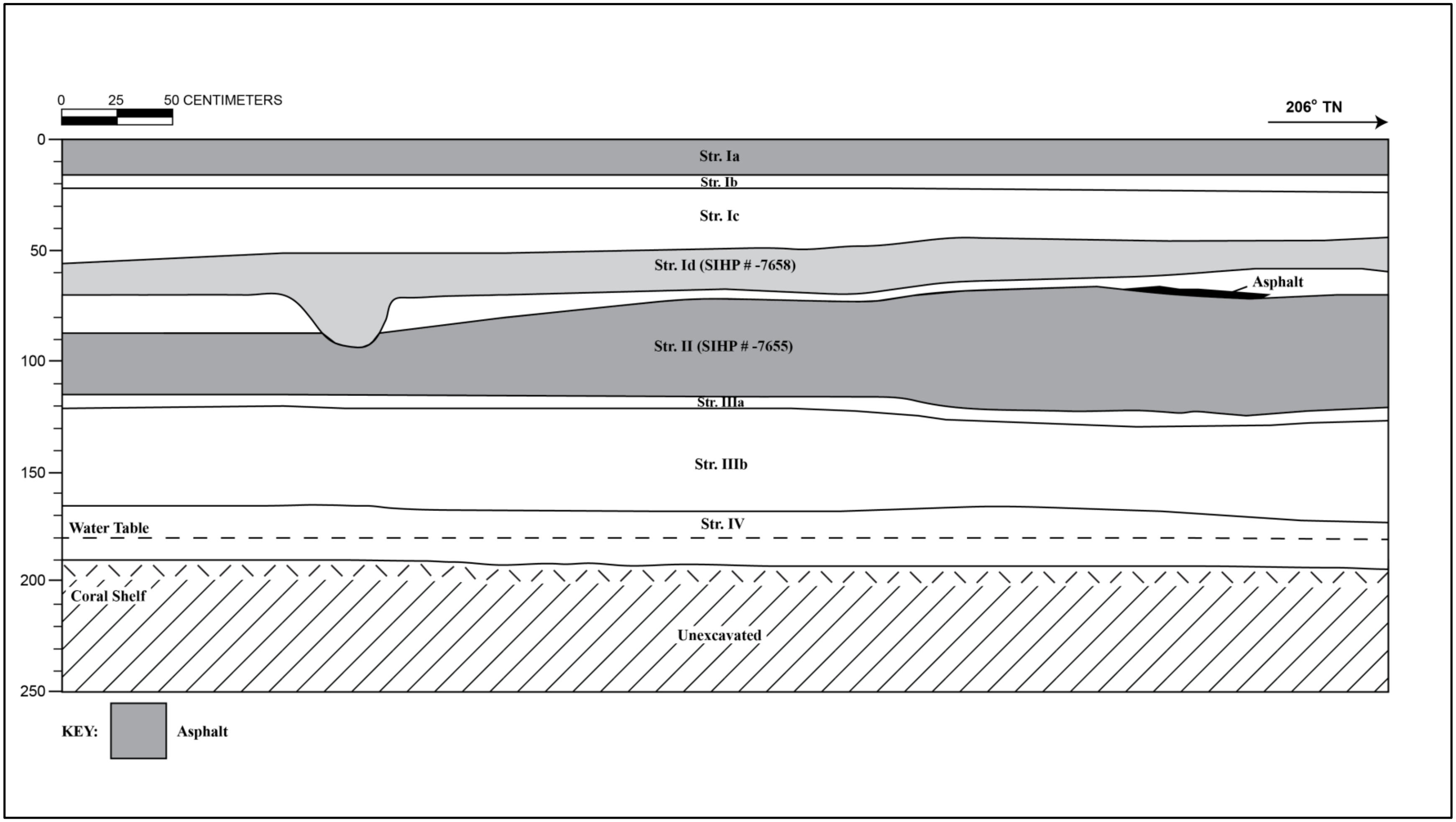

Figure 88. Profile of TE 10, southeast wall

Table 11. TE 10 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–15	Asphalt surface
Ib	15–22	Fill; 7.5YR 4/2, brown; extremely gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with the asphalt surface
Ic	22–55	Fill; 2.5Y 5/3, light olive brown; very gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary; contained brick and asphalt chunks, metal, small glass fragments, and wood (photographed, not collected)
Id	43–93	SIHP # -7658; 5YR 2.5/2, dark reddish brown, mottled with 2.5Y 5/3, light olive brown; clay loam; weak, fine, crumb structure; moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; disturbed and mottled asphalt layer
Ie	57–87	Fill; 10YR 8/1, white; very fine sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coralline sand with a lens of asphalt near the lower boundary
II	66–120	SIHP # -7655; 2.5Y 7/3, pale yellow; medium sandy clay; weak, fine, blocky structure; moist, very friable consistency; slightly plastic; marine origin; clear, smooth lower boundary; few, fine roots; man-made berm associated with salt pan remnants
IIIa	115–125	Natural; 2.5Y 2.5/1, black; fine sandy clay; moderate, fine, blocky structure; moist, friable consistency; slightly plastic; mixed origin; clear, smooth lower boundary; very fine to fine roots; organic-stained wetland A horizon
IIIb	121–172	Natural; 2.5Y 7/4, pale yellow; fine sandy clay; structureless (massive); moist, firm consistency; very plastic; marine origin; clear, smooth lower boundary; many, very fine roots; wetland sediment
IV	165–191 (BOE)	Natural; 10Y 7/1, light greenish gray; sandy clay; structureless (massive); moist, firm consistency; very plastic; mixed origin; abrupt, smooth lower boundary; wetland sediment containing fine shell fragments; overlying coral shelf

4.1.11 Test Excavation 11 (TE 11)

Test Excavation 11 (TE 11), an exterior trench located in the northeast corner of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.70 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 11 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of gravelly sandy loam (Stratum Ic), remnants of a previous paved surface (Stratum Id/ SIHP # -7658), very gravelly sand (crushed coral) (Stratum Ie), and hydraulic silty clay (Stratum If), overlying a sandy clay man-made berm (Strata IIa and IIb/SIHP # -7655), laminated organic material (Stratum IIc/SIHP # -7655), and silty sand wetland sediment (Stratum III) (Figure 89 through Figure 93, Table 12).

A buried asphalt surface (Stratum Id) was determined to be a component of SIHP # -7658. The asphalt was observed 35 cm below surface, with a thickness of 20 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

The stratigraphic sequence of TE 11 exhibits two building phases associated with salt pan berm construction. The first phase is represented by a salt pan berm feature (Stratum IIb/SIHP # -7655) overlain with a developing A horizon containing charcoal flecks. Based on the presence of this developing A horizon, Stratum IIb served as a stable ground surface for a period of time. A second phase of berm construction is represented by an overlying loamy clay deposit which increased the height of the berm approximately 20 cm (Stratum IIa/SIHP # -7655). The maximum height of the berm was 84 cm above coral shelf. TE 11 also exhibits a transition between the salt pan berm and lower lying salt pan bed. The salt pan bed consisted of natural wetland sediment (Stratum III) overlain by a thin remnant of organic laminations (Stratum IIc/SIHP # -7655).

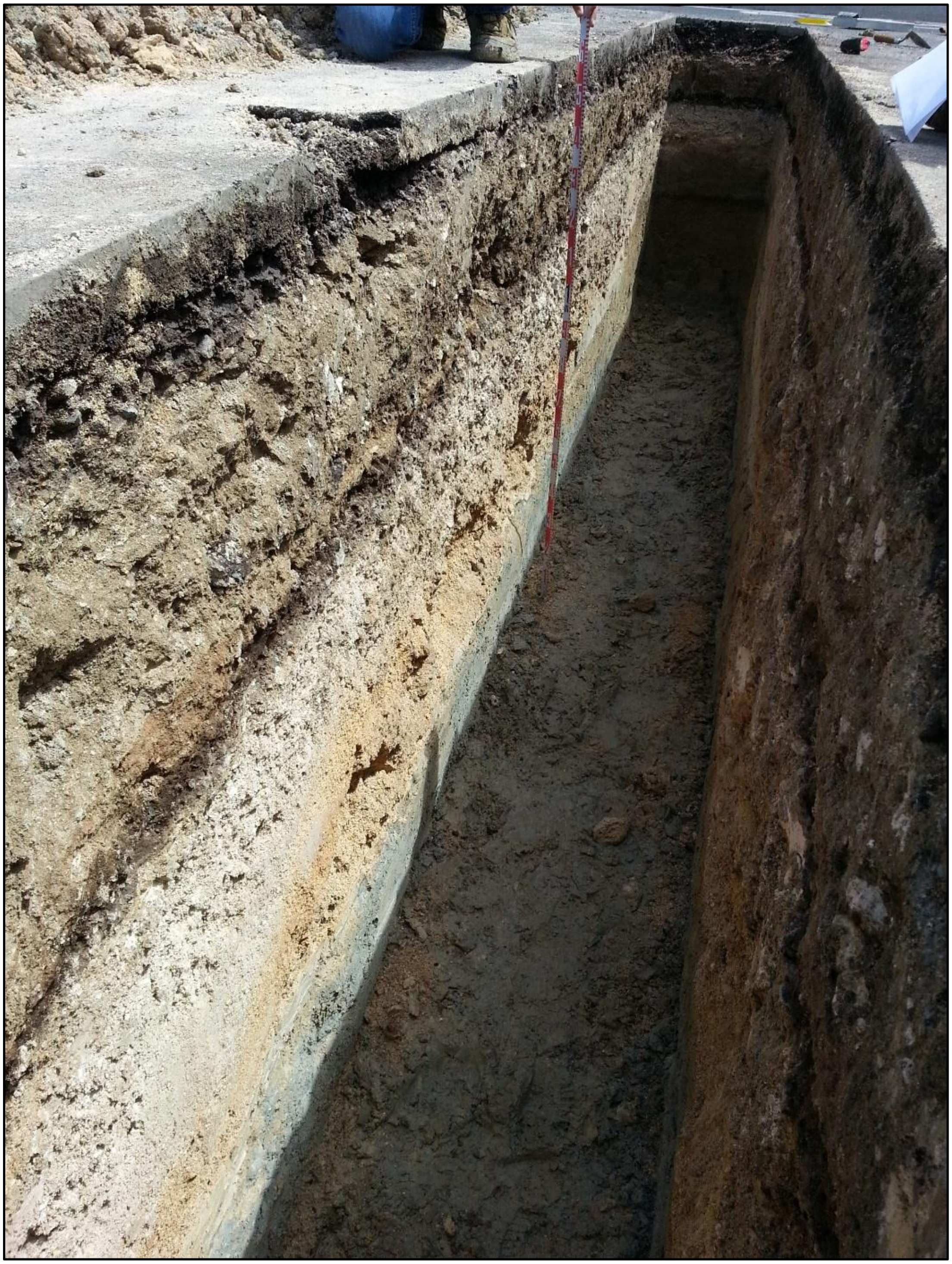

Figure 89. Photograph of TE 11 west wall, view to north

Figure 90. Close-up of man-made salt pan berm feature, SIHP # -7655, view to north

Figure 91. Close-up of *mauka* wall, showing two berm layers separated by a darker stained A horizon, view to north

Figure 92. Close-up of organic laminations (Stratum IIb), SIHP # -7655, overlying natural gleyed wetland sediment (Stratum III)

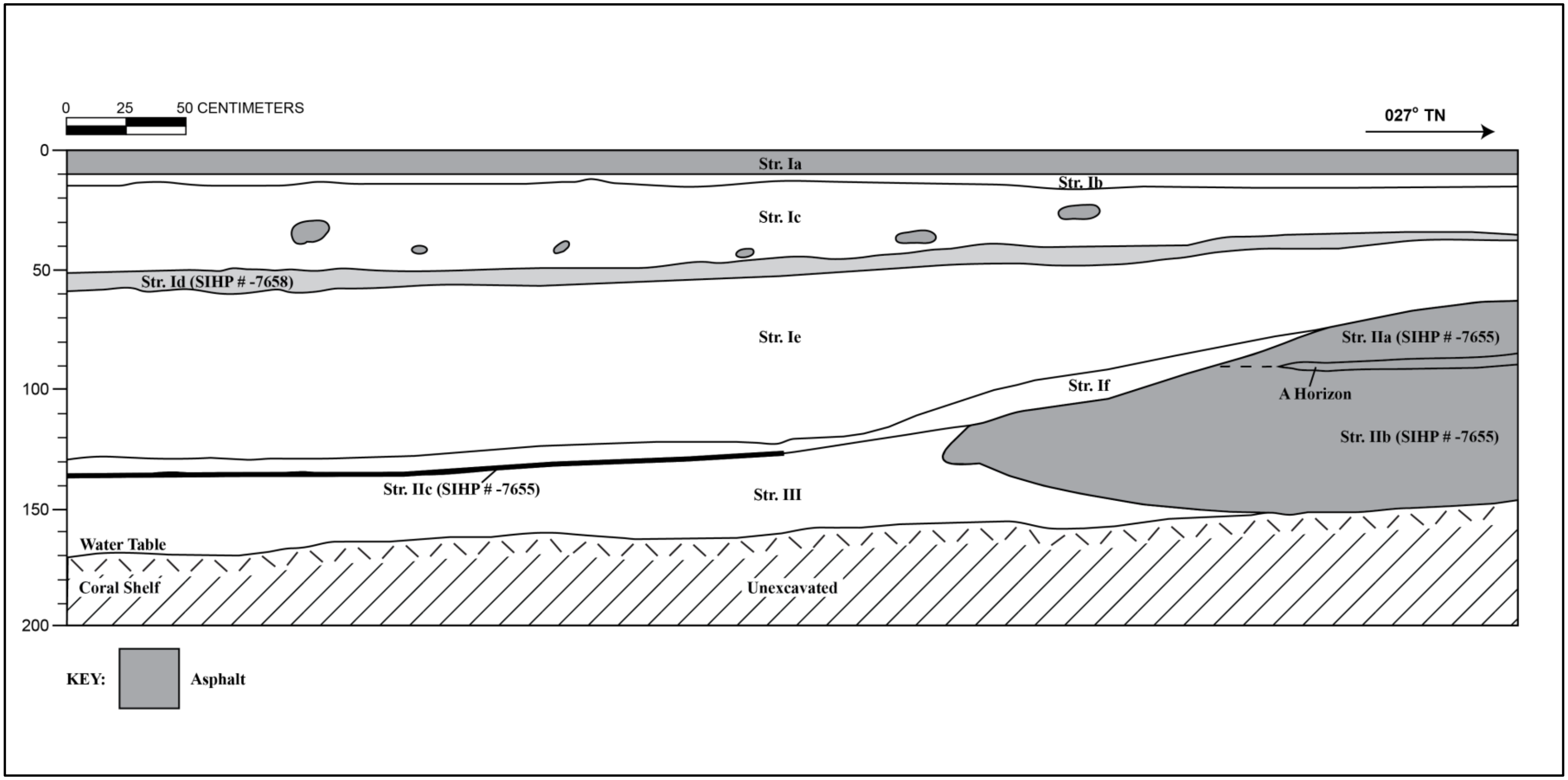

Figure 93. Profile of TE 11, west wall

Table 12. TE 11 Stratigraphic Description

Stratum	**Depth (cmbs)**	**Description**
Ia	0–10	Asphalt surface
Ib	10–15	Fill; 2.5YR 3/1, very dark gray; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	15–50	Fill; 10YR 4/2, dark grayish brown; gravelly sandy loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary; contained coral cobbles and asphalt pieces
Id	35–55	SIHP # -7658; 7.5YR 3/2, dark brown; sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; remnant paved surface
Ie	38–130	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
If	80–135	Fill; 2.5Y 6/3, light yellowish brown; silty clay; structureless (massive); moist, extremely firm consistency; very plastic; marine origin; clear, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	85–90	SIHP # -7655; 2.5Y 7/1, light gray; loamy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, smooth, discontinuous lower boundary; upper portion of a man-made berm associated with salt pan remnants
IIb	65–156	SIHP # -7655; 2.5Y 6/3, light yellowish brown; sandy clay; weak, fine, crumb structure; wet, slightly sticky consistency; plastic; marine origin; clear, irregular lower boundary; man-made berm associated with salt pan remnants; overlain by a forming A horizon and a later berm building event (Stratum IIa)
IIc	120–122	SIHP # -7655, organic laminations associated with salt pan remnants
III	115–170 (BOE)	Natural; 10GY 6/1, greenish gray; silty sand; structureless (single-grain); wet, slightly sticky consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; wetland sediment overlying coral shelf

4.1.12 Test Excavation 12 (TE 12)

Test excavation 12 (TE 12), an exterior trench located in the central Ward Warehouse driveway entrance, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 0.8 mbs. The base of excavation was determined by a concrete jacket running the length of the trench. The stratigraphy of TE 12 consisted of asphalt surface (Stratum Ia) and associated base course (Stratum Ib), followed by a cobbly loam fill (Stratum Ic) and very gravelly sand (crushed coral) (Stratum Id) (Figure 94, Figure 95, Table 13).

Due to the complex of subsurface utilities within this portion of the project area, the placement of TE 12 was problematic. TE 12 was located within a narrow area believed to have the highest likelihood of avoiding subsurface utilities; however, the presence of a concrete jacket running diagonally through the majority of the test excavation floor prevented excavation to the natural stratigraphy and/or coral shelf.

Figure 94. Photograph of TE 12 northwest wall, view to west

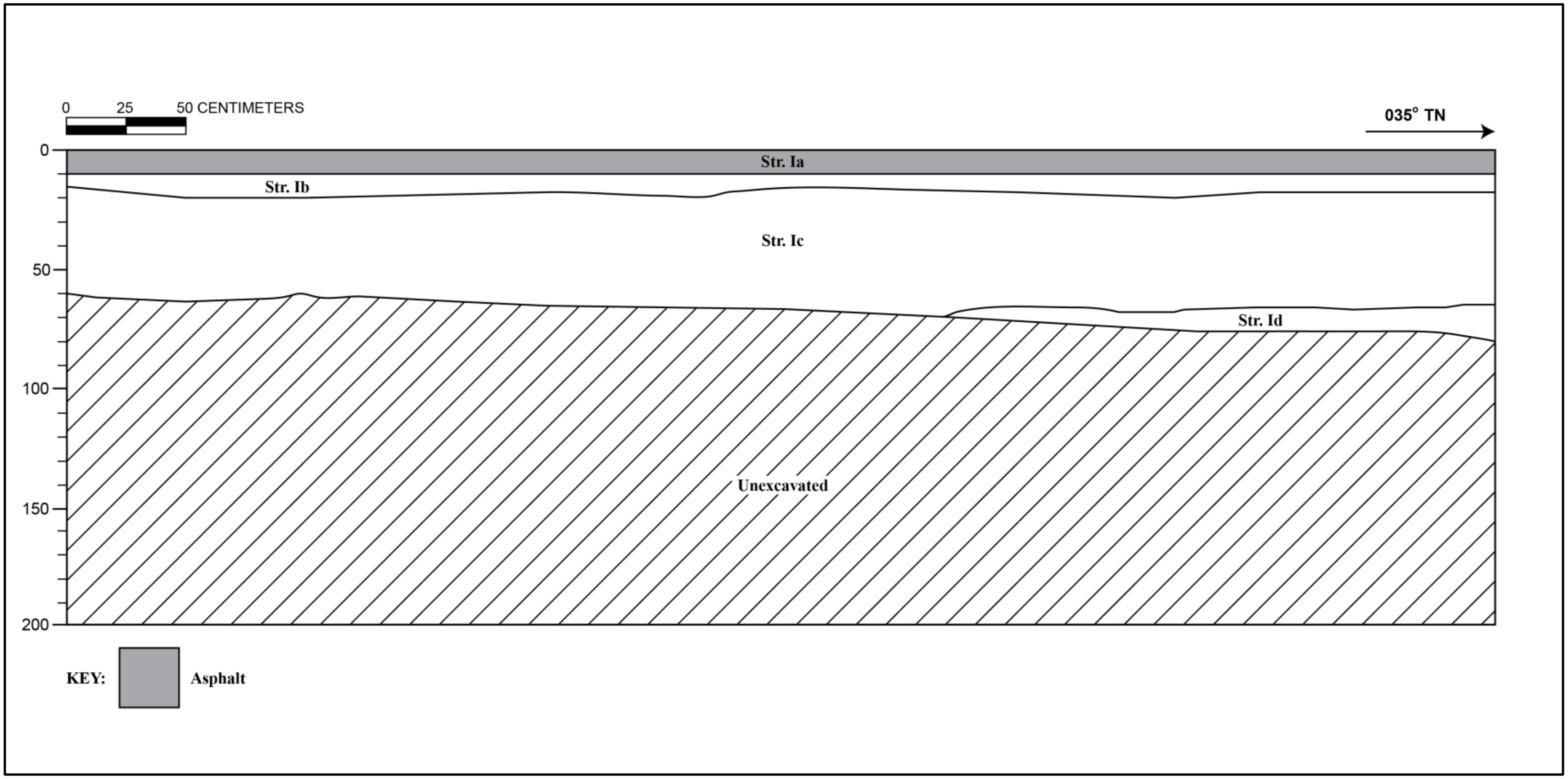

Figure 95. Profile of TE 12, northwest wall

Table 13. TE 12 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–20	Fill; 7.5YR 3/2, dark brown; extremely gravelly cobbly loam; moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	15–70	Fill; 10YR 3/2, very dark grayish brown; cobbly loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; lower boundary not visible
Id	65–80 (BOE)	Fill; 10YR 8/2, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; lower boundary not visible; crushed coral fill associated with land reclamation events; BOE due to presence of concrete jacket

4.1.13 Test Excavation 13 (TE 13)

Test Excavation 13 (TE 13), an exterior trench located in the western portion of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.67 m wide with a maximum depth of 1.76 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 13 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various layers of fill consisting of gravelly sandy loam (Stratum Ic), black cinder (Stratum Id), very gravelly sand (crushed coral) (Stratum Ie), and hydraulic silty sand (Stratum If), overlying a man-made sandy clay berm (Stratum II/SIHP # -7655) and natural sandy clay wetland sediment (Stratum III) (Figure 96, Figure 97, Figure 98, Table 14).

TE 13 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II). The berm extended across the length of the test excavation, with the apex located in the *mauka* portion of the trench, sloping downwards to the *makai* end. Construction of the berm appears to have removed any in situ natural sediment above the coral shelf within the *mauka* portion of TE 13. The maximum height of the berm was 1.10 m above coral shelf.

Figure 96. Photograph of TE 13 northwest wall, view to west

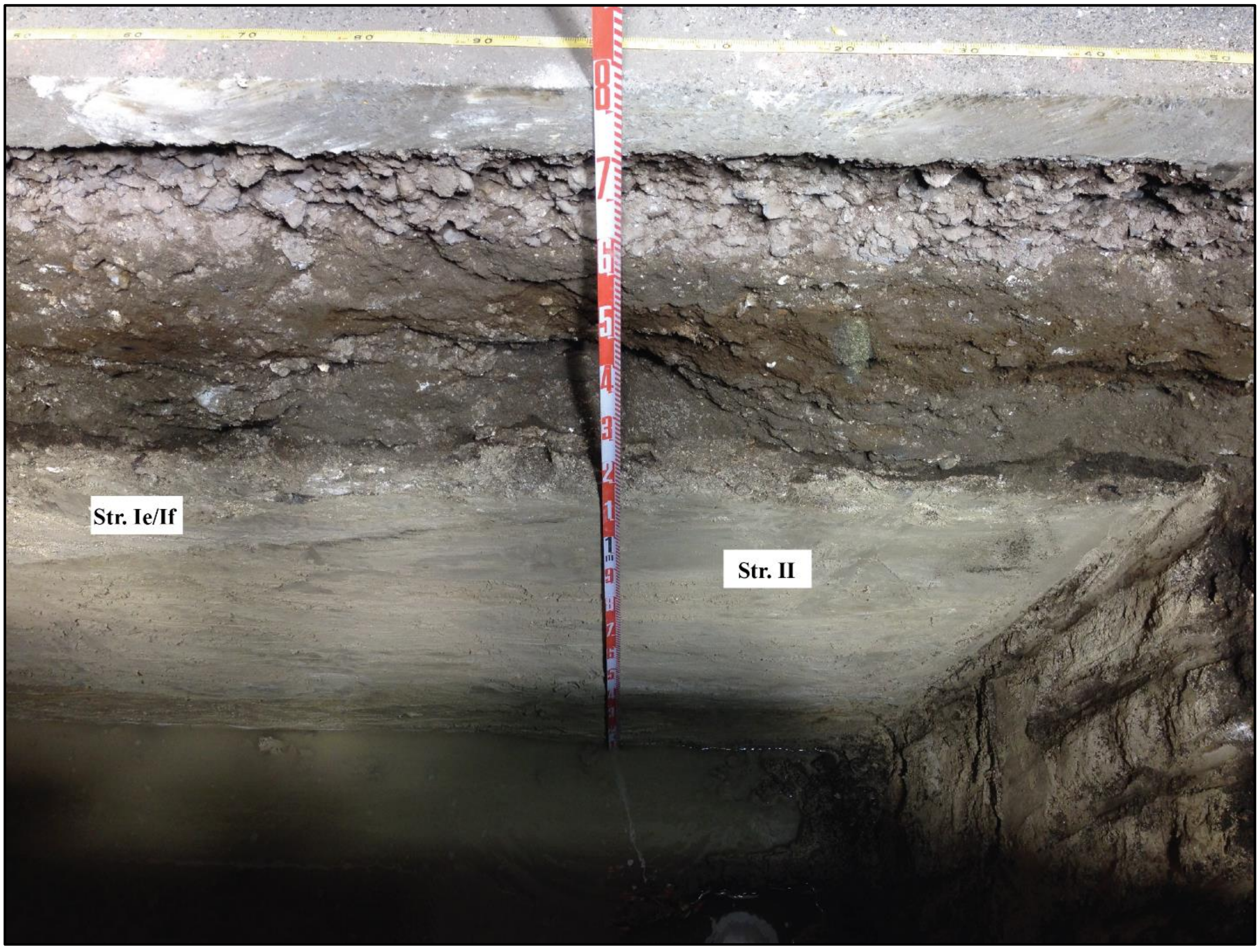

Figure 97. Close-up photograph of man-made berm (Stratum II), SIHP # -7655, underlying crushed coral (Stratum Ie) and hydraulic dredge (Stratum If), within the *mauka* end of the northwest sidewall and descending to *makai*, view to northwest

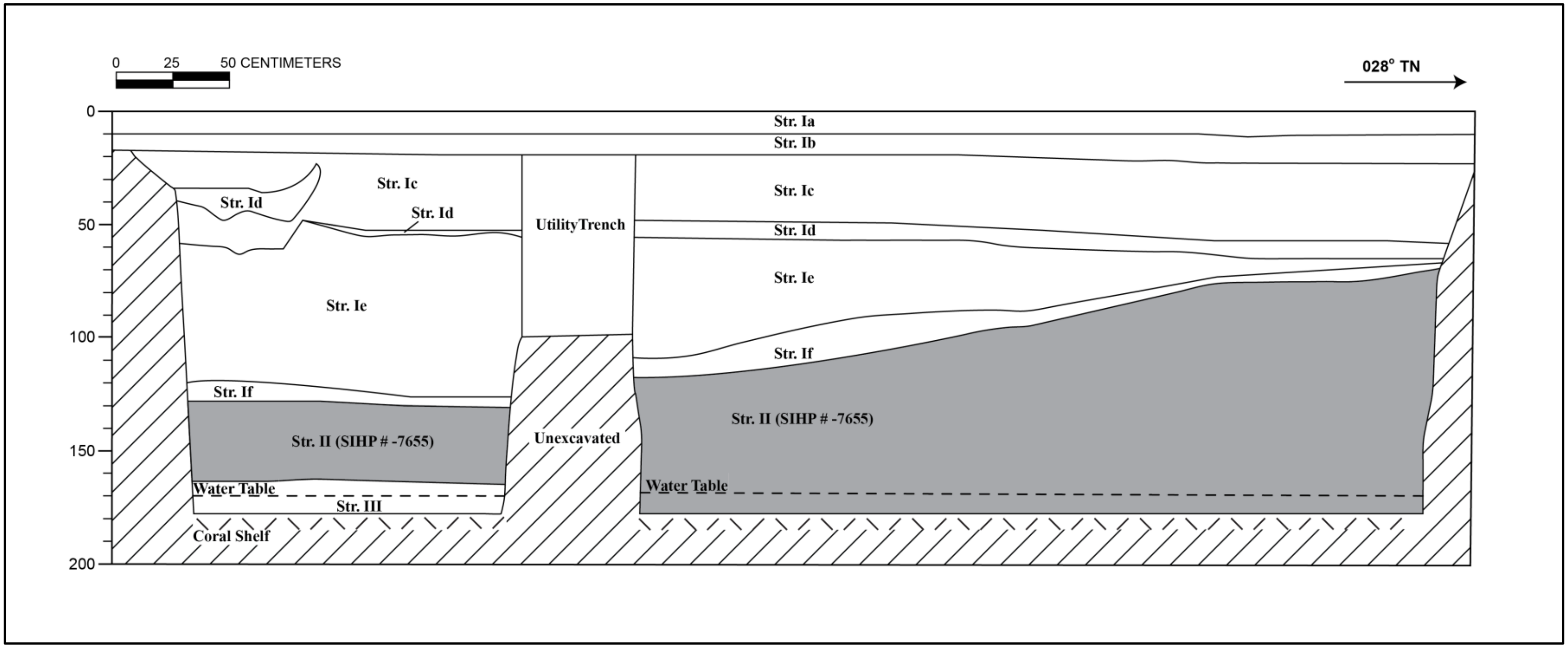

Figure 98. Profile of TE 13, northwest wall

Table 14. TE 13 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	9–23	Fill; 10YR 3/2, very dark grayish brown; gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	18–99	Fill; 7.5YR 2.5/2, very dark brown; gravelly sandy loam; weak, fine, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; clear, broken/discontinuous lower boundary; contained rebar debris
Id	23–65	Fill; 10YR 2/1, black; coarse sand; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, broken/discontinuous lower boundary; imported black cinder
Ie	49–125	Fill; 10YR 7/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken/discontinuous lower boundary; crushed coral fill associated with land reclamation events
If	66–130	Fill; 10YR 7/2, light gray; silty fine sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken/discontinuous lower boundary; hydraulic dredge fill associated with land reclamation events
II	68–176 (BOE)	SIHP # -7655; 2.5Y 6/2, light brownish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; clear, discontinuous lower boundary; root staining observed; man-made berm associated with salt pan remnants
III	162–176 (BOE)	Natural; 5G 6/1, greenish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, discontinuous lower boundary; natural wetland sediment overlying coral shelf

4.1.14 Test Excavation 14 (TE 14)

Test Excavation 14 (TE 14), an interior trench located in the *mauka* commercial building of Ward Warehouse, was oriented in a northwest-southeast direction and measured 6.1 m long by 0.65 m wide with a maximum depth of 2.16 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 14 consisted of tiled concrete surface (Stratum Ia) and various fill layers consisting of very coarse cinder (Stratum Ib), very gravelly sandy loam containing a utility trench (Stratum Ic), gravelly sandy loam (Stratum Id), a buried asphalt surface (Stratum Ie/ SIHP # -7658), very gravelly sand (crushed coral) (Stratum If), and hydraulic silty clay (Stratum Ig), overlying laminated organic material (Stratum II/SIHP # -7655) and sandy clay wetland sediment (Stratum III) (Figure 99, Figure 100, Figure 102, Table 15)

A buried asphalt surface (Stratum Ie), determined to be a component of SIHP # -7658, was disturbed by a utility trench in the northeast and central portions of the test excavation. The asphalt was observed at 105 cm below surface, with an average thickness of 14 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 14 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of laminated organic material (Stratum II) (Figure 100). The organic layer extended along the majority of the test excavation, excepting the southern end of the trench where a utility pit and hydraulic fill extended to the natural wetland sediment (Stratum III).

A sample of the organic salt pan deposit (Stratum II) was collected for further analysis in the CSH laboratory. A thin band of lamination was identified along the upper boundary of the stratum, followed by subsequent striations of sandy clay and laminations (Figure 101).

Figure 99. Photograph of TE 14 southwest wall, view to southwest

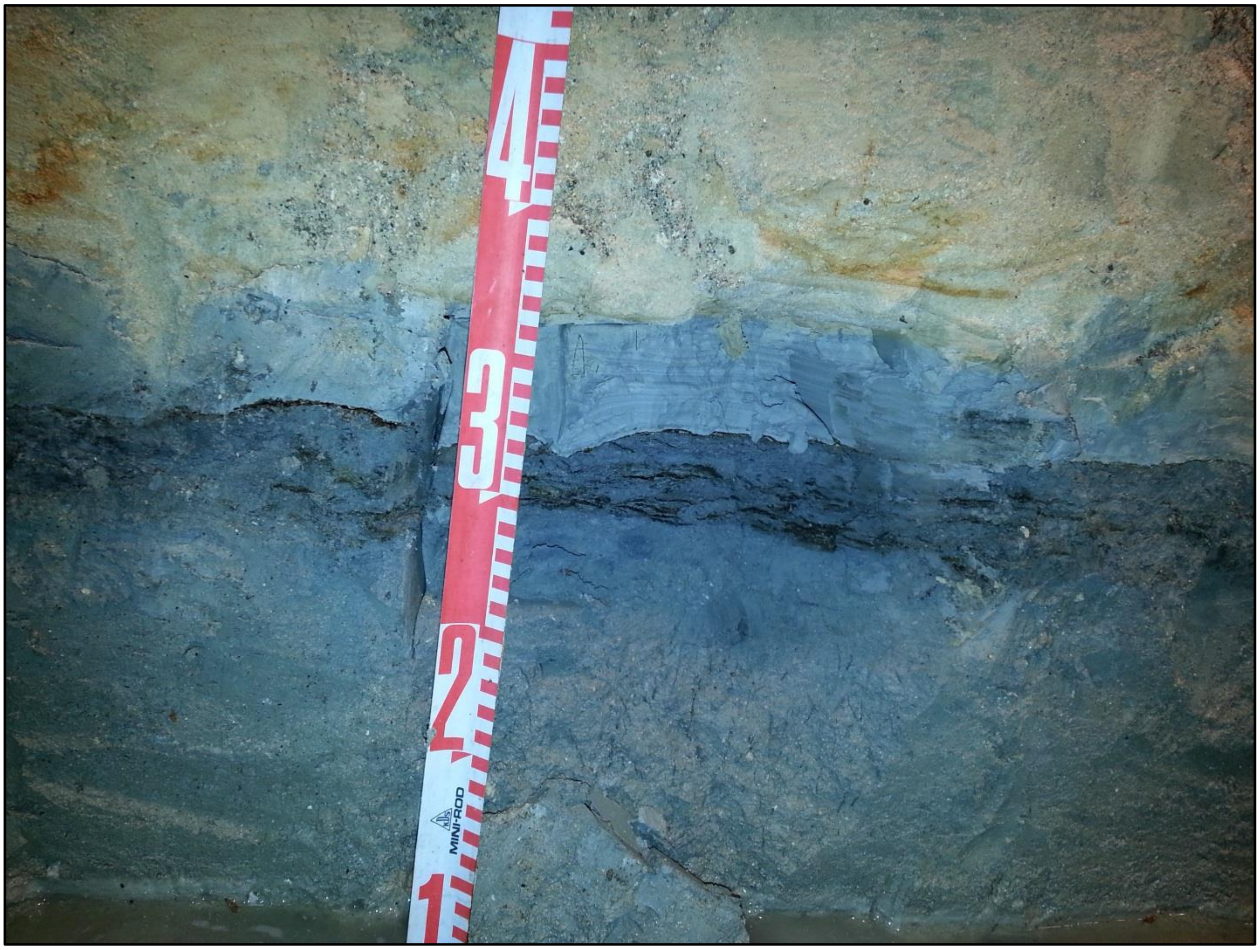

Figure 100. Close-up photograph of laminated organic layer (Stratum II; SIHP # -7655) within TE 14, underlying hydraulic fill and overlying natural wetland sediment

Figure 101. Close-up photograph of laminated organic material (Stratum II) within TE 14 (SIHP # -7655), underlying hydraulic fill (Stratum Ig)

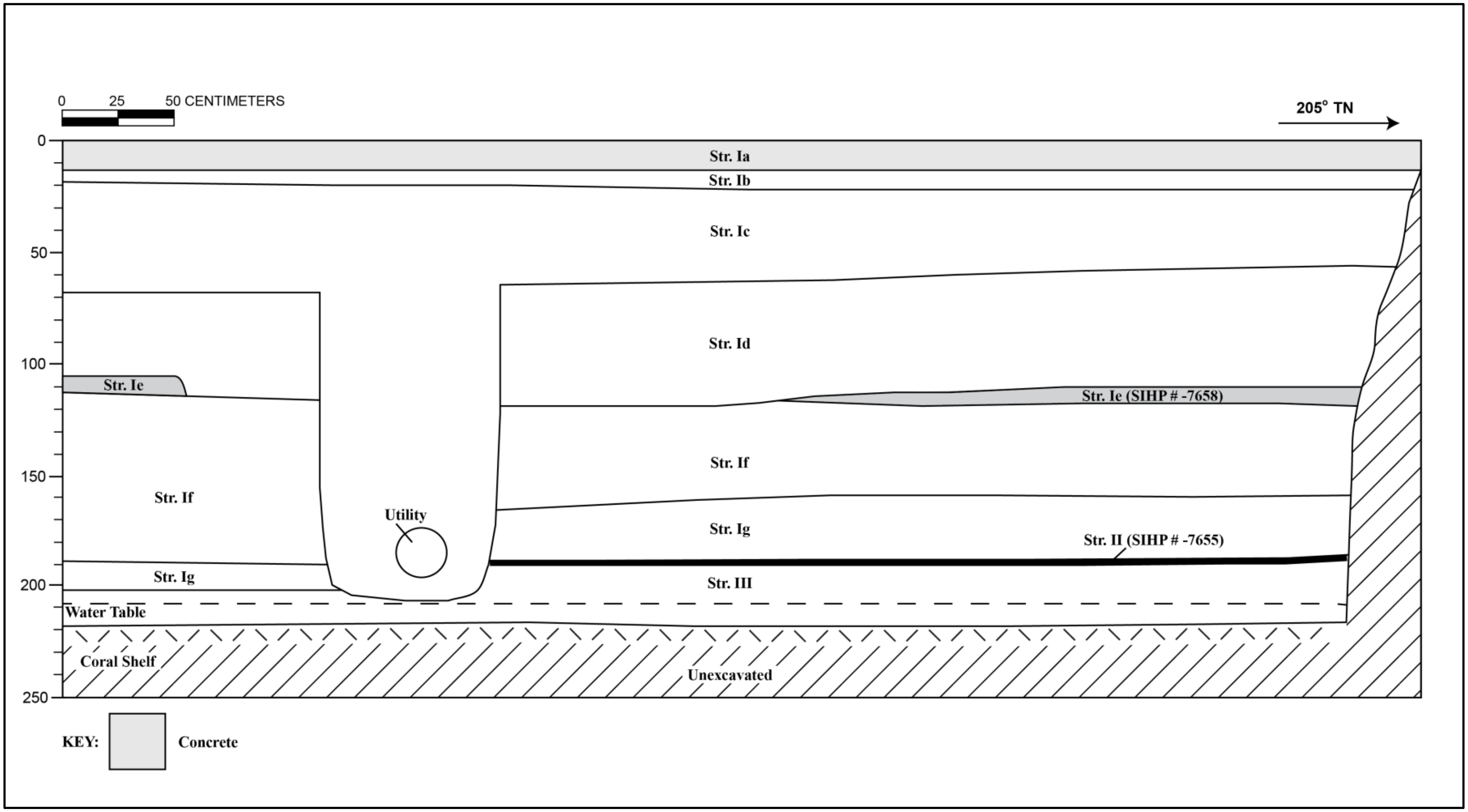

Figure 102. Profile of TE 14, southwest wall

Table 15. TE 14 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–14	Tiled concrete surface
Ib	12–23	Fill; 10YR 2/1, black; very coarse cinder; dry, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported cinder
Ic	19–205	Fill; 10YR 4/2, dark grayish brown; gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, irregular lower boundary; a utility trench originates from this stratum
Id	56–118	Fill; 10YR 2/2, very dark brown; gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, discontinuous lower boundary
Ie	105–119	SIHP # -7658; buried asphalt surface; discontinuous within the southern portion of the test excavation
If	112–189	Fill; 10YR 8/1, white; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, discontinuous lower boundary; crushed coral fill associated with land reclamation events
Ig	159–200	Fill; 10YR 8/3, very pale brown grading to 10BG 7/1, light greenish gray; silty clay; structureless (massive); moist, firm consistency; very plastic; marine origin; abrupt, discontinuous lower boundary; hydraulic (dredge) fill associated with land reclamation events; silt grading to clay
II	187–195	SIHP # -7655; organic laminations associated with salt pan remnants
III	195–216 (BOE)	Natural; 10BG 6/1, greenish gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment containing marine shell fragments; overlying coral shelf

4.1.15 Test Excavation 15 (TE 15)

Test Excavation 15 (TE 15), an exterior trench located in the grassy landscape along Ala Moana Boulevard, was oriented in a northwest-southeast direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.26 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 15 consisted of gravelly clay loam topsoil (Stratum Ia) and various layers of fill consisting of gravelly silty loam (Stratum Ib), medium sand (Stratum Ic), and very fine sand (Stratum Id), overlying a redeposited local silty sandy clay (Stratum II) and natural silty sandy clay marine sediment (Stratum III) (Figure 103, Table 16). [Note: Photographs are unfortunately not available for TE 15]

TE 15 documented the presence of various utilities and utility trenches which appeared to have disturbed much of the natural marine deposits in this area. In particular, a water line was documented extending along the *mauka* sidewall at the lower boundary of Stratum II, approximately 10 cm above the coral shelf. Only a 6 cm thick deposit of in situ natural marine sediment (Stratum II) was observed, while Stratum Ie appeared to consist of local marine sandy clay repurposed as utility trench fill.

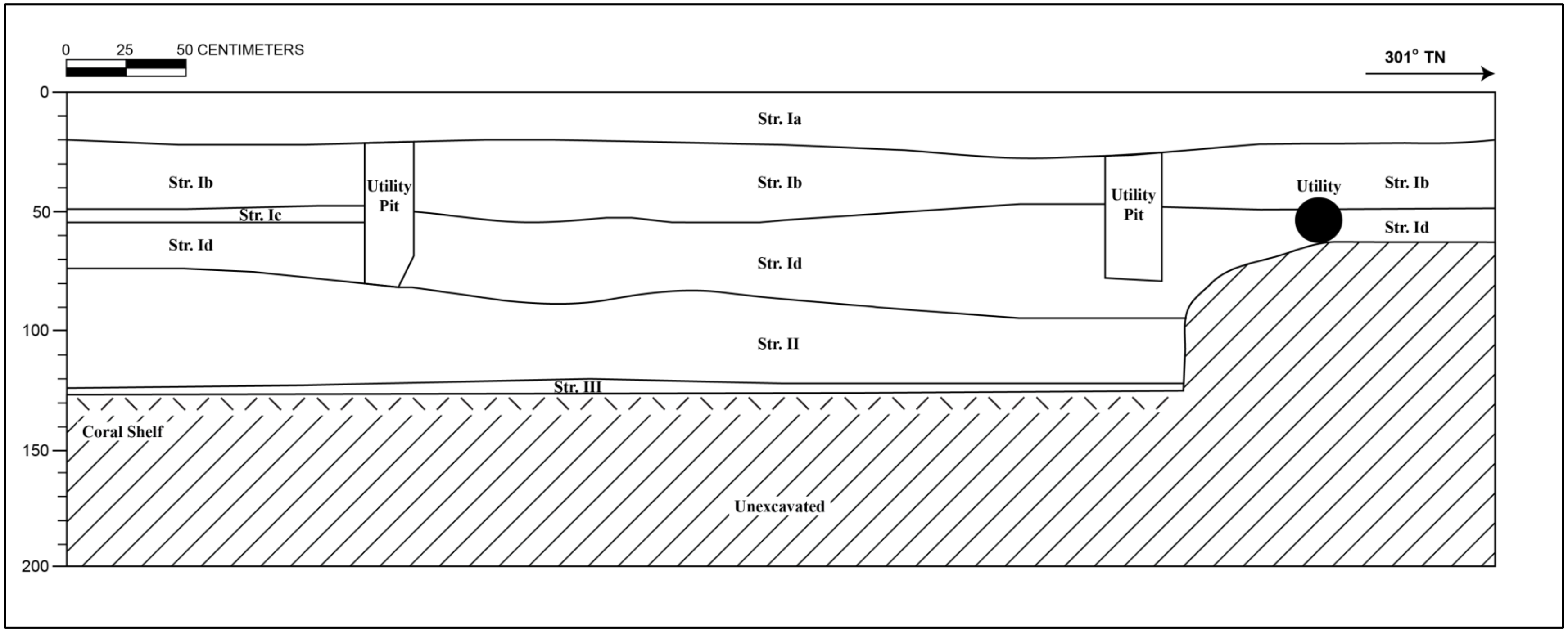

Figure 103. Profile of TE 15 southwest (*makai*) wall; a water line was documented running perpendicular within the opposite (northeast) wall at the lower boundary of Stratum II

Table 16. TE 15 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–28	Fill; 10YR 3/2, very dark grayish brown; gravelly clay loam; weak, fine, crumb structure; moist, very friable consistency; plastic; terrigenous origin; clear, smooth lower boundary; common, fine roots; landscape fill with grassy surface
Ib	20–54	Fill; 10YR 5/2, grayish brown; gravelly silty loam; weak, fine, crumb structure; moist, very friable consistency; non-plastic; mixed origin; diffuse, smooth lower boundary
Ic	48–55	Fill; 10YR 5/1, gray; medium sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, discontinuous lower boundary; few, medium roots
Id	48–100	Fill; 10YR 7/2, light gray with mottles of 10YR 5/3, brown; very fine sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; diffuse, wavy lower boundary
II	74–124	Disturbed natural; 10YR 6/2, light brownish gray; silty sandy clay; structureless (massive); wet, sticky consistency; plastic; clear, smooth lower boundary; locally procured and redeposited marine sediment; contained a utility line within the lower portion along the *mauka* sidewall
III	120–126 (BOE)	Natural; 10Y 6/1, greenish gray; silty sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; marine sediment overlying coral shelf

4.1.16 Test Excavation 16 (TE 16)

Test Excavation 16 (TE 16), an exterior trench located near the northeast boundary of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 2.14 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 16 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib) and various fill layers consisting of gravelly loam (Stratum Ic), gravelly sandy loam (Stratum Id), a buried road surface (Stratum Ie/ SIHP # -7658), very gravelly sand (crushed coral) (Stratum If), and hydraulic silty clay (Stratum Ig), overlying a small section of a man-made sandy clay berm (Stratum IIa/SIHP # -7655), laminated organic material (Stratum IIb/SIHP # -7655), and natural sandy clay wetland sediment (Stratum III) (Figure 104 through Figure 107, Table 17).

A buried asphalt surface (Stratum Ie), determined to be a component of SIHP # -7658, was observed as a continuous layer throughout the test excavation. The asphalt was observed at 85 cm below surface, with an average thickness of 15 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 16 also documented the presence of historic salt pan remnants (SIHP # -7655) in the form of a small man-made berm feature (Stratum IIa) and laminated organic material (Stratum IIb). The man-made berm was located within the northeast (*mauka*) portion of the trench, with a maximum thickness of approximately 12 cm (Figure 106). It appeared to run perpendicular through the test excavation. The berm sloped down on either side, transitioning to level salt pan beds consisting of a thin layer of laminated organic material (Stratum IIb) overlying natural wetland sediment (Stratum III). The laminated organic layer was approximately 1 cm thick and contained observable grass stalks (Figure 105).

Figure 104. Photograph of TE 16 northeast wall, view to north

Figure 105. Close-up of thin laminated organic layer containing grass stalks (Stratum IIb), SIHP # -7655, overlying natural wetland sediment (Stratum III)

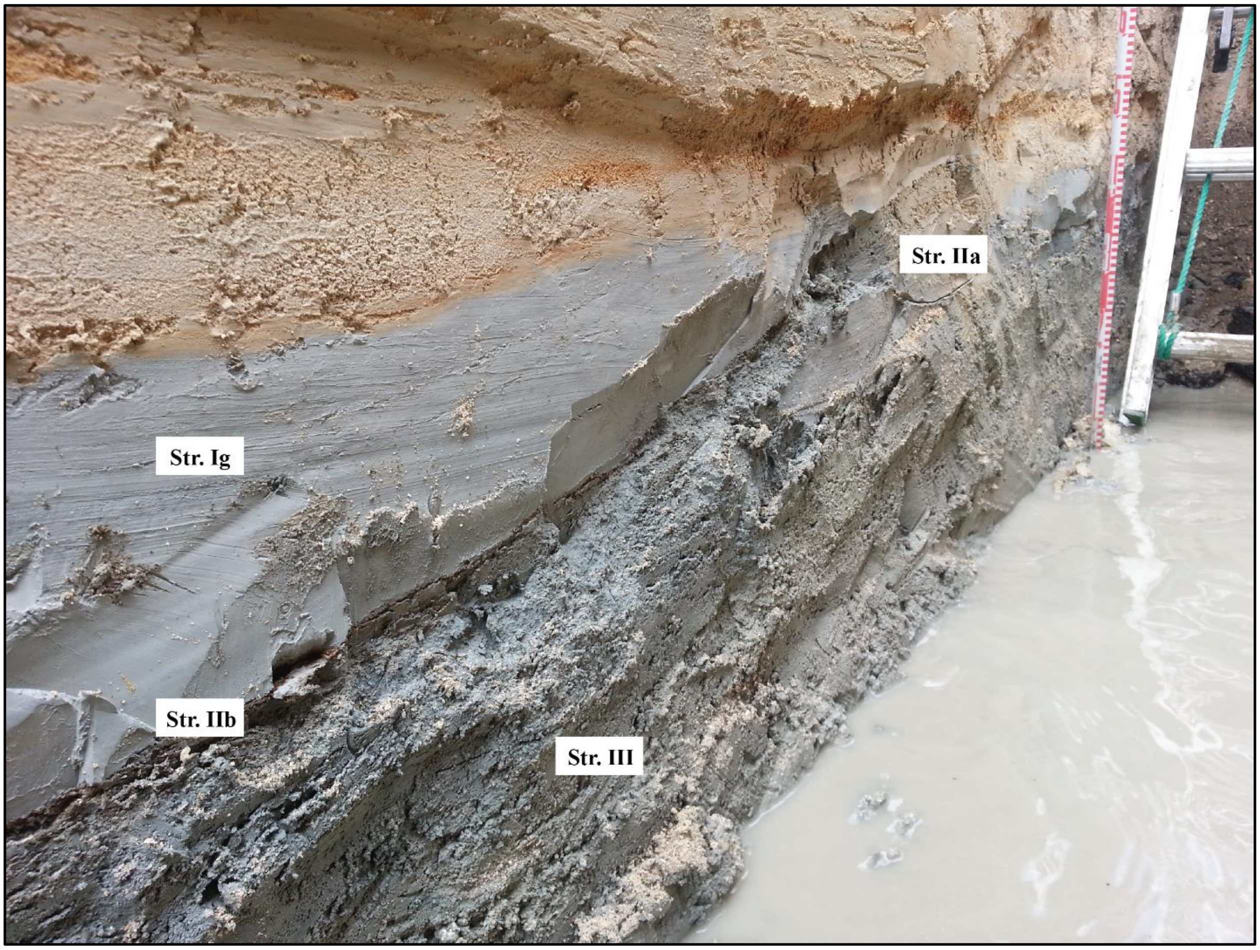

Figure 106. Close-up of salt pan berm (Stratum IIa), SIHP # -7655, and laminated organic layer (Stratum IIb) overlying natural wetland sediment (Stratum III) utilized as a salt pan bed

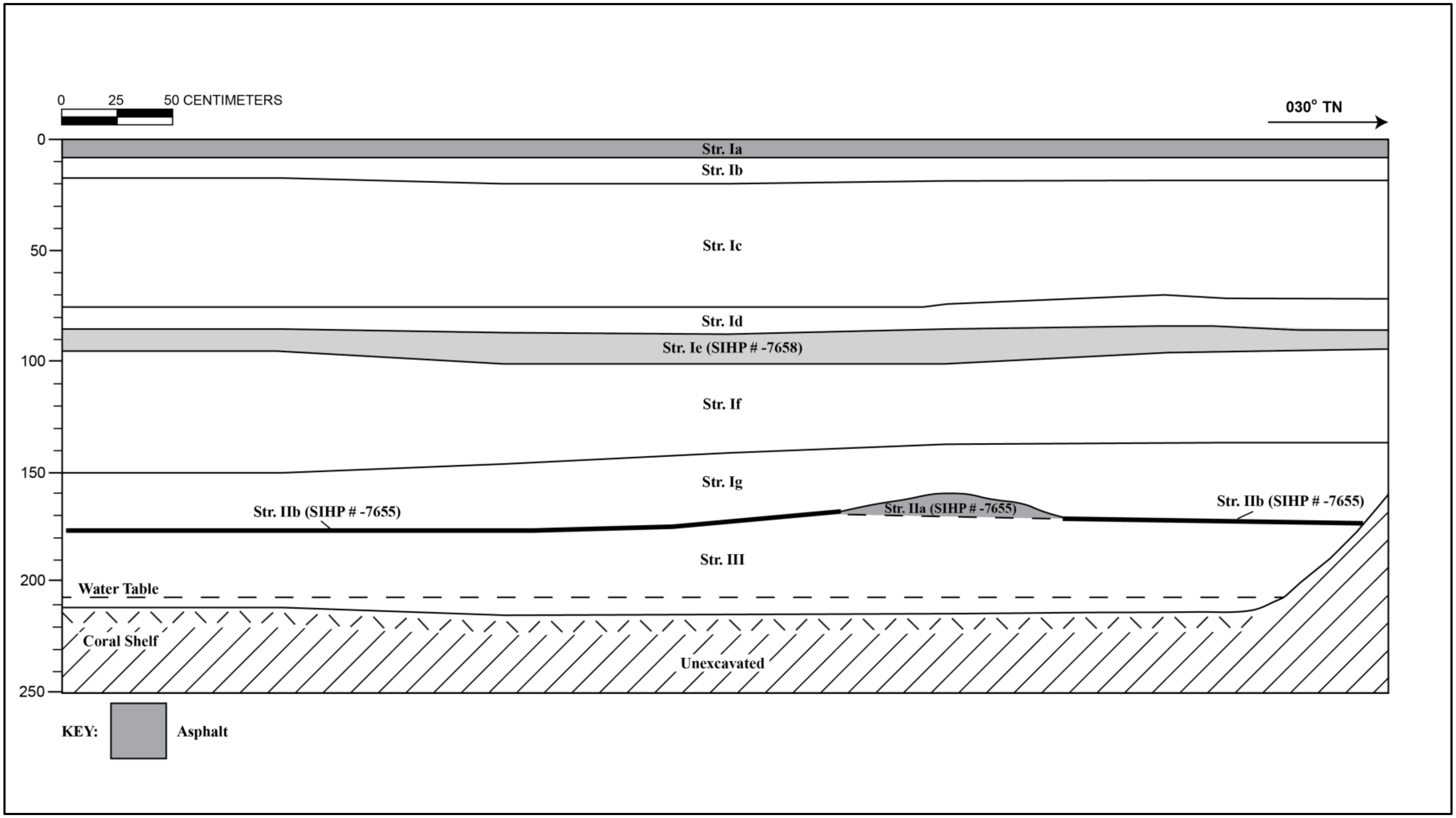

Figure 107. Profile of TE 16 northwest wall

Table 17. TE 16 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–8	Asphalt surface
Ib	8–20	Fill; 10YR 2/2, dusky red; extremely gravelly cobbly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	17–75	Fill; 7.5YR 4/3, brown; gravelly loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary
Id	75–87	Fill; 10YR 7/3, very pale brown; gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary
Ie	85–100	SIHP # -7658; 10YR 3/3, dark brown; very gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; compacted surface; former road surface
If	95–150	Fill; 10YR 8/2, very pale brown; cobbly course sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
Ig	135–175	Fill; 10YR 8/2, very pale brown; fine sand to silty clay; stuctureless (massive); wet, sticky consistency; very plastic; marine origin; abrupt, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	157–167	SIHP # -7655; 10YR 7/2, light gray; sandy clay; weak, fine, crumb structure; moist, loose consistency; non-plastic; marine origin; diffuse, discontinuous lower boundary; man-made berm associated with salt pan remnants
IIb	165–172	SIHP # -7655; organic laminations associated with salt pan remnants
III	170–214 (BOE)	Natural; 10Y 6/1, greenish gray; sandy clay; strong, fine, blocky structure; wet, slightly sticky consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.17 Test Excavation 17 (TE 17)

Test Excavation 17 (TE 17), an exterior trench located in the western portion of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.72 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 17 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), very gravelly loam fill containing a cinder lens (Stratum Ic), an oil-rolled surface (Stratum Id/ SIHP # -7658), clay (Stratum Ie), and very gravelly sand (crushed coral) (Stratum If), overlying a sandy clay man-made berm (Stratum IIa/SIHP # -7655), natural sandy clay wetland sediment (Stratum III), and coarse sandy clay marine sediment (Stratum IV) (Figure 108, Figure 109, Table 18).

An oil-rolled former land surface (Stratum Id) in TE 17 was determined to be a component of SIHP # -7658. This petroleum based layer was observed 41 cm below surface, with a thickness of 15 cm. The former land surface was disturbed by a utility pit and overlies crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the oil-rolled surface likely dates from 1939 to 1952.

TE 17 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a berm (Stratum II). The berm extended across the length of the test excavation, with the apex located in the center of the sidewall and the sides sloping downwards at both the *mauka* and *makai* ends. The presence of an apex indicates that TE 17 likely documented a cross-section of a berm oriented northwest-southeast, parallel to the shoreline. The maximum height of the berm was 99 cm above coral shelf.

Figure 108. Photograph of TE 17 northwest wall, showing a dark oil-rolled, buried surface (Stratum Id/SIHP # -7658) overlying crushed coral (Stratum If) and a man-made berm (Stratum II/SIHP # -7655), view to west

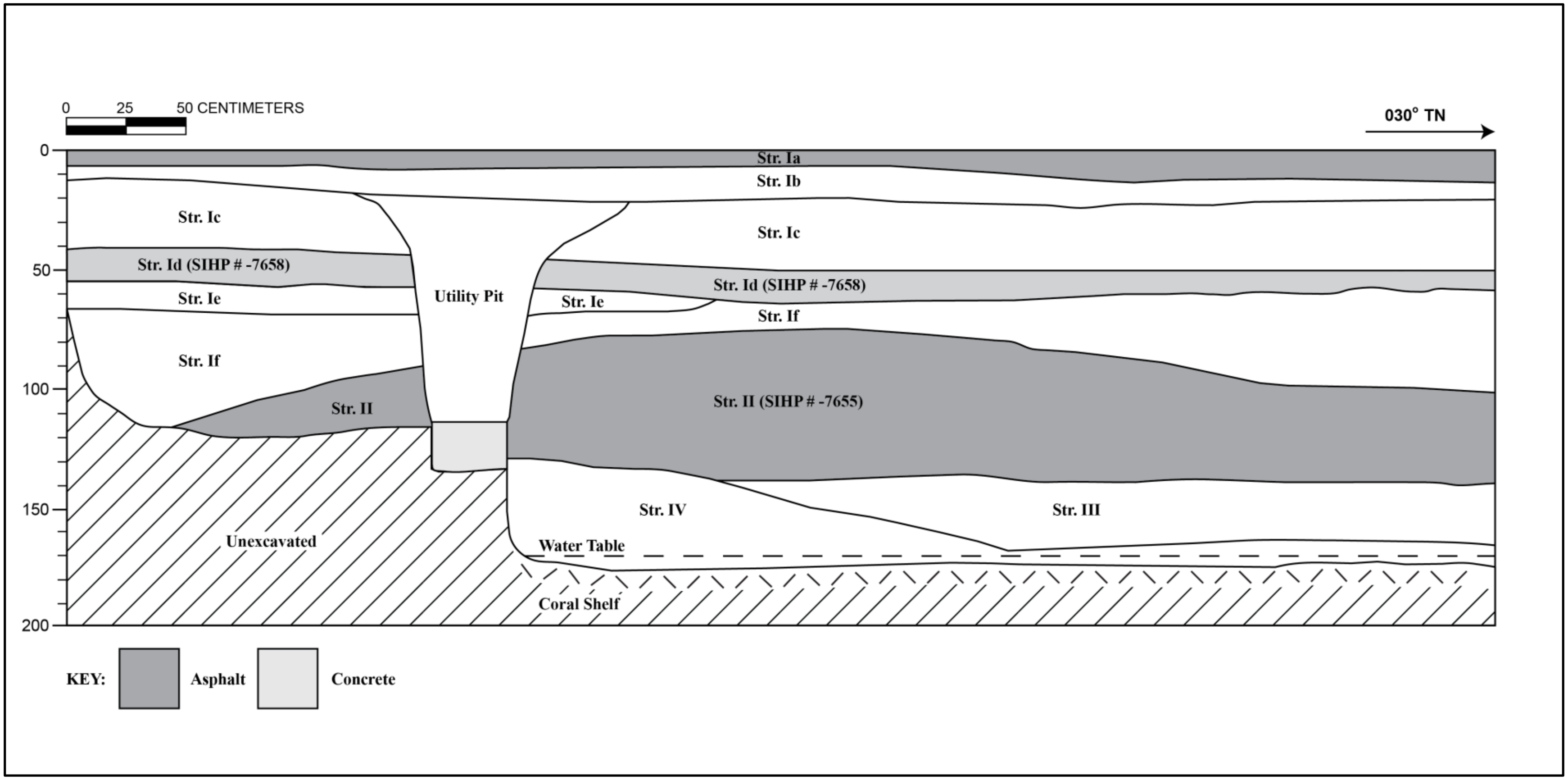

Figure 109. Profile of TE 17, northwest wall

Table 18. TE 17 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–18	Asphalt surface
Ib	6–22	Fill; gravel; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	12–50	Fill; 10YR 3/1, very dark gray; very gravelly loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, broken/discontinuous lower boundary; contained a fine cinder lens along lower boundary
Id	41–64	SIHP # -7658; oil-rolled surface
Ie	55–64	Fill; 5YR 3/3, dark reddish brown; clay; structureless (massive); moist, extremely firm consistency; very plastic; terrigenous origin; abrupt, broken/discontinuous lower boundary
If	57–116	Fill; 10YR 8/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken lower boundary; crushed coral fill associated with land reclamation events
II	75–140	SIHP # -7655; 10YR 8/4, very pale brown; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; man-made berm associated with salt pan remnants
III	136–166	Natural; 10YR 7/6, yellow; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; root staining; diffuse, wavy lower boundary; natural wetland sediment
IV	127–172 (BOE)	Natural; 5BG, 7/1, light greenish gray; coarse sandy clay; moderate, coarse, blocky structure; moist, friable consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; natural marine sediment overlying coral shelf

4.1.18 Test Excavation 18 (TE 18)

Test Excavation 18 (TE 18), an exterior trench located in the southwest portion of the project area, was oriented in a northwest-southeast direction and measured 6.0 m long by 0.72 m wide with a maximum depth of 1.72 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 18 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of gravelly loam (Stratum Ic), very gravelly sand (crushed coral) (Stratum Id), and two very gravelly sandy loam utility pits, overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) and natural sandy clay wetland sediment (Stratum III). (Figure 110, Figure 111, Figure 112, Table 19).

Due to the presence of two modern utility pits within the central and southeastern portions of the test excavation, as well as a shallow structural foundation footing in the northwest corner, only discontinuous segments of the test excavation were able to be excavated to the coral shelf. However, the presence of historic salt pan remnants, SIHP # -7655, was documented within the central portion of the test excavation, consisting of a man-made berm (Stratum II), which sloped sharply downwards to the natural wetland sediment (Stratum III) on its southern end. Within the west-central portion of the test excavation, the berm extended to the coral shelf and appeared to have removed the underlying wetland stratum during its construction. The maximum height of the berm was 1.22 m above coral shelf.

Figure 110. Photograph of TE 18 northeast wall, view to east

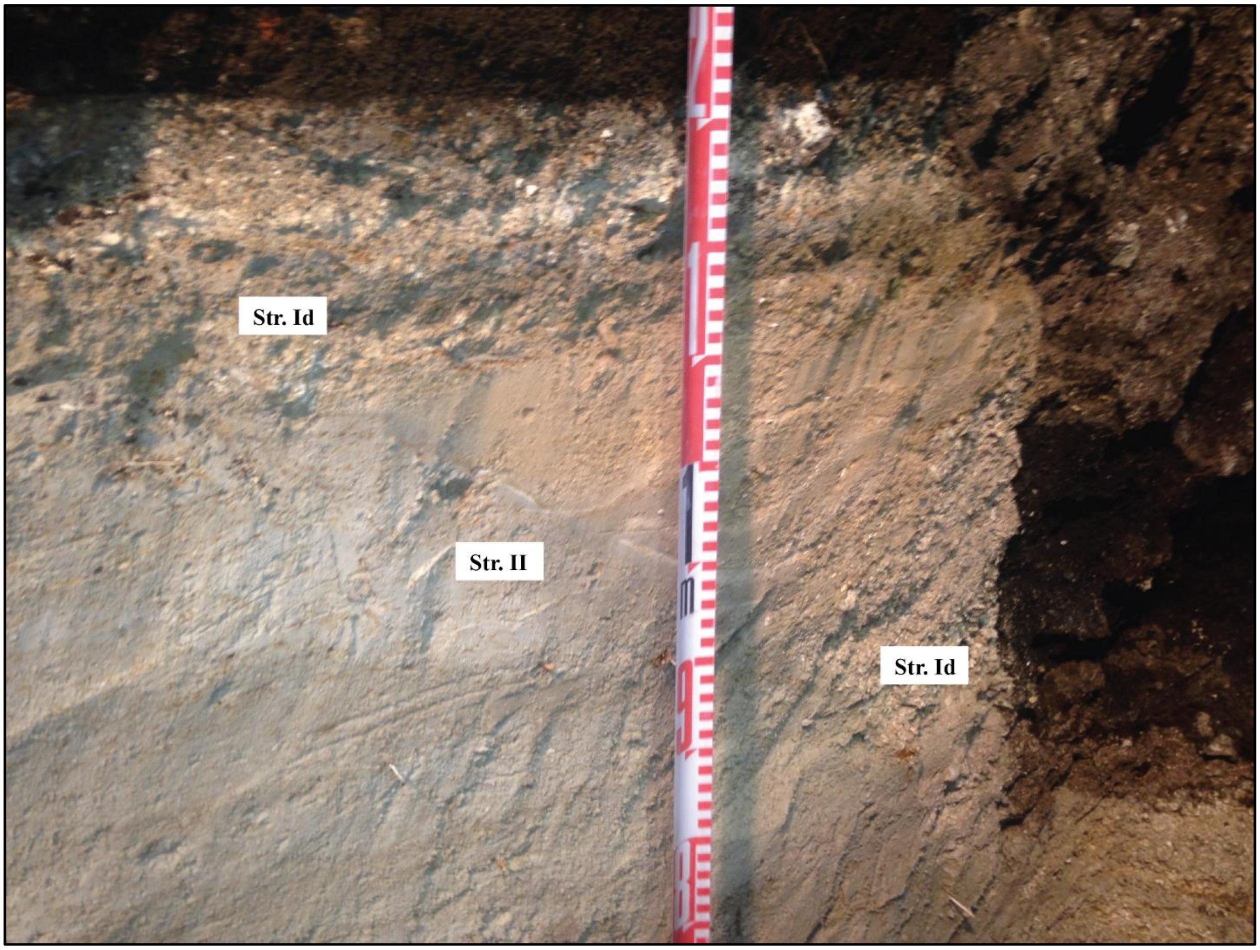

Figure 111. Close-up of man-made berm structure (Stratum II), SIHP # -7655, beneath crushed coral fill (Stratum Id), curving steeply downwards, northeast sidewall

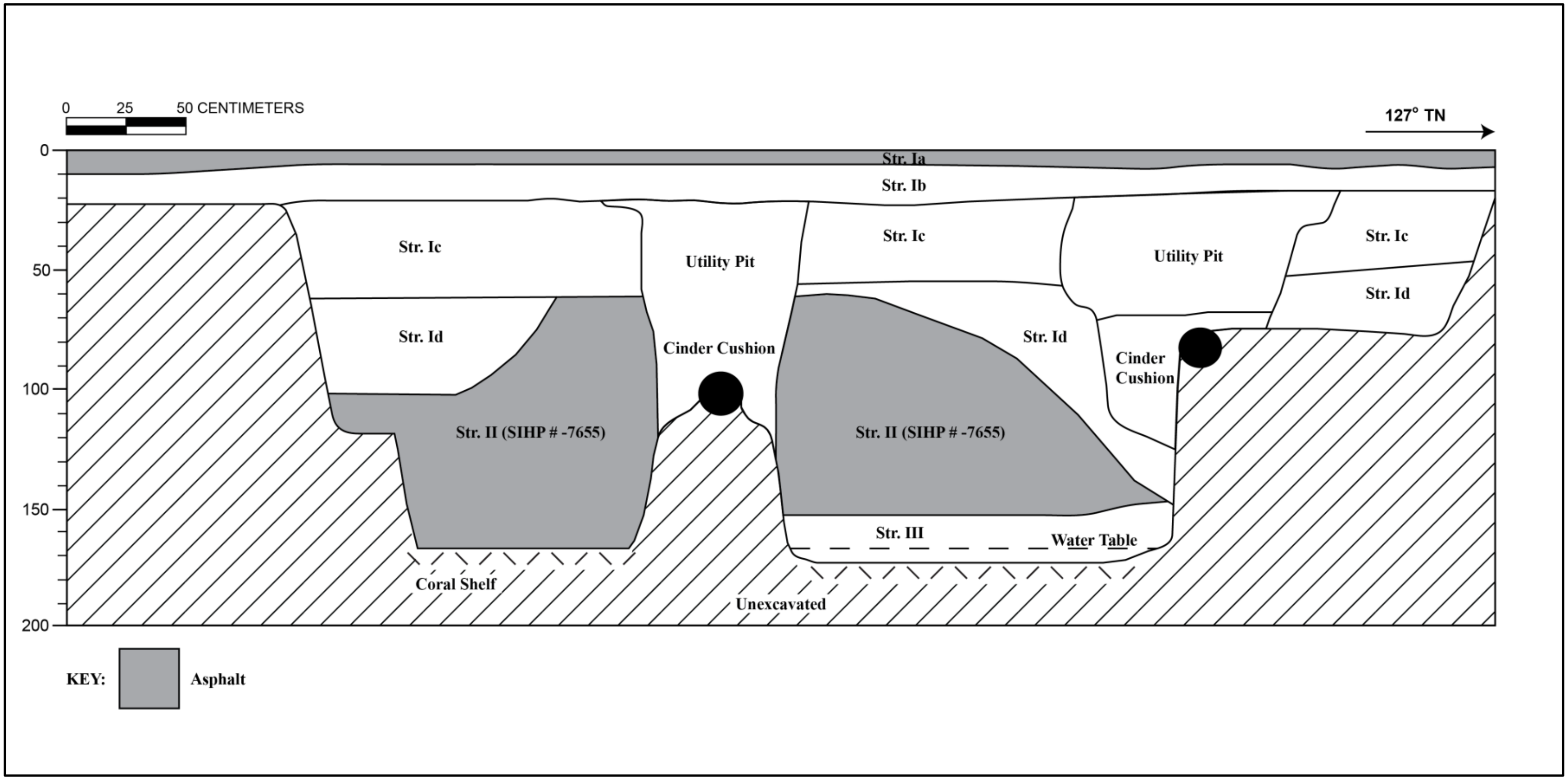

Figure 112. Profile of TE 18, northeast wall

Table 19. TE 18 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	6–24	Fill; gravel; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	20–63	Fill; 5YR 3/3, dark reddish brown; gravelly loam; weak, medium, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, broken/discontinuous lower boundary; contained cinder mottles
Utility Fill	22–73; 17–71	Fill; 2.5Y 5/2, grayish brown; very gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; abrupt, broken/discontinuous lower boundary; consisted of gravel overlying cinder fill
Id	56–150	Fill; 2.5Y 8/2, pale yellow; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, wavy/discontinuous lower boundary; crushed coral fill associated with land reclamation events
II	62–167	SIHP # -7655; 2.5Y 7/4, pale yellow; sandy clay; structureless (massive); moist, firm consistency; plastic; mixed origin; clear lower boundary; root staining; man-made berm associated with salt pan remnants
III	149–174 (BOE)	Natural; 5BG, 7/1, light greenish gray; clay; structureless (massive); moist, firm consistency; plastic; marine origin; few, fine roots; abrupt, discontinuous lower boundary; natural wetland sediment overlying coral shelf

4.1.19 Test Excavation 19 (TE 19)

Test Excavation 19 (TE 19), an exterior excavation located in the southwestern portion of the project area, was oriented in a northwest-southeast direction and measured 4.0 m long by 0.65 m wide with a maximum depth of 1.72 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 19 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of gravelly sandy loam (Stratum Ic), gravelly silt loam (Stratum Id), gravelly sand (Stratum Ie), silty clay (Stratum If), gravelly sand (Stratum Ig), and three utility and/or structural pits, overlying a sandy clay man-made berm (Stratum II/SIHP # -7655), natural silty loam wetland sediment (Stratum III), and sandy silty clay marine sediment (Stratum IV) (Figure 113, Figure 114, Table 20).

Due to the complex of utilities and surface structures within this portion of the project area, the location of TE 19 was shifted to the near vicinity of TE 18 and necessarily shortened to 4.0 m in length.

TE 19 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of a man-made berm (Stratum II) overlying natural, in situ wetland sediments (Strata III and IV). The sandy clay berm extended evenly across the length of the test excavation. The maximum height of the berm was 86 cm above coral shelf.

Figure 113. Photograph of TE 19 southwest wall, view to west

Figure 114. Close-up of man-made berm (Stratum II), SIHP # -7655, underlying crushed coral fill (Stratum Ig) and consisting of homogenous light gray sandy clay sediment

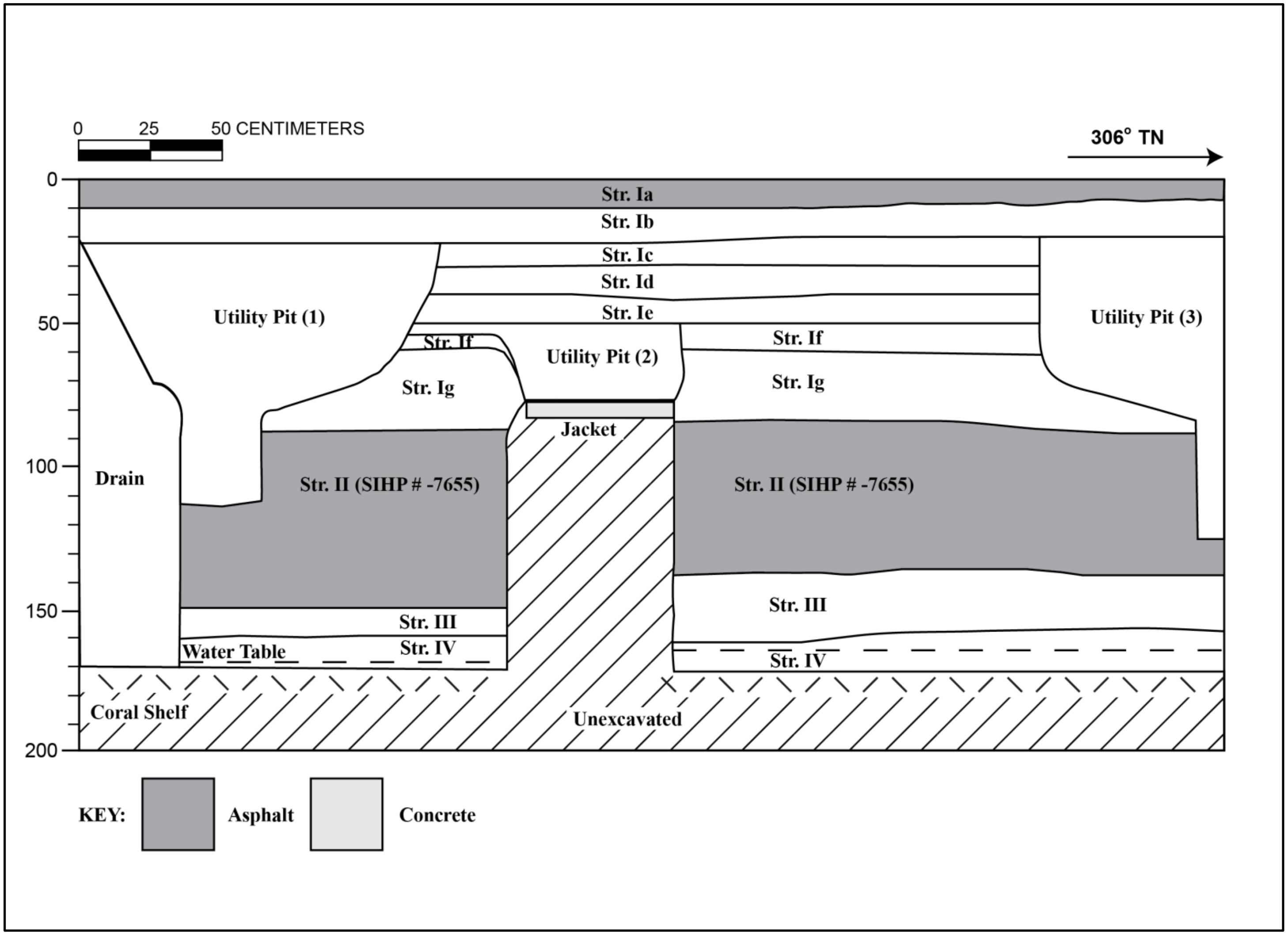

Figure 115. Profile of TE 16, southwest wall

Table 20. TE 19 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–23	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	20–30	Fill; 10YR 2/2, very dark brown; gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; abrupt, broken/discontinuous lower boundary
Id	30–42	Fill; 10YR 2/2, very dark brown; gravelly silt loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, broken/discontinuous lower boundary
Ie	40–50	Fill; 10YR 5/3, brown; gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary
If	50–61	Fill; 10YR 3/3, dark brown; silty clay; structureless (massive); moist, firm consistency; plastic; terrigenous origin; clear, broken/discontinuous lower boundary
Ig	58–86	Fill; 10YR 6/2, light brownish gray; very gravelly sand; stuctureless (single-grain); moist, loose consistency; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; crushed coral fill associated with land reclamation events; contained thin layer of silty clay dredge at lower boundary
Utility Pit (1)	22–113	Fill; 10YR 3/4, dark yellowish brown; gravelly loam; weak, fine to medium, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; abrupt, discontinuous lower boundary; contained glass fragments
Utility Pit (2)	50–76	Fill; 10YR 5/4, yellowish brown; gravelly silty loam; weak, fine to medium, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; abrupt, discontinuous lower boundary; overlying concrete jacket
Utility Pit (3)	20–125	Fill; 10YR 3/4, dark yellowish brown; gravelly sandy loam; weak, fine, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; abrupt, discontinuous lower boundary; column foundation
II	83–149	SIHP # -7655; 10YR 7/2, light gray; sandy clay; moderate, fine, blocky; structure; moist, firm consistency; slightly plastic; marine origin; smooth, broken/discontinuous lower boundary; root staining; man-made berm associated with salt pan remnants

Stratum	Depth (cmbs)	Description
III	149–157	Natural; 10YR 7/3, very pale brown; silty loam; weak, fine, granular structure; moist, loose to very friable consistency; slightly plastic; marine origin; clear, broken/discontinuous lower boundary; few, very fine roots; wetland sediment
IV	155–170 (BOE)	Natural; 10Y 6/1, greenish gray; sandy silty clay; weak, fine to medium, blocky structure; wet, sticky consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; marine sediment

4.1.20 Test Excavation 20 (TE 20)

Test Excavation 20 (TE 20), an exterior trench located near the central portion of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.70 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 20 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various layers of fill consisting of very gravelly loamy sand (Stratum Ic), a buried asphalt surface (Stratum Id/ SIHP # -7658), very gravelly sand (crushed coral) (Stratum Ie), and hydraulic sand and clay fill (Stratum If), overlying laminated organic material (Stratum II/SIHP # -7655) and natural sandy clay wetland sediment (Stratum III) (Figure 116, Figure 117, Figure 118, Table 21).

A buried asphalt surface (Stratum Id), determined to be a component of SIHP # 7658, was disturbed by a utility pit in the southeast portion of TE 20. The asphalt was observed 60 cm below surface, with a thickness of 17 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 20 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of a thin layer of organic laminations (Stratum II) less than 1 cm thick, overlying natural wetland sediment (Stratum III) utilized as a salt pan bed (Figure 117). Stratum II extended evenly across the length of the test excavation.

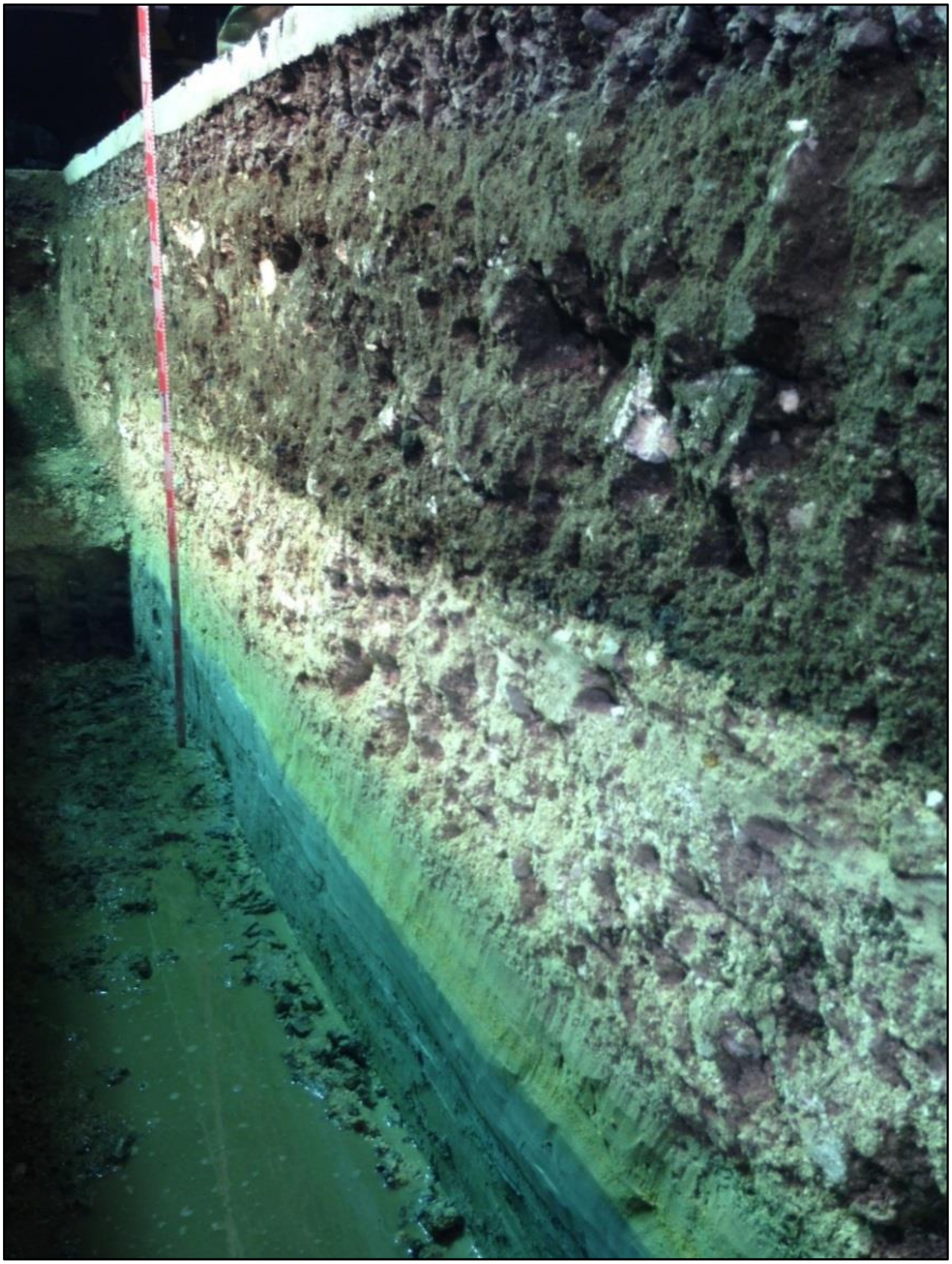

Figure 116. Photograph of TE 20 northwest profile, view to west

Figure 117. Close-up of thin laminated organic layer (Stratum II), SIHP # -7655, overlying natural wetland sediment (Stratum III) utilized as a salt pan bed

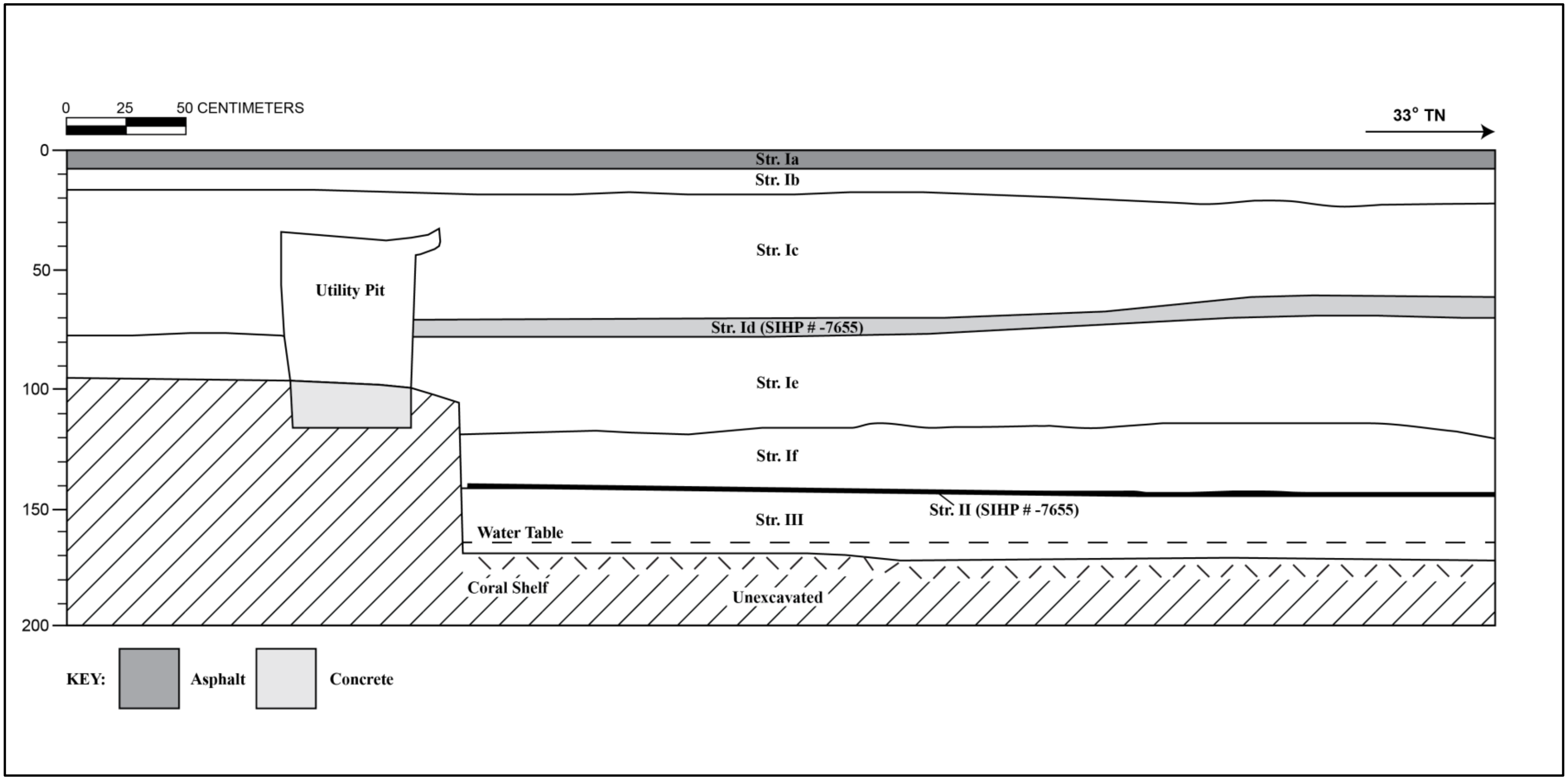

Figure 118. Profile of TE 20, northwest wall

Table 21. TE 20 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–8	Asphalt surface
Ib	8–22	Fill; 10YR 2/2, very dark brown; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	16–75	Fill; 10YR 4/3, brown; very gravelly loamy sand; structureless (single-grain); moist, loose to very friable consistency; non-plastic; terrigenous origin; clear, smooth lower boundary
Id	60–77	SIHP # -7658; buried asphalt surface
Ie	68–118	Fill; 10YR 7/3, very pale brown; extremely gravelly coarse sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, smooth lower boundary; crushed coral fill associated with land reclamation events
If	114–143	Fill; 10YR 7/4, very pale brown, grading to N 6/1, gray; very fine sand grading to clay; structureless (single-grain to massive); moist, loose to firm consistency; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	140–141	SIHP # -7655; organic laminations associated with salt pan remnants
III	141–170	Natural; 10Y 5/1, greenish gray; sandy clay; structureless (massive); wet, sticky consistency; slightly plastic to plastic; marine origin; abrupt, smooth lower boundary; wetland sediment

4.1.21 Test Excavation 21 (TE 21)

Test Excavation 21 (TE 21), an exterior excavation located in the central parking lot of the project area, was oriented in a north-south direction and measured 5.0 m long by 0.67 m wide with a maximum depth of 1.8 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 21 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various layers of fill consisting of very gravelly loam (Stratum Ic), very gravelly clay (Stratum Id), very gravelly sand (crushed coral) (Stratum Ie), and hydraulic silt and clay (Stratum If), overlying a man-made berm (Stratum IIa/SIHP # -7655), laminated organic material (Stratum IIb/SIHP # -7655), and natural clay wetland sediment (Stratum III) (Table 22).

Due to a complex of subsurface utility lines, the location of TE 21 was angled and the length shortened to 5 m to avoid conflict. During excavation, a utility was encountered in the southern portion of the trench, preventing complete excavation of the entire test excavation.

TE 21 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a berm (Stratum IIa) and a thin layer of laminated organic material (Stratum IIb). The berm was located within the southern portion of the test excavation, sloping downward to the north and transitioning to level salt pan beds consisting of a thin layer of laminated organic material overlying natural wetland sediment (Stratum III). The organic laminations were quite thin, less than 1 cm in width. The maximum height of the berm was 80 cm above coral shelf.

Figure 119. Photograph of TE 21 east wall, view to southeast

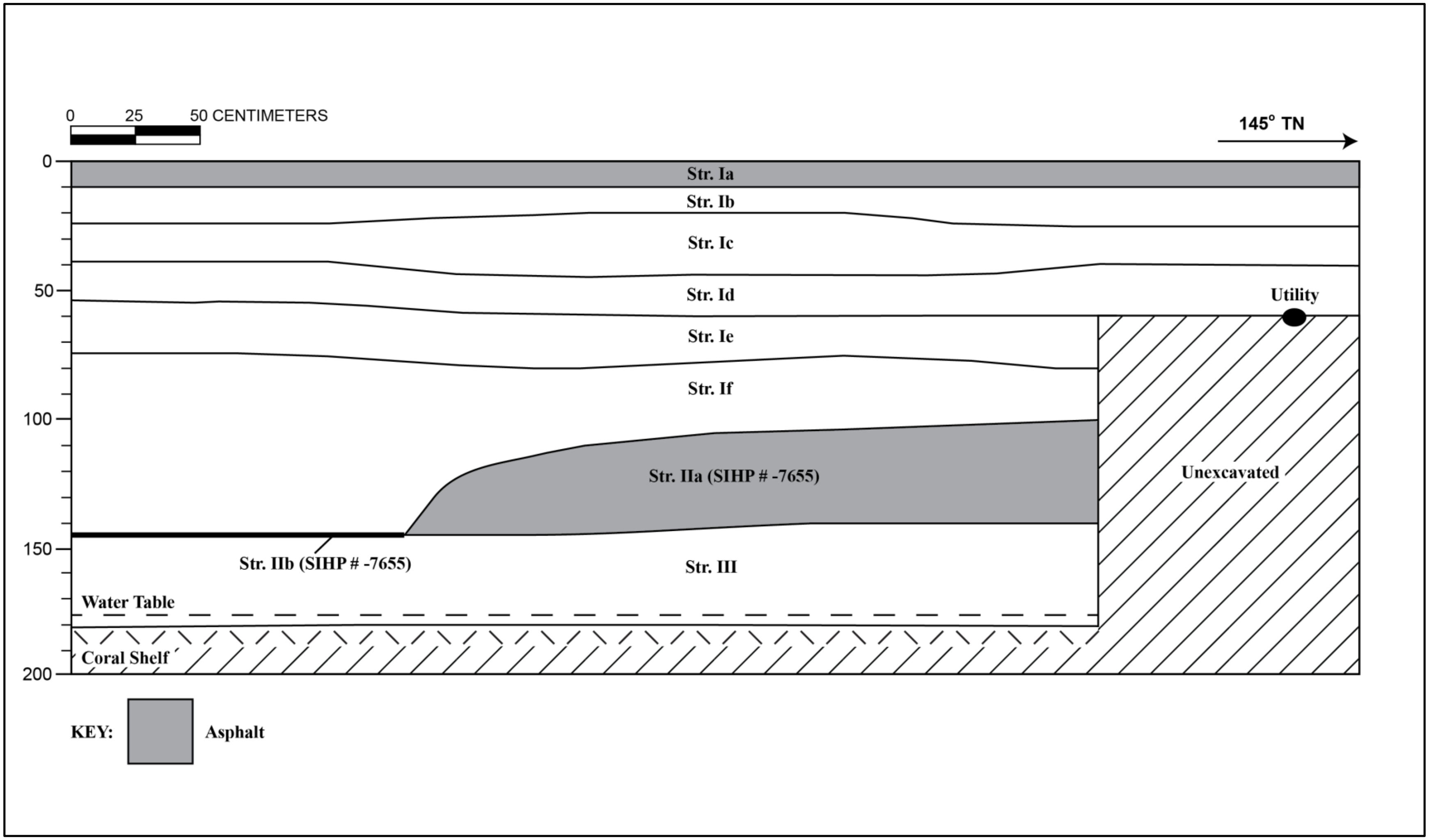

Figure 120. Profile of TE 21 east wall

Table 22. TE 21 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–25	Fill; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	20–45	Fill; 10YR 2/2, very dark brown; very gravelly loam; weak, fine crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary
Id	40–60	Fill; 10YR 3/6, dark yellowish brown; very gravelly clay; structureless (massive); moist, friable consistency; plastic; terrigenous origin; clear, smooth lower boundary
Ie	55–80	Fill; 10YR 8/1, white; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, smooth lower boundary; crushed coral fill associated with land reclamation events
If	75–145	Fill; 10YR 8/2, very pale brown; fine sand grading to clay; structureless (single-grain to massive); moist, loose to firm consistency; non-plastic to plastic; marine origin; abrupt, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	100–145	SIHP # -7655; 10YR 8/2, very pale brown; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, smooth lower boundary; man-made berm associated with salt pan remnants
IIb	145–147	SIHP # -7655; organic laminations associated with salt pan remnants
III	140–180 (BOE)	Natural; 10Y, 6/1, greenish gray; clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment

4.1.22 Test Excavation 22 (TE 22)

Test Excavation 22 (TE 22), an exterior excavation located in the central parking lot of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.72 m wide with a maximum depth of 1.72 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 22 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of cobbly sand (Stratum Ic), cobbly loamy sand (Stratum Id), a disturbed asphalt surface (Stratum Ie/SIHP # -7658), very gravelly sand (crushed coral) (Stratum If), and hydraulic sand (Stratum Ig), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) and natural silty clay wetland sediment (Stratum III) (Figure 121, Figure 122, Figure 123, Table 23).

A thin buried asphalt surface (Stratum Ie), determined to be a component of SIHP # -7658, was located in the southwest portion of TE 22 and was discontinuous. The asphalt was observed at 60 cm below surface, with an average thickness of 5 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 22 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II). The berm extended across the length of the test excavation, sloping gently downwards within the *mauka* portion of the trench. The maximum height of the berm was 1.03 m above the coral shelf.

Figure 121. Photograph of TE 22 northwest wall, view to southwest

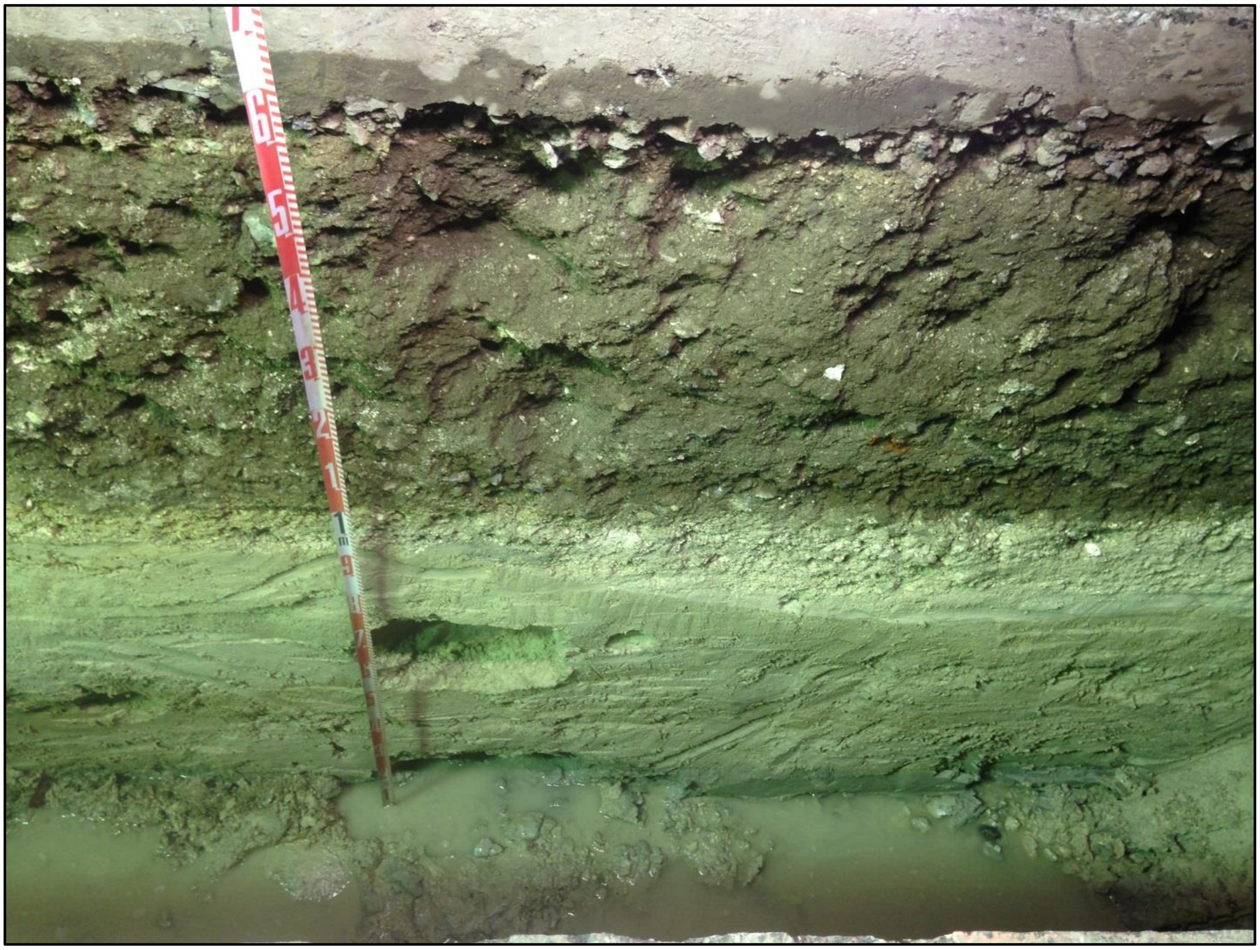

Figure 122. Close-up of Stratum II, man-made berm associated with historic salt pans (SIHP # -7655), underlying crushed coral (Stratum If) and hydraulic fill (Stratum Ig)

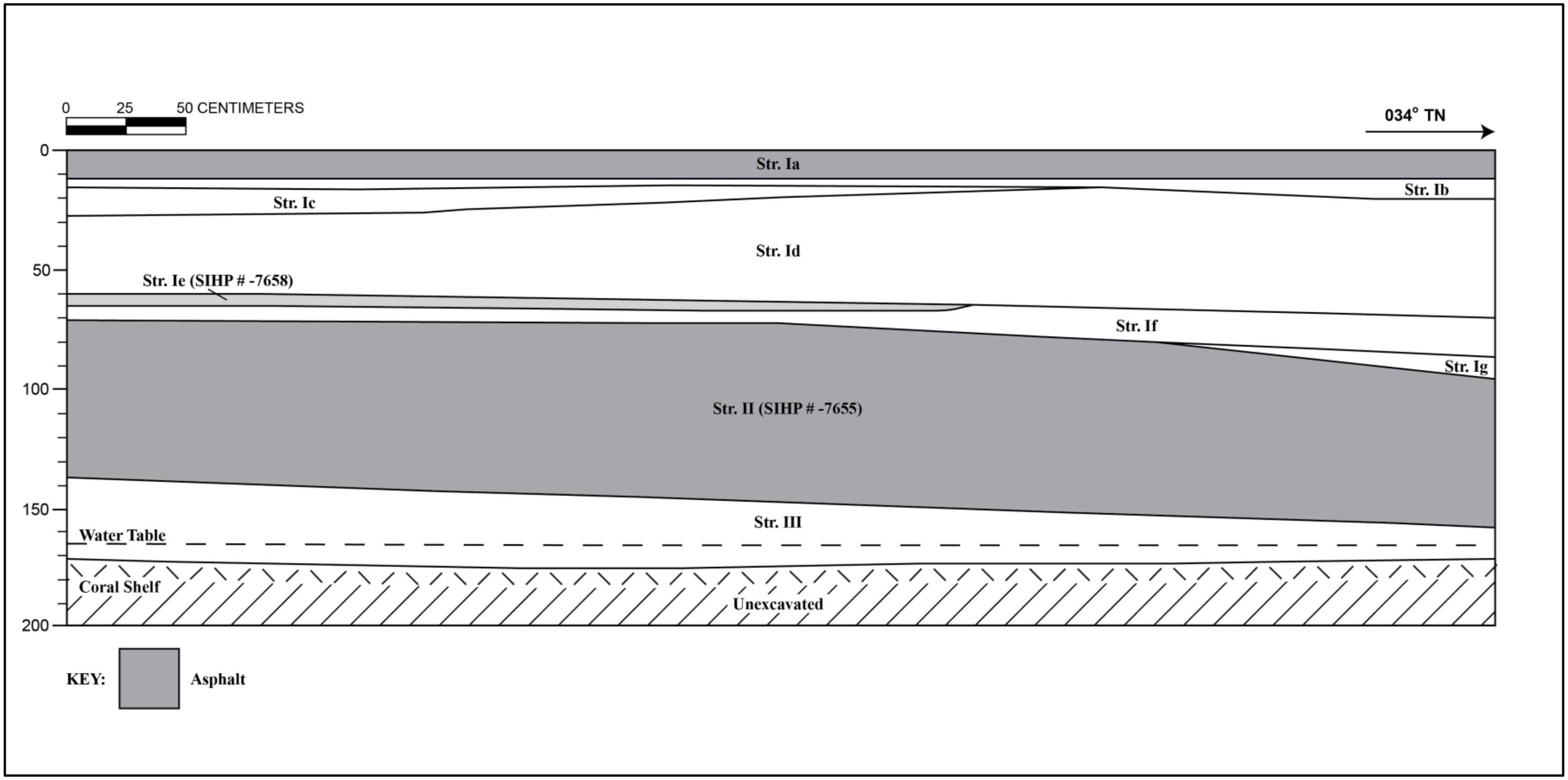

Figure 123. Profile of TE 22, northwest wall

Table 23. TE 22 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–12	Asphalt surface
Ib	12–20	Fill; 7.5YR 3/3, dark brown; extremely gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	15–28	Fill; 7.5YR 6/3, reddish yellow; cobbly sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, discontinuous lower boundary
Id	15–70	Fill; 10YR 4/2, dark grayish brown; cobbly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary
Ie	60–65	SIHP # -7658; 10YR 3/3, dark brown; very gravelly loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; disturbed asphalt layer
If	65–85	Fill; 10YR 8/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, wavy lower boundary; crushed coral fill associated with land reclamation events
Ig	85–95	Fill; 10YR 8/1, white; very fine sand grading to clay; structureless (single-grain to massive); moist, loose to firm consistency; non-plastic to plastic; marine origin; abrupt, discontinuous lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	72–157	SIHP # -7655; 2.5Y 7/2, light gray; sandy clay; structureless (massive); moist, friable consistency; slightly plastic; marine origin; clear, smooth lower boundary; root staining; man-made berm associated with salt pan remnants
III	137–170 (BOE)	Natural; 10Y 6/1, greenish gray; silty clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; common, fine roots; natural wetland sediment overlying coral shelf

4.1.23 Test Excavation 23 (TE 23)

Test Excavation 23 (TE 23), an exterior excavation located in the central parking lot of Ward Warehouse, was oriented in a northeast-southwest direction and measured 4.8 m long by 0.75 m wide with a maximum depth of 1.7 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 23 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various layers of fill consisting of cobbly loamy sand (Stratum Ic), a buried asphalt surface (Stratum Id/SIHP # -7658), extremely gravelly sand (Stratum Ie), clay (Stratum If), silty clay (Stratum Ig), very fine sand (Stratum Ih), and hydraulic clay (Stratum Ii), overlying laminated organic material (Stratum II/SIHP # -7655), and natural sandy clay wetland sediment (Stratum III) (Figure 124 through Figure 127, Table 24).

Due to a complex of subsurface utility lines, the location of TE 23 was angled and the length shortened to 5 m to avoid conflict. During excavation, a utility was encountered in the southern portion of the trench, preventing complete excavation of the entire test excavation.

A buried asphalt surface (Stratum Id), determined to be a component of SIHP # 7658, was disturbed by a utility trench in the south end of TE 23. The asphalt was observed at 46 cm below surface, with a thickness of 6 cm, overlying four fill layers, including crushed coral and hydraulic (dredge) associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 23 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of a thin layer of laminated organic material (Stratum II). The organic layer was observed within both sidewalls and extended across the length of the test excavation. A sample of Stratum II, laminated organic material associated with the historic salt pans (SIHP # -7655), and the underlying wetland sediment (Stratum III) were submitted to PaleoResearch Institute, Inc. for pollen and microcharcoal analysis. The majority of the observed pollen consisted of *kolea* (*Myrsine*), an endemic Hawaiian tree. Cyperaceae pollen was documented in both samples, but not in a concentration indicative of a sedge marsh.

Pollen from introduced species was observed within both samples, including *kiawe* (*Prosopis*), *koa haole* (*Leucaena*). This may indicate that both samples date to the historic period. Alternatively, the alien species within the wetland sediments (Sample 11) may be a result of contamination during recent or historic times. A small amount of Poaceae was found in the laminated organic material (Sample 10), while small amounts of fern spores were identified in the underlying wetland sediment (Sample 11). *Cressa* (morning glory family) and *Artemisia* (possibly *ʻAhinahina*) pollen were identified in Stratum II (Sample 10). *Chenopodium*, possibly *ʻaheahea* or *ahea*, a native shrub, was observed within Stratum III (Sample 11). The laminated organic material (Stratum II) contained a larger variety of pollen and a higher concentration value than the underlying wetland sediment (Stratum III).

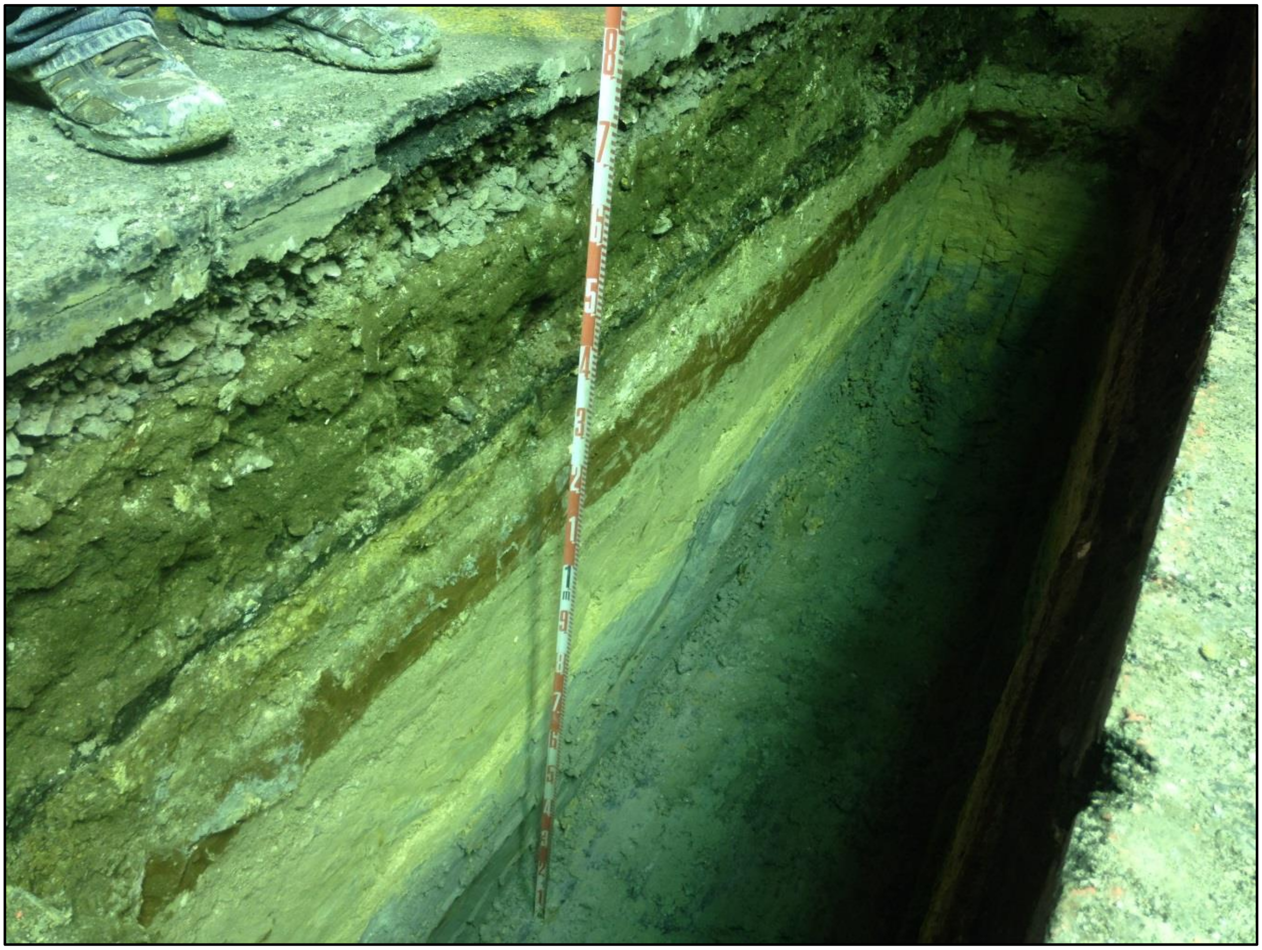

Figure 124. Photograph of TE 23 west wall, view to northwest

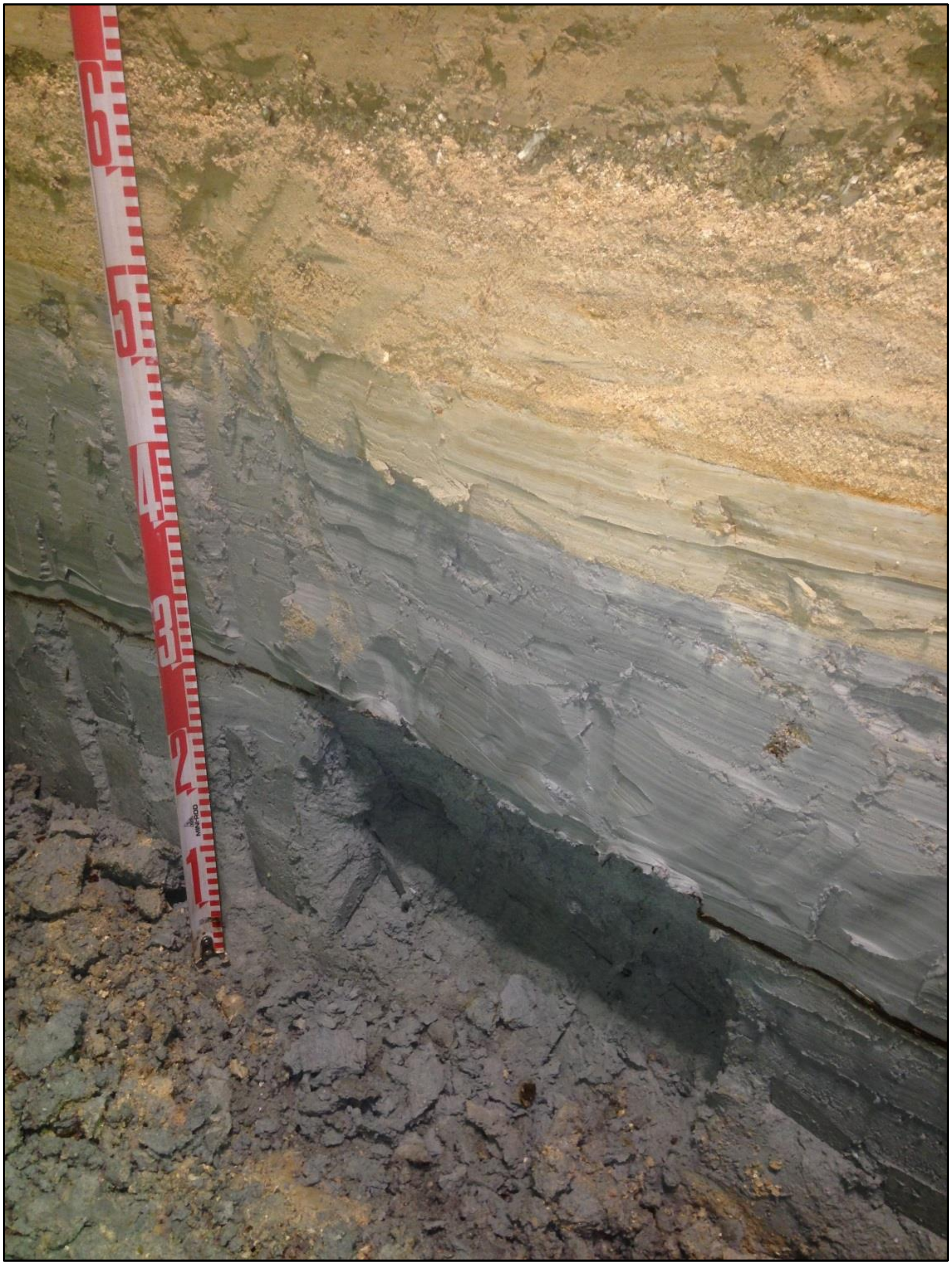

Figure 125. Close-up of dark laminated organic layer (Stratum II, SIHP # -7655), overlying natural wetland sediment; showing bulk sample area

Figure 126. Close-up of Stratum II, organic laminations associated with historic salt pans (SIHP # -7655), overlying natural wetland sandy clay (Stratum III)

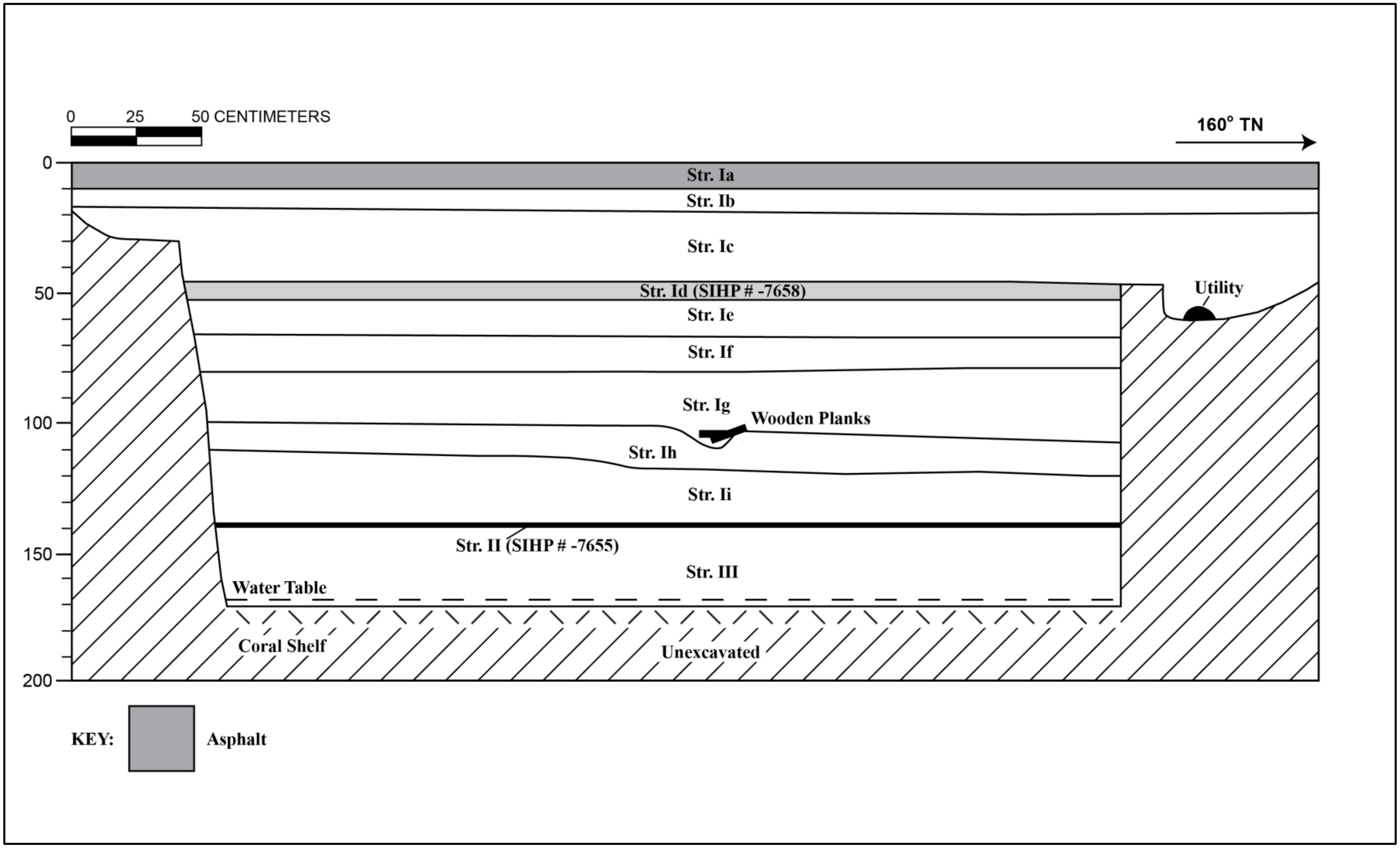

Figure 127. Profile of TE 23, west wall

Table 24. TE 23 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–20	Fill; extremely gravelly sandy loam; weak, fine, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	17–46	Fill; 10YR 2/2, very dark brown; cobbly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary
Id	46–52	SIHP # -7658; asphalt surface
Ie	52–66	Fill; 10YR 6/3, pale brown; extremely gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; abrupt, smooth lower boundary; crushed coralline sand
If	66–81	Fill; 2.5YR 2.5/4, dark reddish brown; clay; structureless (massive); moist, extremely firm consistency; very plastic, terrigenous origin; clear, smooth lower boundary
Ig	81–110	Fill; 10YR 6/1, gray; silty clay; structureless (massive); moist, friable consistency; slightly plastic; terrigenous origin; diffuse, broken/discontinuous lower boundary; contained a concentration of wooden planks from 87–98 cmbs
Ih	100–120	Fill; 10YR 7/3–8/4, very pale brown; very fine sand; structureless (single grain); moist, loose consistency; non-plastic; marine origin; diffuse, smooth lower boundary; crushed coral fill associated with land reclamation events
Ii	110–140	Fill; 10YR 8/4, very pale brown grading to N 6/1, gray; clay; structureless (massive); moist, very firm consistency; plastic; marine origin; abrupt, smooth lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	140–141	SIHP # -7655; organic laminations associated with salt pan remnants
III	141–170 (BOE)	Natural; 5BG 7/1, light greenish gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin, abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.24 Test Excavation 24 (TE 24)

Test Excavation 24 (TE 24), an exterior excavation located in the central parking lot of Ward Warehouse, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.72 m wide with a maximum depth of 1.8 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 24 consisted of asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of very gravelly loamy sand (Stratum Ic), a buried asphalt surface (Stratum Id/SIHP # -7658), very gravelly sand (crushed coral) (Stratum Ie), clay (Stratum If), and hydraulic sand (Stratum Ig) overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) and two natural sandy clay sediments (Strata III and IV) (Figure 128, Figure 129, Table 25).

A buried asphalt surface (Stratum Id), determined to be a component of SIHP # -7658, was observed in the southwest portion of TE 24 and slopes downward in the central portion where it terminates. The asphalt was observed at 43 cm below surface, with a thickness of 12 cm, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 24 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of a locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II). The berm extended across the length of the test excavation, sloping gently downwards within the *mauka* portion of the trench and a slight downward curve at the *makai* end of the trench. The maximum height of the berm was 90 cm above the coral shelf.

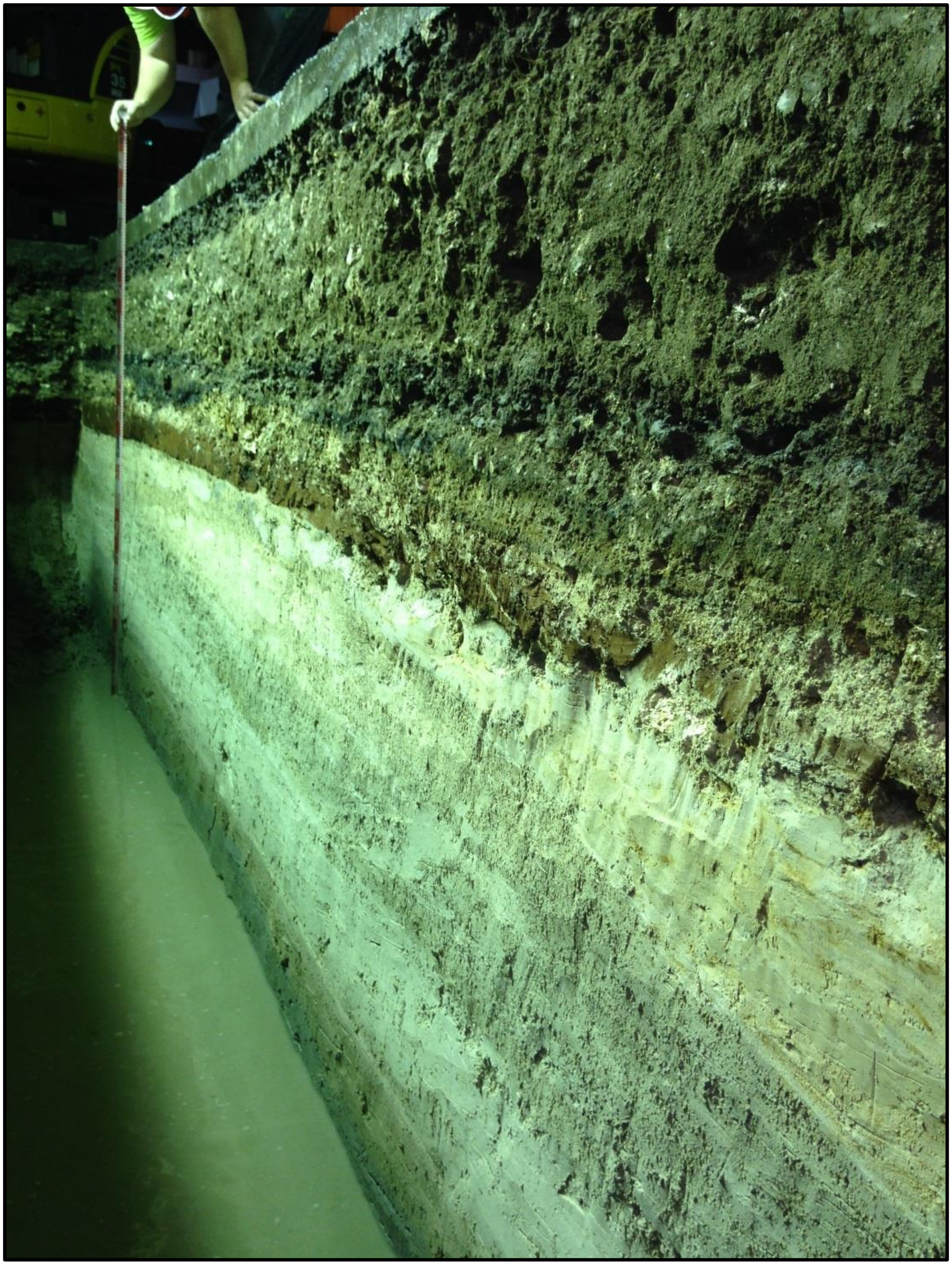

Figure 128. Photograph of TE 24 northwest wall, view to west

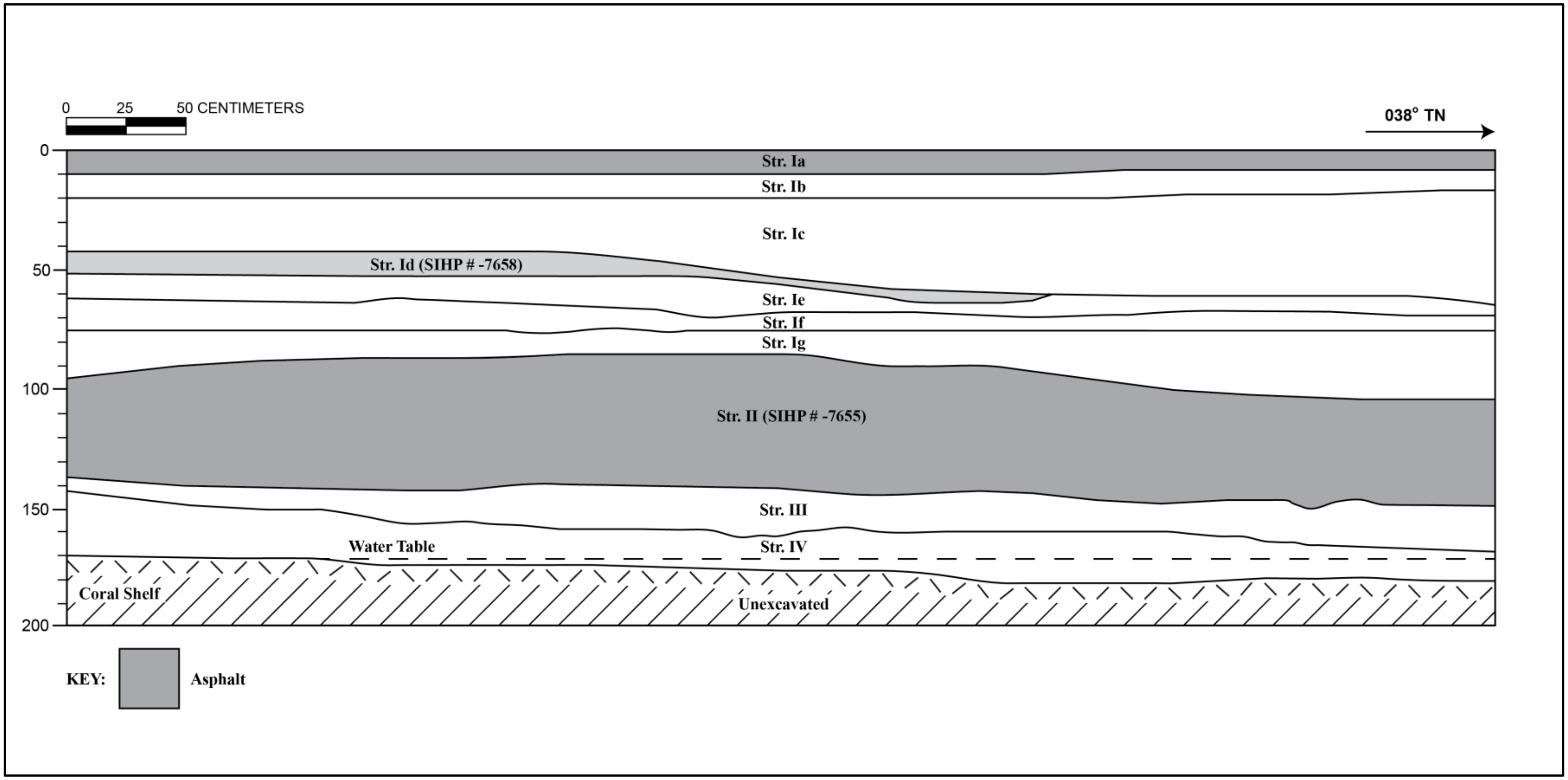

Figure 129. Profile of TE 24, northwest wall

Table 25. TE 24 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–10	Asphalt surface
Ib	10–20	Fill; 10YR 2/2, very dark brown; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	17–65	Fill; 10YR 4/3, brown; very gravelly loamy sand; structureless (single-grain); moist, loose to very friable consistency; non-plastic; mixed origin; clear, smooth lower boundary
Id	43–55	SIHP # -7658; asphalt layer
Ie	52–70	Fill; 10YR 7/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coralline sand
If	62–75	Fill; 2.5YR 2/6, dark red; clay; structureless (massive); moist, extremely firm consistency; very plastic; terrigenous origin; abrupt, smooth lower boundary
Ig	75–104	Fill; 10YR 7/4, very pale brown; very fine sand; stuctureless (single-grain); moist, loose to very friable consistency; non-plastic; marine origin; clear, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	85–149	SIHP # -7655; 10YR 7/1, very pale brown; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, smooth lower boundary; root staining; man-made berm associated with salt pan remnants
III	135–165	Natural; 10YR 7/4, very pale brown; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, smooth lower boundary; common, fine roots; wetland sediment
IV	143–180 (BOE)	Natural; 10BG, 7/1, light greenish gray; sandy clay; structureless (massive); moist, friable consistency; plastic; marine origin; abrupt, smooth lower boundary; marine sediment overlying coral shelf

4.1.25 Test Excavation 25 (TE 25)

Test Excavation 25 (TE 25), an exterior excavation located along the southern boundary of the project area, was oriented in a northeast-southwest direction and measured 6.0 m long by 0.7 m wide with a maximum depth of 1.71 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 25 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various layers of fill consisting of cobbly loam (Stratum Ic), clay (Stratum Id), gravelly clay loam (Stratum Ie), a disturbed asphalt surface (Stratum If/ SIHP # -7658), and very gravelly sand (crushed coral) (Stratum Ig), overlying two man-made berm deposits (Strata IIa and IIb) and natural sandy clay wetland sediment (Stratum III) (Figure 130, Figure 131, Figure 132, Table 26).

A thin layer with buried asphalt chunks (Stratum If), determined to be a component of SIHP # -7658, was truncated in the central portion of TE 25 by Stratum Id. The asphalt was observed from 60 to 66 cm below surface. This historical property overlies a crushed coral fill associated with 1919-1926 land reclamation. Based on historic maps and aerial photos, the layer with buried asphalt chunks likely dates from 1939 to 1976.

TE 25 also documented the presence of historic salt pan remnants (SIHP # -7655), consisting of locally procured natural sediment modified into a structural feature (man-made berm) (Stratum II), running lengthwise through the test excavation. The construction of the berm appeared to have removed the majority of the natural underlying wetland sediments (Stratum III) overlying the coral shelf.. Along the upper boundary of the berm feature, a charcoal stain was observed, although it was unclear whether this represented human activity or natural processes. The maximum height of the berm was 70 cm above coral shelf.

Figure 130. Photograph of TE 25 southeast wall, view to east

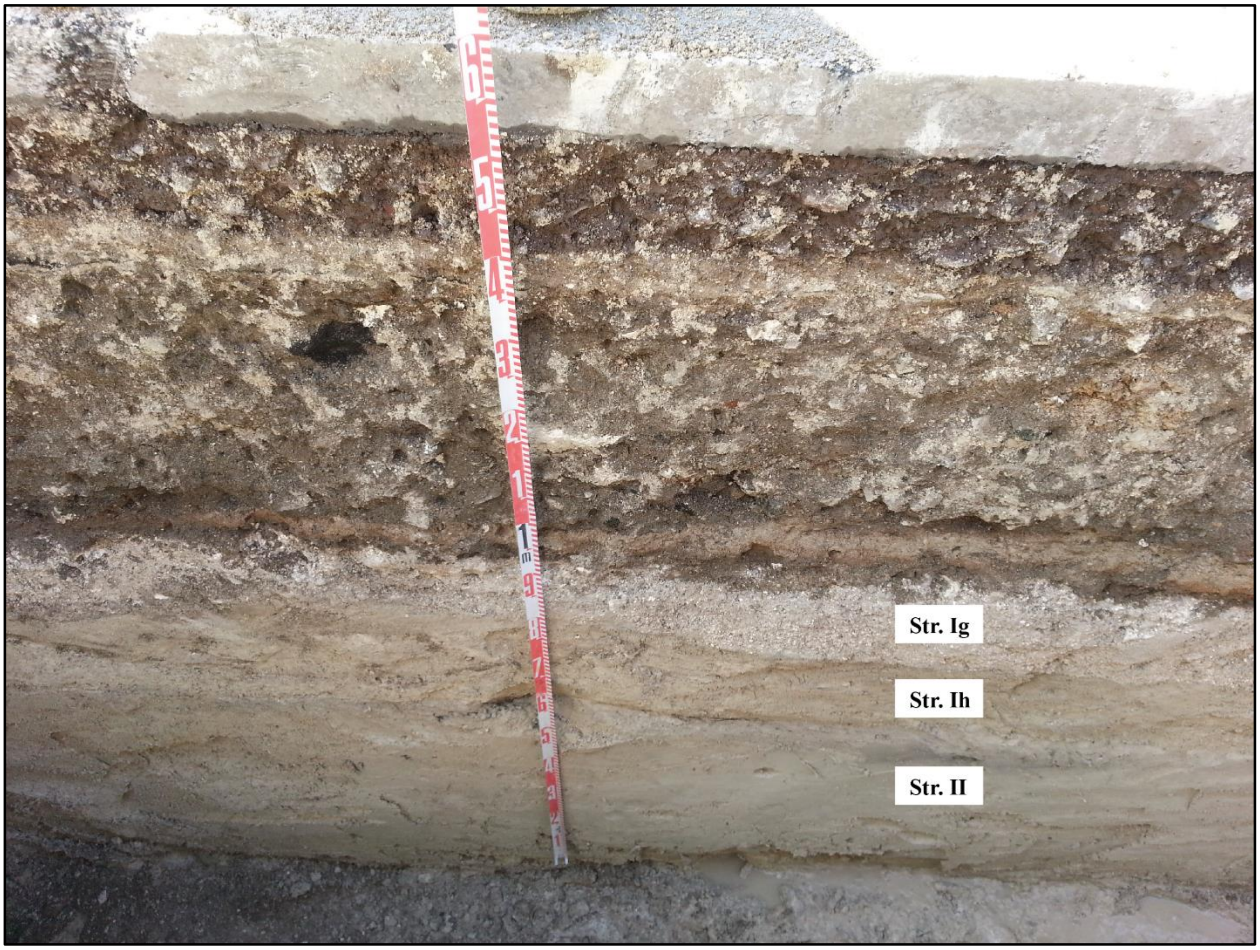

Figure 131. Close-up of man-made berm layer (Stratum II), SIHP # -7655, underlying crushed coral fill (Stratum Ig) and hydraulic dredge (Stratum Ih)

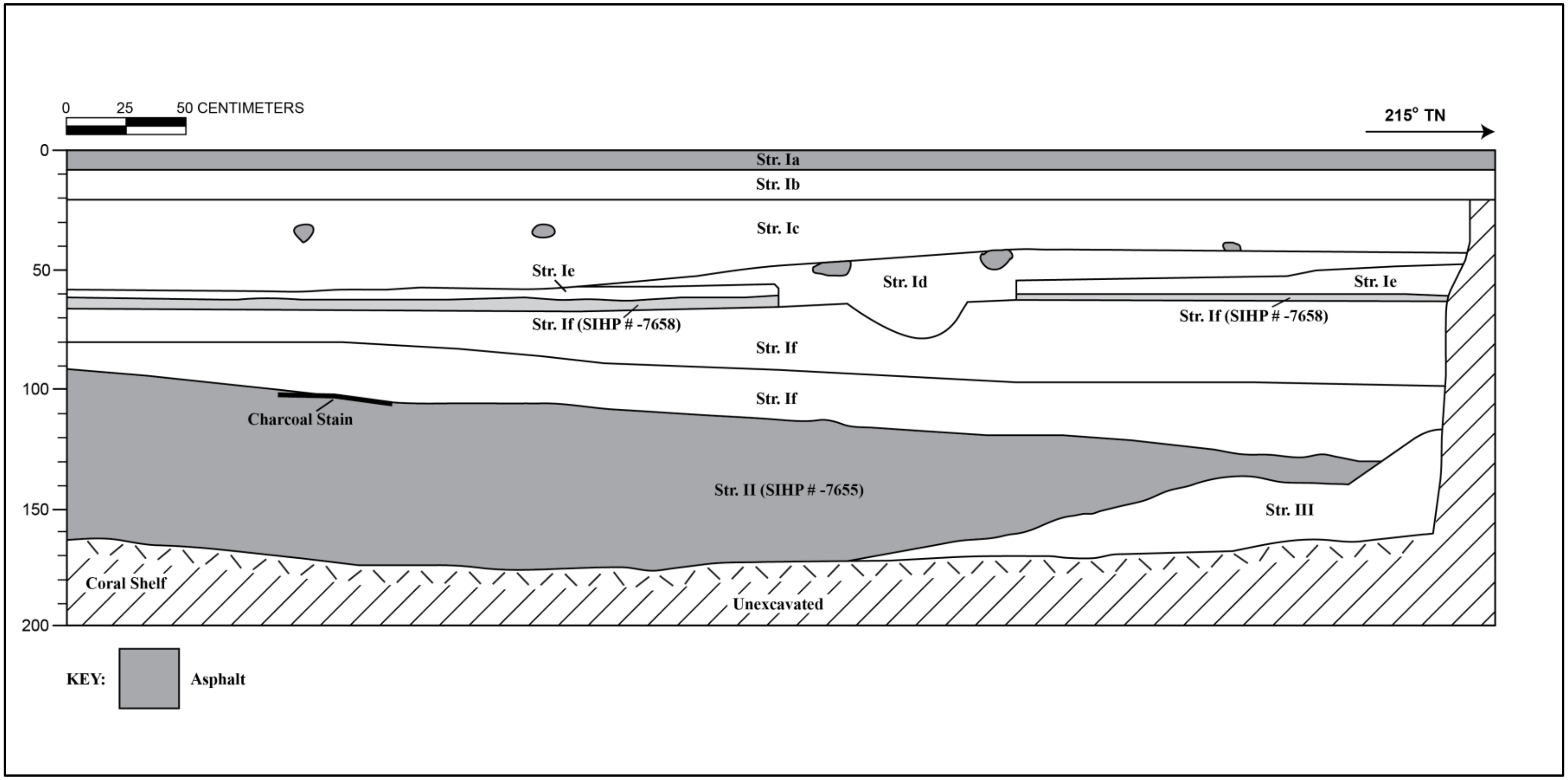

Figure 132. Profile of TE 25, southeast wall

Table 26. TE 25 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–8	Asphalt surface
Ib	8–20	Fill; 7.5YR 3/1, very dark gray; extremely gravelly cobbly loam; structureless (single-grain); moist, loose consistency; non-plastic; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	20–59	Fill; 10YR 4/2, dark grayish brown; cobbly loam; weak, medium to very course, crumb structure; moist, loose consistency; non-plastic; mixed origin
Id	41–79	Fill; 5YR 3/2, dark reddish brown; clay; strong, fine, blocky structure; moist, very firm consistency; very plastic; terrigenous origin; clear, irregular lower boundary
Ie	48–62	Fill; 2.5Y 5/4, light olive brown; gravelly clay loam; weak to moderate, medium to course, crumb structure; moist, loose consistency; non-plastic; mixed origin; clear, discontinuous lower boundary
If	60–66	SIHP # -7658; 7.5YR 3/2, dark brown; silty loam and asphalt; weak, fine to medium, crumb structure; moist, loose consistency; non-plastic; terrigenous origin; clear, discontinuous lower boundary; likely remnant road surface (portions of the asphalt removed and incorporated into overlying layers)
Ig	63–98	Fill; 10YR 8/2, very pale brown; cobbly course sand; stuctureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill associated with land reclamation events
Ih	80–129	Fill; 2.5Y 6/3, light yellowish brown; clay sand; weak, fine, granular structure; moist, very friable consistency; non-plastic; marine origin; clear, smooth lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	92–171	SIHP # -7655; 2.5Y 7/1, light gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear to abrupt, irregular lower boundary; man-made berm associated with salt pan remnants; upper boundary contained charcoal staining
III	115–171 (BOE)	Natural; 5GY 6/1, greenish gray mottled with 2.5Y 7/3, pale yellow; sandy clay to clay; strong, fine, blocky structure; wet, sticky consistency; plastic; marine origin; abrupt, discontinuous lower boundary; contains root stains; natural wetland sediment overlying coral shelf

4.1.26 Test Excavation 26 (TE 26)

Test Excavation 26 (TE 26), an exterior excavation located along the southern boundary of the project area, was oriented in a north-south direction and measured 5.65 m long by 0.72 m wide with a maximum depth of 1.70 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 26 consisted of the asphalt surface (Stratum Ia), associated base course (Stratum Ib), and various fill layers consisting of very gravelly loamy sand (Stratum Ic), a buried asphalt surface (Stratum Id/SIHP # -7658), very gravelly sand (Stratum Ie), clay (Stratum If), and two strata of very gravelly sand with hydraulic dredge at the lower boundary (Strata Ig and Ih), overlying a sandy clay man-made (Stratum IIa/SIHP # -7655), laminated organic material (Stratum IIb/SIHP # -7655), and natural sandy clay wetland sediment (Stratum III) (Figure 133 through Figure 136, Table 27).

Due to a complex of subsurface utility lines, the location of TE 26 was angled and the length shortened to 5.65 m to avoid conflict. During excavation, a utility was encountered in the northern portion of the trench, preventing complete excavation of the entire test excavation.

A buried asphalt surface (Stratum Id), determined to be a component of SIHP # -7658, was disturbed in the north end of the test excavation by a utility pit for a drain line. The asphalt was observed at 45 cm below surface, with a thickness of 9 cm, overlying crushed coral, dark red clay, and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the buried asphalt surface likely dates from 1939 to 1976.

TE 26 also documented the presence of historic salt pan remnants, SIHP # -7655, consisting of two man-made structural features (berms) (Stratum IIa) and laminated organic material (Stratum IIb) overlying natural wetland material (Stratum III) utilized as a salt pan bed. The larger berm extended across both sidewalls and appeared to be running *mauka-makai*. The smaller berm was visible only within the extreme southern portion of the trench. It appeared to be extending to intersect with the larger berm just to the west of the test excavation. Based on these observations, TE 26 may have documented the corner of a salt pan bed.

Figure 133. Photograph of TE 26, profile of east wall on left, view to south

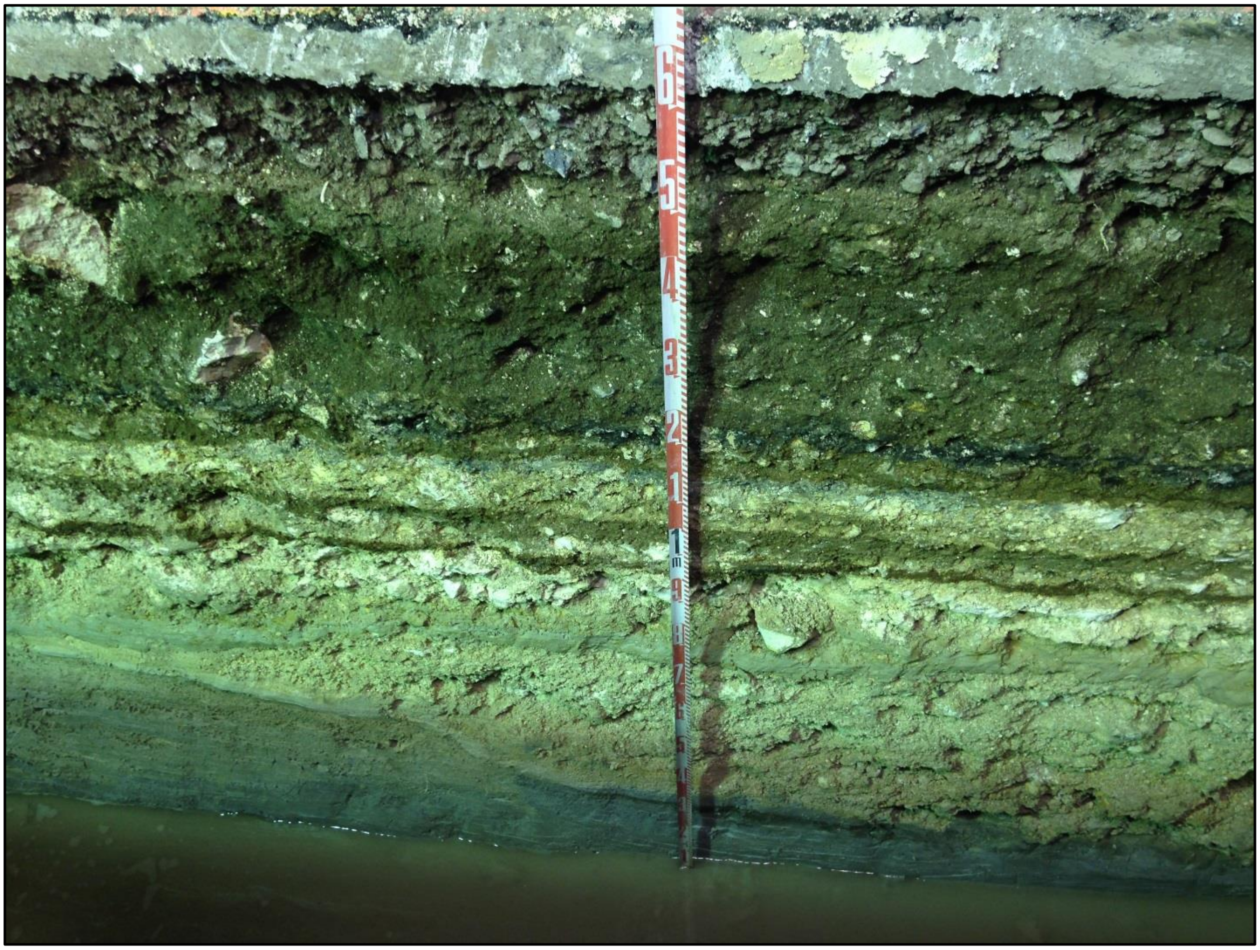

Figure 134. Close-up of central portion of TE 26, showing a man-made berm (left) (Stratum IIa) beneath crushed coral fill, sloping down to a laminated organic layer (Stratum IIb) over wetland sediments (salt pan bed), SIHP # -7655

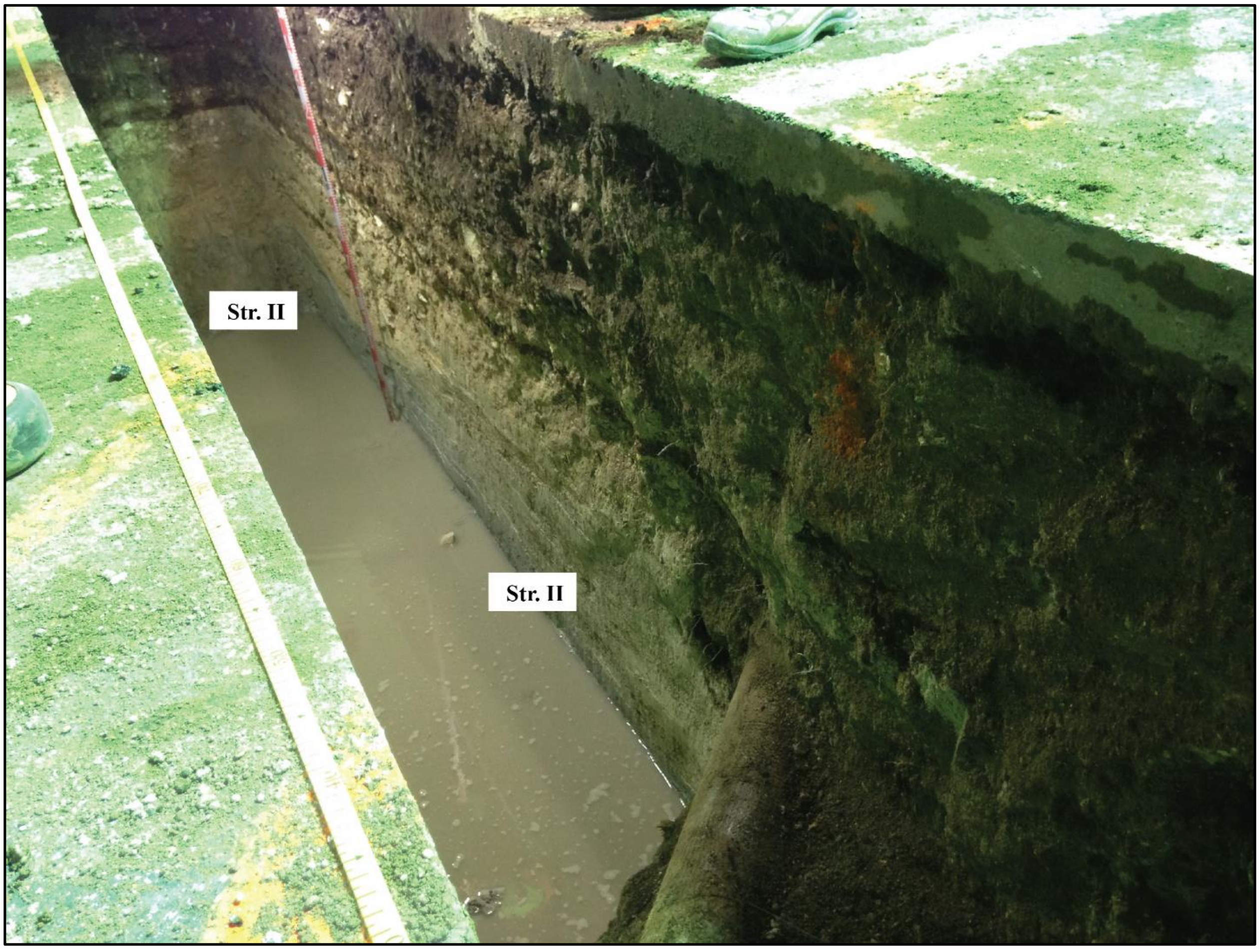

Figure 135. Photograph of TE 26 west wall, showing two berm features (Stratum II), SIHP # -7655, close intersection

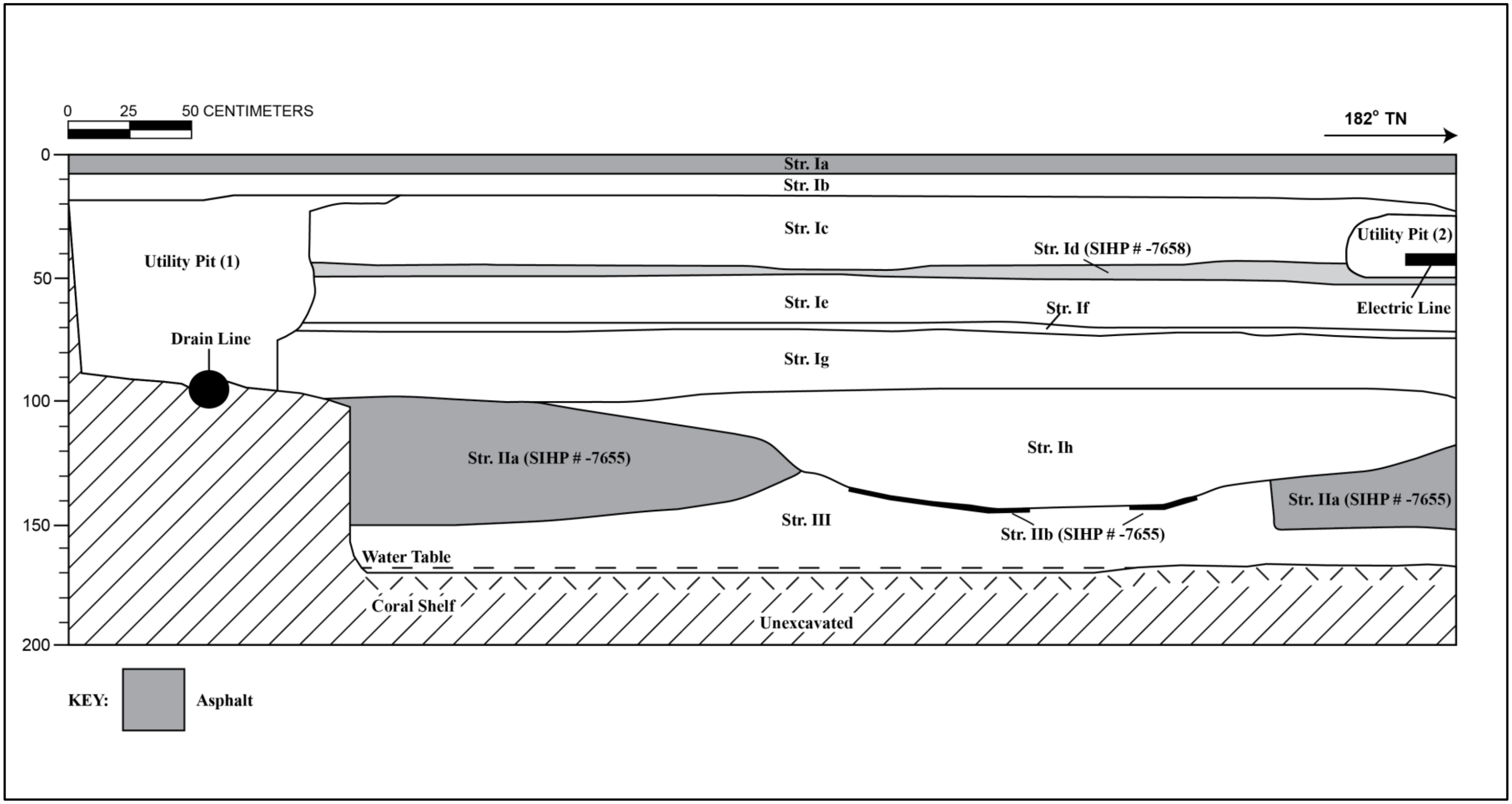

Figure 136. Profile of TE 26, east wall

Table 27. TE 26 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–7	Asphalt surface
Ib	7–17	Fill; 10YR 8/2, very dark brown; extremely gravelly loam; structureless (single-grain); moist, loose consistency; non-plastic; abrupt, smooth lower boundary; imported base course fill associated with asphalt surface
Ic	17–45	Fill; 10YR 4/3, brown; very gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary
Id	45–54	SIHP # -7658; buried asphalt surface
Ie	50–72	Fill; 10YR 7/3, very pale brown; very gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, smooth lower boundary; multiple banded fill layers
If	68–75	Fill; 2.5YR 3/6, dark red; clay; structureless (massive); moist, extremely firm consistency; very plastic; terrigenous origin; abrupt, smooth lower boundary
Ig	70–98	Fill; 10YR 7/3, very pale brown; very gravelly silt grading to silty clay; stuctureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; crushed coral fill grading to a thin layer of hydraulic dredge; associated with land reclamation events
Ih	95–145	Fill; 10YR 7/1, white; very gravelly silty sand grading to silty clay; stuctureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, wavy lower boundary; crushed coral fill grading to a thin layer of hydraulic dredge; associated with land reclamation events
Utility Pit (1)	17–95	Fill; extremely gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; diffuse and broken/discontinuous lower boundary; pit fill
Utility Pit (2)	25–50	Fill; course black sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; abrupt and broken/discontinuous lower boundary; cinder fill
IIa	98–153	SIHP # -7655; 10YR 7/2, light gray; sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; clear, broken/discontinuous lower boundary; root stains; man-made berm associated with salt pan remnants
IIb	136–146	SIHP # -7655; organic laminations associated with salt pan remnants
III	125–170 (BOE)	Natural; 10BG 7/1, light greenish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; natural wetland sediment overlying coral shelf

4.1.27 Test Excavation 27 (TE 27)

Test Excavation 27 (TE 27), an exterior excavation located in the grassy landscape along Ala Moana Boulevard, was oriented in a northwest-southeast direction, and measured 6.1 m long by 0.5 m wide with a maximum depth of 1.35 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 27 consisted of silty clay topsoil (Stratum Ia) and very gravelly sandy loam fill (Stratum Ib), overlying a disturbed natural wetland deposit consisting of very gravelly sandy clay (Stratum II) and in situ sandy clay (Stratum III) (Figure 137, Figure 139, Table 28).

TE 27 documented the presence of various utilities which appeared to have disturbed much of the natural marine deposits in this area. In particular, a water line was documented extending along the *makai* sidewall at the lower boundary of Stratum II, approximately 0-5 cm above the coral shelf. Only a thin layer of in situ natural marine sediment (Stratum III) was observed, while Stratum II appeared to consist of local marine sandy clay repurposed as utility trench fill. Milled wood fragments were found beneath the water line on top of the coral shelf. These wood fragments may originate from a disturbed posthole, affected by the installation of the utility line, and is likely associated with mid-twentieth century historic development of the project area (SIHP # -7658) (see Sections 4.1.29 and 4.1.32) (Figure 138).

A fragment of a goat (*Capra aegagrus hircus*) long bone (humerus) was also observed in the spoils pile, however no further provenience could be specified.

Figure 137. Photograph of TE 27, view to northwest, showing large sewer pipe and disturbed/redeposited natural sandy clay sediment (Stratum II)

Figure 138. Photograph of milled wood fragments found beneath the water utility and overlying the coral shelf; the wood may represent a wooden post associated with mid-twentieth century historic development of the project area, SIHP # -7658

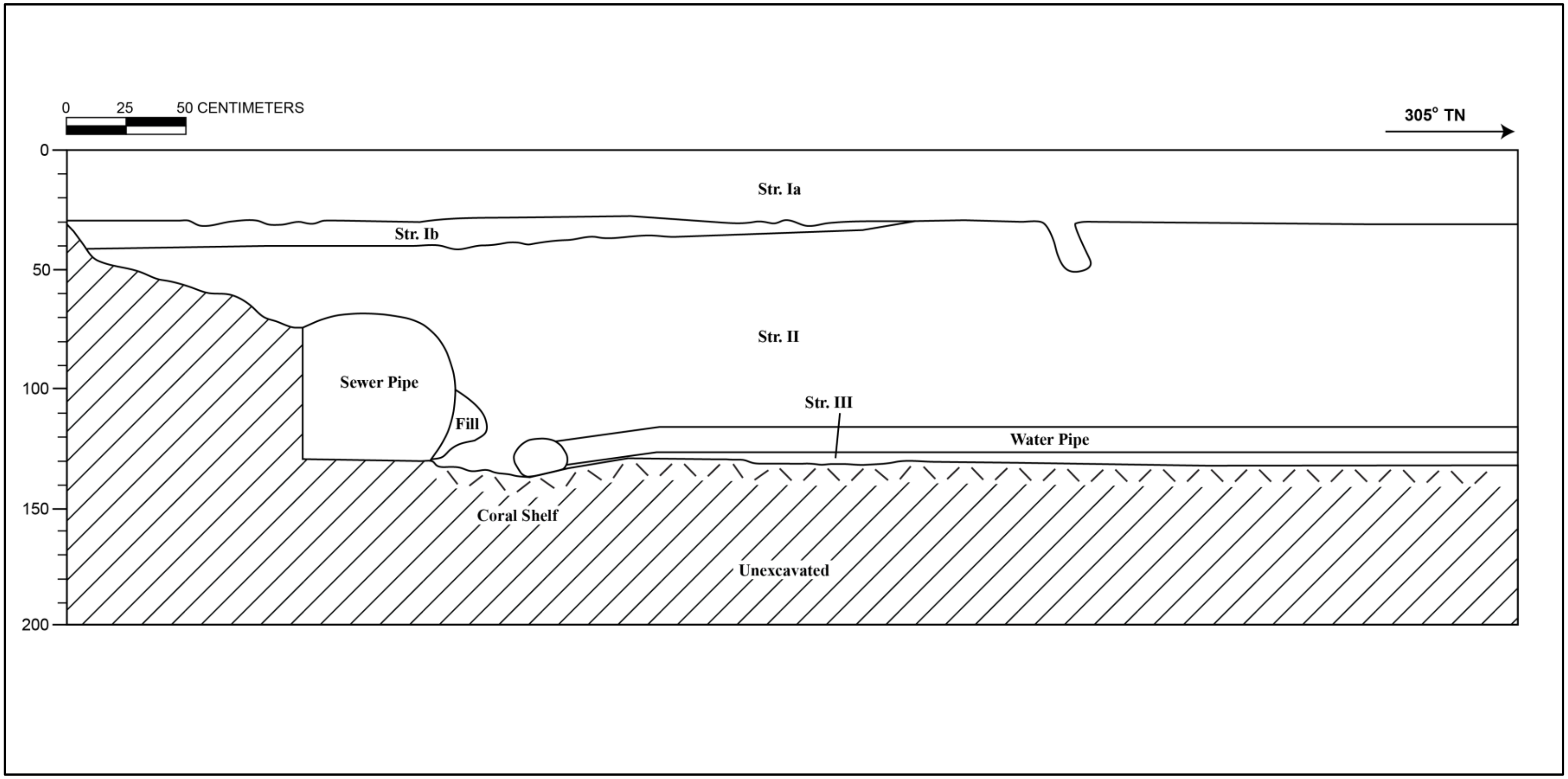

Figure 139. Profile of TE 27 southwest (*makai*) wall

Table 28. TE 27 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–30	Fill; 5YR 2.5/2, dark reddish brown; silty clay; moderate, fine, crumb structure; moist, firm consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; many, fine to medium roots; imported landscape fill
Ib	30–40	Fill; 2.5Y 4/3, olive brown mottled with 2.5Y 5/4, light olive brown (few, fine); very gravelly sandy loam; moderate, fine to medium, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; clear, smooth, discontinuous lower boundary; common, fine to medium roots
II	30–135 (BOE)	Disturbed natural; 2.5Y 6/2, light brownish gray; very gravelly fine sandy clay; structureless (massive); wet, slightly sticky consistency; plastic; marine origin; clear, discontinuous lower boundary; common, medium roots; contained a water line utility at the lower boundary; disturbed/redeposited natural marine deposit containing gastropods and Neritidae *sp*. (*pipipi*)
III	125–130 (BOE)	Natural; 10Y 6/1, greenish gray; fine to medium sandy clay; structureless (massive); wet, sticky consistency; slightly plastic; marine origin; abrupt, discontinuous lower boundary; few roots; truncated by overlying utility; in situ marine sediment overlying coral shelf

4.1.28 Test Excavation 28 (TE 28)

Test Excavation 28 (TE 28), an interior trench located in the *makai* commercial building of Ward Warehouse, was oriented in a northwest-southeast direction, and measured 6.06 m long by 0.62 m wide with a maximum depth of 2.19 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 28 consisted of a tiled concrete surface (Stratum Ia) overlying various fill layers extending to the coral shelf. The underlying fill layers consisted of coarse cinder (Stratum Ib), very cobbly sandy loam (Stratum Ic), very cobbly clay (Stratum Id), sandy clay (Stratum Ie), banded silt and sand hydraulic fill (Strata If), and hydraulic silty clay (Stratum Ig) (Figure 140, Figure 141, Table 29).

TE 28 was composed entirely of imported fill layers with no natural sediment or historic salt pan remnants encountered. Strata If and Ig consisted of hydraulic fill (dredge) sediments and are indicative of historic reclamation efforts to in-fill low-lying wetlands with ocean dredged material. It appears that any previous natural and/or salt pan related sediments were removed from TE 28 during this reclamation process. This can also be seen in the adjacent Test Excavation 30 (see Section 4.2.30), which contained salt pan remnants truncated and partially removed by hydraulic fill.

Figure 140. Photograph of TE 28 northeast wall, view to southeast

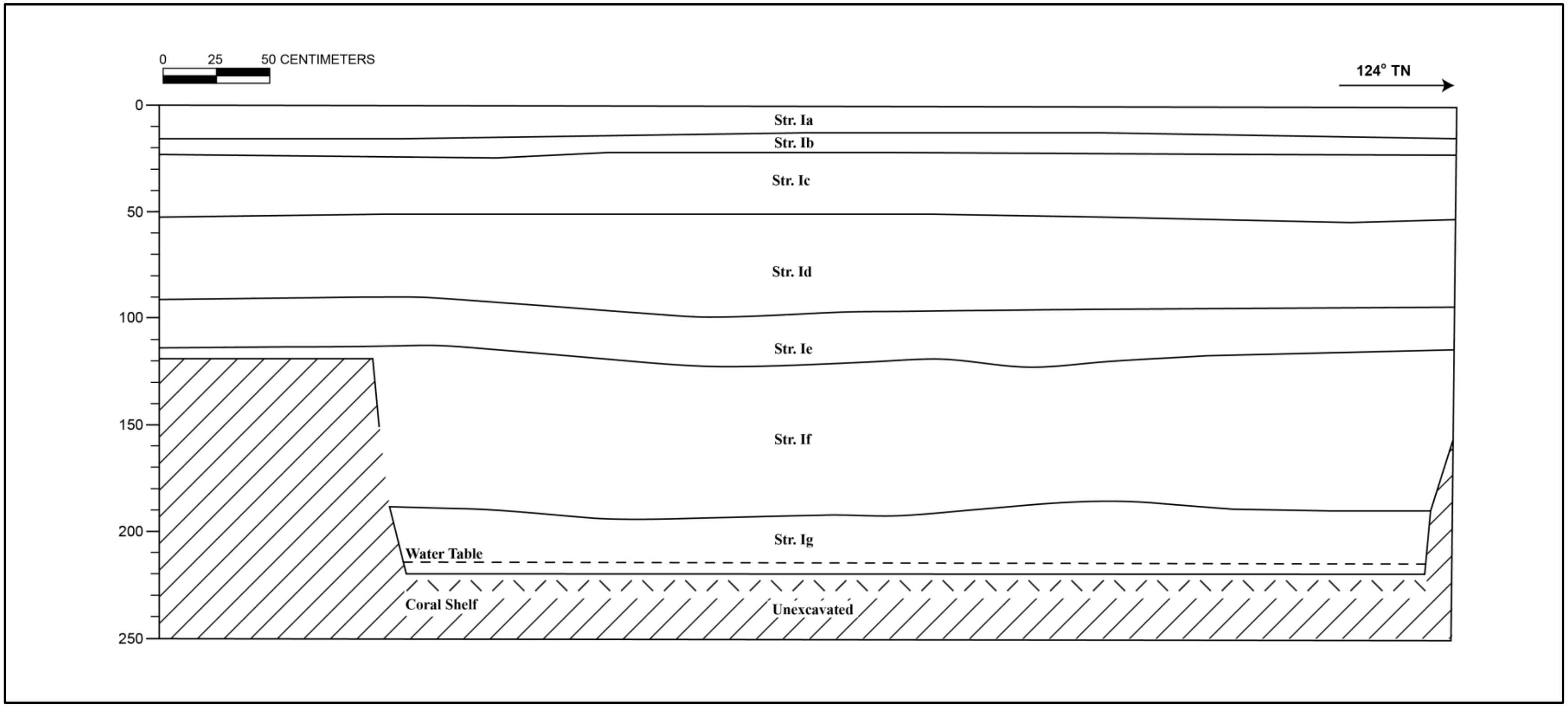

Figure 141. Profile of TE 28 northeast wall

Table 29. TE 28 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–15	Tiled concrete commercial floor
Ib	12–23	Fill; 10YR 2/1, black; coarse sand; structureless (single-grain) moist, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported cinder fill, plastic sheet on upper boundary
Ic	21–53	Fill; 10YR 4/2, dark grayish brown; very cobbly sandy loam; weak, fine, crumb structure; moist, firm consistency; non-plastic; mixed origin; clear, smooth lower boundary; very cobbly on upper boundary
Id	50–99	Fill; 10YR 2/2, very dark brown; very cobbly clay loam; weak, medium, crumb structure; moist, friable consistency; slightly plastic; mixed origin; clear, smooth lower boundary
Ie	89–122	Fill; 7.5YR 3/2, dark brown; sandy clay; moderate, medium, crumb structure; moist, firm consistency; plastic; mixed origin; clear, smooth lower boundary
If	112–194	Fill; 10YR 7/3, very pale brown; fine silt and coarse sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, smooth lower boundary; alternately banded silt and crushed coralline sand; hydraulic (dredge) fill associated with land reclamation events
Ig	185–219 (BOE)	Fill; 2.5Y 6/1, gray; silty clay; structureless (massive); wet, slightly sticky consistency; plastic; marine origin; lower boundary not visible; imported hydraulic fill layer to encountered coral shelf; hydraulic (dredge) fill associated with land reclamation events

4.1.29 Test Excavation 29 (TE 29)

Test Excavation 29 (TE 29), an exterior excavation located in the grassy landscape along Ala Moana Boulevard, was oriented in a northwest-southeast direction, and measured 5.8 m long by 0.6 m wide with a maximum depth of 1.4 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 29 consisted of loamy clay topsoil (Stratum Ia) overlying a buried asphalt surface (Stratum Ib/SIHP # -7658), associated base course (Stratum Ic), hydraulic sandy clay fill (Stratum Id), disturbed natural sandy clay marine sediment (Stratum II), and in situ natural sandy clay (Stratum III) (Figure 142, Figure 144, Table 30).

As with adjacent Test Excavations 15 and 27, TE 29 documented disturbed natural marine sediment (Stratum II) overlying a natural in situ sandy clay deposit (Stratum III). Stratum II was likely churned and redeposited as fill during installation of utilities. A faint forming A horizon along the upper boundary of Stratum II indicates a period of stability prior to the construction of the overlying asphalt surface (Stratum Ib). The natural marine sediment (Stratum III) contained natural marine shell, including Neritidae *sp*. (*pipipi*).

A large milled wooden post, measuring 10 by 10 by 66 cm, originated from Stratum II and terminated at the coral shelf (Figure 143). The post is likely associated with the mid-twentieth century historic development of the project area, SIHP # -7658, and may be related to property fencing, as remnant posts or similar wood pieces were also found in alignment within the adjacent Test Excavations 27 and 32 as well as within the adjacent Block B East project area Test Excavation 14. Also related to historic development, a buried asphalt surface located 25 cm below surface may represent a previous road surface (SIHP # -7658).

Figure 142. Photograph of TE 29, view to northwest

Figure 143. Photograph of milled wooden post extending from Stratum II into the coral shelf, SIHP # -7658

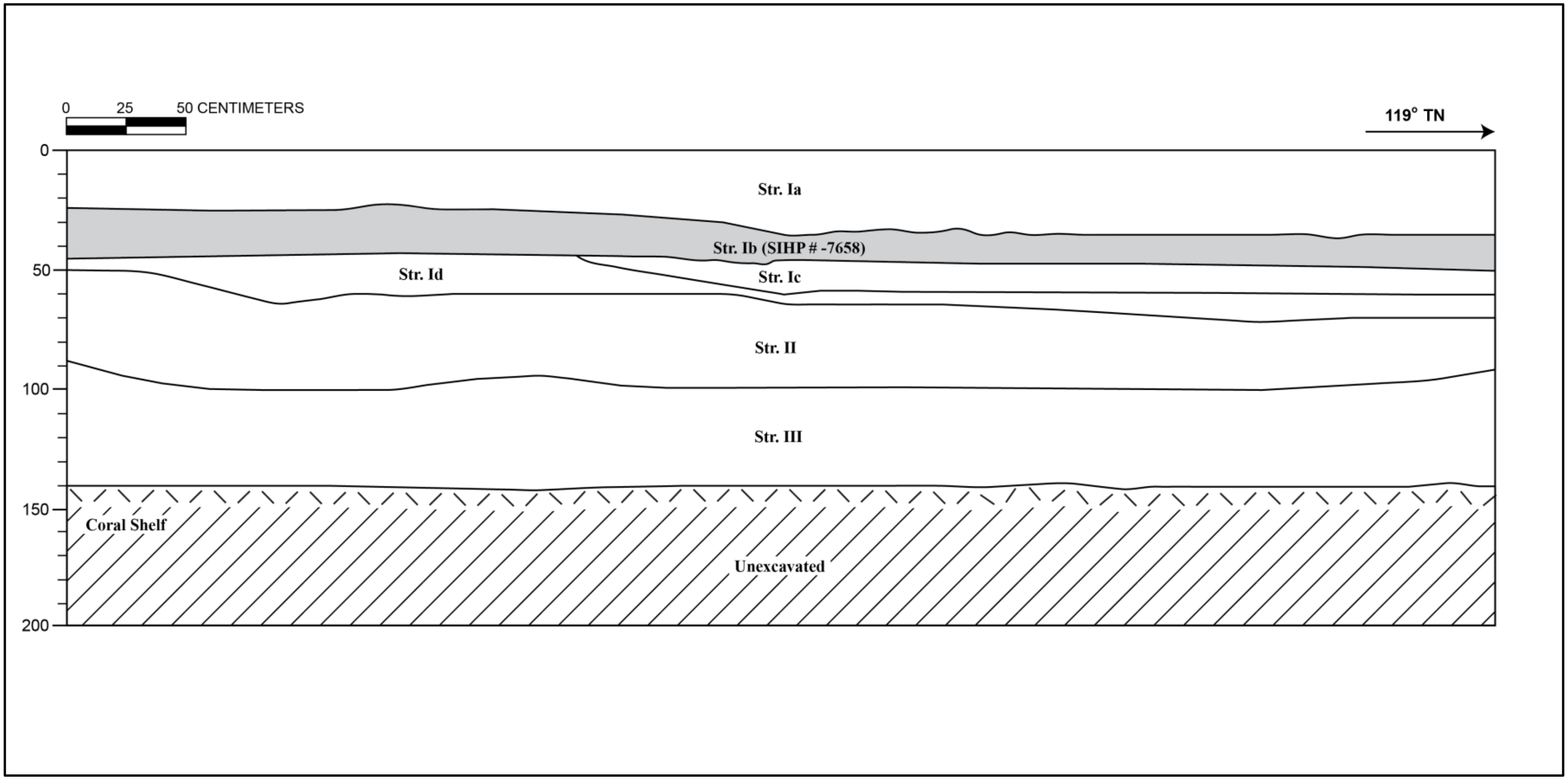

Figure 144. Profile of TE 29 northeast wall

Table 30. TE 29 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–35	Fill; 7.5YR 2.5/2, very dark brown; loamy clay; moderate, fine to medium, crumb structure; moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; many, fine to medium roots; imported landscape fill
Ib	25–50	SIHP # -7658; 2.5Y 3/3, dark olive brown; very gravelly medium sandy loam; weak, medium, crumb structure; moist, very friable consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; few, medium roots; asphalt road surface
Ic	45–60	Fill; 2.5Y 5/2, gray brown; extremely gravelly silty sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; common, fine roots; imported crushed coral and gravel base course
Id	45–70	Fill; 10YR 6/3, pale brown; fine sandy clay; strong, fine, platy structure; moist, very friable consistency; non-plastic; mixed origin; clear, wavy lower boundary; hydraulic (dredge) fill associated with land reclamation events
II	50–100	Disturbed natural; 2.5Y 6/3, light yellow brown; medium sandy clay; moderate, medium, blocky structure; moist, firm consistency; slightly plastic; marine origin; diffuse, smooth lower boundary; common, fine to medium roots; churned and redeposited natural marine sediment with a forming A horizon; contained a large 10 by 10 cm wooden post
III	90–140 (BOE)	Natural; 2.5Y 7/3, pale yellow; fine sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, smooth lower boundary; common, fine roots; natural marine sediment containing marine shell, including Neritidae *sp*. (*pipipi*)

4.1.30 Test Excavation 30 (TE 30)

Test Excavation 30 (T-30), an interior excavation located in the *makai* commercial building of Ward Warehouse, was oriented in a northeast-southwest direction and measured 5.0 m long by 0.61 m wide with a maximum depth of 2.15 mbs. The base of excavation was determined by the presence of the water table at 2.05 mbs. The stratigraphy of T-30 consisted of concrete flooring (Stratum Ia) and various imported fill layers consisting of coarse cinder (Stratum Ib), two layers of gravelly loamy sand (Strata Ic and Id), sandy loam (Stratum Ie), clay (Stratum If), very gravelly sand (crushed coral) (Stratum Ig), and fine sandy clay hydraulic dredge (Stratum Ih), overlying a sandy clay man-made berm (Stratum IIa/SIHP # -7655) and natural sandy clay wetland sediment in the *makai* portion of the excavation, and overlying laminated organic material (Stratum IIb/SIHP # -7655) and natural silty clay wetland sediment (Stratum IV) within the central portion of the excavation (Figure 145 through Figure 148, Table 31).

TE 30 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a high berm (Stratum IIa). The berm sloped steeply downwards to *mauka* and transitioned to a low-lying, thin (2–4 cm thick) layer of laminated organic material (Stratum IIb). The laminated organic layer appeared to have been disturbed and truncated by hydraulic reclamation fill as evidenced by its sloping, discontinuous character. Within the *mauka* end of TE 30, the hydrualic fill extended to the coral shelf, with all traces of salt pan and/or natural sediments absent. The disturbance and/or removal of salt pan and/or natural sediments in this area, caused by the in-filling with hydraulic materials, is also evident within TE 28, located just *mauka* of TE 30 (see Section 4.1.28).

Figure 145. Photograph of TE 30 southeast wall, view to southwest

Figure 146. Close-up of thin organic layer (Stratum IIb), SIHP # -7655, sloping downwards beneath gleyed hydraulic clay fill

Figure 147. Close-up of Stratum IIb organic material, SIHP # -7655, underlying hydraulic clay fill (Stratum Ih)

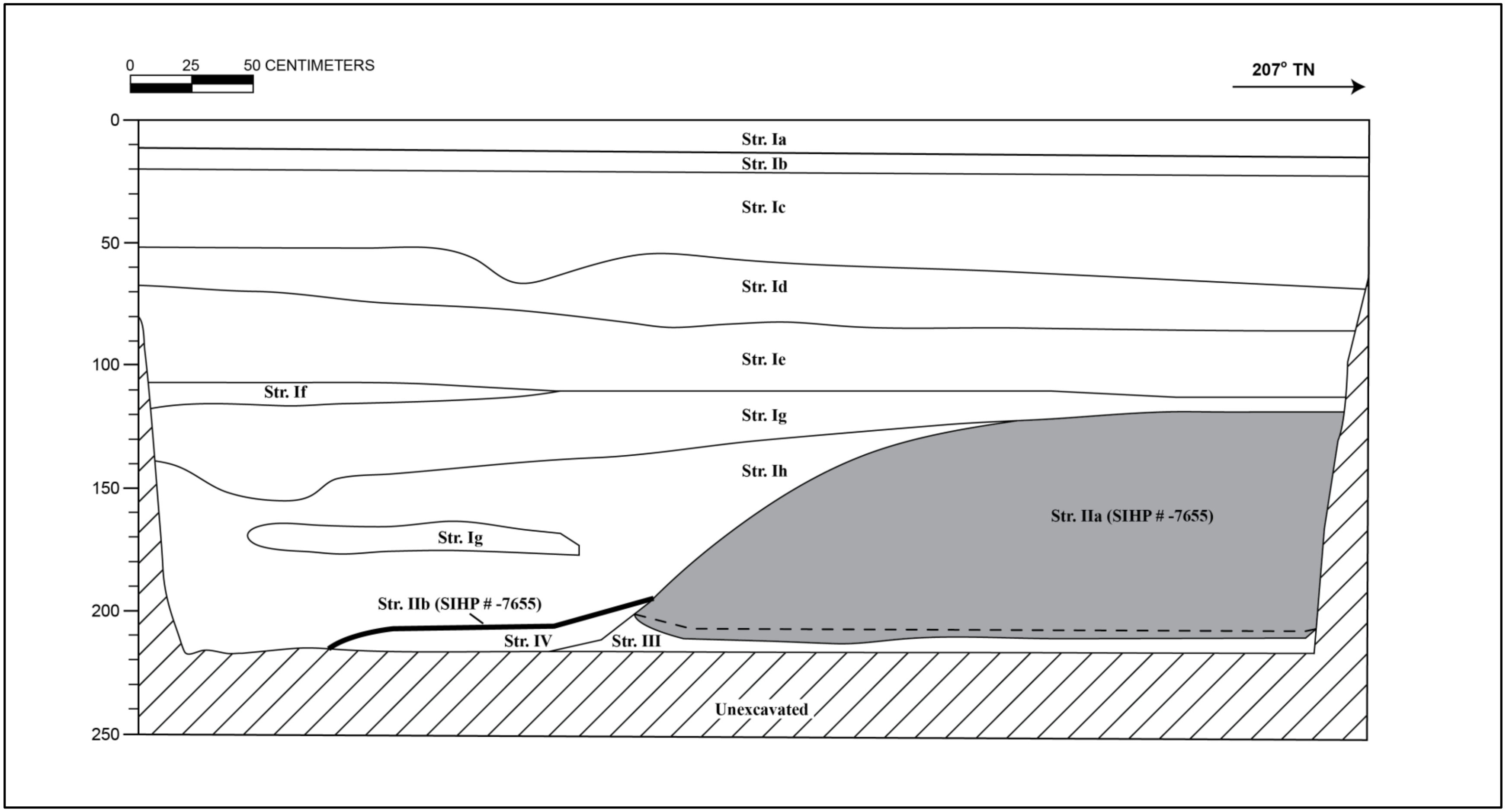

Figure 148. Profile of TE 30 southeast wall

Table 31. TE 30 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–12	Concrete commercial floor
Ib	12–20	Fill; 10YR 2/1, black; coarse sand; structureless (single-grain); dry, loose consistency; non-plastic; terrigenous origin; clear, smooth lower boundary; imported black cinder fill
Ic	20–65	Fill; 10YR 5/3, dark brown; gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, wavy lower boundary; few, fine, medium roots; contained historic brick fragments
Id	51–83	Fill; 10YR 3/2, very dark grayish brown; gravelly loamy sand; weak, medium, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, smooth lower boundary; few, fine, medium roots observed; contained historic brick and brick fragments as well as a large concrete block
Ie	67–110	Fill; 10YR 2/2, very dark brown; sandy loam; moderate, fine, crumb structure; moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary
If	106–117	Fill; 5Y 3/3, dark reddish brown; clay; structureless (massive); wet, sticky consistency; plastic, terrigenous origin, clear, broken/discontinuous lower boundary
Ig	109–155	Fill; 10YR 6/3, cobbly, coarse sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, wavy/irregular lower boundary; crushed coral fill associated with land reclamation events
Ih	120–215 (BOE)	Fill; 10YR 6/3, pale brown grading to 5GY 5/1 greenish gray; silty fine sand grading to silty clay; weak, crumb structure grading to strong, blocky structure; moist, loose to firm consistency; slightly plastic to plastic; marine origin; clear, irregular lower boundary; hydraulic (dredge) fill associated with land reclamation events
IIa	116–210	SIHP # -7655: 10YR 7/1, light gray; sandy clay; strong, fine to medium, crumb texture; wet, sticky consistency, plastic; marine origin; clear, broken/discontinuous lower boundary; root staining; man-made berm associated with salt pan remnants
IIb	195–215 (BOE)	SIHP # -7655; organic material associated with salt pan remnants
III	200–215 (BOE)	Natural; 5GY 6/1, greenish gray; sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; common, fine roots; natural marine deposit

Stratum	Depth (cmbs)	Description
IV	200–215 (BOE)	Natural; 5B 4/1, dark bluish gray; silty clay; structureless (massive); wet, sticky consistency; plastic; clear, wavy/discontinuous lower boundary; natural wetland settlement containing brackish water snails

4.1.31 Test Excavation 31 (TE 31)

Test Excavation 31 (TE 31), an exterior excavation located in the patio area of the *makai* commercial building of Ward Warehouse, was oriented in a northeast-southwest direction and measured 5.15 m long by 0.61 m wide with a maximum depth of 0.41 mbs. The base of excavation was determined by the presence of a concrete slab at 0.41 mbs. The observed stratigraphy of T-31 consisted of the current concrete patio surface (Stratum Ia) overlying a basalt base course fill (Stratum Ib), followed by a concrete slab and paving stones (Stratum Ic/SIHP # -7658) (Figure 149, Figure 150, Table 32).

Due to the presence of the buried concrete slab, excavation was halted at 0.41 mbs. The buried concrete slab (Stratum Ic), determined to be a component of SIHP # -7658, was scored in a decorative pattern, perhaps indicative of a sidewalk or patio surface. In the *mauka* portion of the test excavation, a high step (26 cm thick) transitioned to a grouted paving stone surface. The test excavation is located in a raised area approximately 50 cm above the sidewalk that runs along Ala Moana Blvd. In the initial construction of the Ward Warehouses in 1976, a walkway was built in the area of TE 31. Based on historic aerial photographs it appears the current concrete surface was constructed above the buried concrete slab in order to make the patio/walkway a flat surface.

Figure 149. Photograph of TE 31 southeast wall, view to northeast

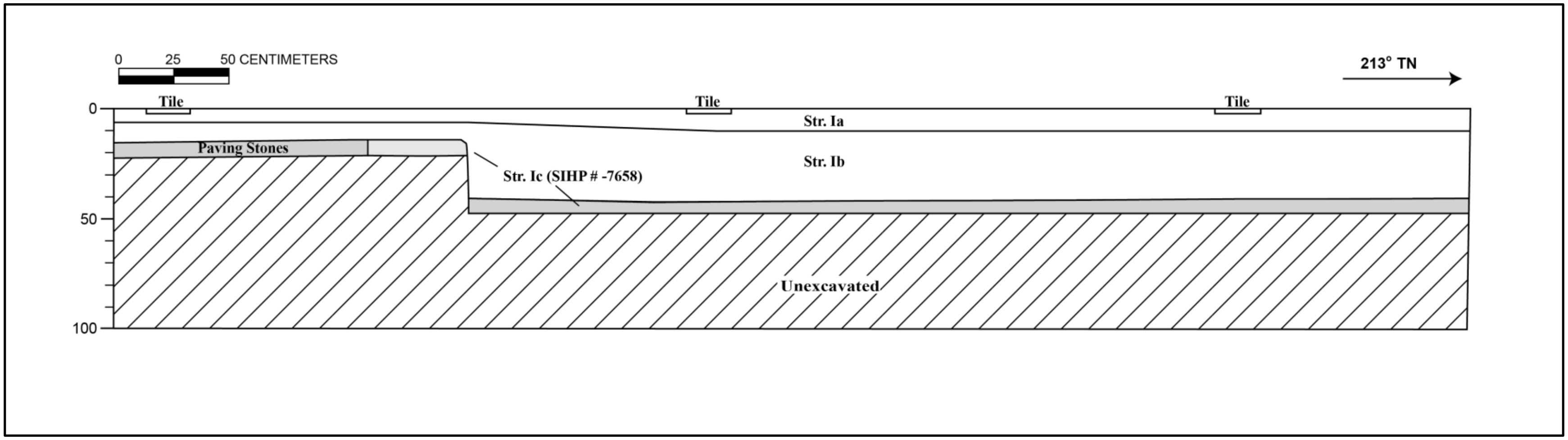

Figure 150. Profile of TE 31 southeast wall

Table 32. TE 31 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–11	Concrete surface
Ib	11–41 (BOE)	Fill; 10YR 3/2, very dark grayish brown; extremely gravelly sandy loam; structureless (single-grain); moist, loose consistency; non-plastic; terrigenous origin; abrupt, irregular lower boundary; contained one piece of wood from construction debris and brick fragments
Ic	41 (BOE)	SIHP # -7658; buried commercial surface

4.1.32 Test Excavation 32 (TE 32)

Test Excavation 32 (TE 32), an exterior excavation located in the landscape along Ala Moana Boulevard, was oriented northwest-southeast direction, and measured 5.35 m long by 0.5 m wide with a maximum depth of 1.40 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 32 consisted of loamy clay topsoil (Stratum Ia) overlying various layers of fill consisting of gravelly sand (Stratum Ib), two sandy clay strata (Strata Ic and Id), gravelly sandy clay loam (Stratum Ie), and extremely gravelly sand (Stratum If), overlying a disturbed natural sandy clay (Stratum II) and in situ natural sandy clay (Stratum III) (Figure 151, Figure 152, Figure 155, Table 33).

Due to the limited space surrounding TE 32, which was confined by a public sidewalk on the *makai* side and the Ward Warehouse commercial building on the *mauka* side, as well as a significant ground surface slope on the *mauka* side, only a limited amount of excavated material could be safely placed alongside the test excavation. Hence, TE 32 was dug in two separate segments. First, the northern portion of TE 32 was excavated to coral shelf, documented, and then backfilled, followed by the excavation and documentation of the southern portion.

TE 32 documented several episodes of historic disturbance. As in the nearby Test Excavations 15, 27, and 29, a natural, in situ fine sandy clay marine sediment (Stratum III) was documented above the coral shelf. This was overlain by a disturbed layer of the same natural marine sediment, which was coarser grained and showed evidence of churning (Stratum II). The *mauka* sidewall also contained a pocket of small cobbles and a mass of basalt and mortar, a heavily mottled and churned pocket, and a milled wooden post with associated pit fill (Figure 154). The wooden post, which measured 8 by 14 cm, was similar to the wooden post documented within the adjacent TE 29 and appeared to be in alignment (Figure 153, Figure 154). The wooden posts and post remains documented within TE 32, TE 29, and TE 27 may represent a fence line and are likely associated with mid-twentieth century historic development of the project area (SIHP # -7658).

Figure 151. Photograph of TE 32, showing the northern half of the profile (*mauka*) wall, view to northwest

Figure 152. Photograph of TE 32, showing the southern half of the profile (*mauka*) wall, view to north; staining from the documented wooden post is visible within the profile wall, SIHP # -7658

Figure 153. Photograph of wooden post extending beneath fill layers to the coral shelf, SIHP # -7658

Figure 154. Photograph of milled wood post, found within the *mauka*/southern corner of TE 32

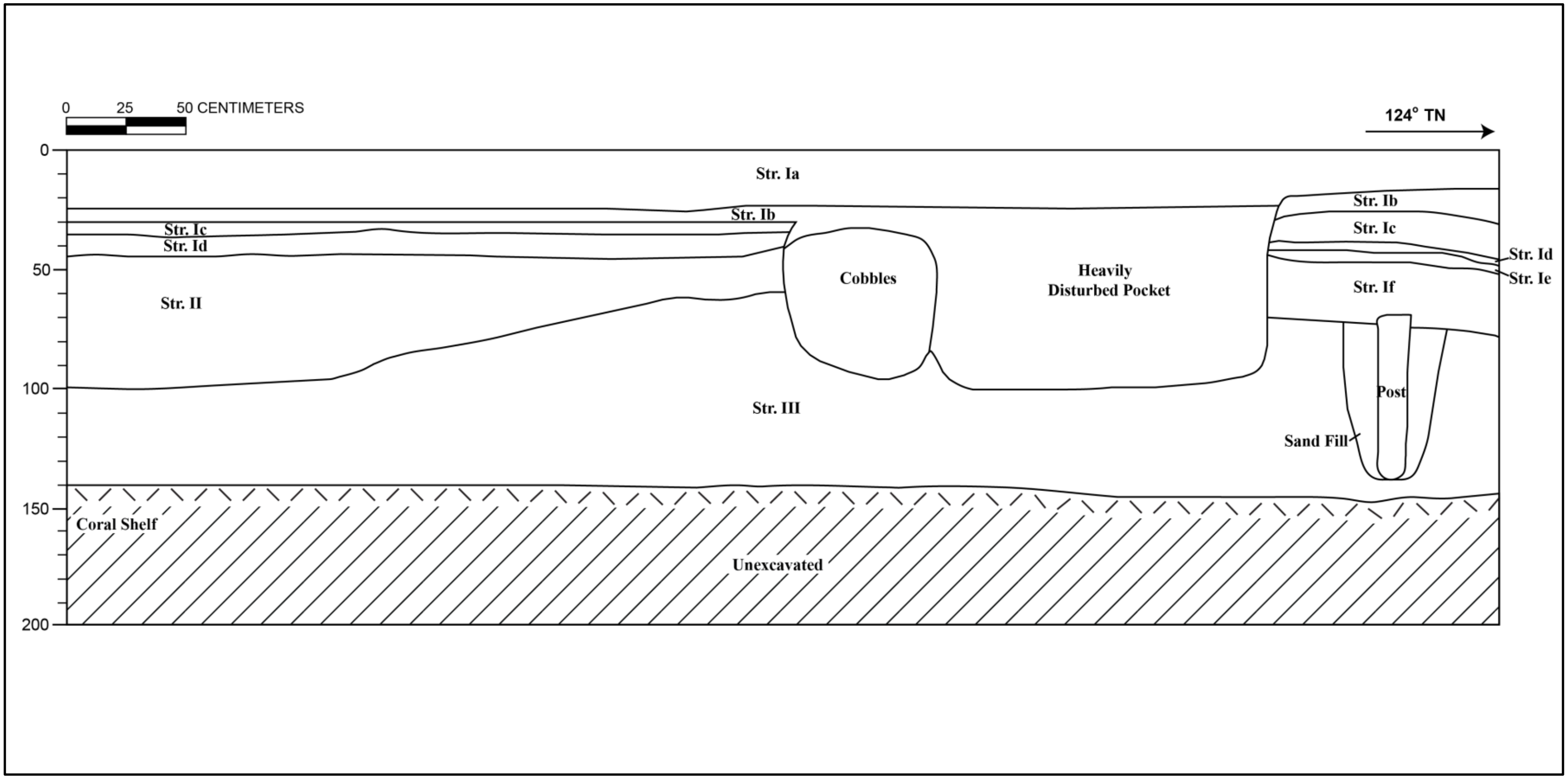

Figure 155. Profile of TE 32 northeast wall

Table 33. TE 32 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–25	Fill; 7.5YR 32, dark brown; structureless (massive); moist, loose consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; common, fine roots; imported landscape fill
Ib	16–32	Fill; 7.5YR 2.5/2, very dark brown; extremely gravelly course sand; structureless (single-grain) to crumb; moist, loose consistency; non-plastic; marine origin; clear, smooth, discontinuous lower boundary; common, fine to medium roots
Ic	30–46	Fill; 5YR 3/4, dark reddish brown; medium sandy loamy clay; structureless (massive); moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth, discontinuous lower boundary; common, medium roots
Id	35–45	Fill; 5YR 2.5/2, dark reddish brown; medium loamy sandy clay; structureless (massive); moist, friable consistency; slightly plastic; mixed origin; clear, smooth, discontinuous lower boundary; common, fine to medium roots
Ie	40–52	Fill; 10YR 3/3, dark brown; gravelly sandy clay loam; structureless (massive); moist, friable consistency; slightly plastic; mixed origin; diffuse, broken/discontinuous lower boundary
If	45–80	Fill; 2.5YR 6/3, light yellowish brown; extremely gravelly course sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, broken/discontinuous lower boundary; common, fine to medium roots; contained a milled wooden post (photographed)
II	45–100	Disturbed natural; medium to coarse sandy clay; structureless (massive); moist, very friable consistency; slightly plastic; marine origin; diffuse, broken/discontinuous lower boundary; many, fine to medium roots; disturbed marine sediment containing rootlets and natural marine shell
III	65–140 (BOE)	Natural; fine sandy clay; structureless (massive); moist, very friable consistency; plastic; marine origin; abrupt, smooth lower boundary; common, fine roots; natural marine sediment containing rootlets and natural marine shell

4.1.33 Test Excavation 33 (TE 33)

Test Excavation 33 (TE 33), an exterior excavation located in the food court area of the *makai* commercial building of Ward Warehouse, was oriented in a northeast-southwest direction and measured 6.1 m long by 0.6 m wide with a maximum depth of 2.17 mbs. The base of excavation was determined by the hard coral shelf. The stratigraphy of TE 33 consisted of the modern concrete surface (Stratum Ia) and various layers of fill consisting of coarse cinder (Stratum Ib), very gravelly sandy loam (Stratum Ic), clay loam (Stratum Id), and very gravelly loam (Stratum Ie), overlying a sandy clay man-made berm (Stratum II/SIHP # -7655) and natural marine clay (Stratum III) (Figure 156, Figure 157, Table 34).

TE 33 documented the presence of historic salt pan remnants, SIHP # -7655, consisting of locally procured natural sediment modified into a man-made berm (Stratum II). The berm extended evenly across the length of the test excavation. The maximum height of the berm was 1.0 m above the coral shelf, representing a relatively high berm. As TE 33 is located along the coastal boundary of SIHP # -7655, the high berm may represent use of the natural coastal sediments to “build up” a containment edge or boundary for the salt pans. A high berm is also evident in TE 30, similarly located at the coastal boundary of the historic property.

Figure 156. Photograph of TE 33, view to northwest

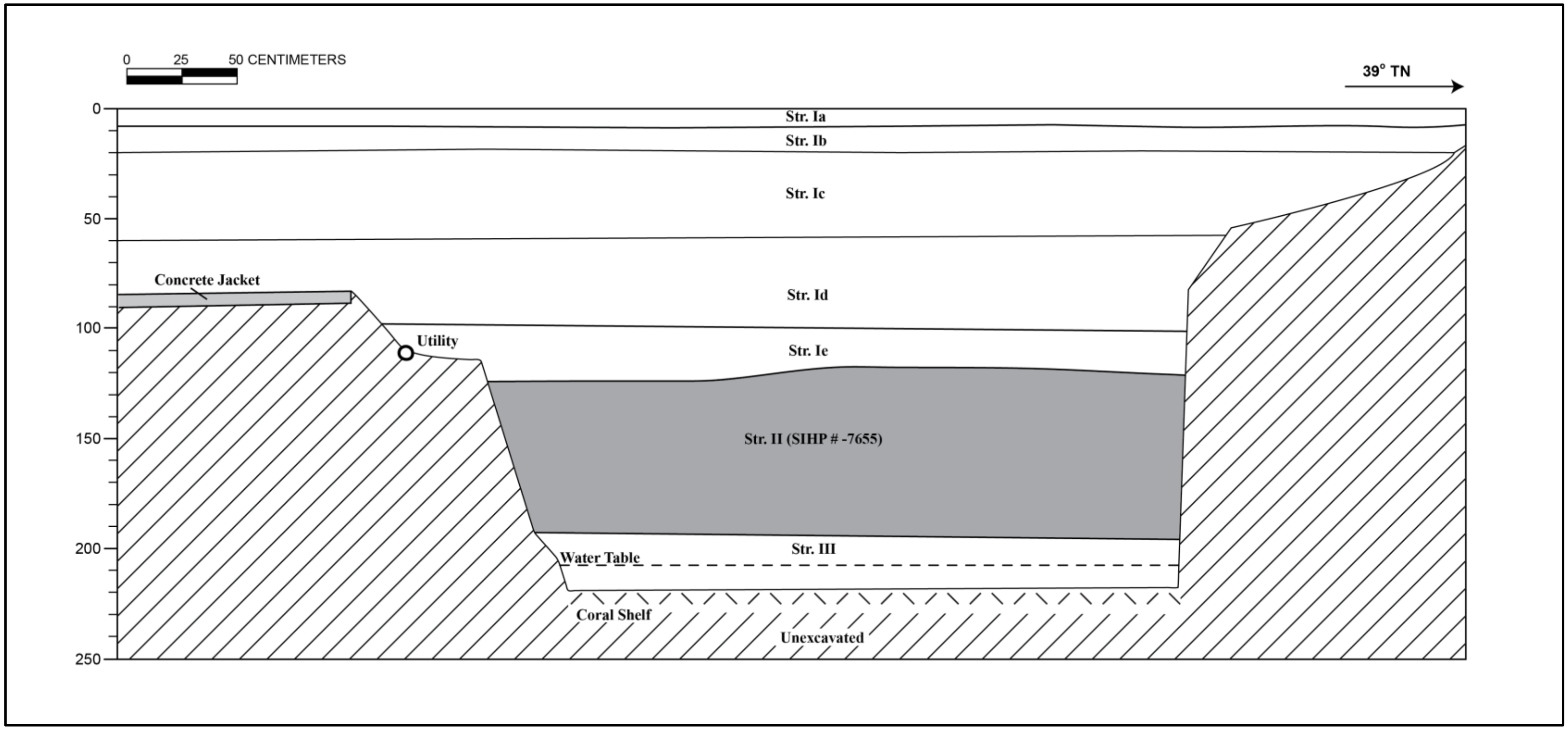

Figure 157. Profile of TE 33 northwest wall

Table 34. TE 33 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–8	Concrete floor surface
Ib	8–20	Fill; 10YR 2/1, black; very coarse sand; structureless (single-grain); dry, loose consistency; non-plastic; terrigenous origin; abrupt, smooth lower boundary; imported cinder fill layer, plastic sheet along upper boundary
Ic	19–60	Fill; 10YR 4/2, dark grayish brown; very gravelly sandy loam; weak, fine, crumb structure; moist, very friable consistency; mixed origin; clear, smooth lower boundary; indurated coral cobble layer on upper boundary
Id	57–102	Fill; 10YR 3/3, dark brown; clay loam; moderate, medium, crumb structure; moist, friable consistency; slightly plastic; mixed origin; clear, smooth lower boundary
Ie	98–123	Fill; 10YR 7/2, light gray; very gravelly loam; weak, fine, crumb structure; moist, very friable consistency; non-plastic; mixed origin; clear, smooth lower boundary
II	117–200	SIHP # -7655; 2.5Y 7/2, light gray; sandy clay, structureless (massive); moist, firm consistency; plastic; marine origin; diffuse, smooth lower boundary; roots staining; man-made berm associated with salt pan remnants
III	198–217 (BOE)	Natural; 10BG 7/1, light greenish gray; clay, structureless (massive); wet, sticky consistency; very plastic; marine origin; abrupt, smooth lower boundary; marine sediment overlying coral shelf

4.1.34 Test Excavation 34 (TE 34)

Test Excavation 34 (TE 34), an exterior excavation located in the landscaping along Ala Moana Boulevard, was oriented in a northwest-southeast direction, and measured 6.0 m long by 0.5 m wide with a maximum depth of 1.48 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 34 consisted of gravelly loamy clay topsoil (Stratum Ia), very gravelly loamy sand (Stratum Ib), and fine silty sand (Stratum Ic), overlying disturbed natural sandy clay (Stratum II), in situ natural sandy clay (Stratum III), a pocket of Jaucas sand (Stratum IV), and gleyed sandy clay marine sediment (Stratum V) (Figure 158, Figure 159, Figure 161, Table 35).

Due to the limited space surrounding TE 34, which was confined by a public sidewalk on the *makai* side and the Ward Warehouse commercial building on the *mauka* side, as well as a significant ground surface slope on the *mauka* side, only a limited amount of excavated material could be safely placed alongside the test excavation. Hence, TE 34 was dug in two separate segments. First, the southern portion of TE 34 was excavated to coral shelf, documented, and then backfilled, followed by the excavation and documentation of the northern portion. Due to safety concerns, the field crew did not enter the test excavation and documented the stratigraphy from the ground surface.

TE 34 documented disturbed natural marine sediment (Stratum II) overlying two natural in situ sandy clay marine deposits (Strata III and V). Stratum II appeared to be composed of disturbed and churned Stratum III. A small pocket of Jaucas sand (Stratum IV) was also observed above Stratum V within both the *mauka* and *makai* sidewalls (Figure 160). Faunal bone (cow cervical vertebrae) was documented within the back dirt associated with Strata II–IV, however no further provenience could be specified.

Two pit disturbances, likely associated with landscaping activities, were observed in the southern portion of the test excavation, as well a historic pit within the northern end of TE 34 which extended to the coral shelf.

Figure 158. Photograph of southern portion of TE 34 northeast wall, view to southeast

Figure 159. Photograph of northern portion of TE 34 northeast wall, view to north

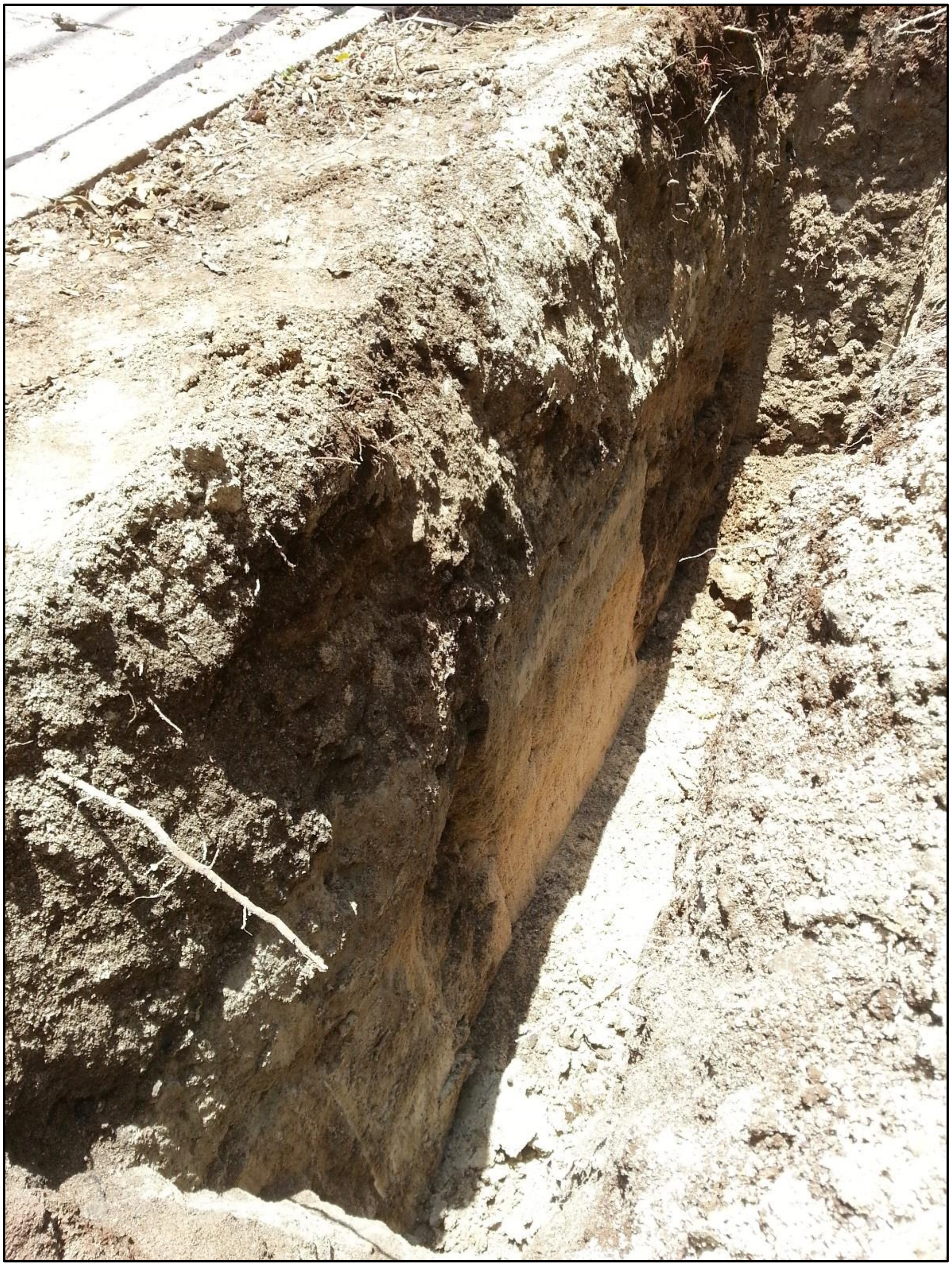

Figure 160. Photograph of TE 34 southwestern (*makai*) wall, showing historic disturbance surrounding a section of in situ natural sand and sandy clay sediments

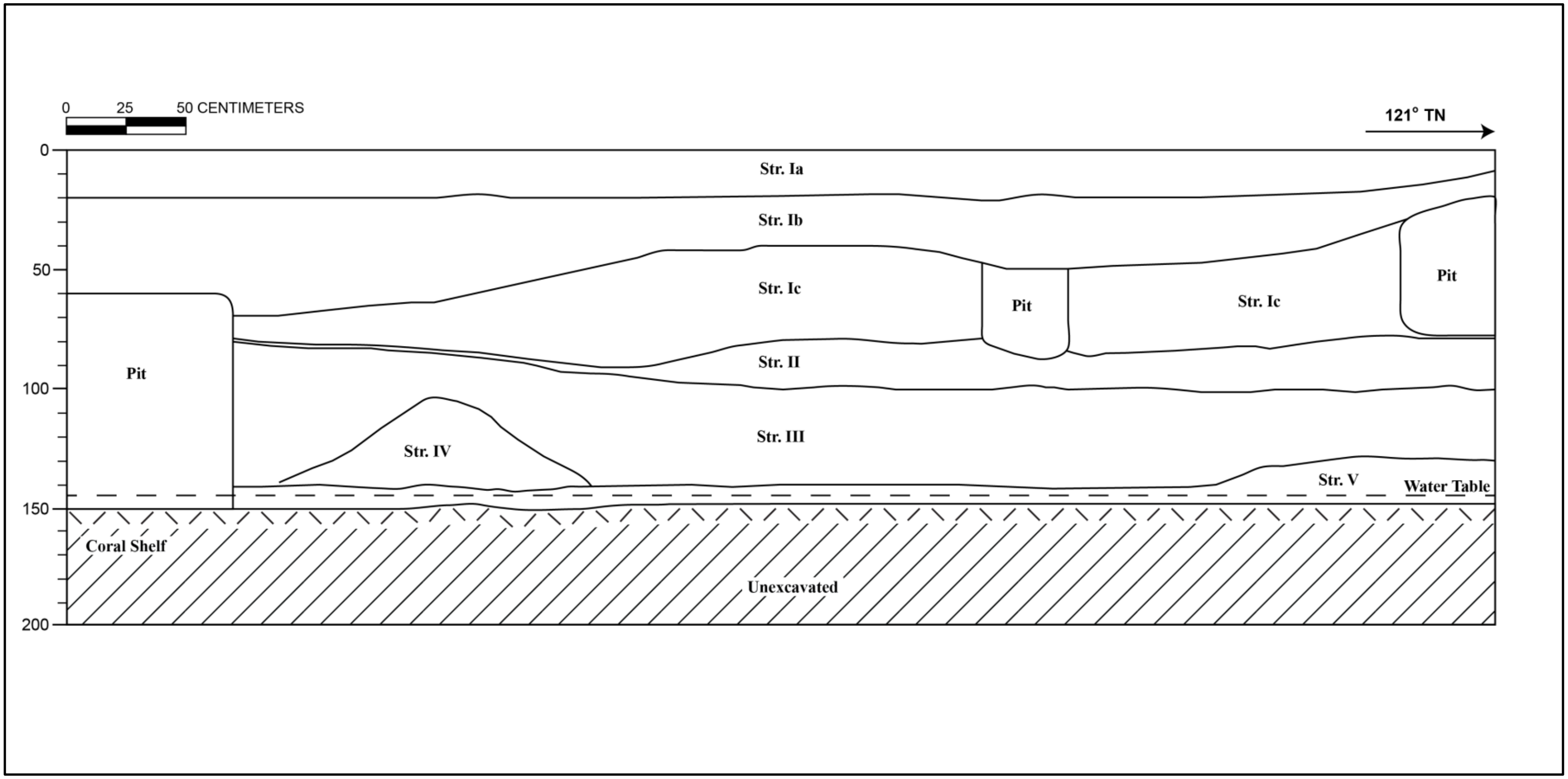

Figure 161. Profile of TE 34 northeast (*mauka*) wall

Table 35. TE 34 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–25	Fill; 7.5YR 2.5/2, very dark brown; gravelly loamy clay; strong, medium, crumb structure; moist, friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; many, medium to course roots; imported landscape fill
Ib	20–70	Fill; 10YR 3/2, very dark grayish brown; very gravelly loamy sand; structureless (single-grain); moist, loose consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; common, medium roots; contained pipe fragments, asphalt chunks, and a ceramic mug/jug handle
Ic	30–92	Fill; 10YR 5/2, grayish brown; silty fine sand with pockets of coarse gravelly sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; clear, broken/discontinuous lower boundary; common, medium roots
II	78–100	Disturbed natural; 5Y 6/2, light olive gray; medium to coarse sandy clay; structureless (massive); moist, friable consistency; slightly plastic; marine origin; diffuse, broken/discontinuous lower boundary; common, fine roots; disturbed natural marine sediment containing rootlets and natural marine shell
III	80–142	Natural; 5Y 7/2, light gray; fine sandy clay; structureless (massive); moist, firm consistency; plastic; marine origin; abrupt, broken/discontinuous lower boundary; many, fine roots; in situ marine wetland sediment containing rootlets and natural marine shell
IV	94–140	Natural; 2.5Y 7/2, pale yellow; fine to medium sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; abrupt, broken/discontinuous lower boundary; pocket of Jaucas sand
V	128–148 (BOE)	Natural; GLEY 1, 10Y 6/1, greenish gray; fine to medium sandy clay; structureless (massive); wet, sticky consistency; plastic; marine origin; lower boundary not visible; common, fine roots; natural marine sediment terminates on top of the coral shelf, water table at 145 cmbs

4.1.35 Test Excavation 35 (TE 35)

Test Excavation 35 (TE 35), an exterior excavation located in the landscaping along Ala Moana Boulevard, was oriented in a northwest-southeast direction, and measured 2.6 m long by 0.4 m wide with a maximum depth of 1.45 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 35 consisted of gravelly clay loam topsoil (Stratum Ia) and various layers of fill consisting of gravelly clay loam (Strata Ib and Ic), and sandy clay (Stratum Id), overlying disturbed natural sandy clay (Stratum II) and in situ natural sandy clay (Stratum III) (Figure 162, Figure 163, Figure 164, Table 36).

Due to the limited space surrounding TE 35, which was confined by a public sidewalk on the *makai* side and the Ward Warehouse commercial building on the *mauka* side, as well as a significant ground surface slope on the *mauka* side, only a limited amount of excavated material could be safely placed alongside the test excavation (see Figure 162). As with Test Excavations 32 and 34, the trench was excavated in segments. During the excavation of the northern portion of TE 35, however, a broken storm drain line caused severe flooding and sidewall collapse within the trench. Due to the instability of the area and concerns for the integrity of the public sidewalk, the southern portion of TE 35 was not excavated.

TE 35 documented disturbed natural marine sediment (Stratum II) overlying in situ natural sandy clay marine sediment (Stratum III). Stratum II appeared to be composed of disturbed and churned Stratum III. Historic disturbance to the natural sediment within TE 35 was also evidenced by the presence of a storm drain located at the base of excavation and on top of the coral shelf at the northern end of the trench, a previous utility scar, and a buried termite station.

Figure 162. Photograph showing the location of TE 35 between the Ward Warehouse commercial complex and Ala Moana Boulevard sidewalk

Figure 163. Photograph of TE 35 northeast wall, view to northeast

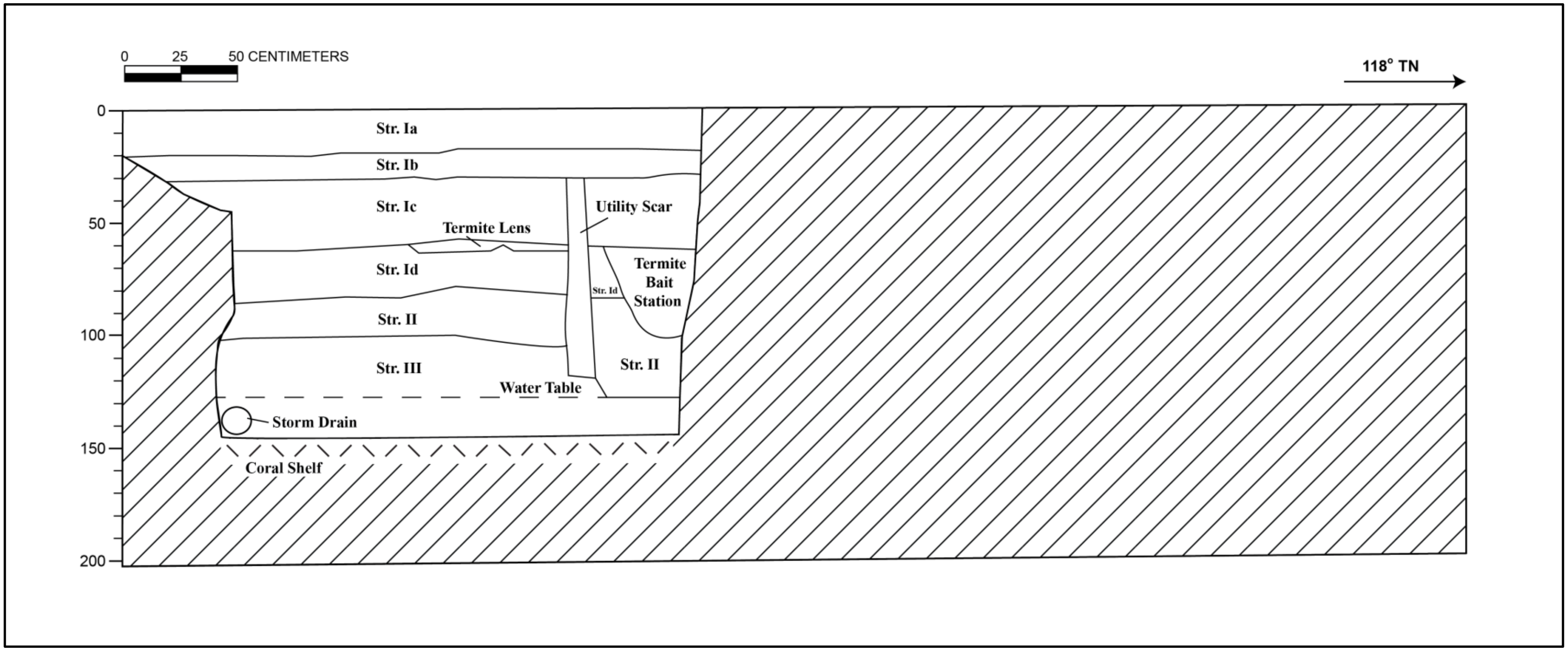

Figure 164. Profile of TE 35 northeast wall

Table 36. TE 35 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–20	Fill; 10YR 3/2, very dark grayish brown; gravelly clay loam; weak, fine, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; clear, smooth lower boundary; many, medium roots; imported landscape fill
Ib	18–30	Fill; 5YR 3/3, dark reddish brown; gravelly clay loam; weak, fine, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; clear, smooth, broken/discontinuous lower boundary; few, fine roots observed
Ic	30–63	Fill; 10YR 5/1, gray; gravelly clay loam; weak, fine, crumb structure; moist, very friable consistency; slightly plastic; mixed origin; clear, smooth, broken/discontinuous lower boundary; few, fine roots observed
Id	58–85	Fill; 10YR 8/2, very pale brown; sandy clay; structureless (massive); moist, very friable consistency; plastic; mixed origin; clear, smooth, broken/discontinuous lower boundary
II	80–105	Disturbed natural; 10YR 7/2, light gray; slightly gravelly coarse clay sand; structureless (single-grain); moist, loose consistency; non-plastic; marine origin; diffuse, irregular lower boundary; few, fine roots observed; disturbed and redeposited natural marine sediment
III	100–145 (BOE)	Natural; 10YR 2/2, very pale brown; medium silty sand; structureless (massive); moist, friable consistency; slightly plastic; marine origin; abrupt, smooth lower boundary; natural marine sediment

4.1.36 Test Excavation 36 (TE 36)

Test Excavation 36 (TE 36), an exterior excavation located in the grassy landscaping on the southeast side of the Ward Warehouse, was oriented in an east-west direction, and measured 6.0 m long by 0.5 m wide with a maximum depth of 1.62 mbs. The base of excavation was determined by the presence of the hard coral shelf. The stratigraphy of TE 36 consisted of silty loam topsoil (Stratum Ia) and various layers of fill consisting of gravelly silty clay loam (Stratum Ib), extremely gravelly sandy loam (Stratum Ic), and hydraulic sandy clay (Stratum Id), overlying two strata of natural marine sandy clay (Strata II and III) (Figure 165, Figure 168, Table 37).

A buried disturbed fill layer with asphalt chunks (Stratum Ic), comprised of black cinder and sand material, was determined to be a component of SIHP # -7658. The layer is disturbed in the east end of TE 36 and was observed from 50 to 88 cm below surface, overlying crushed coral and hydraulic (dredge) fill associated with land reclamation (1919-1926). Based on historic maps and aerial photos, the layer with buried asphalt chunks likely dates from 1939 to 1976.

TE 36 documented two strata of natural marine sediment (Strata II and III) overlying the coral shelf. Due to the presence of a large coconut tree and other shrubs, all of the deposits within TE 36, including natural deposits, evidenced some degree of reworking due to bioturbation. Root stains were observed down to the coral shelf. Two historic artifacts were identified within Stratum Ic, an “Aloha Soda Works” glass bottle and a concrete brick (Figure 166, Figure 167).

Figure 165. Photograph of TE 36 north wall, view to east

Figure 166. Photograph of “Aloha Soda Works” glass bottle collected from Stratum Ic

Figure 167. Photograph of concrete brick identified within Stratum Ic (not collected)

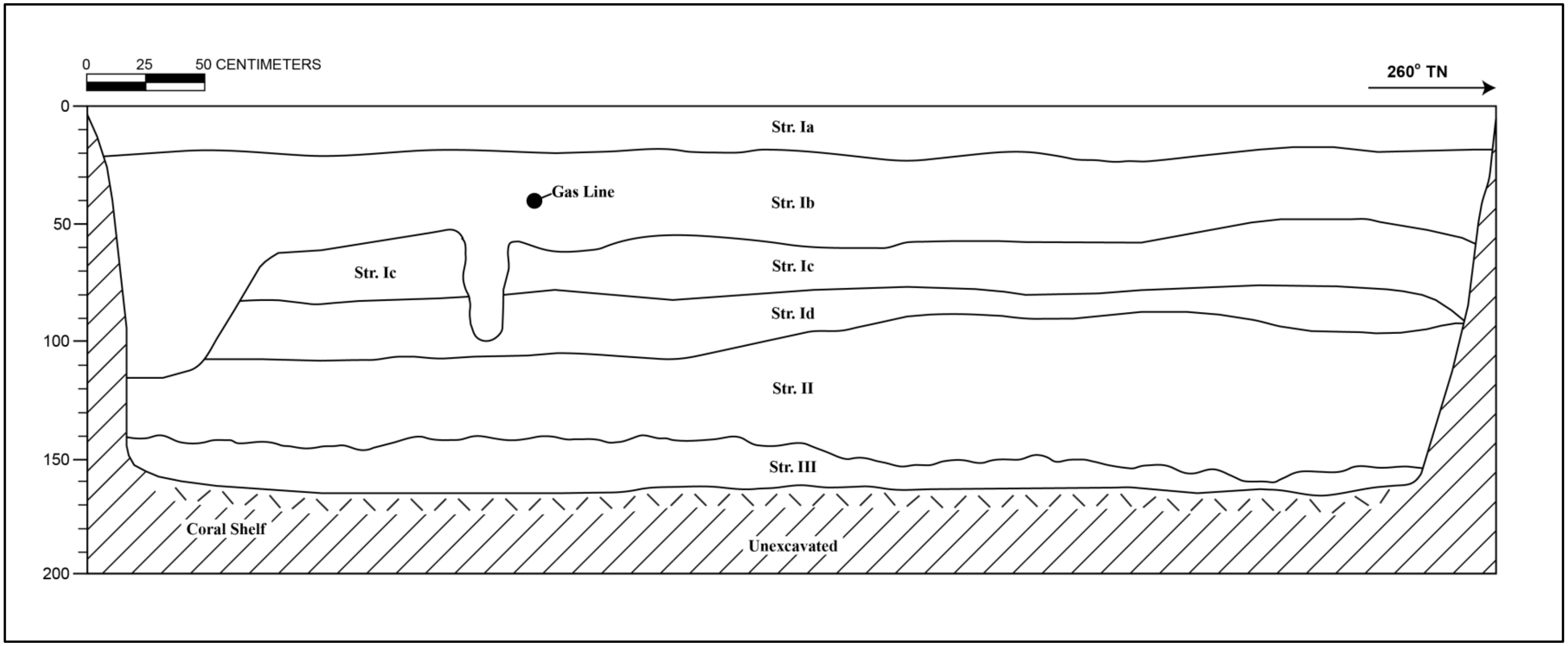

Figure 168. Profile of TE 36 north wall

Table 37. TE 36 Stratigraphic Description

Stratum	Depth (cmbs)	Description
Ia	0–24	Fill; 5YR 3/3, dark reddish brown; silty loam; moderate, fine, blocky structure; moist, very friable consistency; slightly plastic; terrigenous origin; clear, smooth lower boundary; common, fine to medium roots; landscape fill
Ib	18–116	Fill; 7.5YR 3/2, dark brown; silty clay loam; structureless (massive); moist, firm consistency; slightly plastic; mixed origin; clear, irregular lower boundary; common, fine to medium roots; contained pink plastic fragments
Ic	50–88	Fill; 10YR 2/1, black; extremely gravelly coarse sandy loam; moderate, coarse granular structure; moist, loose consistency; non-plastic; mixed origin; clear, broken/discontinuous lower boundary; common, fine to medium roots; contained a large amount of asphalt, possibly from a previous surface (SIHP # -7658); contained a brick (photographed, not collected) and an Aloha Soda Works glass bottle (collected)
Id	80–108	Fill; 10YR 6/4, light yellowish brown; sandy clay; structureless (massive); moist, friable consistency; slightly plastic; mixed origin; clear, wavy lower boundary; common, fine to medium roots; mix of terrigenous sediment and hydraulic (dredge) fill
II	88–160	Natural; 5Y 7/3, pale yellow; fine sandy clay; structureless (massive); moist, friable consistency; plastic; marine origin; diffuse, wavy lower boundary; few, fine roots
III	140–165 (BOE)	Natural; 5GY 6/1, greenish gray; very fine sandy clay; structureless (massive); wet, slightly sticky consistency; plastic; marine origin; abrupt, smooth lower boundary; few, very fine roots; clay content increases at lower boundary above the coral shelf

Section 5 Results of Laboratory Analysis

5.1 Artifact Analysis

No traditional Hawaiian artifacts were encountered during the Block C West AIS excavations. However, various historic artifact fragments and construction debris were documented within historic pit fill and fill deposits within the *mauka* portion of the project area, as well as historic wooden post remnants, construction debris, and a single intact glass soda bottle along the *makai* boundary. The majority of the historic artifacts were highly fragmentary and determined to lack diagnostic features that could give a more refined date other than that of the historic time period. These artifacts were photographed in the field but not collected.

Within the *mauka* portion of the project area, historic artifacts and/or construction debris was identified within seven test excavations (TE 3-TE 6 and TE 8-TE 10). Within all but TE 9, the historic artifacts and debris were located within fill deposits or historic pit fill associated with the modern development of the Ward Warehouse center and overlying the buried historic surfaces associated with earlier, mid-twentieth century development of the project area (SIHP # -7658). Based on the stratigraphic context, the historic artifacts likely date between the 1940s and 1970s. The historic artifacts and construction debris included small glass bottle and ceramic fragments, glass game marbles, red brick fragments, rusted metal, a round top nail, wood fragments, and a leather shoe. A sample of the historic artifacts observed within these fill deposits are provided in Figure 169 through Figure 176.

Along the landscaped *makai* boundary of the project area, several construction-related artifacts were observed within fill deposits, consisting of a circular cement fragment (TE 27), a basalt brick and mortar brick conglomerate possibly representing a structural arch (TE 32), and a cement brick (TE 36) (Figure 177, Figure 178). In addition, an intact Aloha Soda Works glass bottle was found within the TE 36 fill deposit containing the cement brick.

The Aloha Soda Works bottle was collected and further analyzed within the CSH laboratory (Figure 179, Figure 180). While a portion of the neck and lip had been broken off, the remaining portion of the neck was embossed with the word “Aloha”, while “ALOHA SODA WORKS HONOLULU” was visible on the shoulder, ‘NET CONTENTS 6 ½ FLUID OUNCES” was visible on the heel, and “ALoHA” was visible on the base. The bottle showed an Owen-Illinois Glass Co. makers mark, with the numbers “20” on the left and “7” on the right. The bottle evidenced a two piece mold with a crown finish. Based on these attributes and an applied color labeling, the bottle postdates 1933, with a date range up to 1980.

Milled wooden post remnants were also documented within Test Excavations 27, 29, and 32 (Figure 181, Figure 182). In situ portions of the wooden posts were observed within TE 29 and TE 32, extending to or just above the coral shelf, which milled wood fragments were observed in a disturbed context underneath a utility overlying the coral shelf. The milled wood indicates a historic time frame. It was determined that the wooden posts may be remnants of a fence line associated with historic development of the project area (SIHP # -7658).

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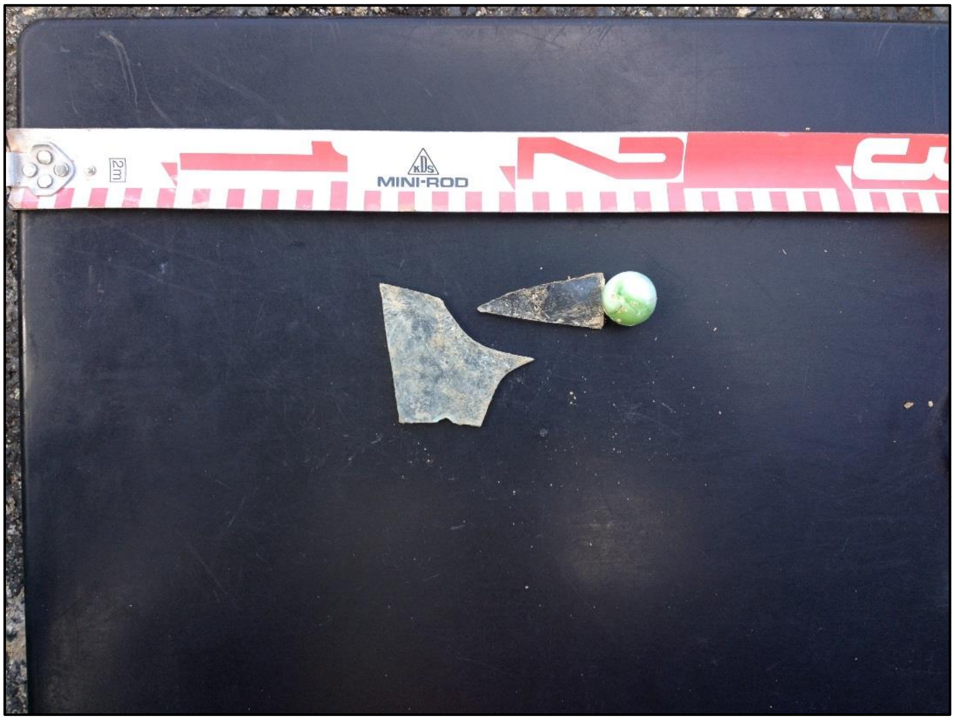

Figure 169. Green glass marble and glass fragments identified within TE 3, Stratum Ic

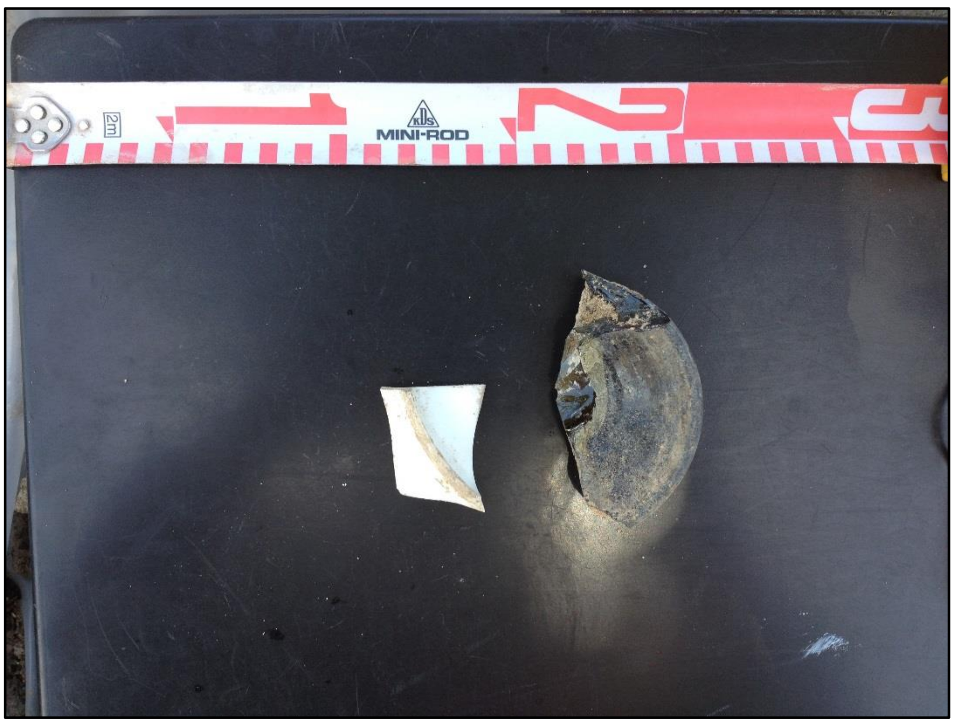

Figure 170. Ceramic fragment and olive green glass base fragment identified within TE 5, Stratum Ic

Figure 171. Metal pipe and fragment identified within TE 6, Stratum Id

Figure 172. Red brick fragment, 3 aqua glass bottle fragments, a round top nail, and 2 ceramic fragments identified within TE 6, Stratum Id

Figure 173. Leather shoe identified within TE 8, historic pit fill

Figure 174. Historic wood fragments identified within TE 8, historic pit fill

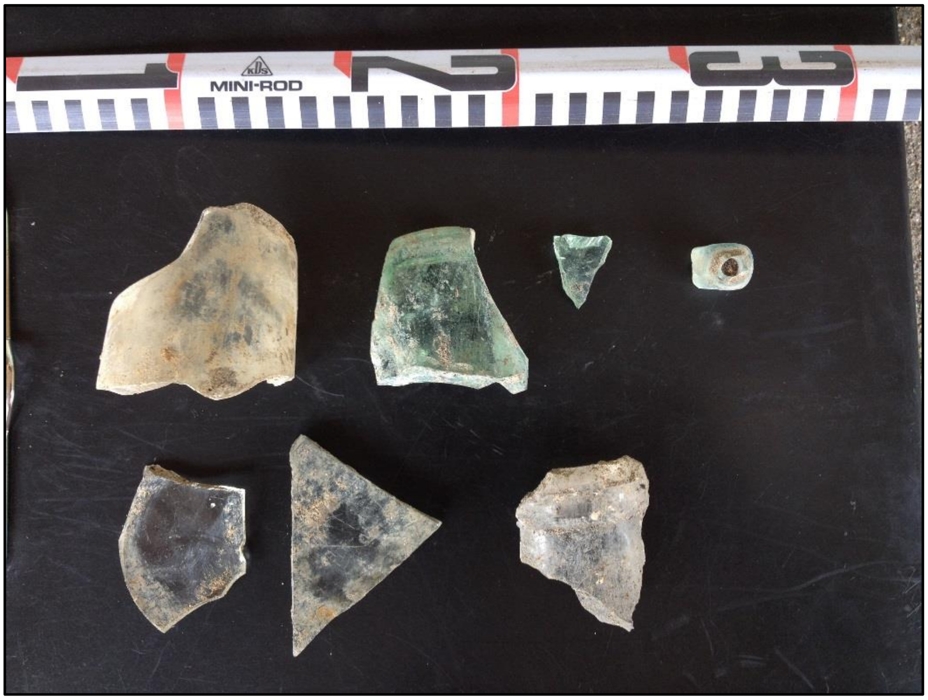

Figure 175. 4 clear and 3 aqua glass fragments identified within TE 9, Stratum If

Figure 176. Milled wood and amber glass bottle fragment identified within TE 10, Stratum Ic

Figure 177. Brick and mortar conglomerate (possible structural arch) identified within TE 32, historic disturbance area

Figure 178. Cement brick identified within TE 36, Stratum Ic

Figure 179. Aloha Soda Works bottle collected from TE 36, Stratum Ic

Figure 180. Aloha Soda Works bottle, showing "ALoHA" embossed on the base

Figure 181. Milled wood post identified within TE 29, determined to be associated with SIHP # -7658

Figure 182. Milled wood post identified within TE 32, determined to be associated with SIHP # -7658

5.2 Faunal Analysis

Vertebrate faunal remains were documented within only three test excavations—TE 3, TE 27, and TE 34. Within TE 3, *Bos taurus* (cow) rib fragment and *Sus scrofa* (pig) tibia (proximal portion) were identified within the upper portion of the salt pan berm structure (Stratum II). Based on the presence of historically introduced cow and metal saw blade butcher marks visible on the cut edge of the cow bone, these faunal remains were deposited in the historic period. This is consistent with the provenience, located atop a historic man-made berm structure. Within TE 27, the distal portion of a *Capra aegagrus hircus* (goat) humerus was found within the spoils pile. While a specific provenience could not be determined, the identification of historically introduced goat remains indicates the historic period. Within TE 34, cervical vertebrae fragments of *Bos taurus* were identified within the back dirt associated with Strata II-IV, which included both in situ marine sediments and disturbed, historically re-deposited marine sediment. While the specific provenience could not be determined, based on the presence of a historically introduced species, it is likely that the cow remains came from the disturbed natural sediments.

5.3 Pollen and Microcharcoal Analysis

Eleven samples from the Block C West and Block B East project areas were submitted to PaleoResearch Institute, Inc. of Golden, Colorado for pollen analysis. The collected samples represent the laminated organic material (labeled "peat" within the pollen report) representing the salt pan beds associated with SIHP # -7655, and the underlying wetland sediments. The eleven sediment samples were analyzed to determine any changes in the environmental record that may be indicative of salt pan use. A report was prepared by PaleoResearch Institute and is presented in Appendix E (Cummings and Varney 2014). Below is a summary of the results.

The samples from Block C West were collected from: Test Excavation 1, Stratum IIb (Sample 7); Test Excavation 6, Strata II (Sample 8) and III (Sample 9); and Test Excavation 23, Strata II (Sample 10) and III (Sample 11). The samples from Block B East were collected from: Test Excavation 6, Strata IIb (Sample 1) and III (Sample 2); Test Excavation 21, Strata II (Sample 3) and III (Sample 4); and Test Excavation 22, Strata II (Sample 5) and III (Sample 6). The samples were collected from the sidewall using a trowel and then carefully separated in the CSH lab to prepare them for analysis.

Pollen was removed using a chemical extraction technique and identified using light microscopy. Pollen grains that were poorly preserved or distorted beyond recognition were identified as "Indeterminate." All other pollen grains were identified to the family, genus, and species level, where possible.

5.3.1 Discussion

The pollen and microscopic charcoal analysis of the samples collected from Block B East and Block C West indicate that these areas may have been inundated with water. The presence of foraminifera (single-celled protists that live in marine and/or freshwater environments) in all of the Block B East samples (Samples 1-6) and in only one of the Block C West samples (Sample 10) suggests that the Block B area may have contained more water than Block C. Additionally, the lower pollen concentration values in the wetland sediments (Stratum III) of Block C West suggest a more rapid sedimentation process in this area.

In general, the pollen record from the eleven sediment samples was dominated by *kolea* (*Myrsine*) (Figure 183). *Kolea* are small to medium-sized native evergreen trees (Little and Skolmen 1989:268) that are most likely insect-pollinated (Vaughn Bryant and Donald Drake, personal communication 2014). Most plants in the Myrsinaceae family are insect-pollinated. According to Dr. Donald Drake, Professor of Botany at University of Hawaii at Mānoa, a study on the pollination of Kolea (Myrsine) trees has never been completed. However, the flowers of the Kolea tree are more adapted to insect or bird-pollination than wind-pollination. Unlike wind-pollinated plants (i.e. grasses, rice, pine) which produce an abundance of pollen that often travels long distances and survives well in the archaeological record, insect-pollinators produce less copious amounts of pollen and are, therefore, usually under-represented in the archaeological record. Although *kolea* pollen has been documented in coastal areas (Cummings 2013), the high percentage of *kolea* pollen in all of the samples from Blocks B East and C West is unusual. One explanation for the abundance may be that *kolea* leaves were utilized to line and waterproof the salt beds. The missionary William Ellis, on his tour of the Hawaiian Islands in 1822 and 1823, noted the final step in the salt making process, which includes the use of evergreen leaves to line the pans:

> The natives of this district (Kawaihae) manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea, into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there for some time, it is conducted into a number of smaller pans about six or eight inches in depth, which are made with great care, and frequently lined with large **evergreen leaves**, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large **evergreen leaves** placed. They were tied up at each end, so as to resemble a narrow dish, and filled with sea water, in which the crystals of salt were abundant [Ellis 1827:403-404].

The presence of *Myrsine* pollen within the underlying wetland sediments (Stratum III) that were analyzed is somewhat unusual. However, considering the samples were collected directly below the overlying laminated organic material (Stratum IIb and II), it is possible that the presence of *Myrsine* pollen is a result of contamination.

Vegetation in the outlying areas of the suspected salt pans included grasses and sedges, indicated by the identification of Poaceae and Cyperaceae pollen in almost all of the samples. The low concentration values of these wind-pollinators suggest that these plants were not growing within the salt pan areas. Fern spores were recovered in almost all of the samples, suggesting that ferns were growing in the vicinity of the project areas.

Pollen representing alien species included Australian pine, *koa haole*, and *kiawe*. The presence of at least one or more of these in each of the samples indicates that the sediments are most likely historic.

Identified Polynesian cultigens included coconut (*Cocos nucifera*), sugarcane (*Saccharum* sp.), and sweet potato (*Ipomoea batatas*-type). Rice (*Oryza*-type) and mango (*Mangifera*-type) were the only introduced cultigens and both were identified in the two samples from Block C West Test Excavation 6 (Samples 8 and 9). It is possible that there were sugarcane fields and rice paddies in

Figure 183. Photograph of *Kolea* (*Myrisine*) leaves which may have been used to line the salt beds (Photographers: Forest & Kim Starr)

the outlying areas of the salt pans. These wind-pollinators are usually well-represented in the pollen record. Therefore, the low concentration and lack of these pollen types suggests that they were not growing within the immediate vicinity of the salt pans. Sweet potato, coconut, and mango, however, are insect-pollinated so their presence may indicate their nearby cultivation. The identification of all of these cultigens (coconut, sugarcane, sweet potato, rice, and mango) within the Test Excavation 6 samples suggests that some of these plants, particularly the insect-pollinators, may have grown near Test Excavation 6. Alternatively, this area may have been used as a trash dump or midden area where these cultigens were deposited at one time. Interestingly, Test Excavation 6 samples did not contain foraminifera which are indicative of inundated areas.

The pollen analysis identified microscopic charcoal fragments in all of the samples. Concentrations were markedly higher in the wetland sediments of Block B East Test Excavations 21 (Sample 4) and 22 (Sample 6), and Block C West Test Excavation 6 (Sample 9). The laminated organic material from Block C West Test Excavation 1 (Sample 7) contained the highest concentration of charcoal in any of the samples from the two project areas. The presence of charcoal may be a result of widespread burning episodes, or it may be attributed to petroleum contamination which is common in coastal areas (Cummings 2014).

In general, the low concentrations of wind-pollinators (i.e. Asteraceae, Cyperaceae, Poaceae, *Chenopodium*, *Casuarina*, ferns, etc.) in the pollen record from Block B East and Block C West sediment samples, suggest that these plant types were not growing within the suspected salt pans, but rather in outlying areas. A few plants, including coconut, mango, and sweet potato may have been cultivated along the salt pan berms. The majority of the sediment samples contain foraminifera, consistent with the presence of open water and possible salt pan production.

Section 6 Historic Property Descriptions

6.1 SIHP # 50-80-14-7655

FORMAL TYPE:	Subsurface salt pan remnants
FUNCTION:	Salt production
NUMBER OF FEATURES:	2
AGE:	Post-Contact
DIMENSIONS:	Approximately 4.4 acres (within the Blocks B East and C West contiguous project areas)
TAX MAP KEY:	[1]1 2-3-001:005 por.
LAND JURISDICTION:	Private; Howard Hughes Corporation (HHC)

SIHP # -7655 consists of a large complex of buried historic salt pan remnants located within the Ward Warehouse commercial center. SIHP # -7655 extends across two contiguous project areas, Block C West and Block B East (refer to Pammer et al. 2014), and extends from Auahi Street to the *makai* edge of the Ward Warehouse commercial buildings, encompassing the majority of both project areas (Figure 184).

The buried salt pan remnants are comprised of an interconnected system of man-made linear structural features (berms) and low-lying, level wetland sediments overlain by thin organic laminations (salt pan beds). Based on the magnitude of this structural complex and the significant earth-moving activity that would have been required to construct the berms, these buried structural features and sediments represent historic commercial salt production activity.

Background research indicates the area of Kakaʻako has a long history of salt production activity, spanning the pre-Contact period to the early twentieth century. Māhele land claims within the Kakaʻako coastal area document a cluster of traditional Hawaiian salt lands, including Land Commission Awards 387, 1903, 10463, and 9549 (see Figure 15). LCA 387, awarded to the American Board of Commissioners for Foreign Missions, contained "fishing grounds, coral flats & salt beds" (see Appendix B). Within LCA 1903, the boundaries of which extended slightly into the *mauka* portion of the Block B East project area, various traditional salt-making features were described by the land claimant, consisting of near-shore ponds that fill with salt water at high tide (*ālia*), the drains (*hoʻoliu*) through which salt water is transferred, the natural depressions (or modified depressions) in the rocks along the shore where salt formed naturally (*poho kai*), and the salt *kula*, or salt fields (see Appendix C).

Traditional Hawaiian salt production was accomplished by diverse methods. The Native Hawaiian historian, David Malo, described one salt making method:

> Salt was manufactured in certain places. The women brought sea-water in calabashes, or conducted it in ditches to natural holes, hollows and shallow ponds (*kekaha*) on the sea-coast, where it soon became strong brine from evaporation. Thence it was transferred to another hollow or shallow vat, where crystallization into salt was completed. [Malo 1951:123]

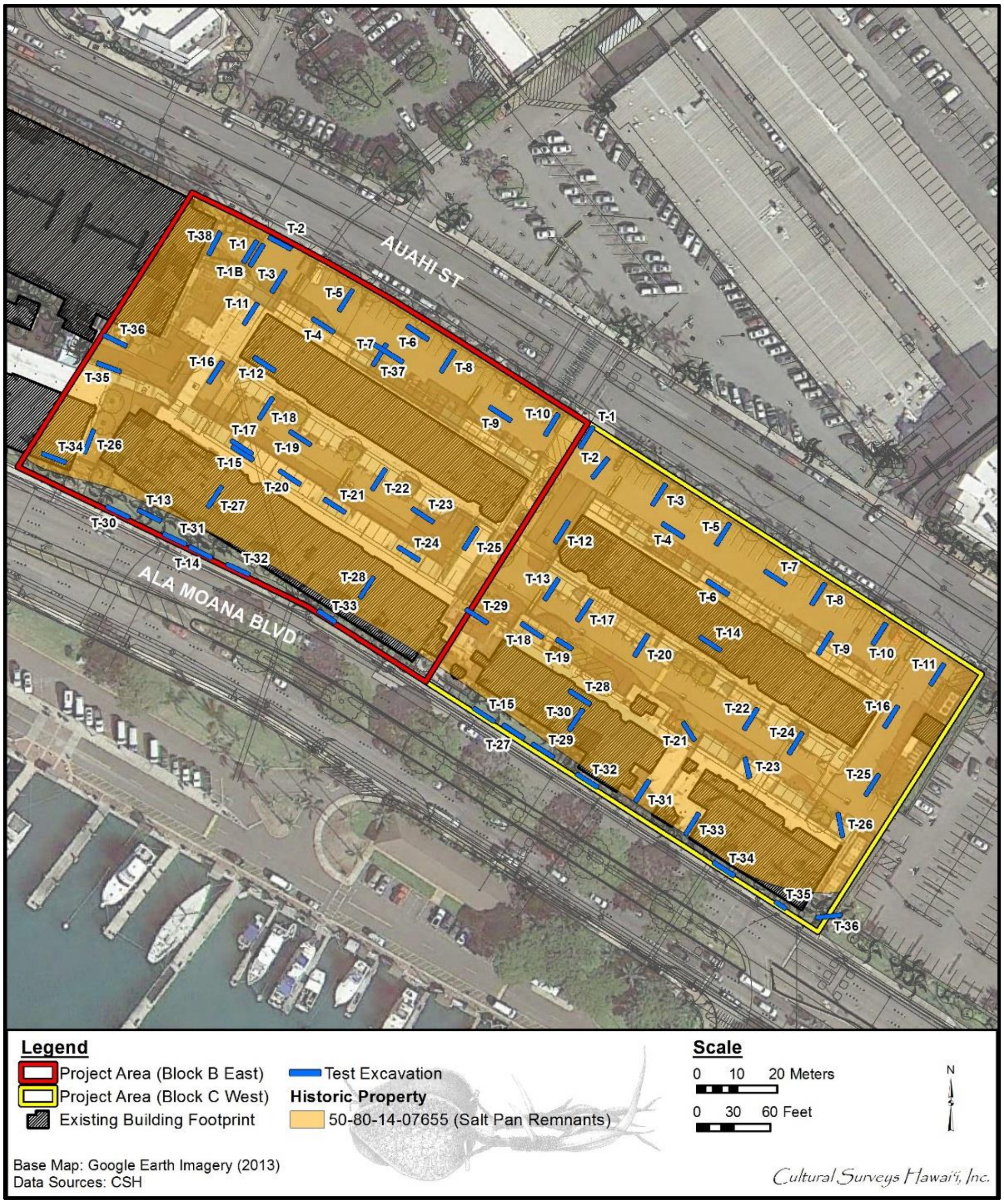

Figure 184. Aerial photograph showing the extent of historic salt pan remnants (SIHP # -7655) documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

Captain Cook was the first to note the method of making salt in prepared salt pans.

> Their salt pans are made of earth, lined with clay; being generally six or eight feet square, and about eight inches deep. They are raised upon a bank of stones near the high-water mark, from whence the salt water is conducted to the foot of them, in small trenches, out of which they are filled, and the sun quickly performs the necessary process of evaporation. . . Besides the quantity we used in salting pork, we filled our empty casks, amounting to sixteen puncheons, in the Resolution only. [Cook 1784:151]

The missionary William Ellis, on a tour of the Hawaiian Islands in 1822 and 1823, also noted these salt pans and recorded the final step of crystallization.

> The natives of this district (Kawaihae) manufacture large quantities of salt, by evaporating sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea, into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there for some time, it is conducted into a number of smaller pans about six or eight inches in depth, which are made with great care, and frequently lined with large evergreen leaves, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large evergreen leaves placed. They were tied up at each end, so as to resemble a narrow dish, and filled with salt water, in which the crystals of salt were abundant. [Ellis 1827:403-404]

Following Western Contact in 1778, commercial trading vessels began to frequent Hawaiian waters at an increasing rate; one important reason for their visit was to trade for salt. In order to supply this demand, commercial salt production works began to multiply throughout the early to late 1800s, including within the Kakaʻako area. The 1883 Baldwin map shows a large grid-like area of historic salt pans which extends across a large portion of Kakaʻako. The Block B East and C West project areas are located at the southern fringe of this zone (Figure 185).

While no specific descriptions of salt production methods and architecture have been located for the current project areas, illustrations and accounts exist for nearby commercial salt works. An 1838 sketch by Auguste Borget titled “Honolulu Salt Pan, near Kakaʻako” likely illustrates large salt works slightly to the west, closer to Honolulu. The sketch depicts long, linear salt pans adjacent to habitation structures (Figure 186). Of particular note are the long length of the inundated salt pan beds and the low, wide earthworks dividing the beds. To the south of the current project areas, was the Kakaʻako Salt Works, managed by E.O. Hall & Sons. A description of these salt works within the January 1892 Planters’ Monthly illustrates the complexity of this commercial industry.

> These salt works are laid out systematically and beautifully and one is surprised with the regularity and evident perfection of every arrangement and of every process in connection with it. One would suppose that a skilled mason with a trowel, stones and cement, had been used in constructing these works, and still nothing of the kind was used. The soil here is of a clay or loamy substance, and can be worked into any shape or form, and seems to be formed by nature for this

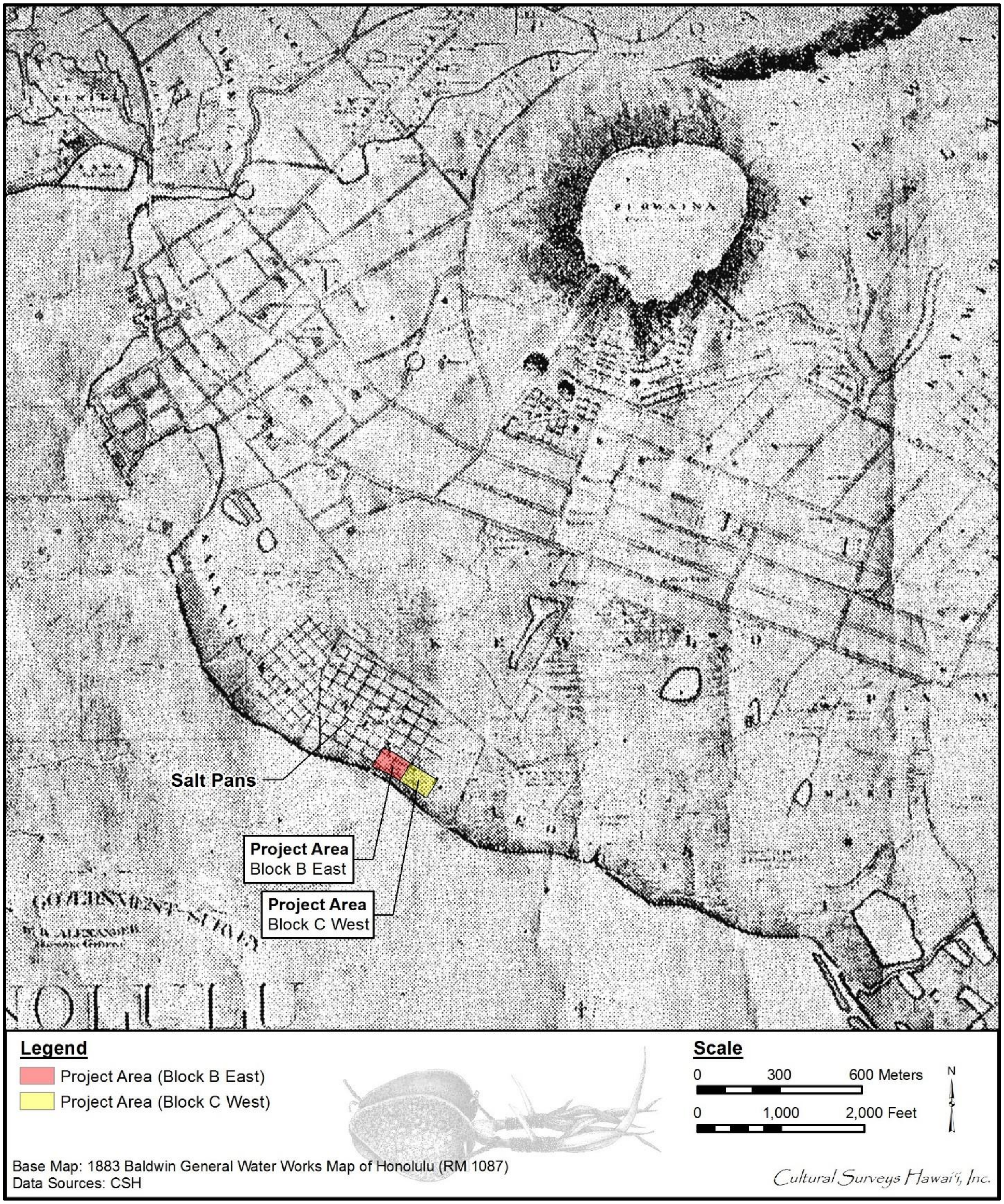

Figure 185. 1883 map of the Honolulu Water Works System by E.D. Baldwin (1883) (Hawaiʻi Land Survey Division, Registered Map 1087), showing a grid symbol representing salt pans. Blocks B East and C West are located at the southern fringe of this area.

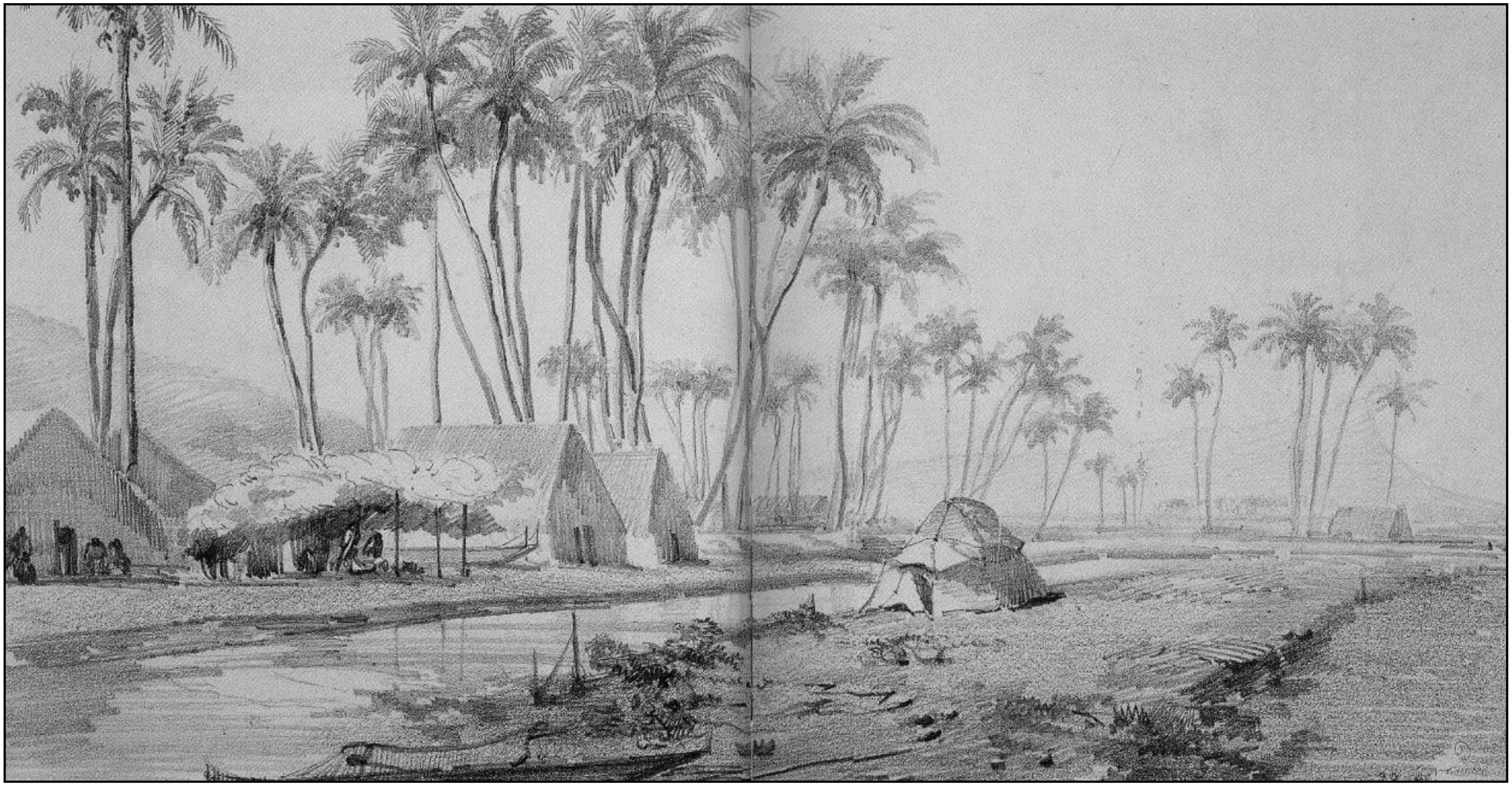

Figure 186. “Honolulu Salt Pan, near Kaka‘ako,” 1838 sketch drawn by a French visitor, Auguste Borget (original sketch at Peabody Essex Museum, Salem, Massachusetts; reprinted in Grant 2000:64-65)

> very purpose. These works are quite extensive covering about eight acres, and comprising at present fifty-six sets of ponds, seven ponds to a set.
>
> On each side of the works there are canals which extend to the ocean. These canals supply the storage ponds, which latter again supply the evaporating ponds, which the water runs into the strike ponds, where the crystals are formed. The salt water passes along gradually from pond to pond, and takes usually a week to reach the strike pond. In this way the water gets denser and denser until it is saturated with a very dense of solution of salt, when it crystalizes rapidly. The water in the strike ponds is not more than 1½ inches deep, the two adjoining ponds, a little deeper the next a little deeper and so on.
>
> These ponds are connected with each other by troughs and wooden pipes. These troughs are well made and twice tarred before being put in place. The strike ponds are also protected from the wind with good substantial fences, the object of this is to keep the water as still as possible.
>
> In the process of crystallization the sun does all the work, the water however has to be agitated at intervals to settle the crystals which have formed on the top of the water, like a thin crust of ice.
>
> There are nearly sixty strike ponds and they each take off a strike every seven to fourteen days, according to the weather, the amount of salt per strike is on an average 850 pounds for each pond. The strike ponds are arranged parallel with each other with their tributary or auxiliary ponds between. These are convenient roads, paths, etc., for the transportation of the salt, and good substantial store-houses for storing the same.
>
> The water used is pure and clean and comes always from the direction of Waikiki. The salt manufactured here is fine grain, white and clean, and looks as good as any of the best salt imported.
>
> The salt is handled with care, and thoroughly dried before being put on the market. The only piece of machinery noticed here is a genuine Chinese pump, made by hand, and is very simple in construction, but at the same time will throw more water than any other pump devised by white men.
>
> The labor on the Salt Farm is all done by Chinese, as no other class of labor has ever given satisfaction, though Hawaiians and Portugese have been employed. The evaporating season commences about April of each year, and lasts six or seven months. No salt can be made in rainy weather. [*Planters' Monthly* 1892:446-448]

Historic salt production within the current project areas was associated with the Ward Estate. Shortly after 1873, the Ward family purchased the coastal lands of Kukukuāe‘o, which included the Ward Warehouse center area, and had the old *kāheka* (salt pans) restored. The Ward salt operation became quite productive and helped to supply the maritime trade (Hustace 2000:41). In 1882 however, Curtis Ward passed away and his widow, Victoria Ward, eventually leased out the family's salt lands. Income from the leased salt lands was noted in the Ward business ledgers through the 1880s (Hustace 2000:50). A page in Victoria Ward's ledger for 1883 noted a yearly income of $651.50, which decreased to $487.40 in 1886.

Thrum (1924:116) states that the apex of the salt export trade in the Hawaiian Islands was in 1870 and that by 1883 “pulu, salt and oil have disappeared entirely” from the list of yearly exports (Thrum 1884:68). However, salt continued to be manufactured for local use, as evidenced by the Ward business ledgers and the continued existence of the Kakaʻako Salt Works until at least 1891. Thrum (1924:116) noted that the only salt producer on Oʻahu in 1916 was the Honolulu Salt Company. This is substantiated by a 1916 Commerce Report that in its discussion regarding salt production only mentioned the Honolulu Salt Company, which operated “salt beds at Puuloa, Kalihi, and Waikiki” (Taylor 1916:723). Based on these documents, salt production within the current project areas ceased sometime between 1887 and the early 1900s.

The historic salt pan remnants observed within the Block B East and Block C West project areas consist of an extensive complex. While this historic property description addresses only those finds documented within these two contiguous project areas, it should be noted that the adjacent Block I, located just *mauka*, and for which an AIS is still in progress, also contains a large area of associated salt pan remnants. This indicates the Ward Estate salt production was a large scale commercial enterprise.

6.1.1 Salt Pan Berms Description

6.1.1.1 Structural Form

The interlacing complex of berm structures was observed extensively throughout the contiguous project areas. Within the Block B East project area, 26 of the 38 test excavations contained berms; within the Block C West project area, 20 of the 36 test excavations contained berms. The observed berms varied widely in height, calculated as absolute height above the coral shelf. The maximum height of the berms was documented at 130 and 125 cm above the coral shelf (TE 9 in Block B East and TE 10 in Block C West, respectively), while the minimum height measured 40 and 32 cm above the coral shelf (TE 12 in Block B East and TE 5 in Block C West, respectively) (Figure 187 through Figure 193). The average height of the berms above the coral shelf was 71 and 84 cm, respectively. In general, the relative height of the berms was significantly above the level of the salt pan beds, indicating considerable earth-moving activity.

Many of the berm structures appeared markedly wide and/or long in extent. While observations were necessarily limited by the 2 by 20 ft dimensions of the test excavations, in many of the trenches the berms extended across the entire length of the test excavation, indicating continuance (TE 3, 5, 10, 13, 19, 22, 24, and 25 within Block C West; TE 5, 7, 11, 12, 15-20, 27, and 28 within Block B East) (see Figure 189, Figure 191). In a few cases, the apex of a berm structure was identifiable, allowing a better estimation of actual berm form and width. Within Block B East, TE 5 documented a berm apex near the center of the trench, measuring 90 cm above the coral shelf with the berm sloping gently down to either side and continuing into the sidewalls. This cross section shows a moderately mounded berm which slopes gently down to a level expanse on either side of the berm, indicating a wide berm extending well over 20 ft in width and oriented northwest-southeast (Figure 192, Figure 193). TE 17 within Block C West shows similar structural characteristics with the berm apex measuring 97 cm above the coral shelf and gently sloping to either side, and again oriented northwest-southeast (Figure 194, Figure 195).

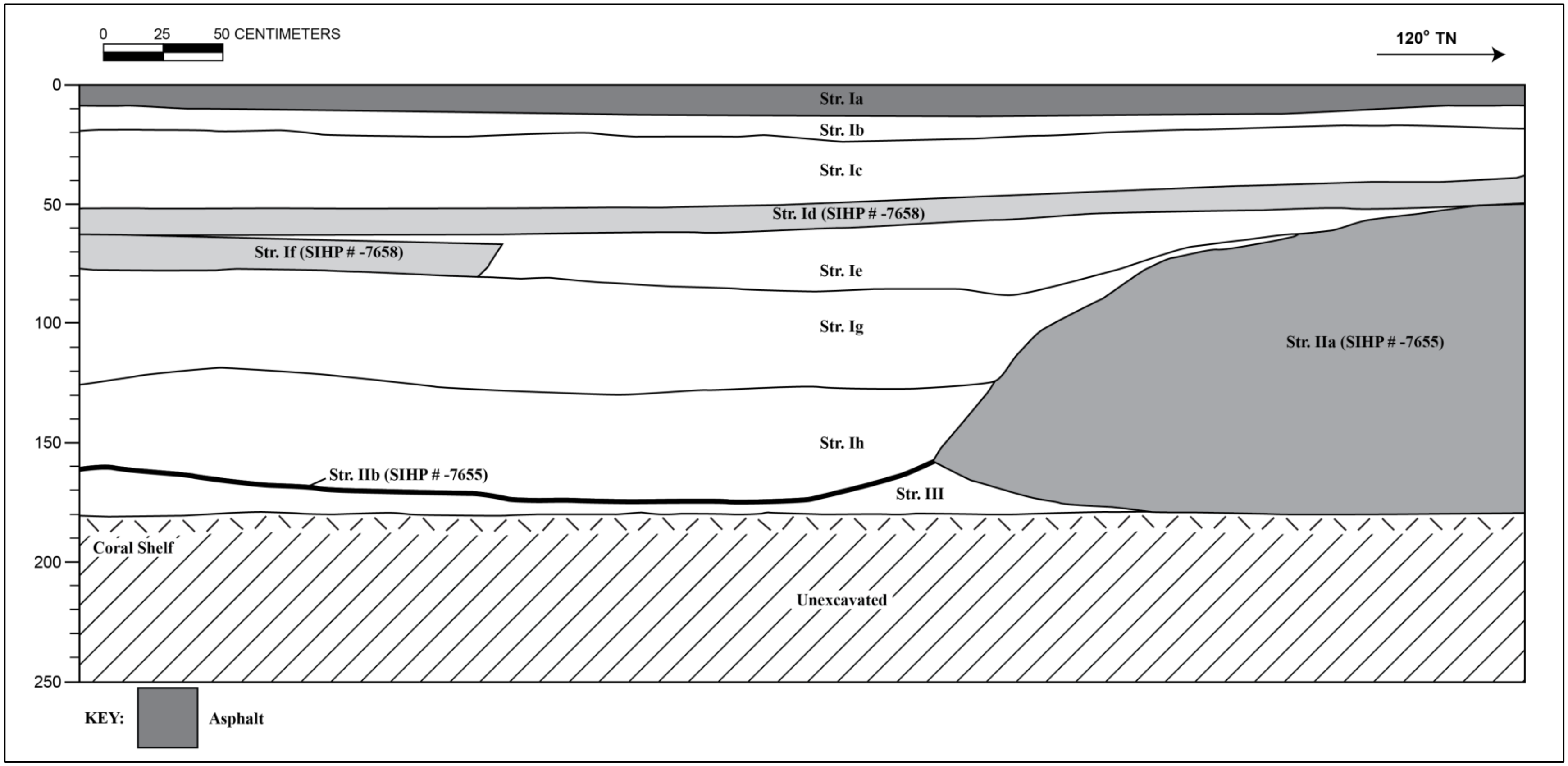

Figure 187. Profile of TE 9 (Block B East) north wall, showing a high berm structure (Stratum IIa/SIHP # -7655), measuring 130 cm above the coral shelf

Figure 188. Photograph of TE 9 north wall, showing a high berm structure sloping down to a low-lying salt pan bed, SIHP # -7655

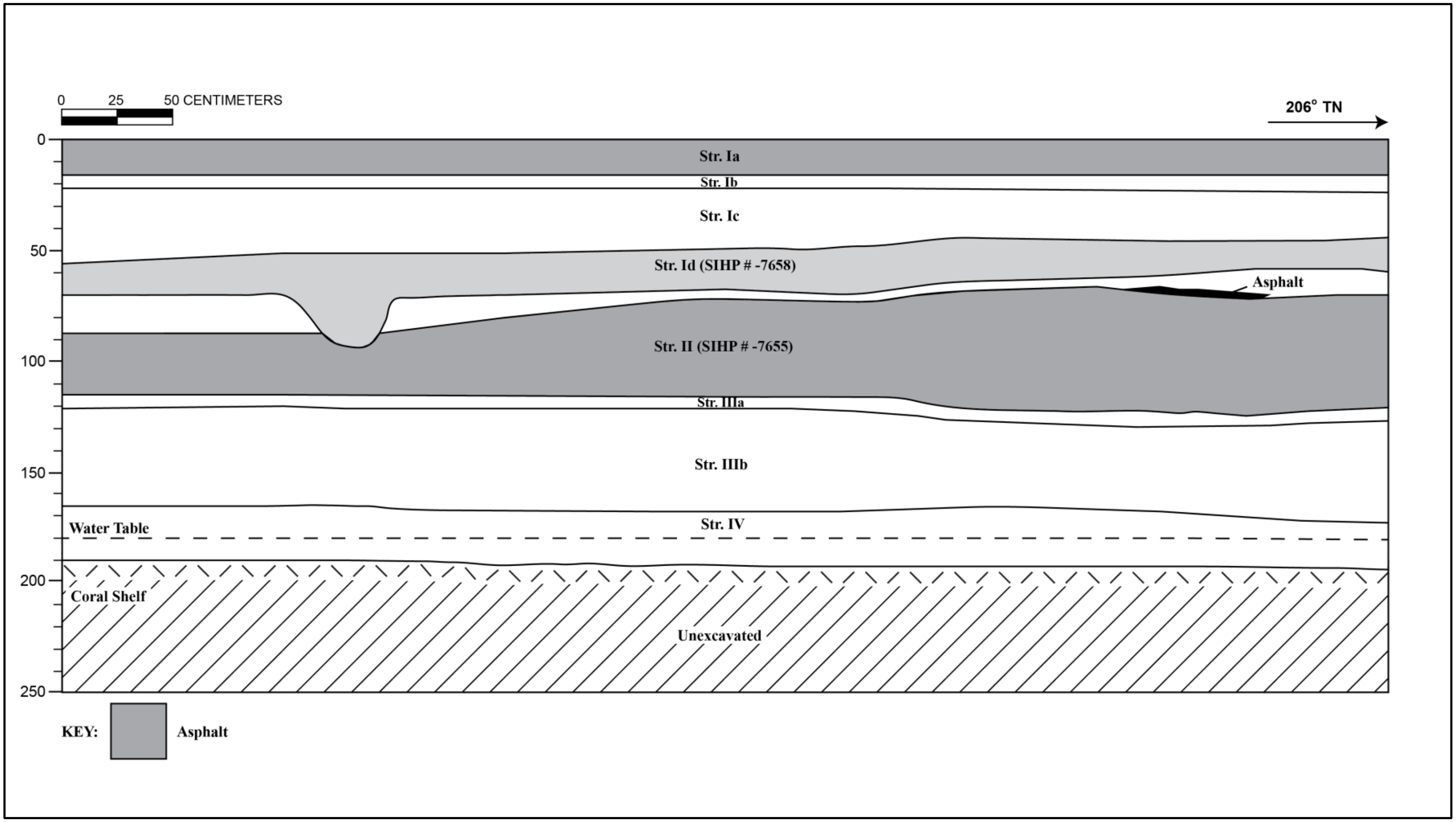

Figure 189. Profile of TE 10 (Block C West) southeast wall, showing a high berm (Stratum II/SIHP # -7655), constructed 125 cm above the coral shelf

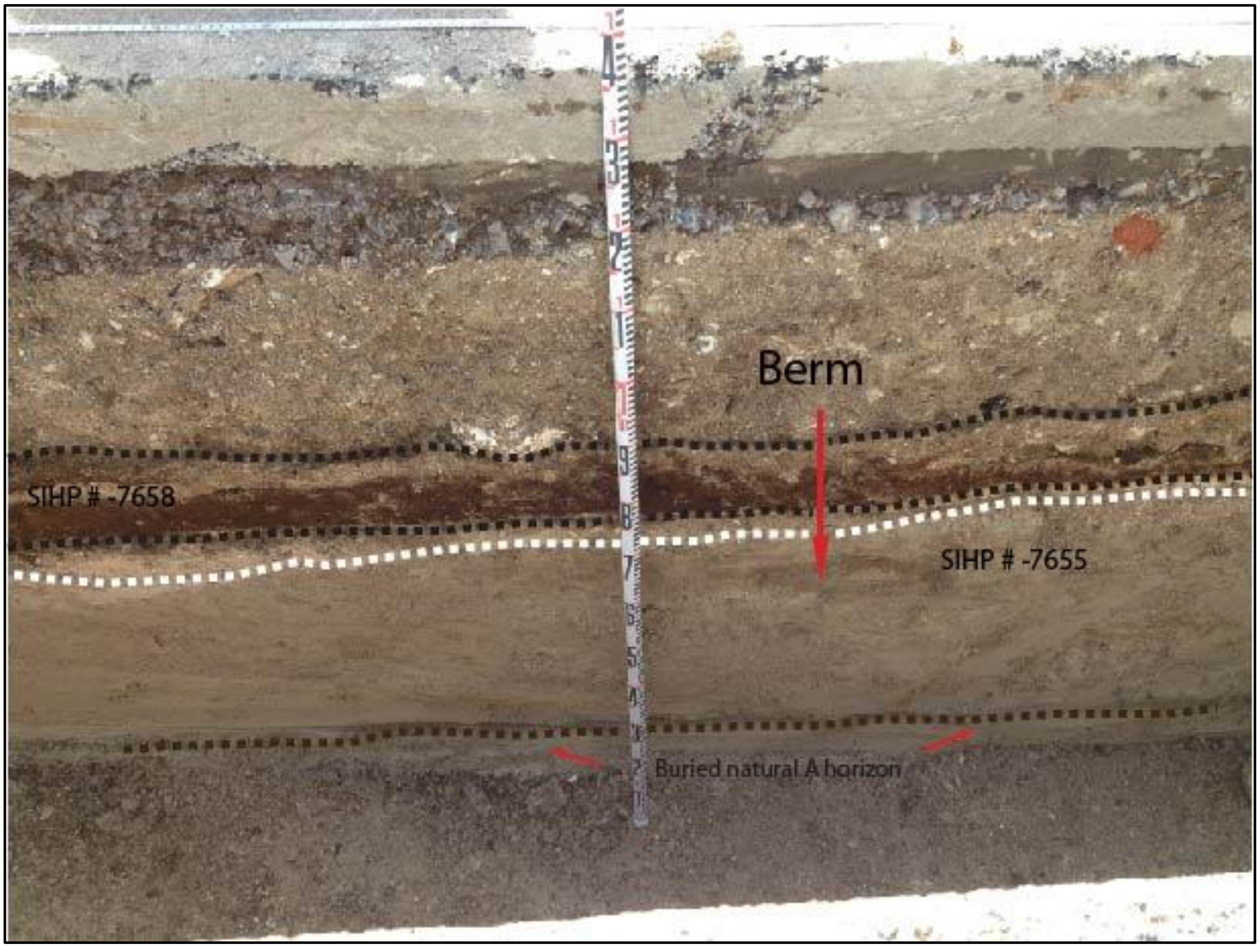

Figure 190. Photograph of TE 10 (Block C West) southeast sidewall, showing a man-made berm structure (Stratum II/SIHP # -7655), overlying a natural A horizon and wetland sediments

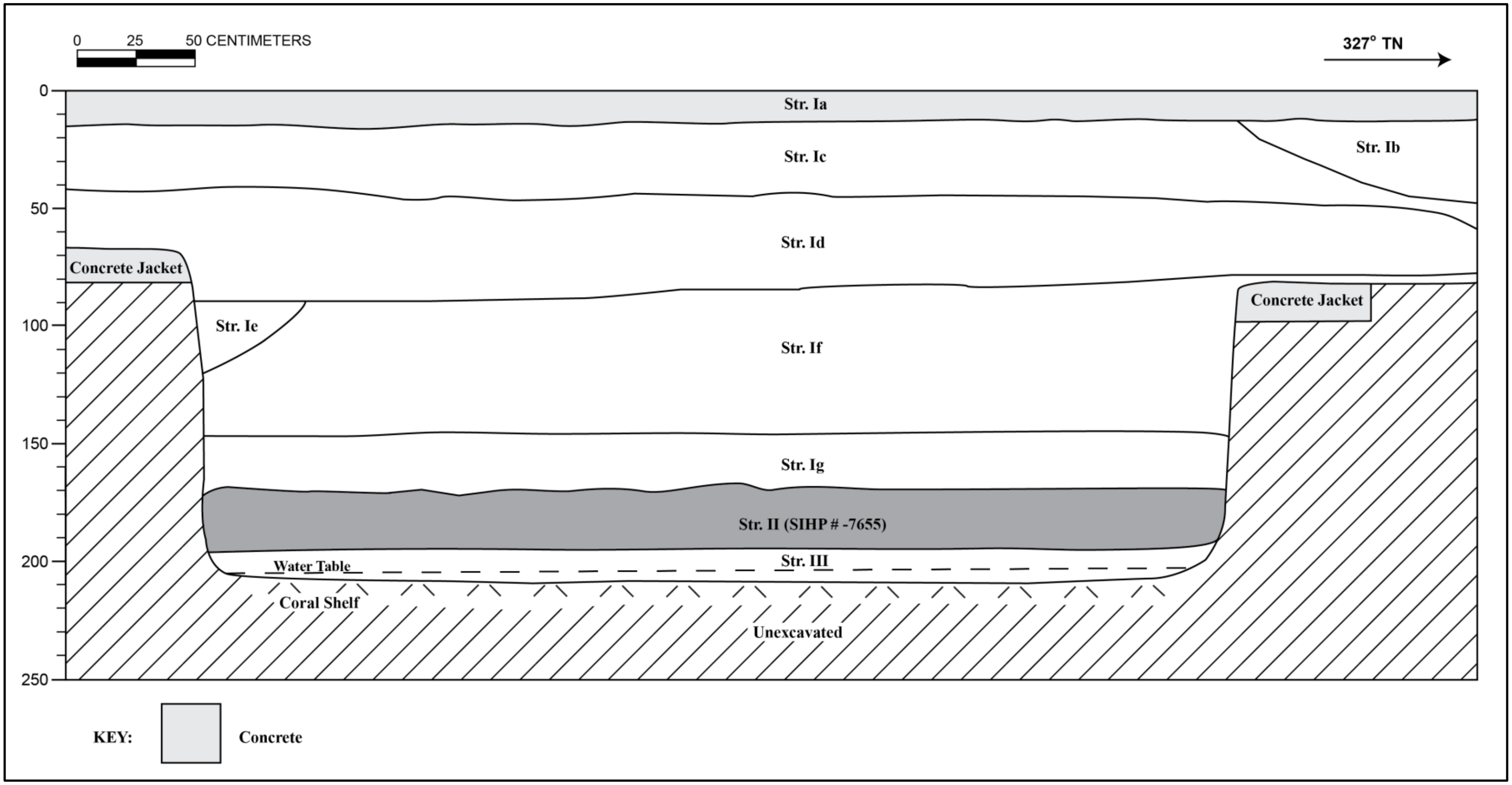

Figure 191. Profile of TE 12 (Block B East) southwest wall, showing a low berm structure (Stratum II/SIHP # -7655), measuring only 40 cm above the coral shelf

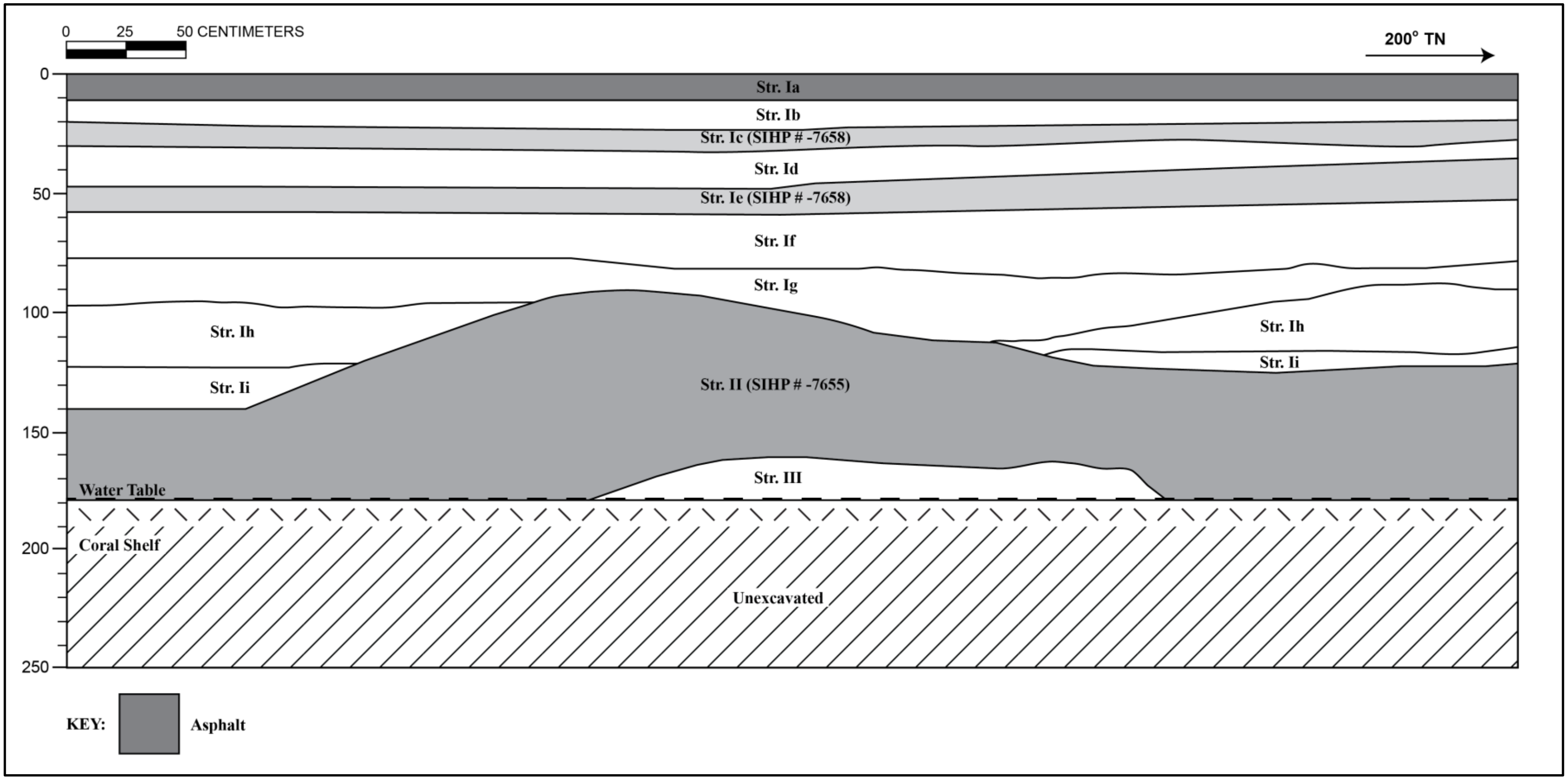

Figure 192. Profile of TE 5 (Block B East) southeast wall, showing a berm apex (Stratum II/SIHP # -7655), measuring 90 cm above the coral shelf, with the berm sloping gently down to either side and continuing into the sidewalls

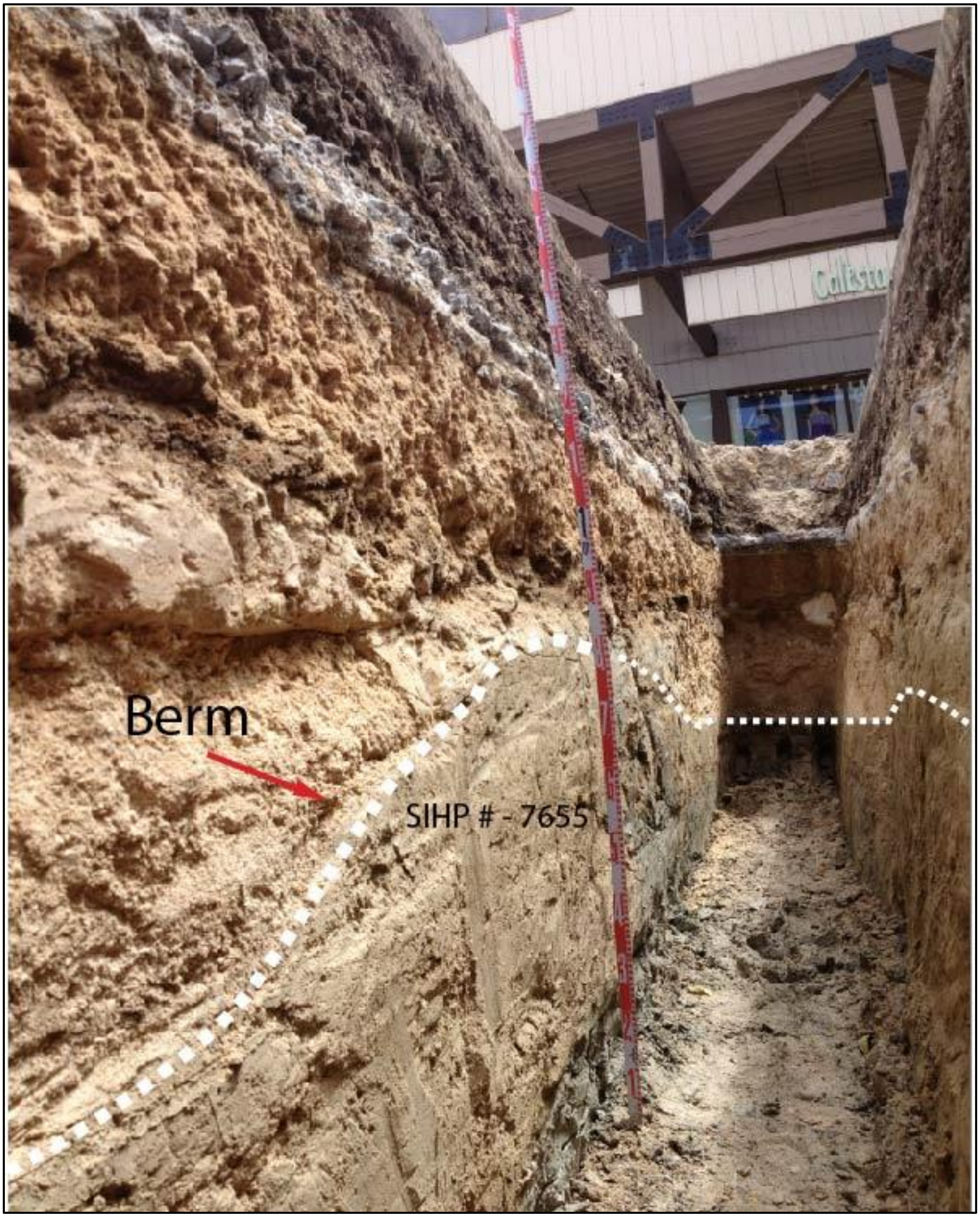

Figure 193. Photograph of the TE 5 southeast sidewall, showing a mounded berm structure, SIHP # -7655

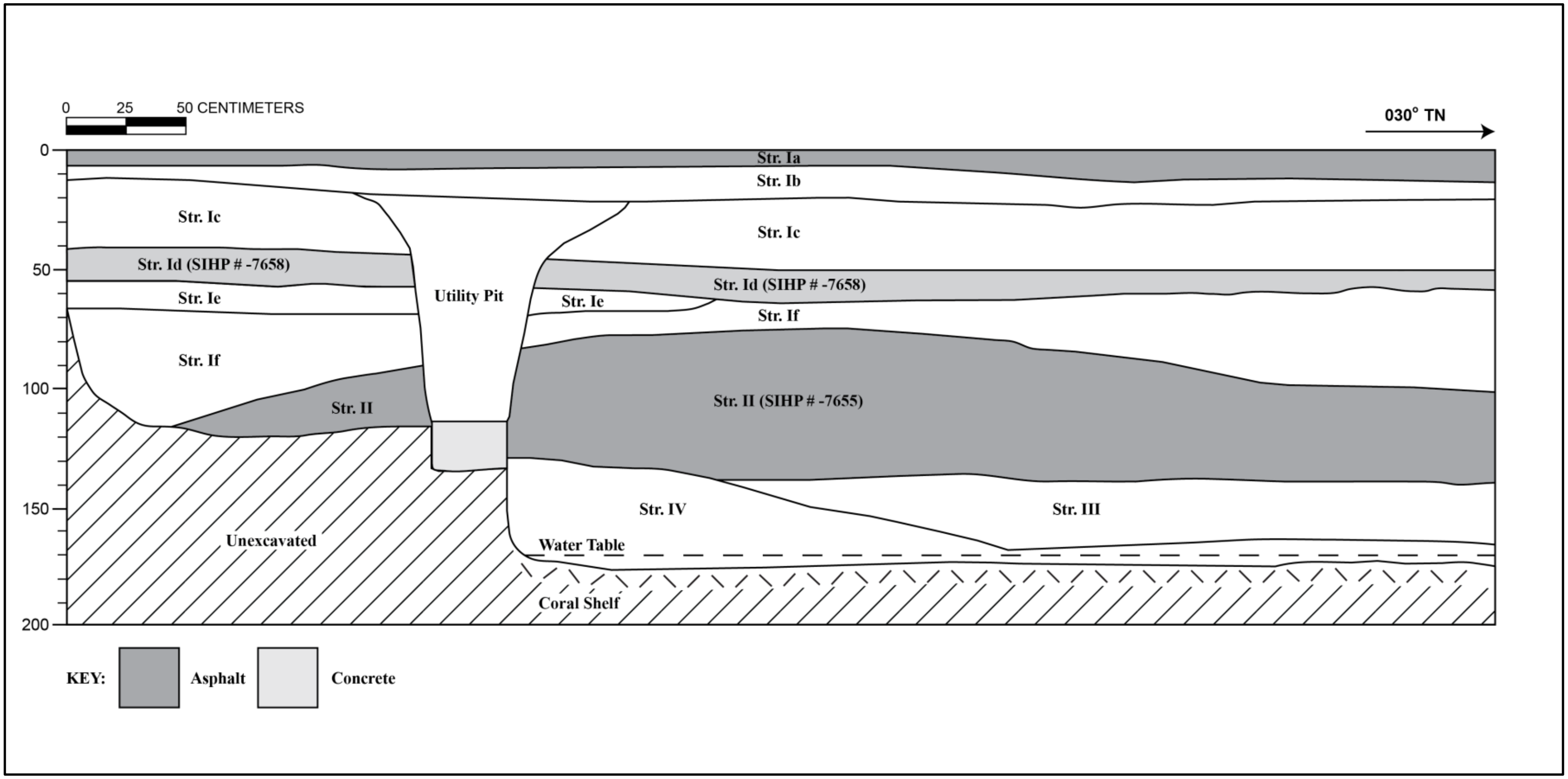

Figure 194. Profile of TE 17 (Block C West) northwest wall, showing a berm apex (Stratum II/SIHP # -7655), measuring 97 cm above the coral shelf, with the berm sloping gently down to either side and continuing into the sidewalls

Figure 195. Photograph of the TE 17 northwest sidewall, showing a mounded berm structure, SIHP # -7655

In order to better understand the structural characteristics of the salt pan berms, an elongated 8.0 m long test excavation (TE 37 within Block B East) was placed to cross section a previously excavated trench (TE 7) which showed a continuous, level berm extending through the test excavation. An inherent interpretive difficulty encountered during the AIS investigations arose from the inability to discern, in those excavations in which the berm was visible running the extent of the sidewall, whether the berm was being observed in cross section or lengthwise. TE 37 documented a cross section of the berm, indicating that TE 7 had exposed the length of the berm, which was oriented *mauka-makai*. Within TE 37, the berm rose relatively steeply from the edge of the salt pan bed, then sloped very gently down towards the southern end and continued into the sidewall (Figure 196, Figure 197). TE 37 documented a wide berm, over 6 m in length, which remained relatively level with a very gentle slope on one side and a steeper slope at the edge of the salt pan bed.

Based on the documented orientation of the above test excavations (as well as several others), the berm complex was oriented *mauka-makai* with perpendicular cross berms, indicating a grid-like system. Many of the berms also appeared to be relatively wide. Interestingly, wide earthen divisions between salt pan beds are also visible in the Borget sketch of Honolulu salt pans (see Figure 186).

While the majority of the berms observed appeared to slope gently, several exceptions were also observed in which the berms rose quite steeply from the edge of the salt pan beds. The most prominent examples were documented within TE 9 and TE 36 (Block B East), as well as the above-mentioned TE 37, and TE 18 and TE 30 (Block C West). In these cases, the salt pan beds were unusually low, located just above the coral shelf with the berms rising at a 45–55° angle (see Figure 187, Figure 198).

While the majority of the documented berms were quite wide and/or long, several smaller berms were also observed. In some cases, the test excavations likely caught the tip of a berm; however, it may also be the case that some berms were smaller in scale. The *Planters' Monthly* description of the Kakaʻako Salt Works mentioned a total of 56 sets of ponds, each containing seven ponds. It may be that the inner set of ponds contained smaller berm divisions than the overall "pond set" boundary. Differences between ponds is also implied in the description of the "strike" ponds (The *Planters' Monthly*: 1892), which stated, "The strike ponds are arranged parallel with each other with their tributary or auxiliary ponds between." TE 4 (within both project areas) contained examples of smaller berm structures (Figure 199, Figure 200, and Figure 201).

In general, the salt pan berm structures were encountered throughout the project area. However, a notable concentration of berm archaeosediments was documented within the western portion of the Block B East project area. An overlay of the trench locations on a 1927 aerial photograph shows the test excavations within an area of dense vegetation along the path of the Ward *ʻauwai* (both the original *ʻauwai* which ran through the vicinity of TE 20 and the modern concretized channel visible running through TE 15 and TE 17 in the figure) (Figure 202, Figure 203, Figure 204). Given the extent of the archaeosediments in this area, and the fact that they extend evenly across the full extent of each of the test excavations (TE 11, 12, 15-20, and 27), this area likely contained a wide causeway. In addition to including the Ward Estate *ʻauwai*, foot trails and/or transport ways were likely present.

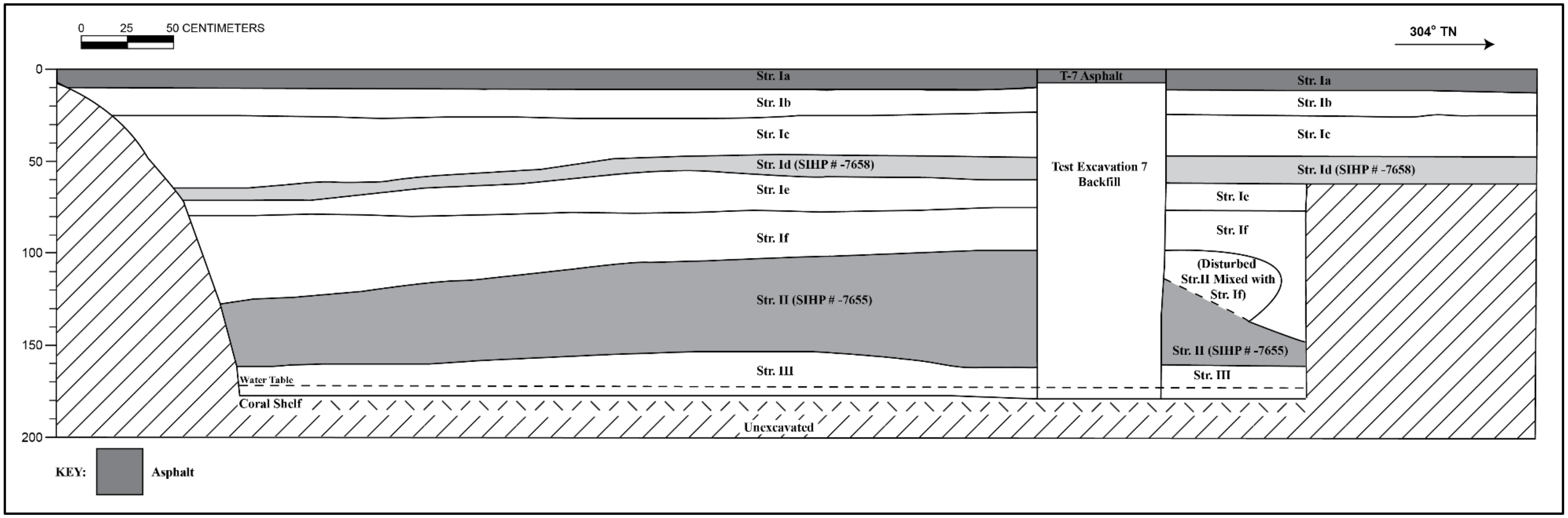

Figure 196. Profile of TE 37 (Block B East) southwest sidewall, showing the cross-section of a wide berm (Stratum II/SIHP # -7655), running *mauka-makai* through the project area

Figure 197. Photograph of the TE 37 southwest sidewall, showing a wide berm, SIHP # -7655, which descends steeply to low-lying wetlands at the northwest (far) wall

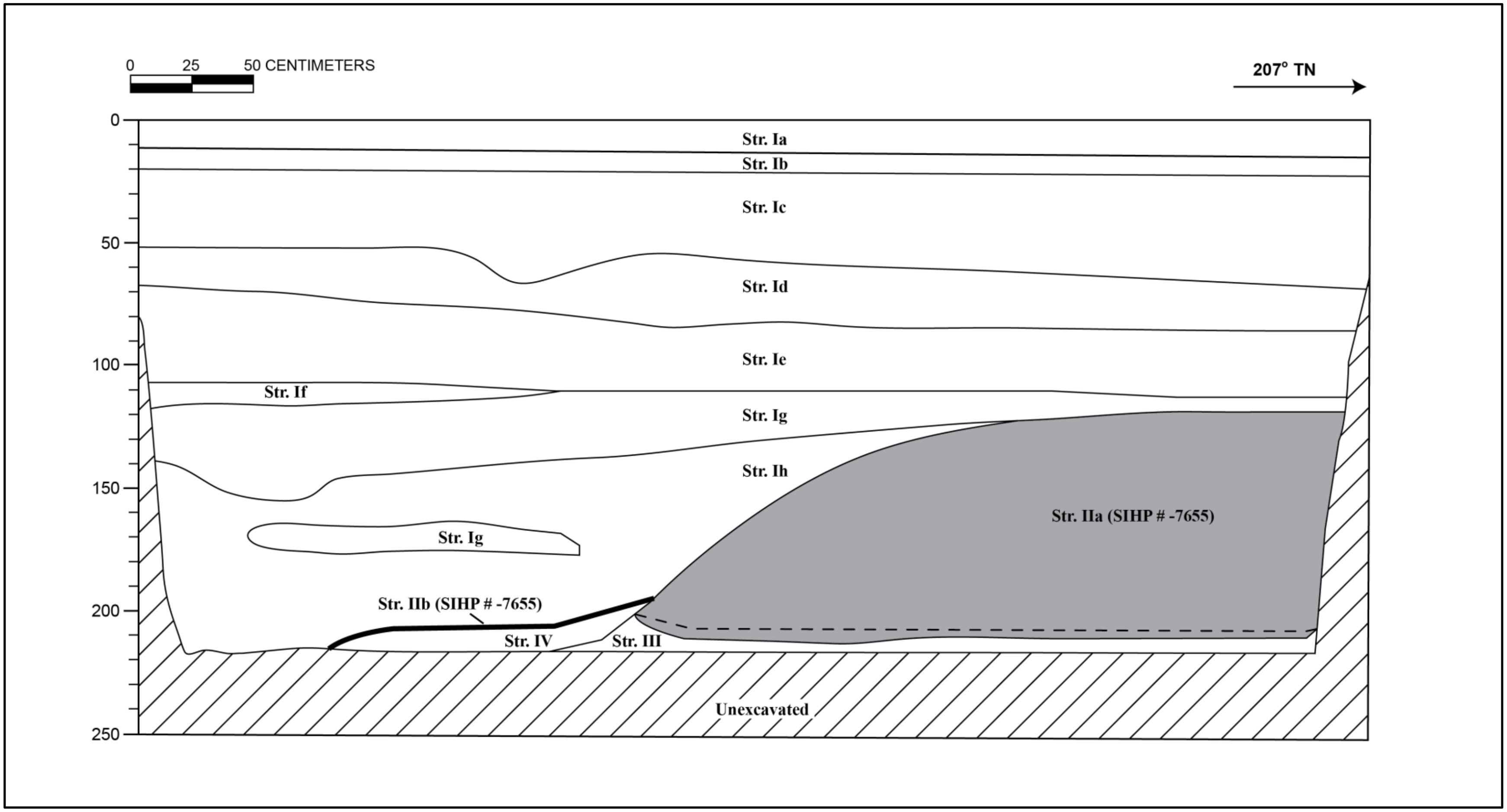

Figure 198. Profile of TE 30 southeast sidewall (Block C West), showing a steep berm (Stratum IIa/SIHP # -7655) transitioning to a very low salt pan bed

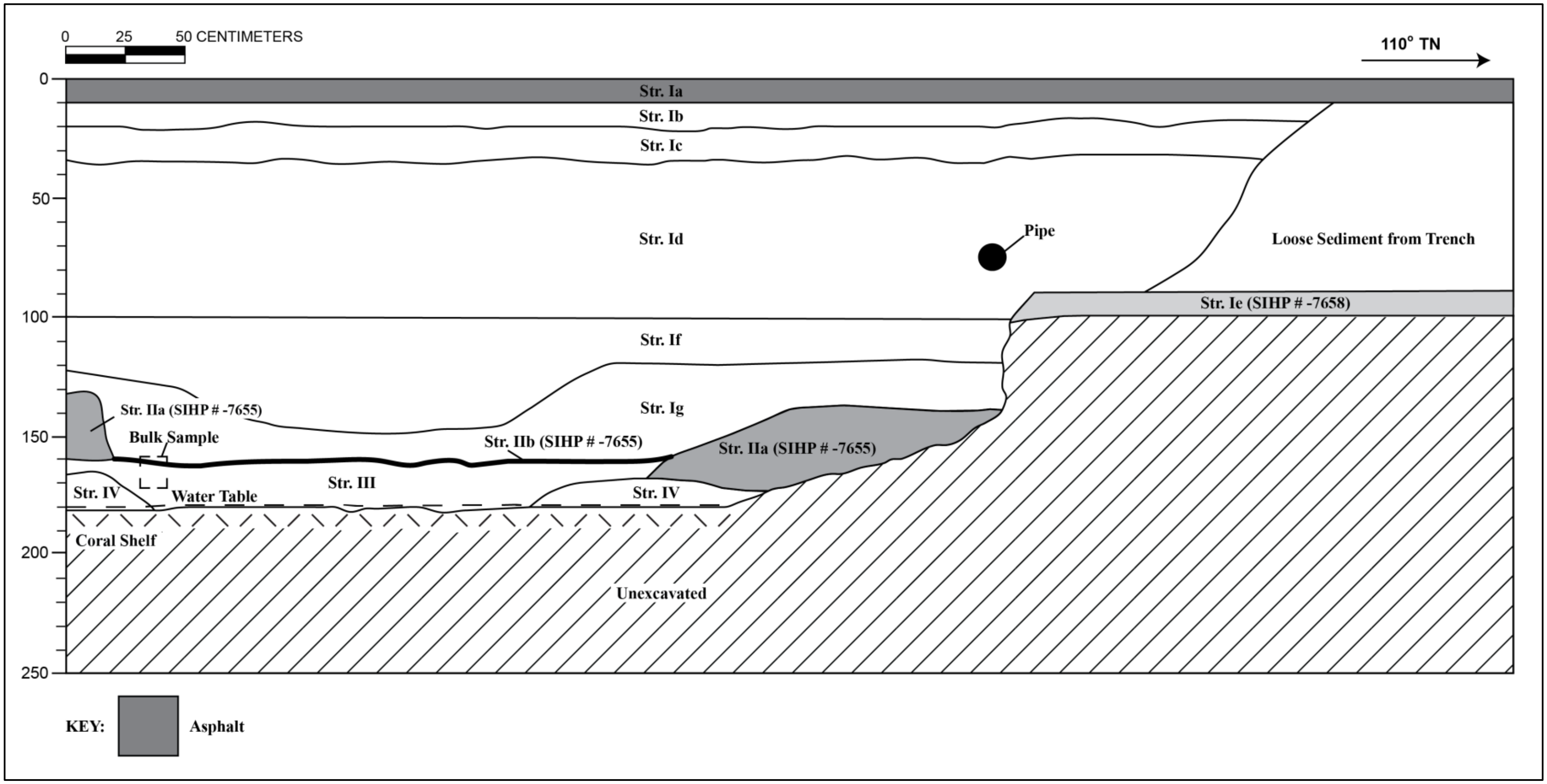

Figure 199. Profile of TE 4 (Block B East) northeast wall, showing two low berm structures (Stratum IIa/SIHP # -7655)

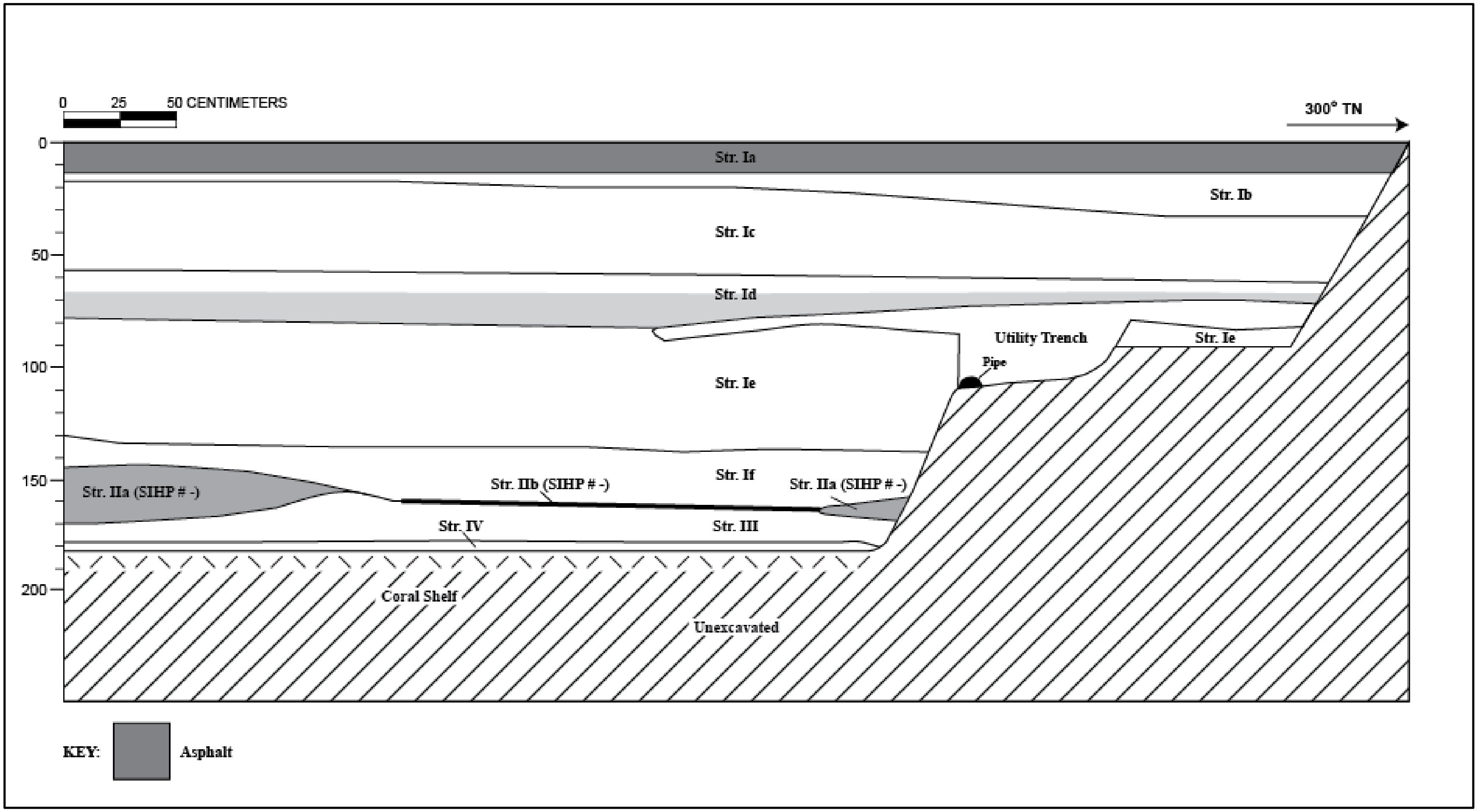

Figure 200. Profile of TE 4 (Block C West), similarly showing low berm structures (Stratum IIa/SIHP # -7655)

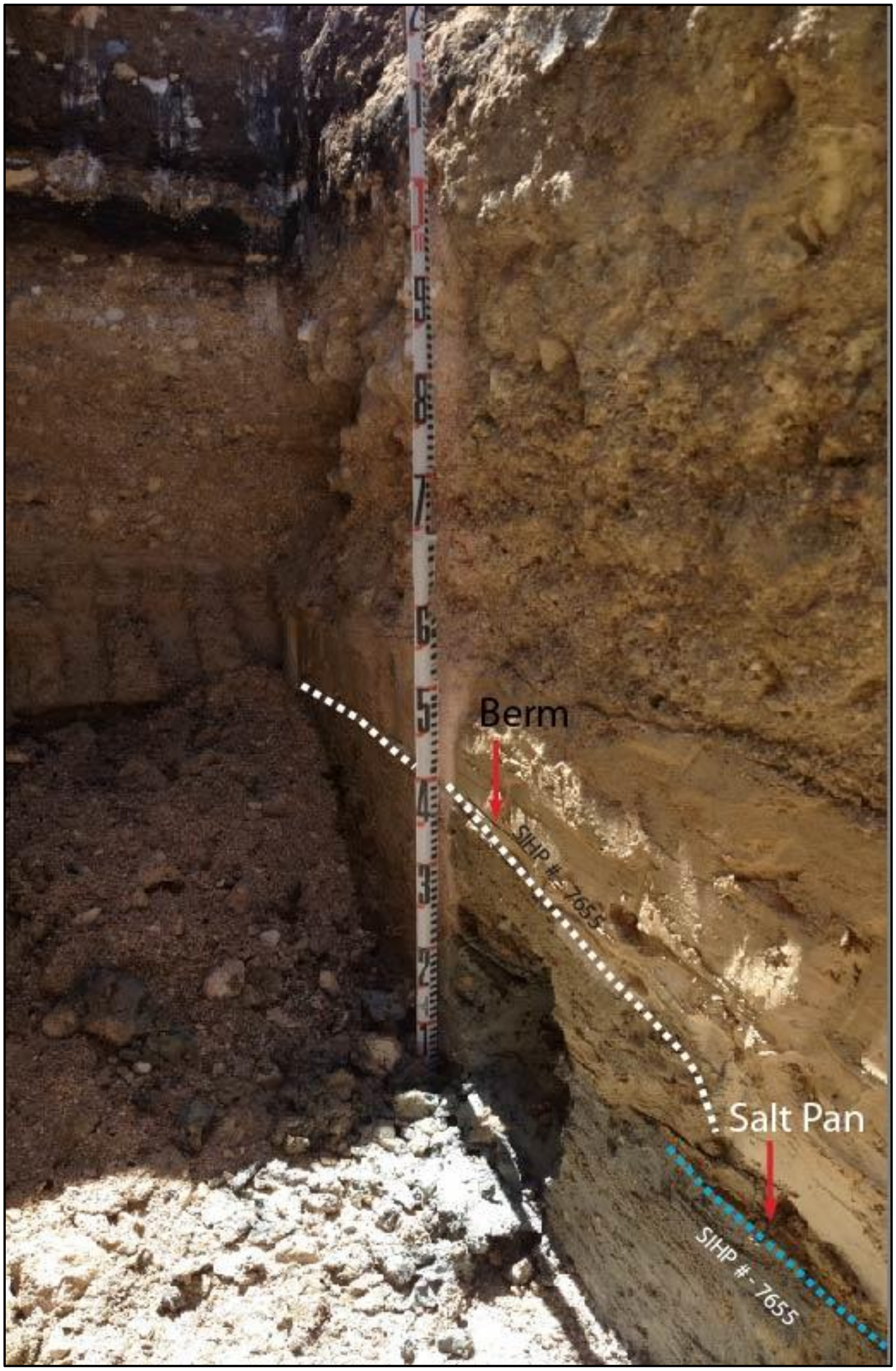

Figure 201. Close-up photo of low berm within TE 4 (Block C West), SIHP # -7655

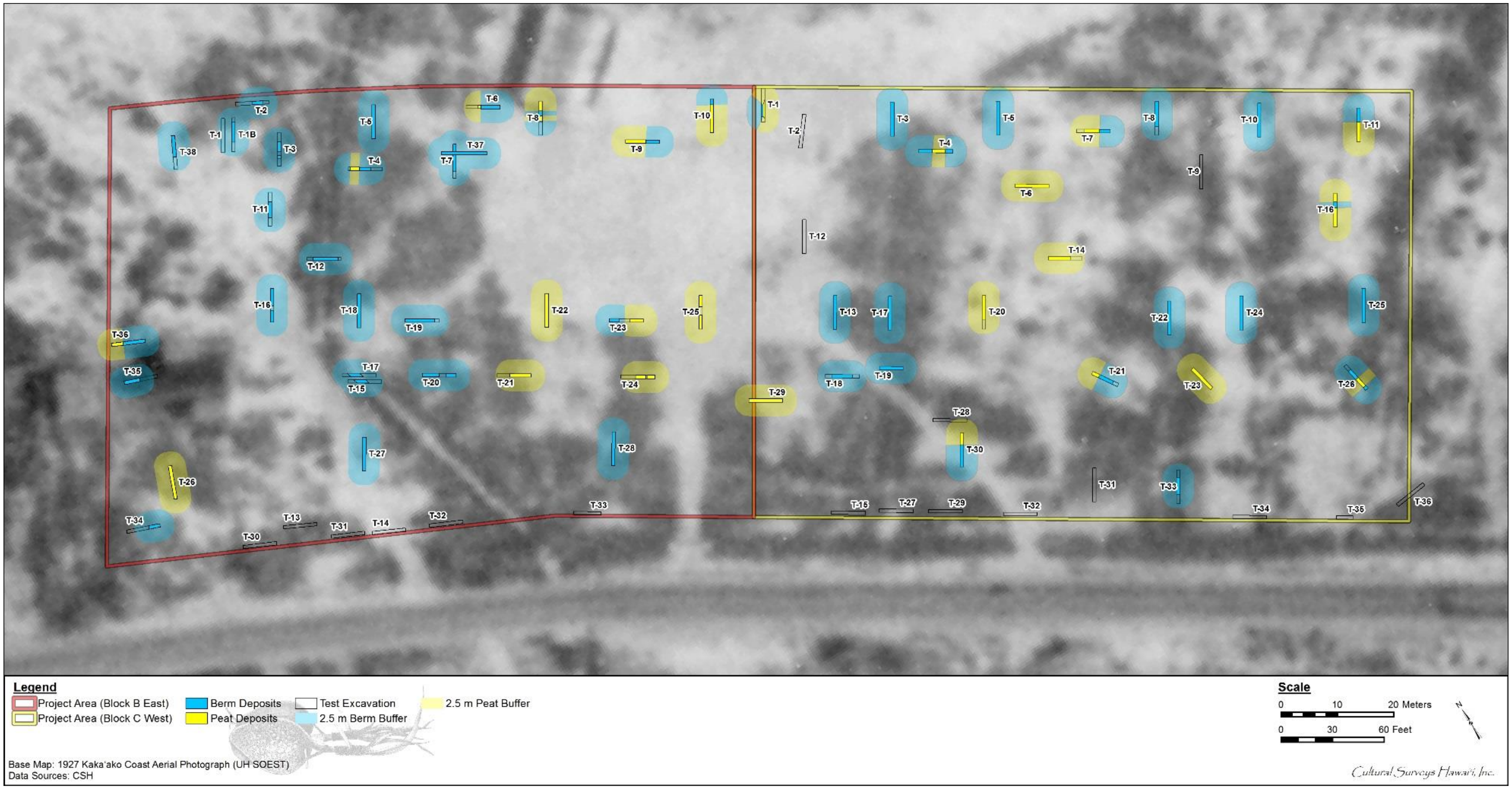

Figure 202. 1927 aerial photograph showing the location of documented salt pan berm remnants (blue) and salt pan bed deposits (yellow) within the Block B East and Block C West project areas (UH SOEST: 1927 Kaka‘ako Coast Aerial Photograph)

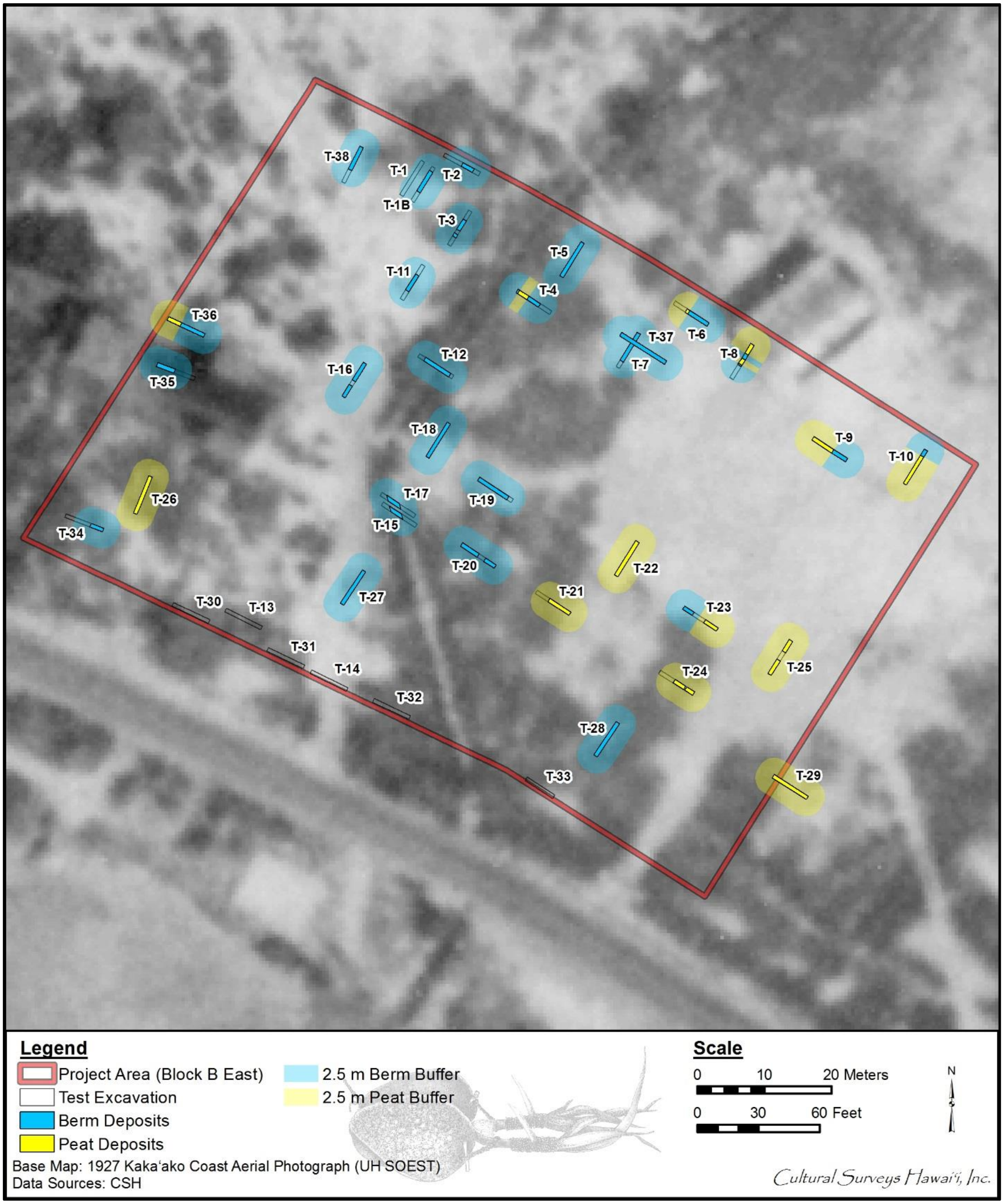

Figure 203. Close-up of Block B East, showing the concentration of berm sediments within a swath of dark vegetation and along the area of the Ward Estate *'auwai* (UH SOEST: 1927 Kaka'ako Coast Aerial Photograph)

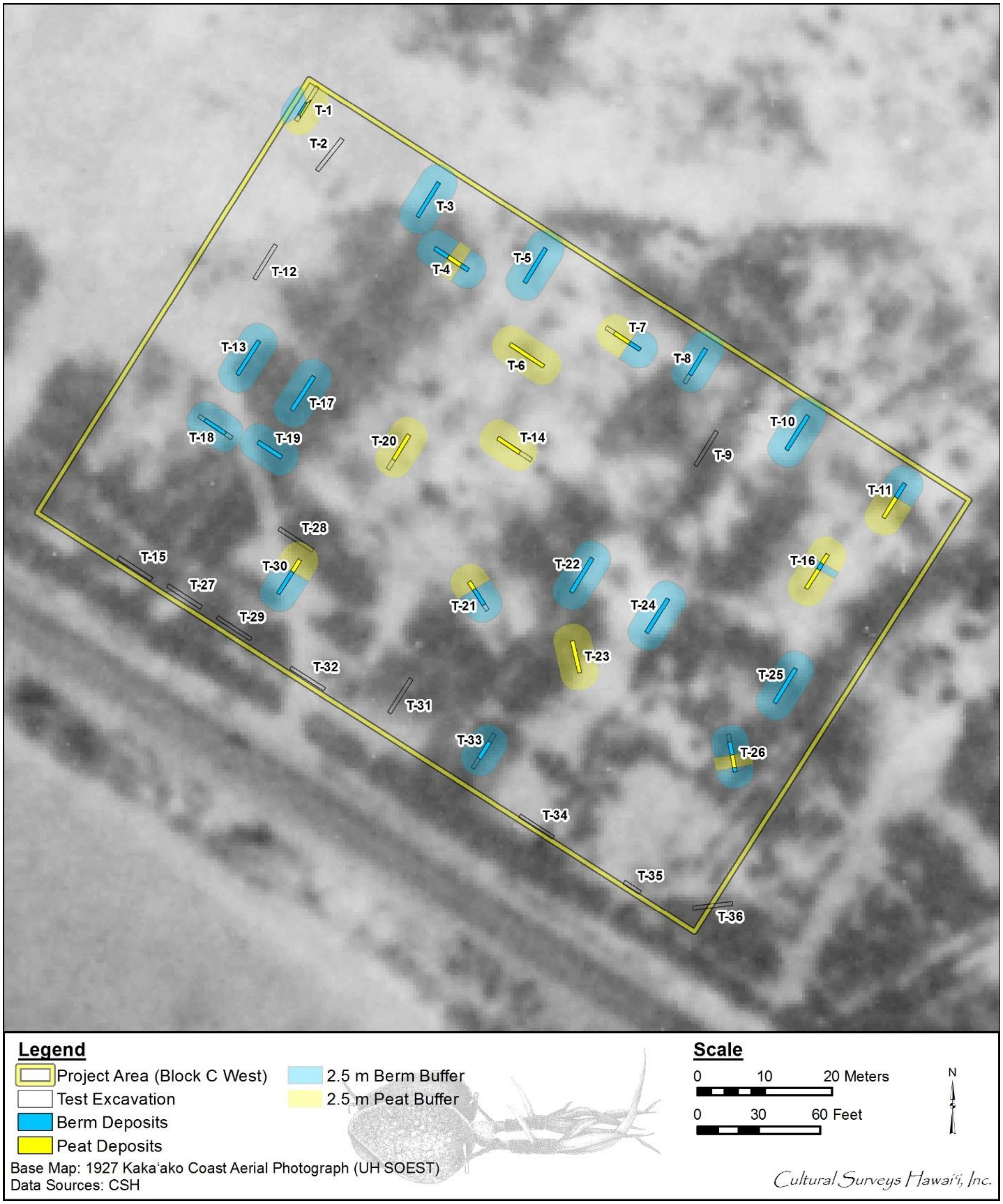

Figure 204. Close-up of Block C West, showing interspersed man-made berm structures and salt pan beds (UH SOEST: 1927 Kaka‘ako Coast Aerial Photograph)

6.1.1.2 Composition

The composition of the salt pan berms was remarkably uniform throughout the Block B East and Block C West project areas, consisting of medium-grained sandy clay. The color of the berm sediment ranged slightly from pale yellow to very pale brown to light gray. Notably, the color, texture, and consistency of the berm sediments corresponded closely with the natural wetland/marine sediments within the project areas, including the natural marine sandy clays along the coastal boundary. It seems most likely that the berms were constructed from the locally available wetland/marine sandy clays, being anthropogenic modifications of the original surface into mounded structures. This can be seen within Test Excavation 10 (Block C West), which consisted of a berm overlying a buried wetland A horizon and natural sandy clays (see Figure 190). The berm was composed of medium sandy clay, pale yellow in color (2.5Y 7/3) with moderate structure. The natural sediment underlying the A horizon consisted of fine sandy clay, pale yellow in color (2.5Y 7/4) with strong structure and strong plasticity, grading to a more gleyed clay at the water table. The berm archaeosediment was slightly coarser and less structured than the natural sandy clays, as would be expected of reworked deposits.

The effects of disturbance and reworking of the natural sandy clays are similarly visible in the test excavations along the *makai* boundary of the project areas, and provide a parallel example of the change in sediment characteristics caused by human activity, as well as substantiate the idea that the berm sediments are composed of local deposits. Within the test excavations along the coastal edge of the project areas, the in situ marine fine sandy clay was overlain by a disturbed sandy clay (generally caused by the installation of subsurface utility lines). The in situ sandy clay was observed as pale yellow in color (2.5Y 7/3) and consisting of a fine, plastic, well-structured sediment. Like the berm sediments, the overlying disturbed sandy clay was light yellowish brown in color (2.5Y 6/3) and consisted of coarser grained, less structured and less plastic sediment.

In some cases, the berm sediments included patches or swirls of gleyed clay, which was scraped up from the underlying gleyed wetland sediments. This was particularly evident in areas where the berm extended to the coral shelf, indicating significant disturbance to and/or complete removal of the natural sediments during berm construction (see Figure 192, Figure 193).

6.1.1.3 Evidence of Land Stability

Historic documents suggest the Ward Estate salt lands were in active production from 1873 until the 1890s or early twentieth century. This represents approximately 15 to 30 years of salt production and maintenance of the salt pan berms and beds. Evidence of this passage of time, or period of land stability, was encountered within several test excavations and consisted of layered berm sediments and developing A horizons. Two berm structures, TE 11 (Block C West) and TE 23 (Block B East), exhibited overlying berm layers, representing multiple berm building events. Within TE 11, the overlying berm sediment (Stratum IIa) was distinguished by a distinct color difference (light gray overlying light yellowish brown/Stratum IIb) and had been constructed atop a forming A horizon located at the upper boundary of Stratum IIb (Figure 205, Figure 206). The second berm deposit raised the overall berm height by 20 cm. The A horizon at the interface of the berm deposits consisted of an organic and charcoal stained, coarser sandy clay layer. Within TE 23, the two overlying berm sediments were distinguished by a very slight color difference and slight textural variation (silty clay versus sandy clay) (Figure 207, Figure 208).

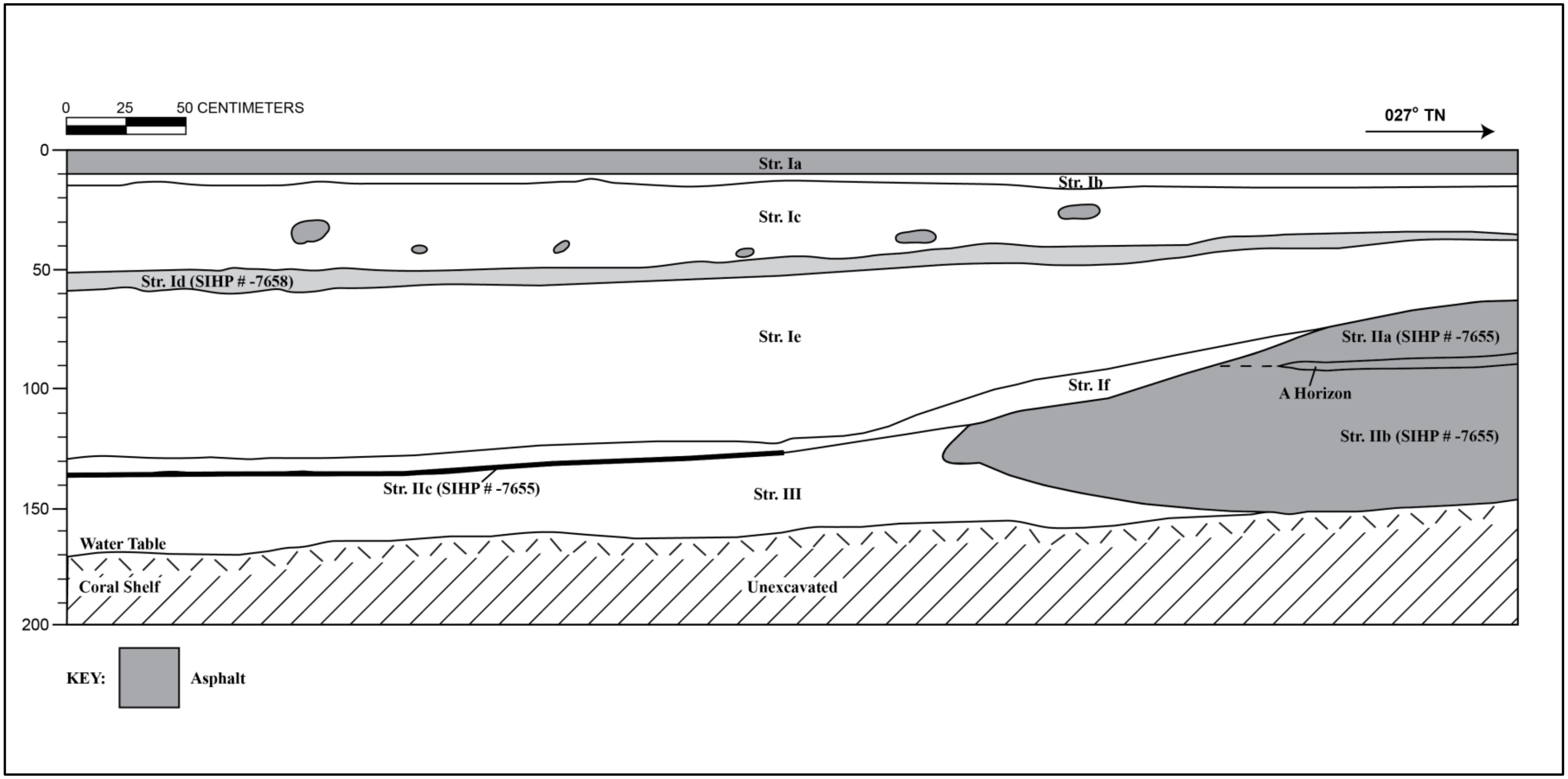

Figure 205. Profile of TE 11 (Block C West) northwest sidewall, showing two berm events (Strata IIa and IIb/SIHP # -7655)), including a forming A horizon at the upper boundary of the earlier (lower) berm deposit

Figure 206. Photograph of TE 11 mauka wall (Block C West), showing two berm deposits separated by a dark-stained A horizon, SIHP # -7655

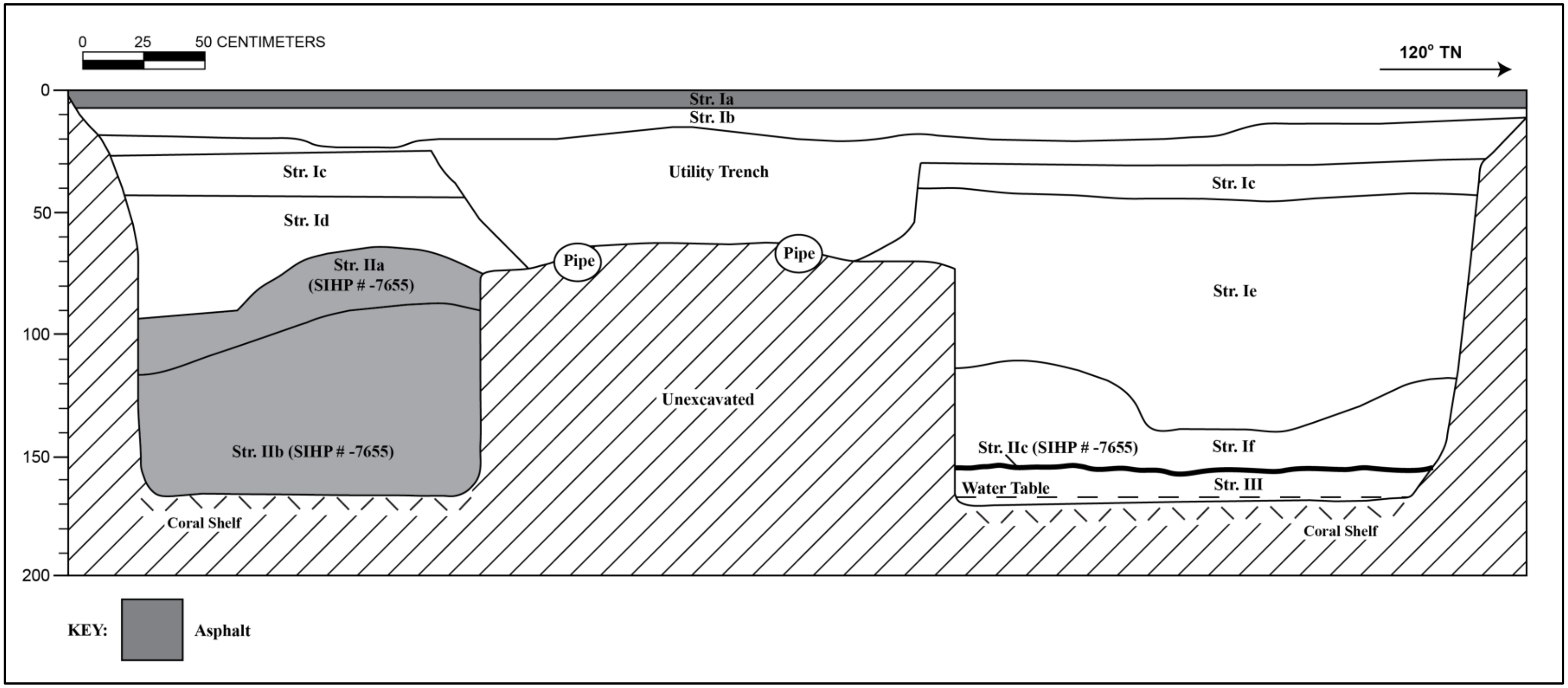

Figure 207. Profile of TE 23 northeast sidewall (Block B East), showing two berm events (Strata IIa and IIb/SIHP # -7655)

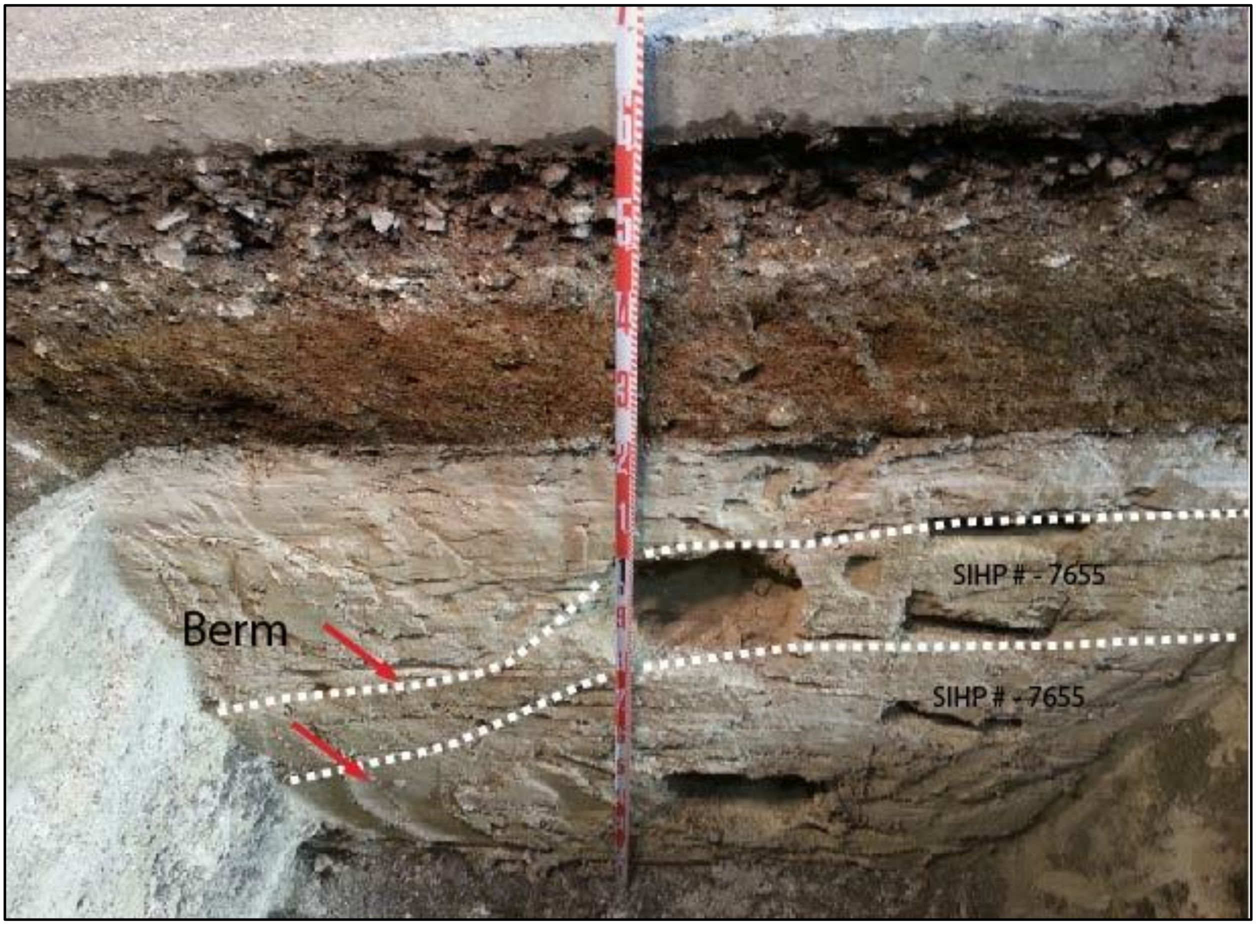

Figure 208. Photograph of the northwest end of the TE 23 northeast sidewall, showing the two berm building events (Strata IIa and IIb), SIHP # -7655

A horizons were also found forming atop berm sediments within TE 7 and TE 37 (Block B East). Within TE 7, the A horizon consisted of an approximately 3 cm thick layer. Within TE 37, a thin dark stained layer was observed at the upper boundary of the berm and included metal fragments. In addition, charcoal from an underground oven or kiln was documented on the steep slope of the berm, which was likely transported to this location and indicative of historic activity.

6.1.1.4 Features

Two distinct structural features were identified as associated with salt pan berm construction. Both features were located within the Block B East project area and consisted of placed tabular limestone boulders.

SIHP # -7655 Feature 1 was documented within Test Excavations 15 and 17, located within the west-central portion of the project area. Feature 1 consisted of a layer of level, tabular limestone boulders which formed a cohesive surface and appeared to have been placed (Figure 209 through Figure 212). The limestone boulders, measuring approximately 20 cm high and 65 cm long, were located at the interface between natural in situ wetland sediment and the overlying man-made berm. The limestone boulders were primarily found within TE 17, extending between both sidewalls. TE 15, which was specifically relocated adjacent to TE 17 in order to further document this feature, contained the tabular limestone blocks only within the northern corner of the test excavation, thus defining the southern boundary of this structure. The blocks appeared to have a structural function and were determined to be associated with historic land modification activities, and likely associated with the salt pan remnants.

SIHP # -7655 Feature 2 was documented within Test Excavation 38, located within the northern corner of the project area. Feature 2 consisted of a formation of limestone boulders and cobbles located at the edge of a salt pan berm (Figure 213 and Figure 214). The structure appeared man-made, with tabular boulders forming a level top surface, which was supported by large, rounded coral blocks in-filled with coral cobbles. None of the blocks showed evidence of having been cut, or modified, but rather appeared to represent an assemblage of naturally available building material. The feature appeared to be integrated into the man-made berm (Stratum IIa), as the low, level berm merged into and slightly over the limestone structure.

Feature 2 was located at the transition between the salt pan berm (Stratum IIa) and natural peaty wetland sediments (Stratum IIc). The peat material appeared to be naturally occurring pond sediments, consisting of marine clays and a large abundance of rootlets. The limestone boulders may have been placed as a lining around the pond to aid in separating the pond from an adjacent salt pan bed; however, the transition between the pond and the limestone boulders was removed by the previous disturbance and unable to be fully analyzed. Additionally, a water line running parallel to the test excavation within the northwest sidewall had removed a portion of the limestone blocks.

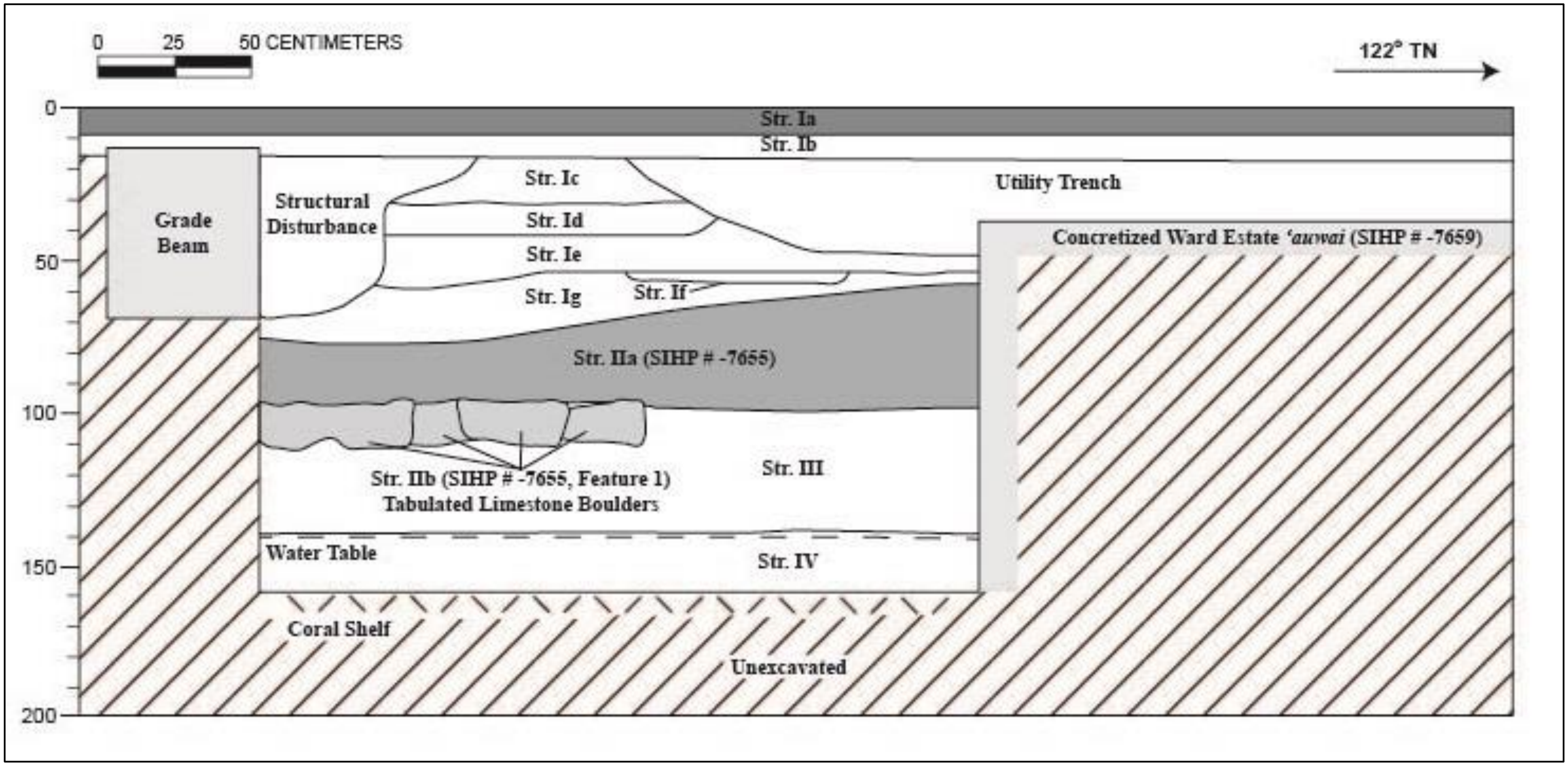

Figure 209. Profile of TE 15 northeast sidewall (Block B East), showing a berm event over tabular limestone from Feature 1(Strata IIa and IIb/SIHP # -7655)

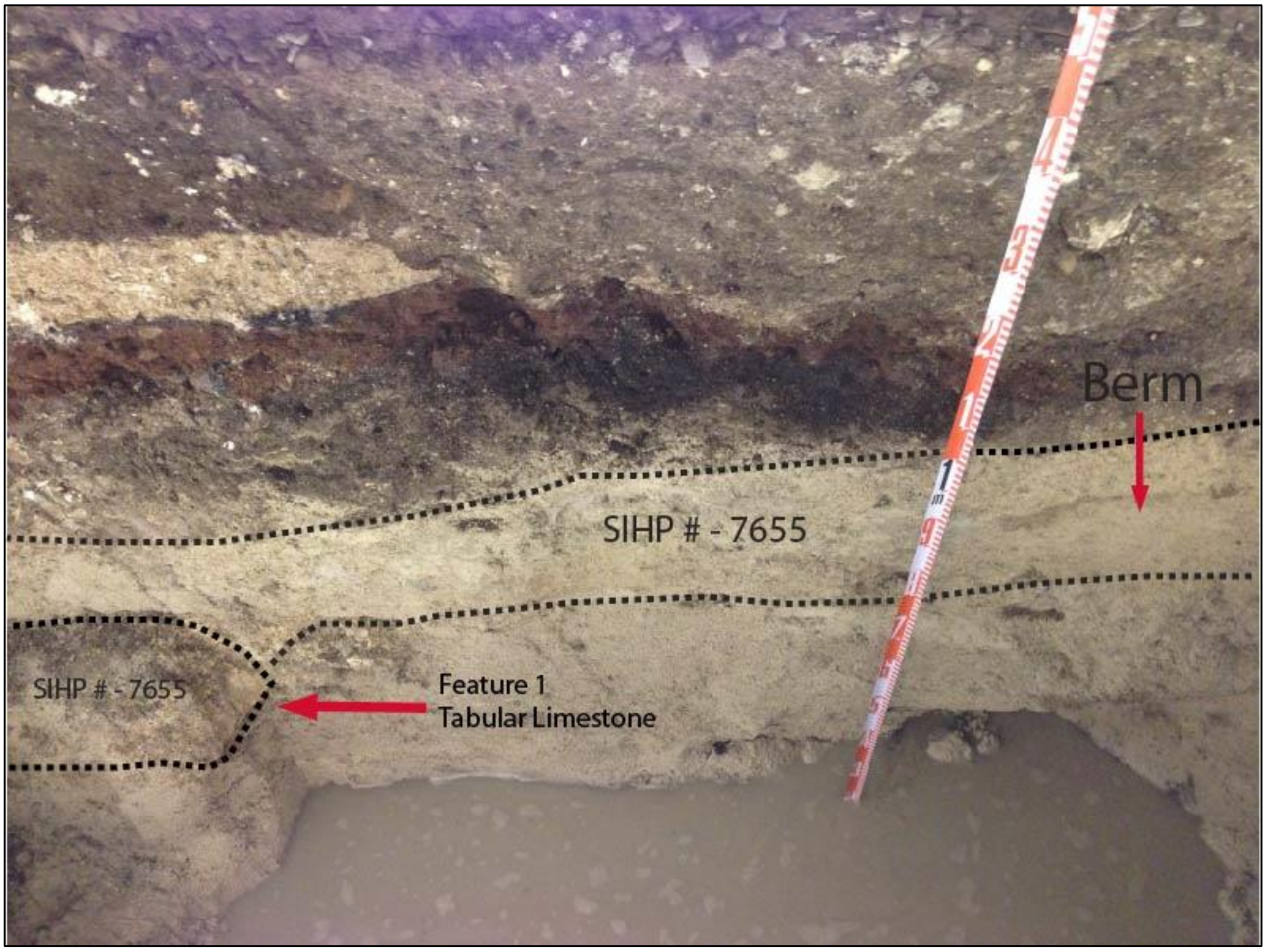

Figure 210. Photograph of TE 15 northeast side wall (Block B East), showing a berm event over tabular limestone from Feature 1(Strata IIa and IIb/SIHP # -7655)

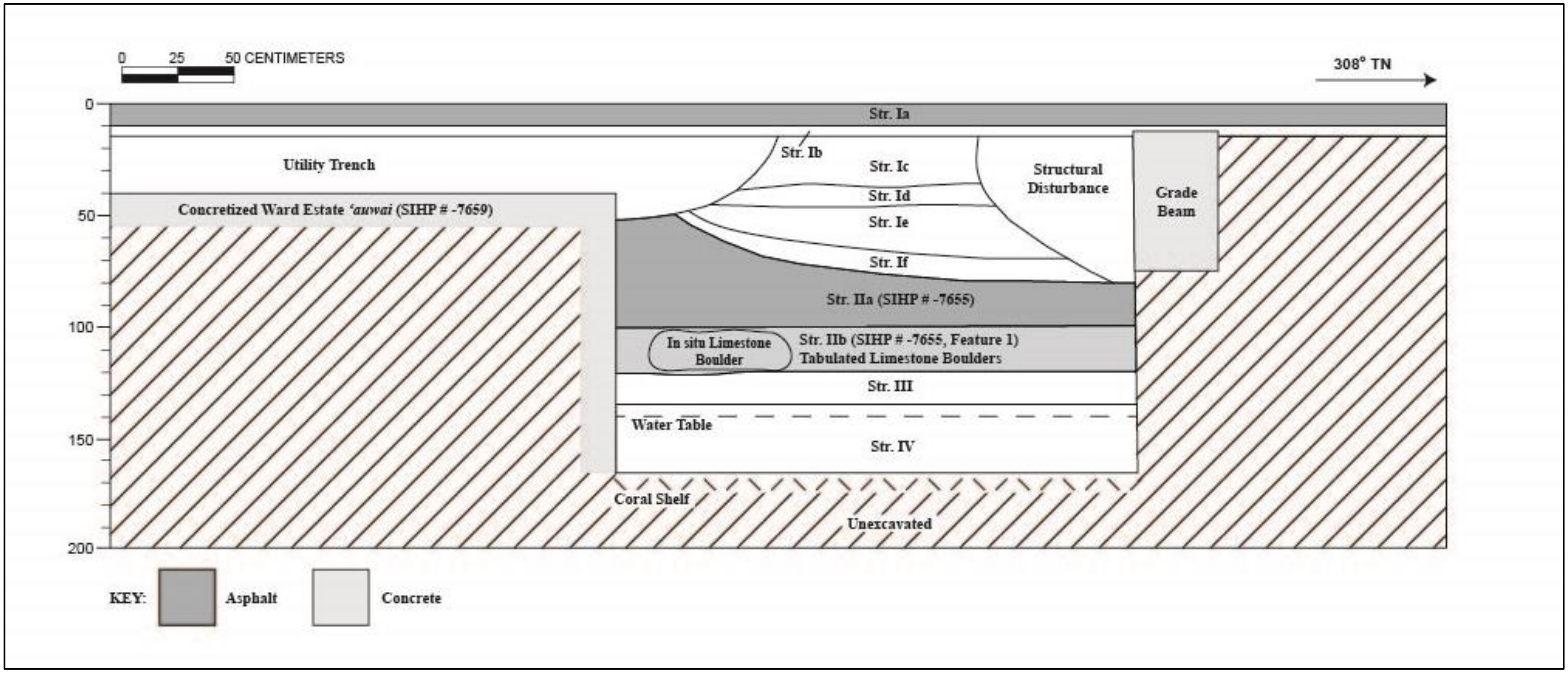

Figure 211. Profile of TE 17 southwest wall (Block B), showing the Ward *´auwai* (SIHP # -7659) laterally associated with a berm event in Stratum IIa (SIHP # - 7655) over tabular limestone boulders in Stratum IIb (SIHP # 7655).

Figure 212. (Left) Photograph of TE 17 southwest wall (Block B), showing the location of tabular limestone boulders in Stratum IIb (SIHP # 7655); (Right) Photograph of tabular limestone after removal from TE 17.

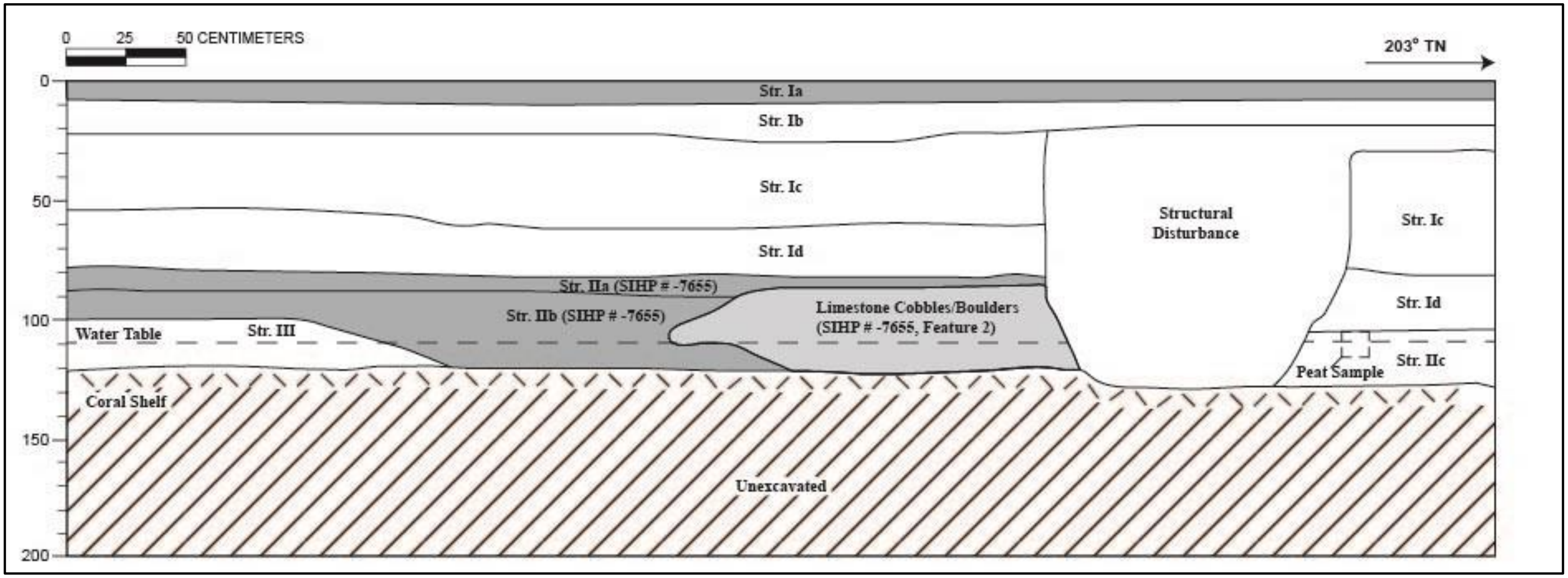

Figure 213. Profile of TE 38 east wall (Block B), showing the limestone boulders and cobbles of Feature 2 (SIHP # -7655) located at the edge of a salt pan berm in Strata IIa and IIb (SIHP # - 7655).

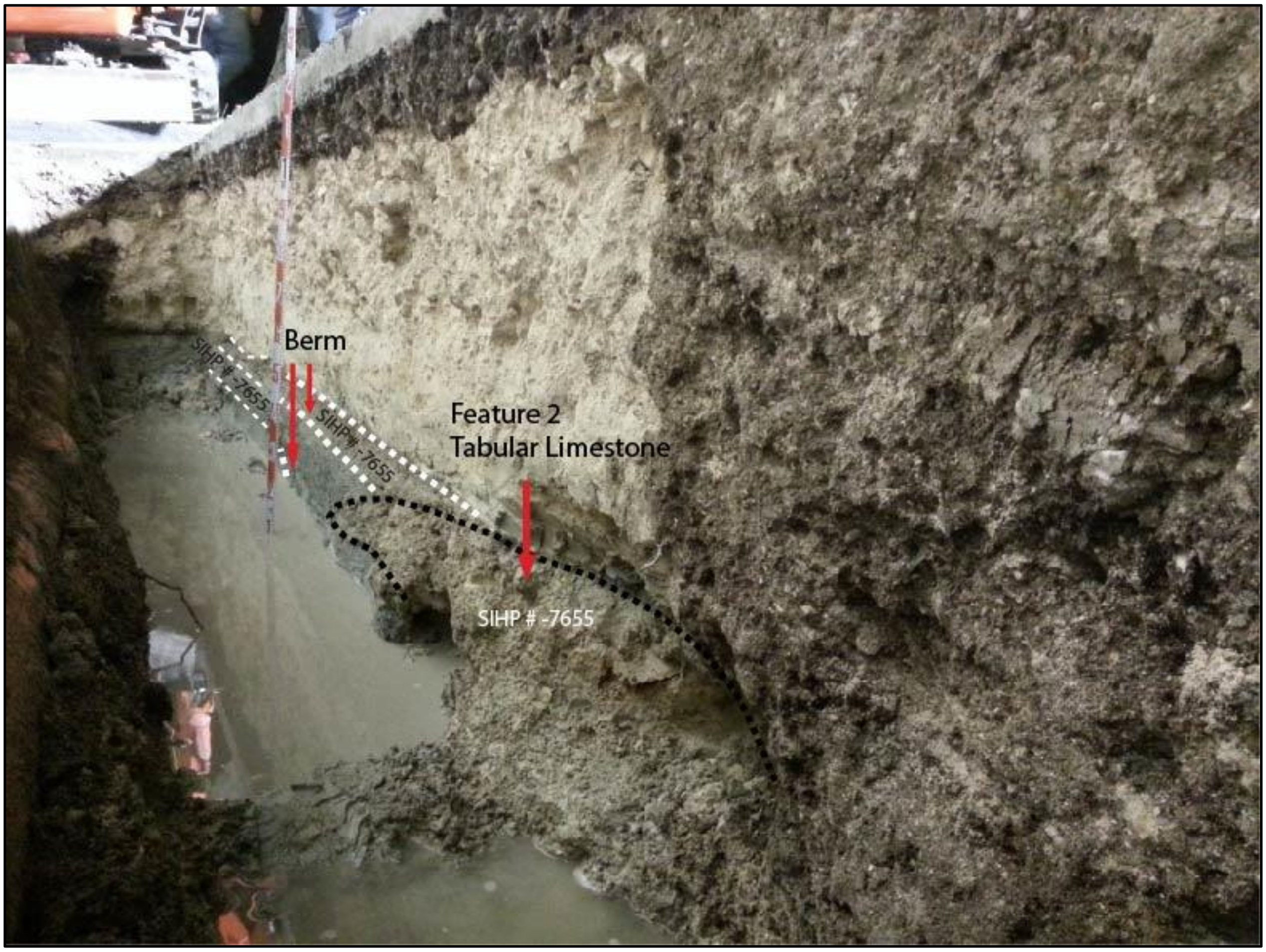

Figure 214. Photograph of TE 38 east wall (Block B), showing the limestone boulders and cobbles of Feature 2 (SIHP # -7655) located at the edge of a salt pan berm in Strata IIa and IIb (SIHP # - 7655).

6.1.2 Salt Pan Beds Description

6.1.2.1 Structure and Composition

Interspersed among and bounded by the salt pan berms was a large area of low-lying natural wetland sediments overlain by thin laminations of organic material, interpreted as salt pan beds. Within the Block B East project area, 14 of the 38 test excavations contained salt pan bed sediments; within the Block C West project area, 12 of the 36 test excavations contained salt pan bed sediments.

The organic laminations consisted of distinct micro-layers, observable as variations of color and texture (Figure 215 through Figure 219, and Figure 101). Some of the layers, in particular along the upper boundary of the deposit, contained flat leaf-like organics and grass-like stalks. In general, these laminated organic deposits ranged from 1 to 4 cm in thickness. During the excavation process, these thin organic layers were identifiable as wetland organic material; however, only upon close inspection were the laminations discernible and able to be differentiated from natural wetland peat deposits. It is believed that the laminations are the result of salt making processes.

In general, the salt pan laminations overlay one to two strata of natural wetland clay sediments. These natural wetlands, located just *mauka* of the coastal sand dunes, appear to have provided a naturally suited landform for the creation of salt pan beds, being composed of fairly impermeable clay sediments located at or near the water table. In many cases, the salt pan creation and/or salt processing methods did not appear to unduly disturb these underlying natural layers. For example, within TE 7 (Block C West), the organic deposit was located 43 cm above the coral shelf, overlying two in situ, natural sandy clay wetland deposits (Figure 220 and Figure 221). However, many of the test excavations evidenced disturbance to these natural layers, likely as a result of the salt production process and the maintenance of the salt beds. In these instances, the laminated salt pan deposit was located much closer to, or just above, the coral shelf, overlying only a thin remnant of the natural wetland sediments. In the most extreme example, within TE 26 (Block B East) the laminated layer was located only 0-4 cm above the coral shelf (Figure 222 and Figure 223). In two instances, the laminated deposit consisted of multiple organic layers interposed with natural clay, perhaps evidencing scraping of the salt beds and intermingling with the underlying clays (TE 22 within Block B East; TE 14 within Block C West) (Figure 224 and Figure 100).

Figure 215. Photograph of laminated organic deposit within TE 21 (Block B East) (Stratum II/ SIHP # -7655), measuring 3 cm thick

Figure 216. Photograph of laminated organic deposit within TE 23 (Block B East) (Stratum II/ SIHP # -7655), measuring 3 cm thick, overlying natural wetland sediment containing brackish-water snails

Figure 217. Close-up of laminated layer within the TE 1 sidewall (Block C West) (Stratum IIb/ SIHP # -7655), overlying natural wetland sediments

Figure 218. Close-up of TE 1 laminated organic material (Stratum IIb SIHP # -7655), showing distinct layering with leaf and organic material visible at the upper boundary

Figure 219. Photograph of laminated organic deposit within TE 23 (Block C West) (Stratum II/ SIHP # -7655), measuring 1 cm thick

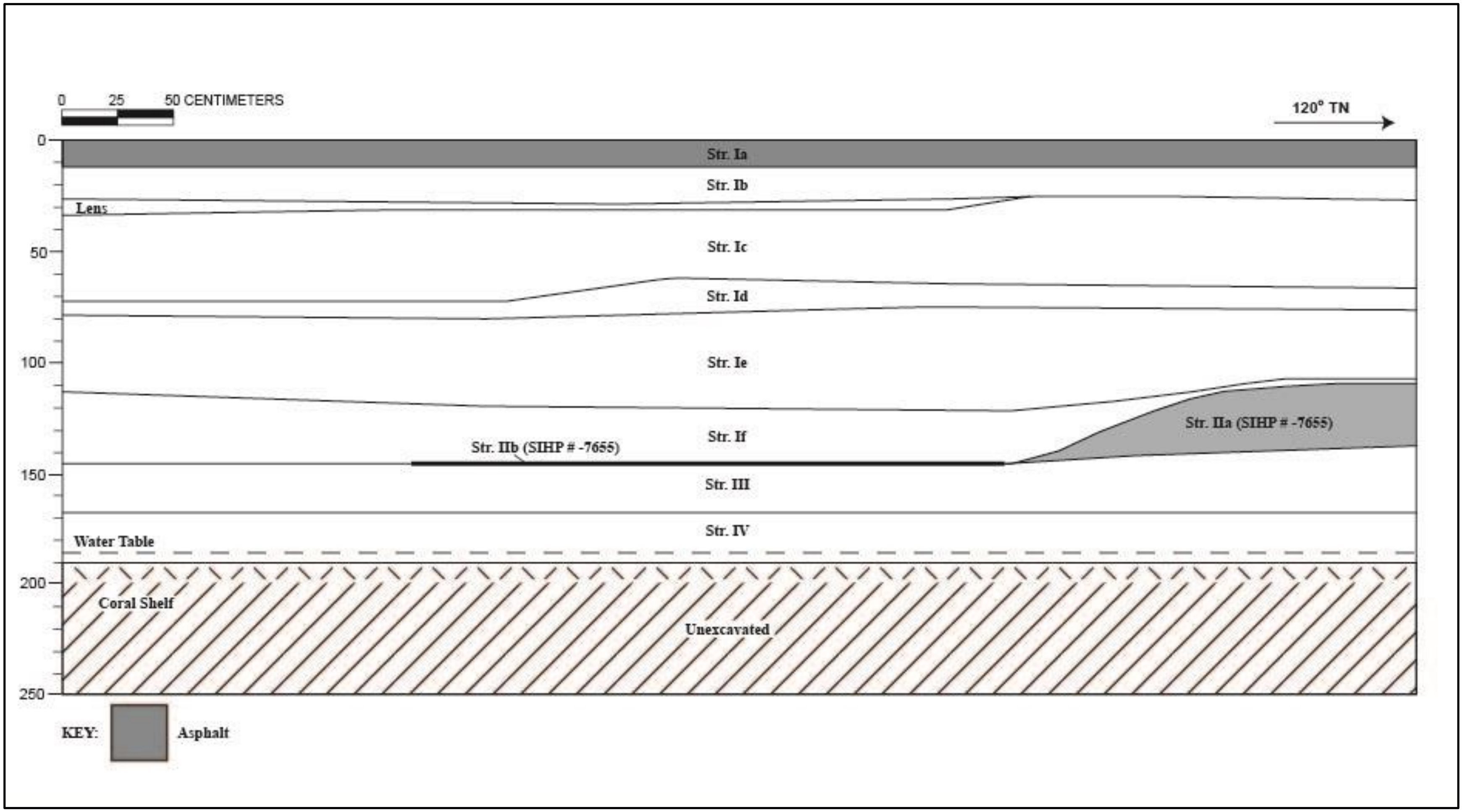

Figure 220. Profile of TE 7 northeast wall (Block C West), the showing the laminated organic deposit (Stratum IIb/SIHP # -7655) located 43 cm above the coral shelf, overlying two in situ, natural sandy clay wetland deposits (Strata III and IV)

Figure 221. Photograph of TE 7 northeast wall (Block C West), the showing the laminated organic deposit (Stratum IIb/SIHP # -7655) located 43 cm above the coral shelf, overlying two in situ, natural sandy clay wetland deposits (Strata III and IV)

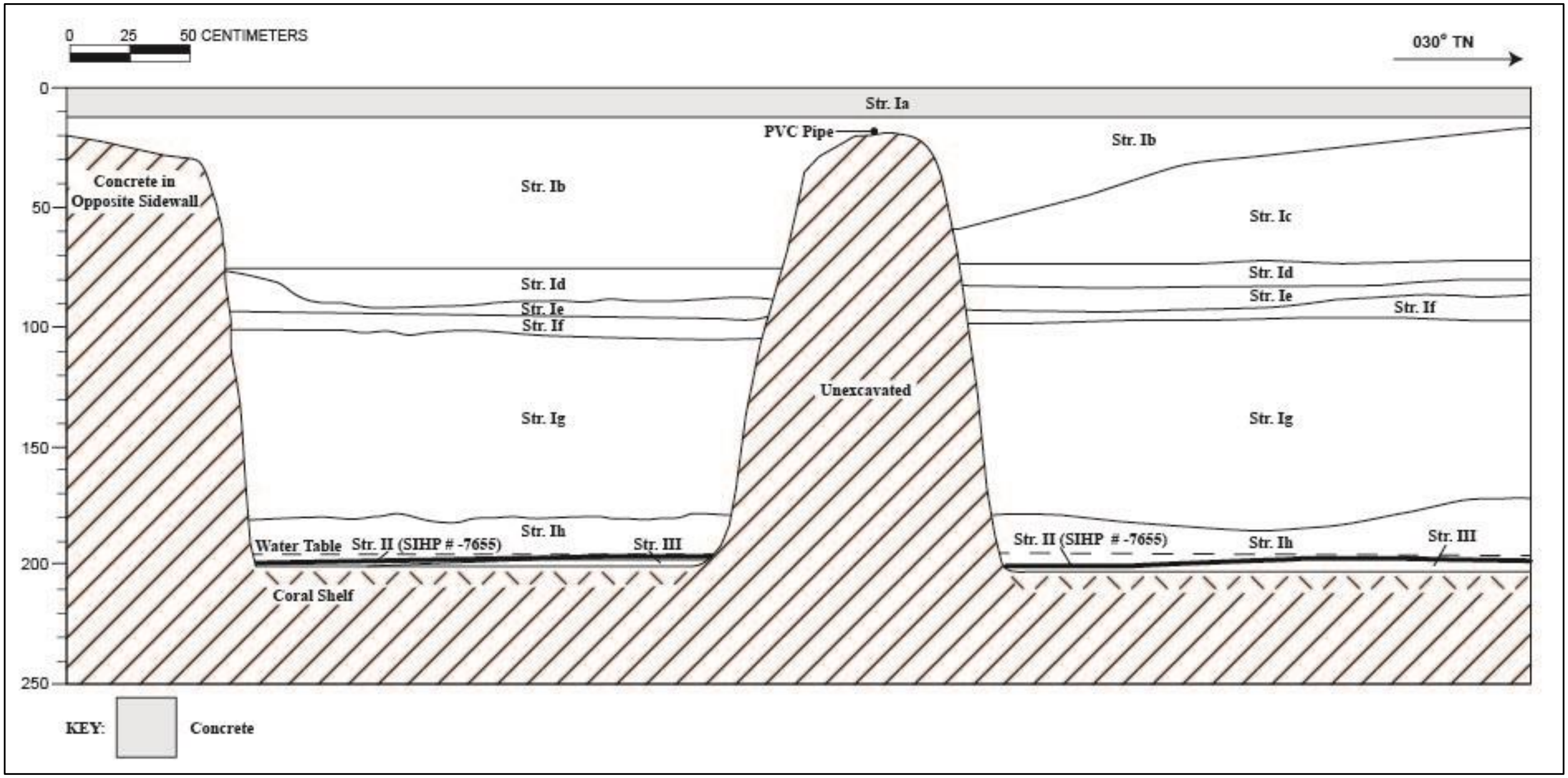

Figure 222. Profile of TE 26 west wall (Block B East), showing laminated organic deposit (Stratum II/SIHP # - 7655), approximately 4 cm above the coral shelf

Figure 223. Photograph of TE 26 west wall, showing laminated organic deposits (Stratum II/SIHP # -7655), just above the coral shelf

Figure 224. Photograph of two layers of laminated organic material within TE 22 (Block B East) (Stratum II/ SIHP # -7655), evidencing possible scraping of the salt pan beds during salt making processes or structural maintenance and the intermingling of the organic layers with the underlying natural wetland clay

Figure 225. Photograph of multiple layers of laminated organic material within TE 14 (Block C West) (Stratum II/SIHP # -7655)

Figure 226. Close-up photograph of multiple laminated deposits within TE 14 (Block C West) (Stratum II/ SIHP # -7655)

6.1.2.2 Function

As indicated by the January 1892 *Planters' Monthly* description of the Kakaʻako Salt Works, historic salt production was a complex, involved process that required the construction of a system of berms and salt pan beds. The salt pan beds varied in function, and likely also in size. The *Planters' Monthly* described several different types of "ponds" consisting of "storage ponds, which latter again supply the evaporating ponds, from which the water runs into the strike ponds, where the crystals are formed" (*Planters' Monthly* 1892: 446). Each step of the process slowly transformed the salt water, until a highly concentrated, dense salt water reached the "strike pond." The article also explained that the salt water became shallower and shallower as it progressed through the system until the water was no more than 1 ½ inches deep within the strike pond.

Organic laminations interpreted as salt pan bed remnants were documented throughout the majority of the Block B East and Block C West project areas. Within these contiguous project areas the laminated deposits were largely consistent, comprised of distinct micro-layers differentiated by color and texture and usually containing partially intact leaf structures and grass-like stalks. Just *mauka* of these two project areas however, within the on-going Block I AIS project area, further salt pan remnants have been documented which are believed to be part of the same salt complex (Sroat et al. 2014). Within the Block I project area, two additional types of organic material deposits associated with salt pan beds were identified, both markedly distinct from the thin laminated deposits found within the current project areas. These organic deposits consisted of a less structured, thicker organic layer in the *makai* portion of the Block I project area (just across Auahi Street from the current project areas), which sequenced into extraordinarily thick laminated deposits in the *mauka* portion, consisting of hundreds of micro-laminations with intact leaf structures. These three distinct organic deposits are interpreted to most likely represent different types of salt pan beds and functions. Given the current project areas' location along the coast, it is likely that these salt pan organic deposits represent remnants from the initial storage ponds. The successive salt pan deposits within Block I likely represent later stage salt processing, such as evaporating ponds and strike ponds.

The laminations observed within the Blocks B East and C West project area salt pan beds possibly signify reworking, or maintenance (such as scraping), of the salt pan beds in the interval between salt water floodings, or alternatively the chemical alteration and biogenic modification of the underlying natural sediments caused by the salt water and organic material. The organic material observed within and/or overlying the laminations, consisting of leaf structures and grass-like stalks, may represent remnants of organic lining of the salt pan beds, as noted by Cook (1784) in his description of traditional Hawaiian salt beds.

6.1.3 Pollen Analysis

Eleven samples from Block B East (Samples 1–6) and Block C West (Samples 7–11) were submitted to PaleoResearch Institute, Inc. of Golden, Colorado for pollen analysis. The collected samples represent the laminated organic material (labeled "peat" within the pollen report) representing the salt pan beds associated with SIHP # -7655 and the underlying wetland sediments. The 11 sediment samples were analyzed to determine any changes in the environmental record that may be indicative of salt pan use. A report was prepared by PaleoResearch Institute and is presented in Appendix E (Cummings and Varney 2014). Below is a summary of the results.

The samples from Block B East were collected from Test Excavation 6, Strata IIb (Sample 1) and III (Sample 2); Test Excavation 21, Strata II (Sample 3) and III (Sample 4); and Test Excavation 22, Strata II (Sample 5) and III (Sample 6). The samples from Block C West were collected from Test Excavation 1, Stratum IIb (Sample 7); Test Excavation 6, Strata II (Sample 8) and III (Sample 9); and Test Excavation 23, Strata II (Sample 10) and III (Sample 11).

6.1.3.1 Discussion

The pollen and microscopic charcoal analysis of the samples collected from Block B East and Block C West indicate these areas may have been inundated with water. The presence of foraminifera (single-celled protists that live in marine and/or freshwater environments) in all of the Block B East samples (Samples 1–6) and in only one of the Block C West samples (Sample 10) suggests the Block B area may have contained more water than Block C. Additionally, the lower pollen concentration values in the wetland sediments (Stratum III) of Block C West suggest a more rapid sedimentation process in this area.

In general, the pollen record from the 11 sediment samples was dominated by *kolea* (*Myrsine*) (Figure 183). *Kolea* are small to medium-sized native evergreen trees (Little and Skolmen 1989:268) that are most likely insect-pollinated (Vaughn Bryant and Donald Drake, personal communication 2014). Most plants in the Myrsinaceae family are insect-pollinated. According to Dr. Donald Drake, Professor of Botany at the University of Hawai‘i at Mānoa, a study on the pollination of *kolea* (*Myrsine*) trees has never been completed. However, the flowers of the *kolea* tree are more adapted to insect or bird-pollination than wind-pollination. Unlike wind-pollinated plants (i.e., grasses, rice, pine) that produce an abundance of pollen that often travels long distances and survives well in the archaeological record, insect-pollinators produce less copious amounts of pollen and are, therefore, usually under-represented in the archaeological record. Although *kolea* pollen has been documented in coastal areas (Cummings 2013), the high percentage of *kolea* pollen in all of the samples from Blocks B East and C West is unusual. One explanation for the abundance may be that *kolea* leaves were utilized to line and waterproof the salt beds. The missionary William Ellis, on his tour of the Hawaiian Islands in 1822 and 1823, noted the final step in the salt making process, which includes the use of evergreen leaves to line the pans:

> The natives of this district (Kawaihae) manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity. They have generally one large pond near the sea, into which the water flows by a channel cut through the rocks, or is carried thither by the natives in large calabashes. After remaining there for some time, it is conducted into a number of smaller pans about six or eight inches in depth, which are made with great care, and frequently lined with large **evergreen leaves**, in order to prevent absorption. Along the narrow banks or partitions between the different pans, we saw a number of large **evergreen leaves** placed. They were tied up at each end, so as to resemble a narrow dish, and filled with sea water, in which the crystals of salt were abundant. [Ellis 1827:403-404]

The presence of *Myrsine* pollen within the underlying wetland sediments (Stratum III) that were analyzed is somewhat unusual. However, considering the samples were collected directly below the overlying laminated organic material (Strata IIb and II), it is possible the presence of *Myrsine* pollen is a result of contamination.

Vegetation in the outlying areas of the suspected salt pans included grasses and sedges, indicated by the identification of Poaceae and Cyperaceae pollen in almost all of the samples. The low concentration values of these wind-pollinators suggest these plants were not growing within the salt pan areas. Fern spores were recovered in almost all of the samples, suggesting ferns were growing in the vicinity of the project areas.

Pollen representing alien species included Australian pine, *koa haole*, and *kiawe*. The presence of at least one or more of these in each of the samples indicates that the sediments are most likely historic.

Identified Polynesian cultigens included coconut (*Cocos nucifera*), sugar cane (*Saccharum* sp.), and sweet potato (*Ipomoea batatas*-type). Rice (*Oryza*-type) and mango (*Mangifera*-type) were the only introduced cultigens and both were identified in the two samples from Block C West Test Excavation 6 (Samples 8 and 9). It is possible there were sugar cane fields and rice paddies in the outlying areas of the salt pans. These wind-pollinators are usually well-represented in the pollen record. Therefore, the low concentration and lack of these pollen types suggests they were not growing within the immediate vicinity of the salt pans. Sweet potato, coconut, and mango, however, are insect-pollinated so their presence may indicate their nearby cultivation. The identification of all of these cultigens (coconut, sugar cane, sweet potato, rice, and mango) within the Test Excavation 6 samples suggests some of these plants, particularly the insect-pollinators, may have grown near Test Excavation 6. Alternatively, this area may have been used as a trash dump or midden area where these cultigens were deposited at one time. Interestingly, Test Excavation 6 samples did not contain foraminifera which are indicative of inundated areas.

The pollen analysis identified microscopic charcoal fragments in all of the samples. Concentrations were markedly higher in the wetland sediments of Block B East Test Excavations 21 (Sample 4) and 22 (Sample 6), and Block C West Test Excavation 6 (Sample 9). The laminated organic material from Block C West Test Excavation 1 (Sample 7) contained the highest concentration of charcoal in any of the samples from the two project areas. The presence of charcoal may be a result of widespread burning episodes, or it may be attributed to petroleum contamination, which is common in coastal areas (Cummings 2014).

In general, the low concentrations of wind-pollinators (i.e. Asteraceae, Cyperaceae, Poaceae, *Chenopodium*, *Casuarina*, ferns, etc.) in the pollen record from Block B East and Block C West sediment samples, suggest these plant types were not growing within the suspected salt pans, but rather in outlying areas. A few plants, including coconut, mango, and sweet potato may have been cultivated along the salt pan berms. The majority of the sediment samples contain foraminifera, consistent with the presence of open water and possible salt pan production.

6.1.4 Comparison with Other Salt Pan Historic Properties within Kaka‘ako

Although no previous archaeological studies have been conducted in the current Block B East and Block C West project areas, potential historic salt pan remnants have been previously identified within the wider Kaka‘ako area (Hammatt 2013; and Morriss et al. 2013; Pammer et al. 2011).

Within the western portion of Kaka‘ako, in an area bounded by Halekauwila, South, Pohukaina, and Keawe Streets, potential historic salt pan remnants were identified by Pammer et al. (2011) within 21 test excavations, designated SIHP # 50-80-14-7190 (Figure 227). The identified salt pan remnants consisted of alternating layers of clay and peat overlying natural marine clay (Figure 228). As described by Pammer et al. (2011:239):

> This A-horizon was typically observed directly overlying the natural marine clay (gley) and commonly at the same level as the water table, if not slightly below it. The striations of clay and peat suggest that this area was repeatedly used as a land surface which was exposed long enough to accumulate organic debris before being covered with clay. Based on research of the project area, it is suggested that this A-horizon is the result of the repeated flooding, drying, scraping and removal of salt during salt production. The clay observed within the peat may have been deliberately placed on the bottom of the salt bed to prevent the salty water from soaking into the ground. [Pammer et al. 2011]

Similar potential salt pan stratigraphy was subsequently identified within Pohukaina Street by Hammatt (2013) during the Honolulu High-Capacity Transit Corridor Project AIS (Figure 229). These salt pan deposits were considered an extension of SIHP # -7190 documented by Pammer et al. (2011). Within Test Excavation 230, a natural silty clay deposit containing lenses of peat was identified overlying natural marine sand (Figure 230, Figure 231). The alternating layers of peat and silty clay were observed to be comparable to the Pammer et al. (2011) sediments. Within Test Excavation 229, a potential salt pan berm was documented, consisting of an undulating berm of light grayish brown sandy clay with root inclusions (Figure 232, Figure 233).

The berm structure identified by Hammatt (2013) is markedly similar to the salt pan berm structures documented within the current study area. As with SIHP # -7655, the berm material in SIHP # -7190 appears to have been derived from local wetland or marine sandy clay sediments and formed into a retaining structure. The berm also evidenced significant disturbance to the underlying natural sediments during the berm construction process, as indicated by the near absence of these sediments. While the identified salt pan bed sediments differ somewhat from the thin laminated organic layers observed within the Blocks B East and C West project area historic salt pans (SIHP # -7655), they similarly consisted of alternating layers containing distinct organic inclusions. Notably, Test Excavations 14 (C West) and 22 (B East) did evidence a pattern of alternating peat and clay more comparable to the sediments found within SIHP # -7190, and were similarly interpreted as potentially representative of salt production processes, such as the scraping of the salt pan beds.

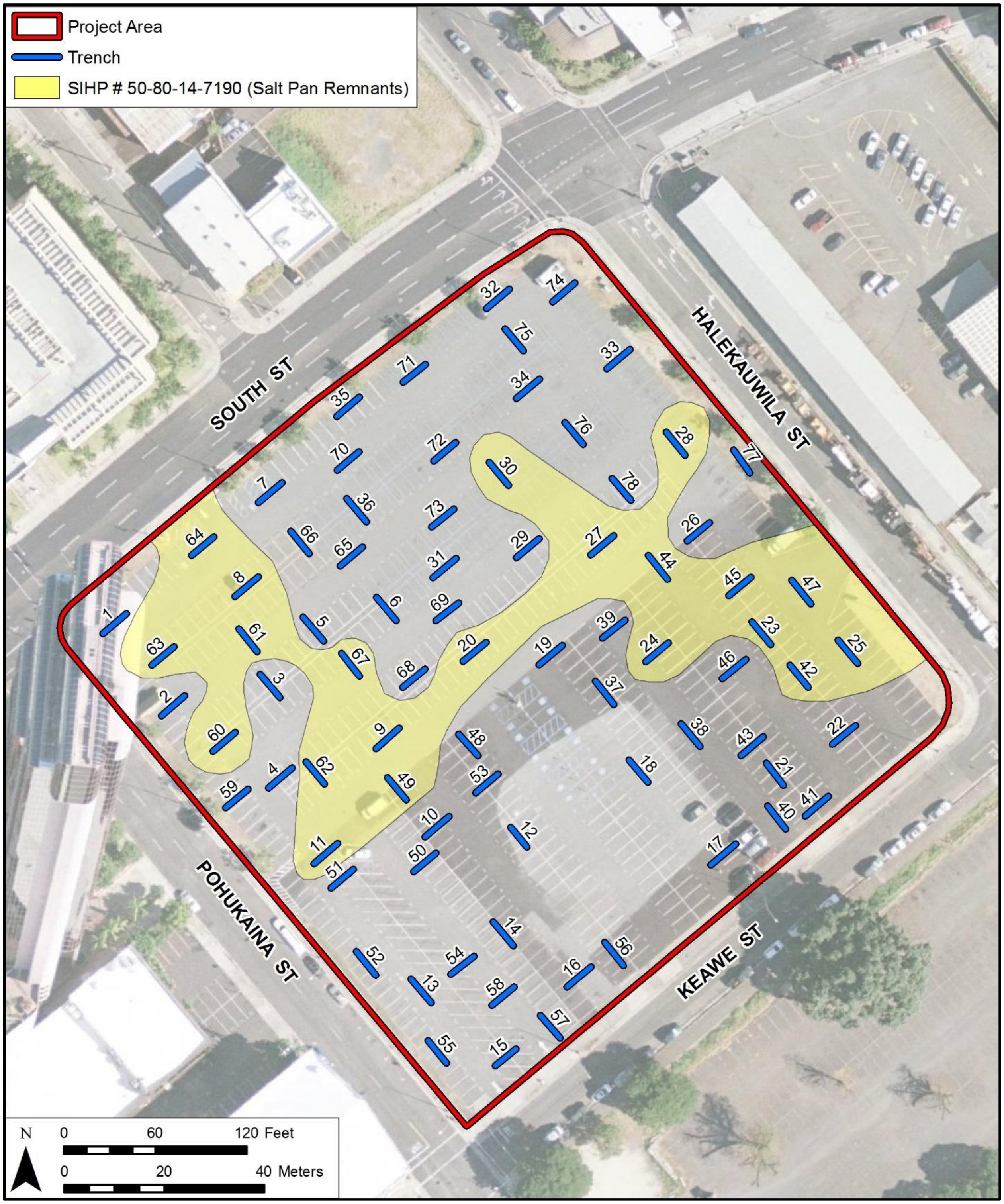

Figure 227. Figure from the Pammer et al. (2011) AIS report showing the location of potential historic salt pan remnants within western Kakaʻako

Figure 228. Photograph of Test Trench 45 (Pammer et al. 2011) showing dark peat alternating with the lighter colored clay

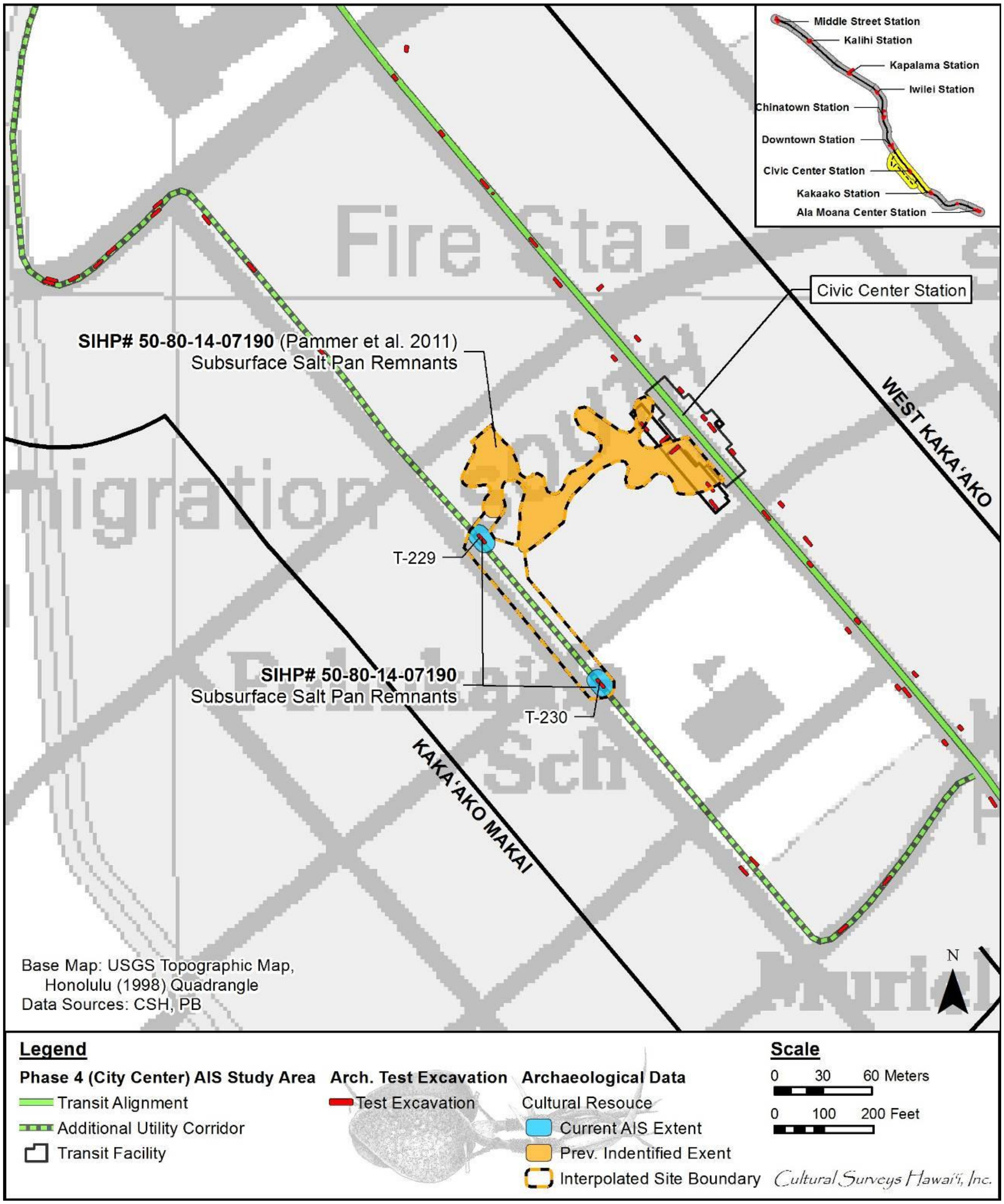

Figure 229. Figure from the Honolulu High-Capacity Transit Corridor Project AIS report, showing the location of SIHP # -7190 as identified by Pammer et al. (2011) and extended by Hammatt (2013)

Figure 230. Photograph of T-230 (Hammatt 2013), showing Stratum II clay and peat salt pan sediments (SIHP #-7190)

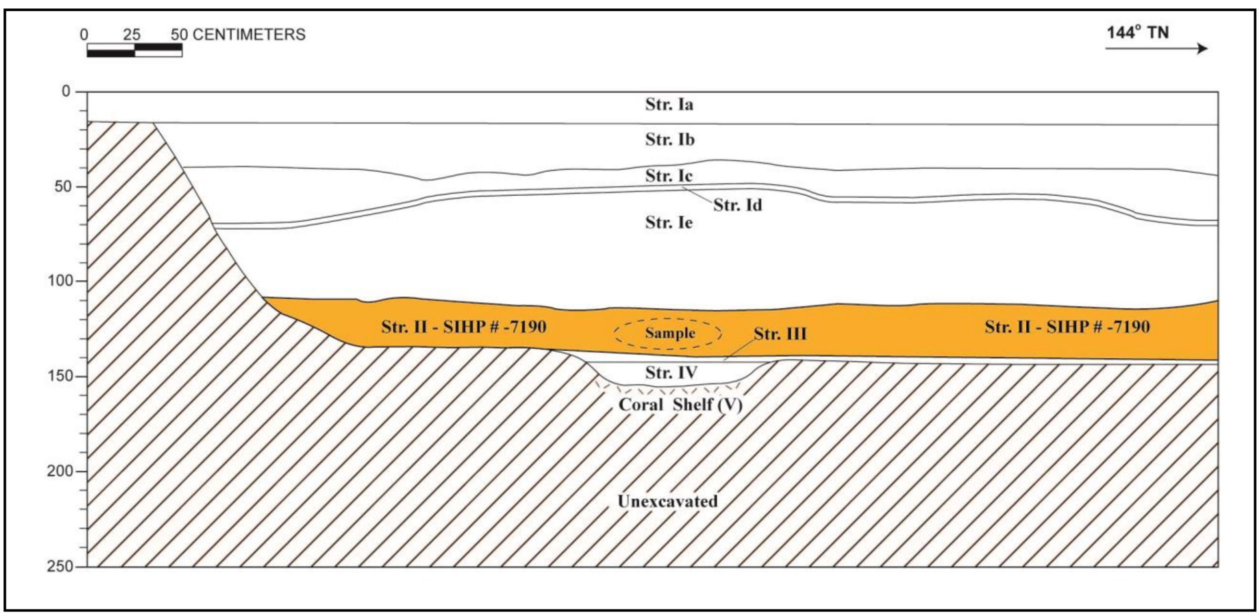

Figure 231. Profile of T-230 northeast wall (Hammatt 2013), showing Stratum II salt pan sediments (SIHP #-7190)

Figure 232. Photograph of T-229 (Hammatt 2013), showing possible a salt pan berm consisting of light grayish brown sandy clay overlying the coral shelf (SIHP #-7190)

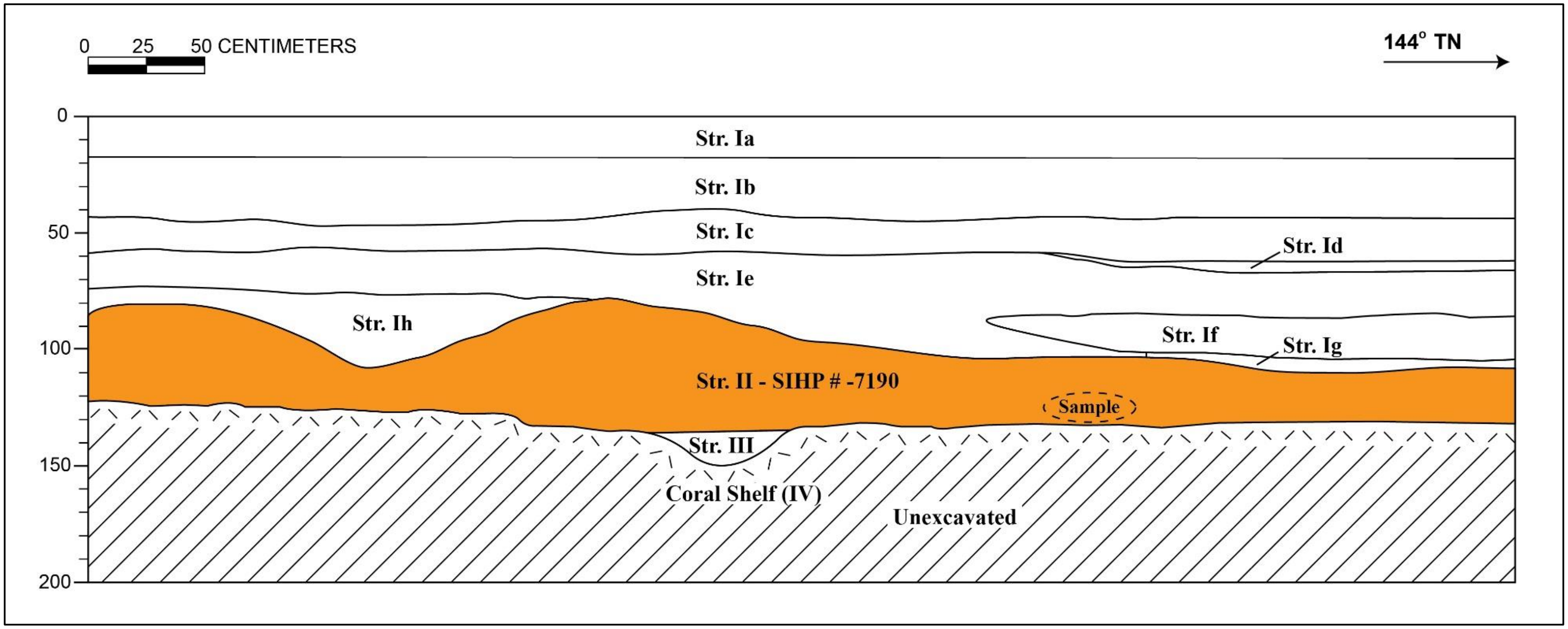

Figure 233. Profile of T-229 northeast wall (Hammatt 2013), showing a possible salt pan berm (Stratum II) designated as a component of SIHP #-7190

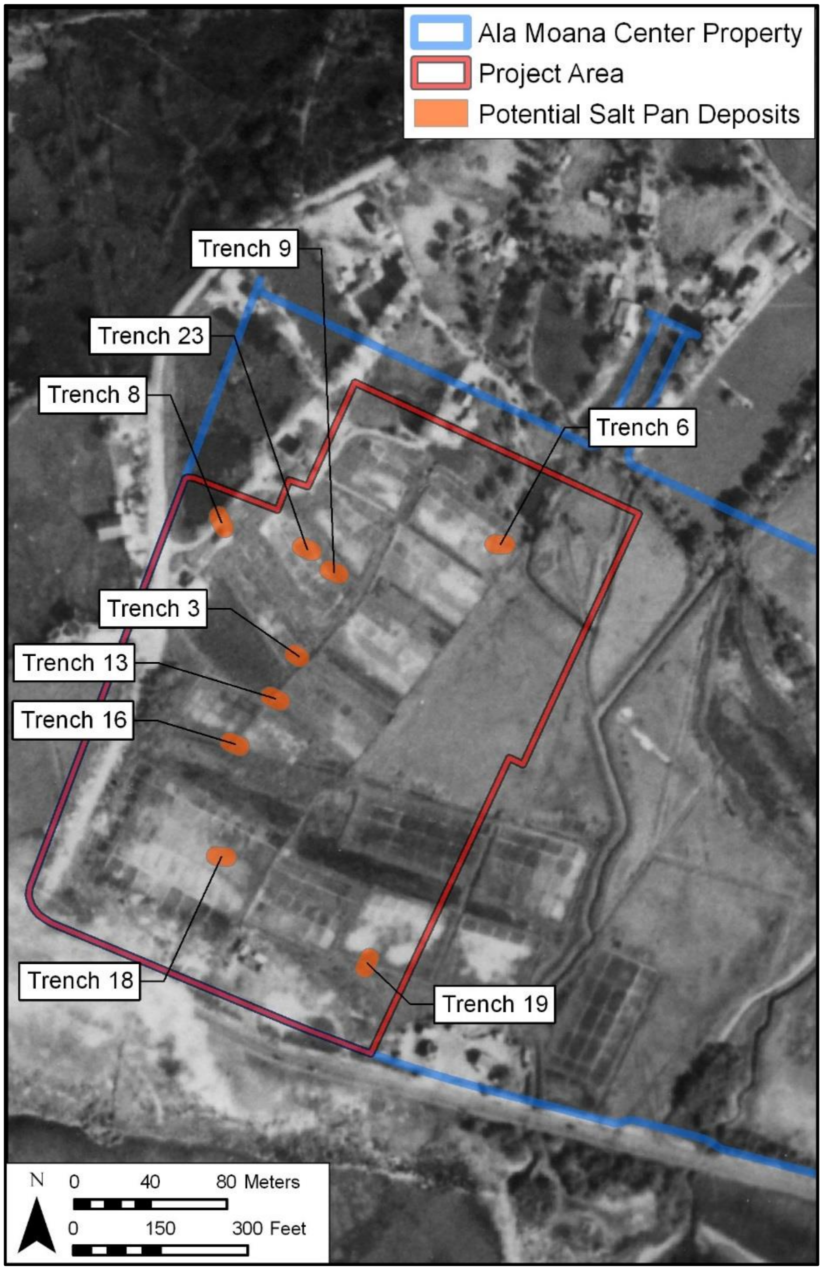

Figure 234. Figure showing the location of potential historic salt pan remnants documented by Morriss et al. (2013) within the Ala Moana Shopping Center area

Within the southern portion of Kaka‘ako, in an area currently occupied by the Ala Moana Shopping Center, potential historic salt pan remnants were identified by Morriss et al. (2013) (Figure 38). Although the project area was located within an area identified as part of SIHP # 50-80-14-6636, the natural Kewalo wetlands, based on historic research this was also an area of historic salt production. Within this area, peat was observed as “distinct layers, usually directly above the [wetland] sandy clay, and as inclusions within the sandy clays” (Morriss 2013:170). Both pollen and phytolith analyses were conducted on the peat and natural wetland sediments in an attempt to ascertain whether salt pan sediments could be definitively identified in this area. Interestingly, the pollen record evidenced a potential change from a natural marsh environment to a less vegetated, possibly anthropogenic altered environment:

> The pollen record from sample 6 (Trench 13) might reflect an anthropogenic change in the natural environment. While the pollen taxa from the underlying sediments reflect sedge marsh, the pollens from sample 6 indicate that the area was transformed into an open water or evaporative surface that did [not] support much vegetation. Cyperaceae (sedge) pollen, indicative of marshland, was virtually absent in sample 6. These findings correspond with, but do not prove, the interpretation that the area was utilized in the early 20th century for salt production. [Morriss et al. 2013:174]

6.1.5 Summary

SIHP # -7655 consists of a large complex of buried historic salt pan remnants located within the Ward Warehouse commercial center, extending across two contiguous project areas, Block C West and Block B East. The buried salt pan remnants are comprised of an interconnected system of man-made linear structural features (berms) and low-lying, level wetland sediments overlain by thin organic laminations (salt pan beds). Based on the results of the Block B East and Block C West AIS investigations, SIHP # -7655 is assessed as significant under Hawai‘i state historic property significance criterion “c” (embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value) and criterion “d” (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR § 13-284-6. Based on the potential for SIHP # -7655 to provide further additional information related to the construction, content, and distribution of buried salt pan remnants within Kaka‘ako, a data recovery program is believed to be warranted.

6.2 **SIHP # 50-80-14-7658**

FORMAL TYPE:	Historic buried surfaces
FUNCTION:	Commercial surface
AGE:	Mid- to late twentieth century
DIMENSIONS:	Approximately 4.4 acres (within the Blocks B East and C West contiguous project areas)
TAX MAP KEY:	[1] 2-3-001:005 (por.)
LAND JURISDICTION:	Private; Howard Hughes Corporation (HHC)

SIHP # -7658 consists of buried structural remnants possibly associated with several periods of development during the late nineteenth to mid-twentieth century. This noncontiguous historic property is distributed throughout the project areas of Block B East and Block C West (Sroat et al. 2014).

SIHP # -7658 is composed of 42 subsurface structures: three buried oiled, rolled surfaces, a highly compacted cinder surface, 17 layers of buried asphalt surface, four layers with disturbed asphalt chunks, three layers of buried asphalt surfaces overlying three buried concrete slabs, four buried concrete slabs not associated with an asphalt surface, three buried coral and tar pavement surfaces, and four buried wooden post remnants (Figure 235). There are 18 buried surfaces associated with Block B East and 24 buried surfaces associated with Block C West. Continuity of the structures could not be established except for a concrete surface observed in Block B East Test Excavations (TE) 7 and 37, in which TE 37 intersects TE 7.

From the late nineteenth to the late twentieth century, the project areas of Block B East and C West underwent a variety of changes, including land reclamation and multiple stages of urban development. The subsurface structures are remnants of the numerous building events that took place following infilling associated with the Kewalo reclamation (1919–1926) and prior to the 1976 construction of the current Ward Warehouse structures. Aerial photos were used to aid in estimating a date range for each of the buried surfaces; however, due to the time span between each of the aerial photos, the observed buried surfaces may have been associated with country roads and structures not shown.

SIHP # -7658 contains three buried oiled, rolled surfaces within the project areas of Block B East and C West (Figure 236 and Figure 237). Two oiled, rolled surfaces were identified in Block B East, located within Test Excavations 18 and 20, at depths ranging from 45 to 50 cmbs. The average thickness of these surfaces was 2-3 cm. The single oiled, rolled surface identified in Block C West Test Excavation 17 was found at a depth of 41 cmbs with a thickness of 13 cm. The oiled, rolled surfaces were all observed overlying crushed coral fill and hydraulic fill associated with the 1919–1926 land reclamation.

It is difficult to determine the exact time frame related to the oiled surface. No indication of a roadway or paved surface is seen on a 1927 aerial (Figure 238), which shows the two project areas as relatively barren with the white dredge material clearly visible. On a 1939–1941 aerial (Figure 239), the two project areas remain relatively barren, although development can be seen beginning along the western corner of Block B East. By the time a 1952 UH SOEST aerial map was taken (Figure 240), a parking lot in Block B East and a roadway in Block C West were already

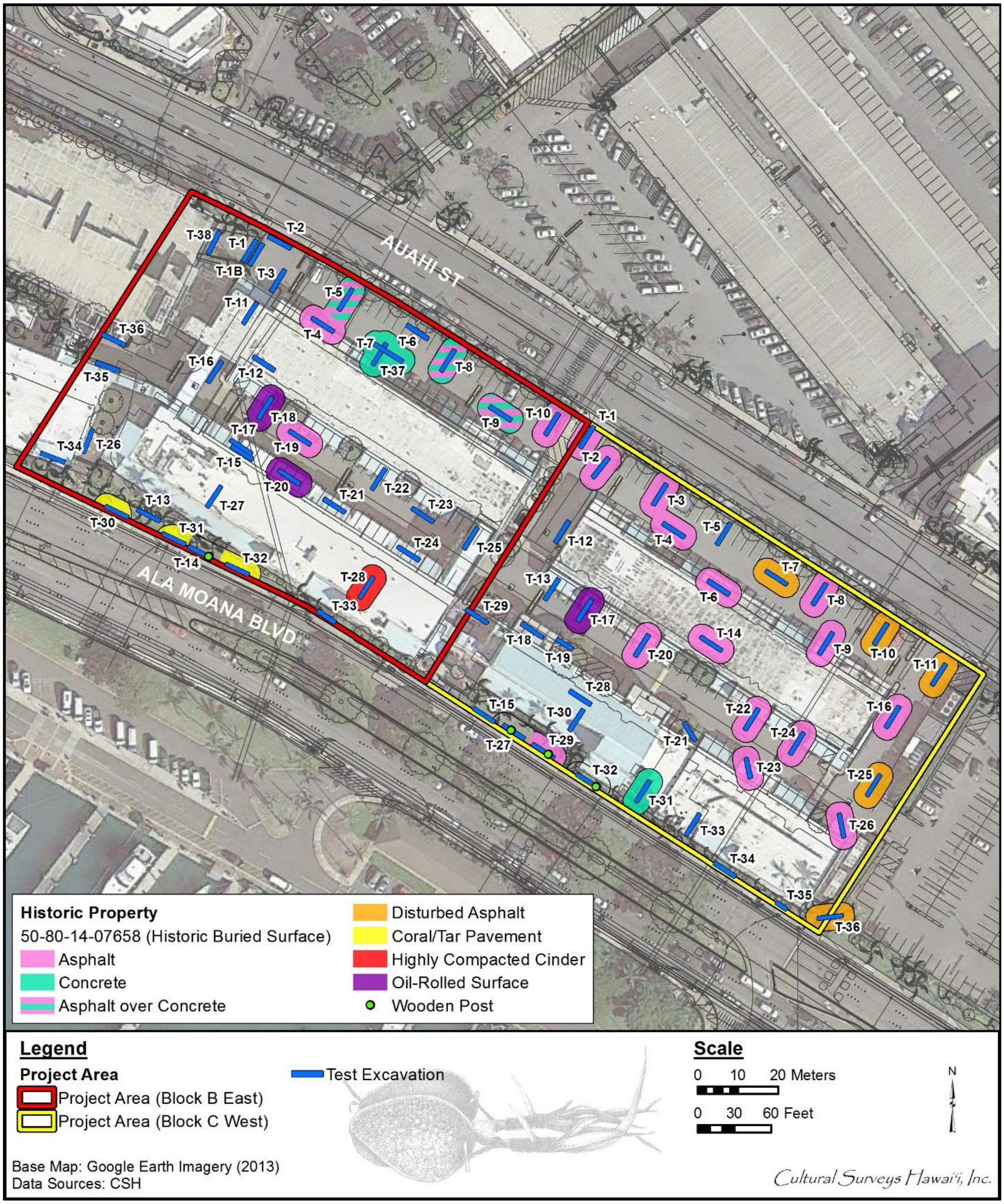

Figure 235. Aerial photograph showing the extent of the historic buried surfaces (SIHP # -7658) documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

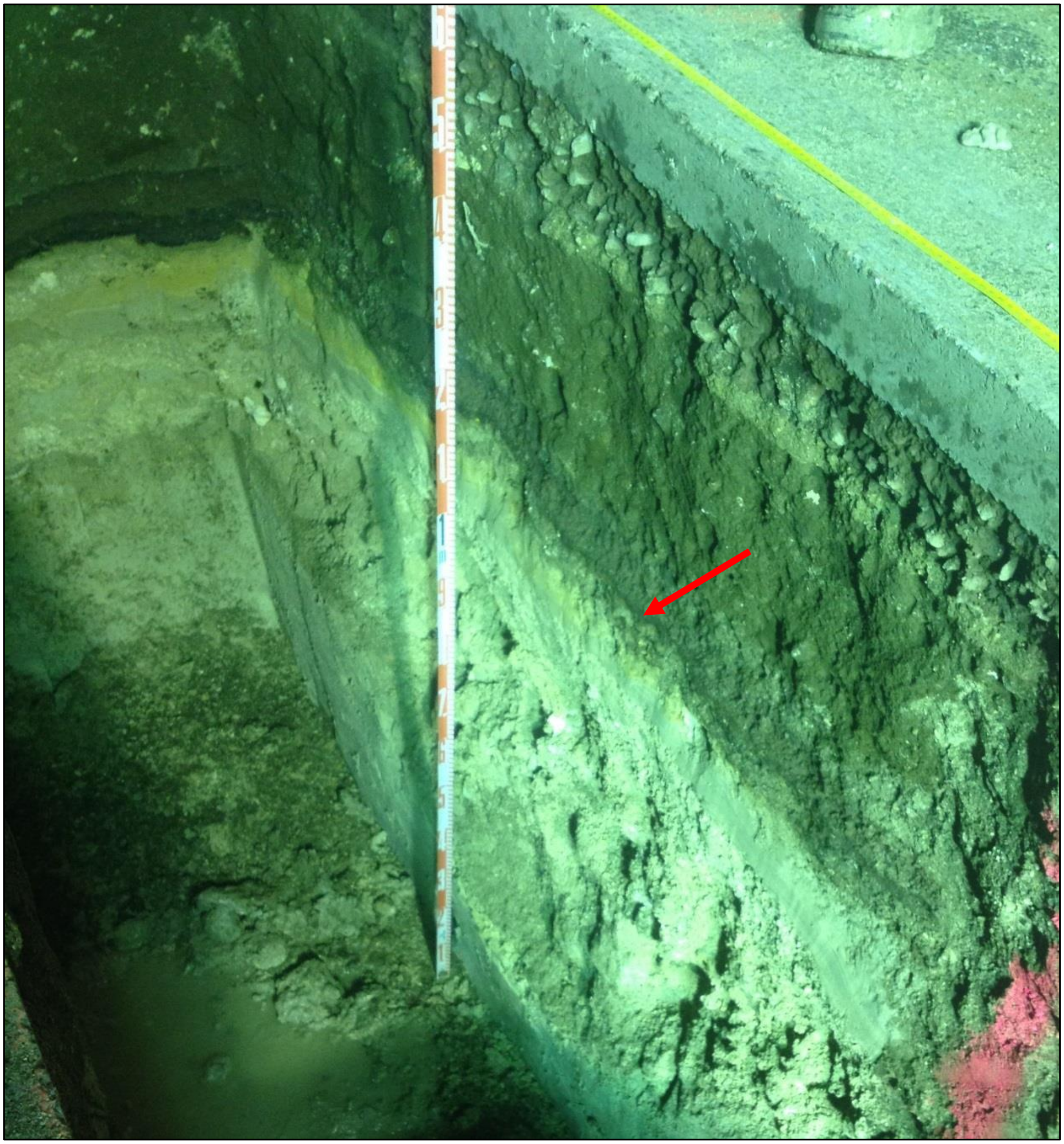

Figure 236. Close-up of an oil-rolled former land surface (SIHP # -7658) within the Block B East TE 20, southwest sidewall, indicated by a red arrow

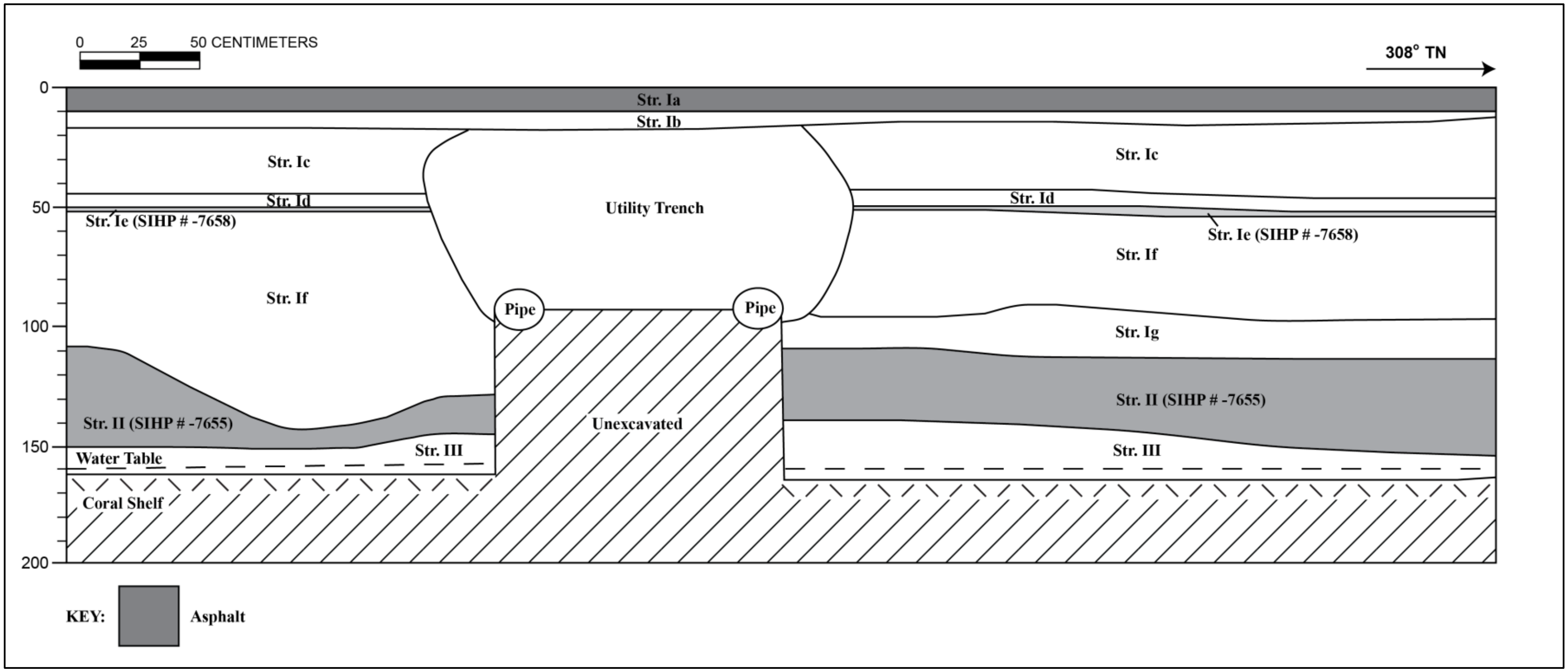

Figure 237. Profile of Block B East TE 20, showing the oil-rolled former land surface (SIHP # -7658) within the, southwest sidewall

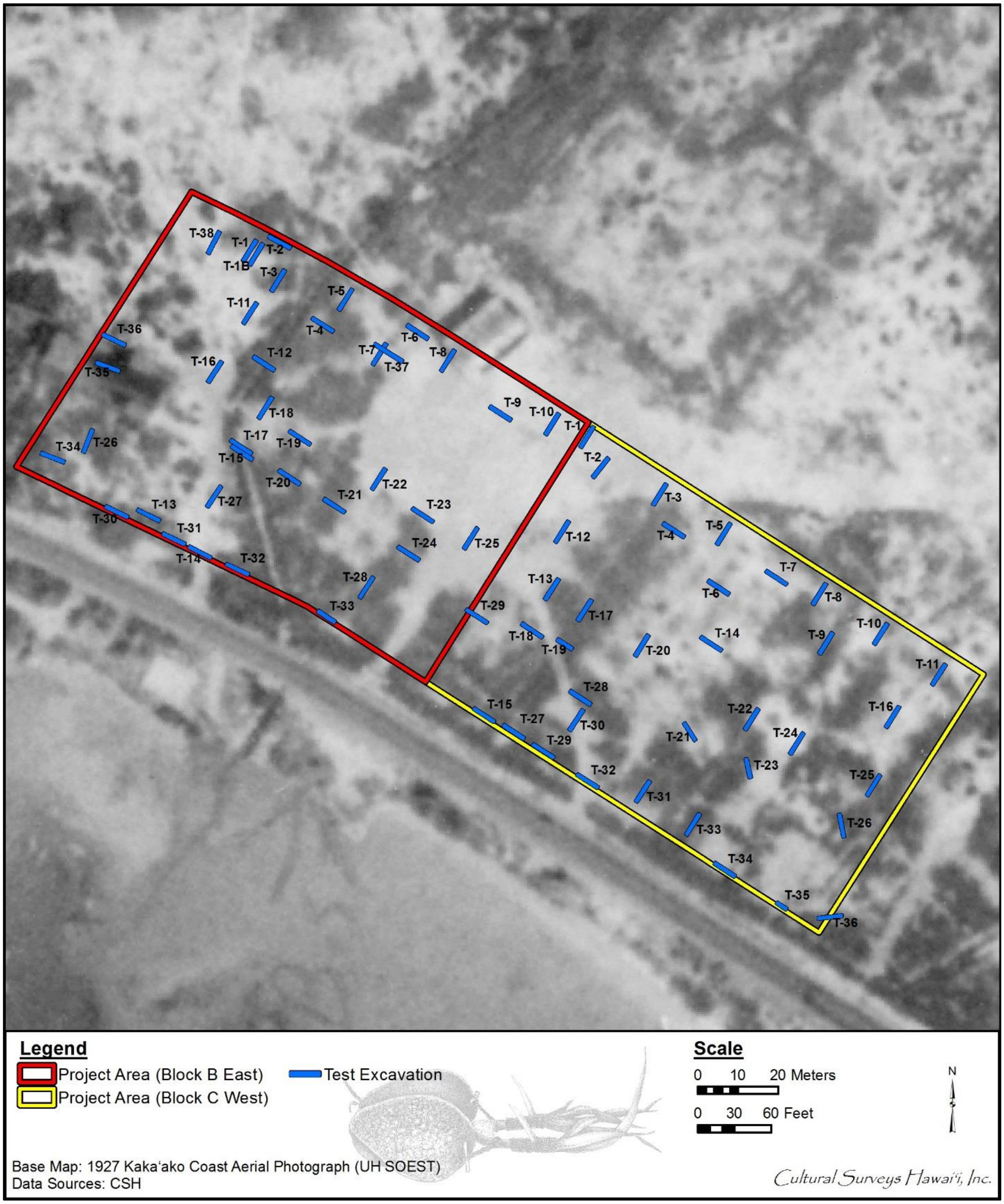

Figure 238. 1927 USGS aerial photograph of the Kaka‘ako area with an overlay of the Block B East and Block C West project areas and test excavations locations (USGS; mosaic of photograph sheets from Hawai‘i Coastal Geology Group)

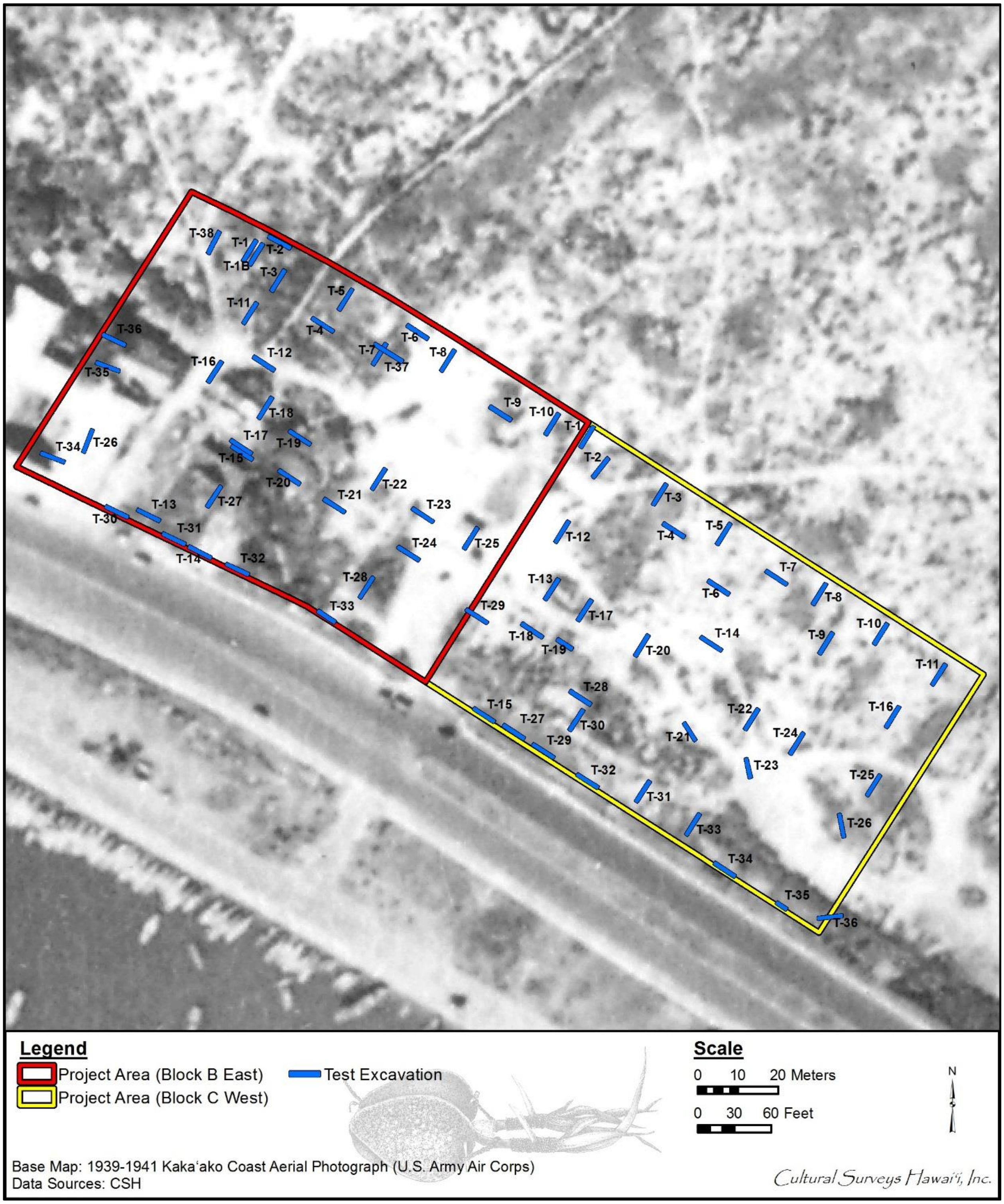

Figure 239. 1939–1941 aerial photograph (U.S. Army Air Corps) of Kakaʻako with an overlay of the Block B East and Block C West project areas and test excavations locations

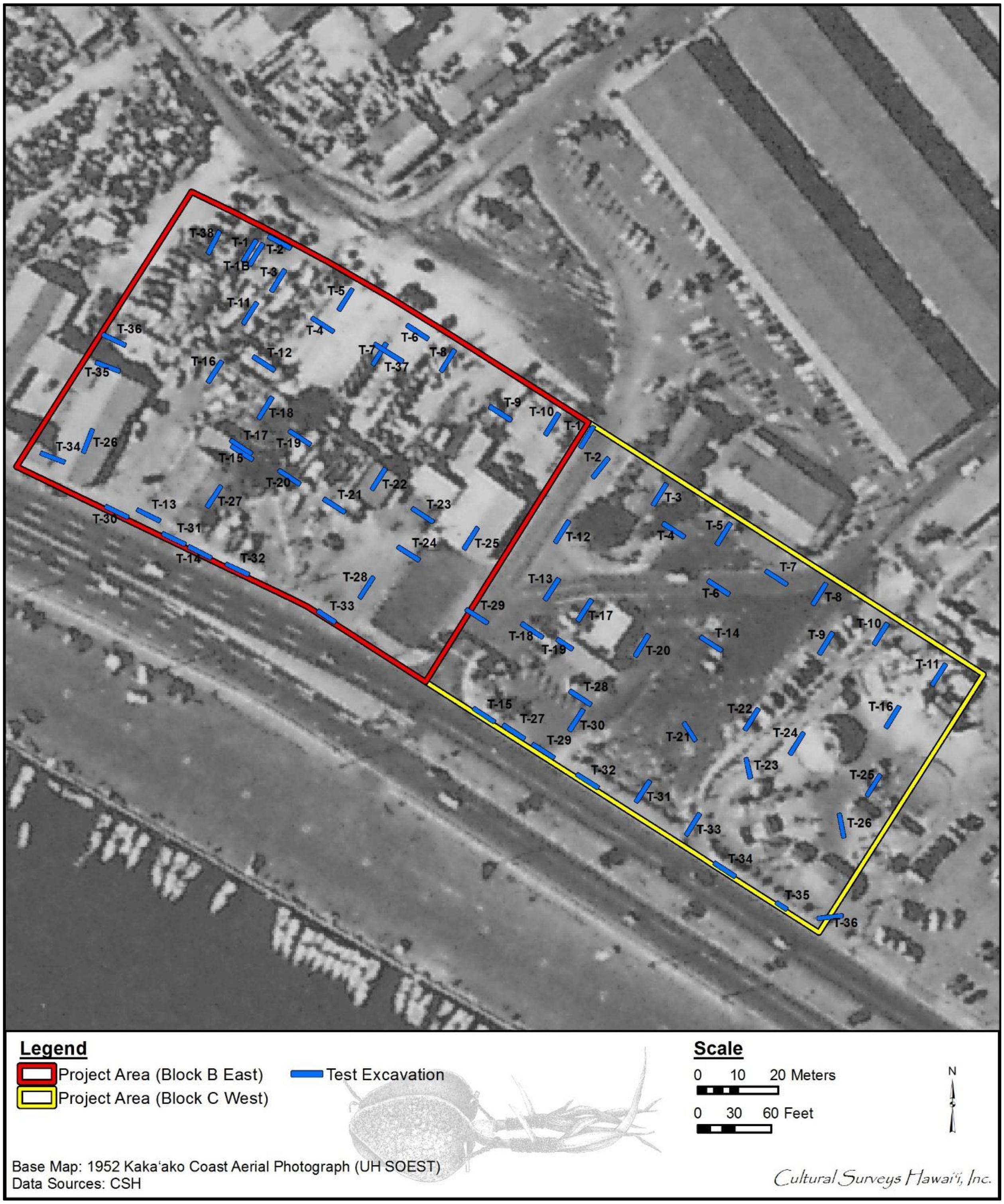

Figure 240. 1952 aerial photograph with an overlay of the Block B East and Block C West project areas and test excavations locations (U.S. Army Air Corps, mosaic of sheets from Hawai‘i Coastal Geology Group)

constructed, along with several more buildings. If the oiled surface was related to the surfaces seen on the 1952 aerial, it likely would have been more widespread than these three test excavations, suggesting the oiled, rolled surfaces likely date between 1927 and 1952.

SIHP # -7658 contains a thin, highly compacted cinder structure observed in Block B East Test Excavation 28, located in the southern portion of Block B East (Figure 242 and Figure 243). The upper boundary of the buried, highly compacted cinder surface in Block B East was observed at 87 cmbs, 125 cm above the coral shelf. Additional components of the buried, highly compacted cinder surface were not identified. The cinder material and associated basalt gravel base course were observed overlying the 1919–1926 land reclamation fill. The first evidence of roadways within the Block B East project area can be seen on the 1952 UH SOEST aerial photograph (see Figure 240); a subsequent 1970 aerial (see Figure 241) depicts a new series of structures and parking areas. Although filling of the project area was complete by 1926, no evidence of a roadway or surface is visible on the 1927 or the 1939–1941 aerial photos (see Figure 238 and Figure 239), suggesting the cinder roadway likely post-dates 1939–1941 and pre-dates construction of the current Ward Warehouse structure (1976).

SIHP # -7658 contains a total of 17 buried asphalt surfaces within the project area boundaries of Block B East and Block C West (see Figure 235). Two of the buried asphalt surfaces were observed in Block B East Test Excavations 10 and 19 (Figure 244 and Figure 245). The upper boundaries of the buried asphalt surfaces in Block B East were observed between 35 and 87 cmbs and between 100 and 130 cm above the coral shelf. Continuity of the buried asphalt surfaces could not be identified and the asphalt surfaces are distributed throughout the project area. Asphalt parking areas are not visible on the 1939–1941 aerial photo (see Figure 239), indicating these surfaces date between 1939 and 1976. The surface may be associated with several parking lots and structures observed on the 1952 (see Figure 240) and 1970 (Figure 241) aerial photos.

Fifteen of the buried asphalt surfaces were observed in Block C West Test Excavations 1, 2, 3, 4, 8, 9, 11, 14, 16, 20, 22, 23, 24, 26, and 29 (Figure 246 and Figure 247). The upper boundaries of the buried asphalt surfaces in Block C West range from 25 to 105 cmbs face and between 110 and 148 cm above the coral shelf. The wide range of depths below the current land surface are mostly attributed to differences of elevation of the current surface due to raised surfaces such as sidewalks, the grade of the parking lot for drainage, and high building foundations. The smaller range of upper boundary heights above the coral shelf shows less variability in the stratigraphic position of the asphalt surfaces in SIHP # -7658. The asphalt surfaces are distributed primarily in the northeast (*mauka*) portion of the project area; however, continuity of the asphalt could not be identified. Asphalt parking areas are not visible on the 1939–1941 aerial photo (see Figure 239), indicating these surfaces date between 1939 and 1976. The surfaces may be associated with several roadways, parking lots, and structures observed on the 1952 (see Figure 240) and 1970 (see Figure 241) aerial photos.

SIHP # -7658 includes four layers with disturbed asphalt chunks, all of which are located within the Block C West project area (Figure 248 and Figure 249). The four layers were identified in Block C West Test Excavations 7, 10, 25, and 36. Due to the nature of disturbance, the upper boundary depths for the layers ranged between 43 and 60 cmbs, and between 111 and 162 cm above the coral shelf, with an average thickness of 36 cm. The buried asphalt surfaces and

Figure 241. 1970 aerial photograph (R.M. Towill), Block B East and Block C West project areas and test excavations locations

Figure 242. Photograph of the buried compacted cinder layer (SIHP # -7658) within the Block B East TE 28 northwest sidewall, indicated by the red arrow

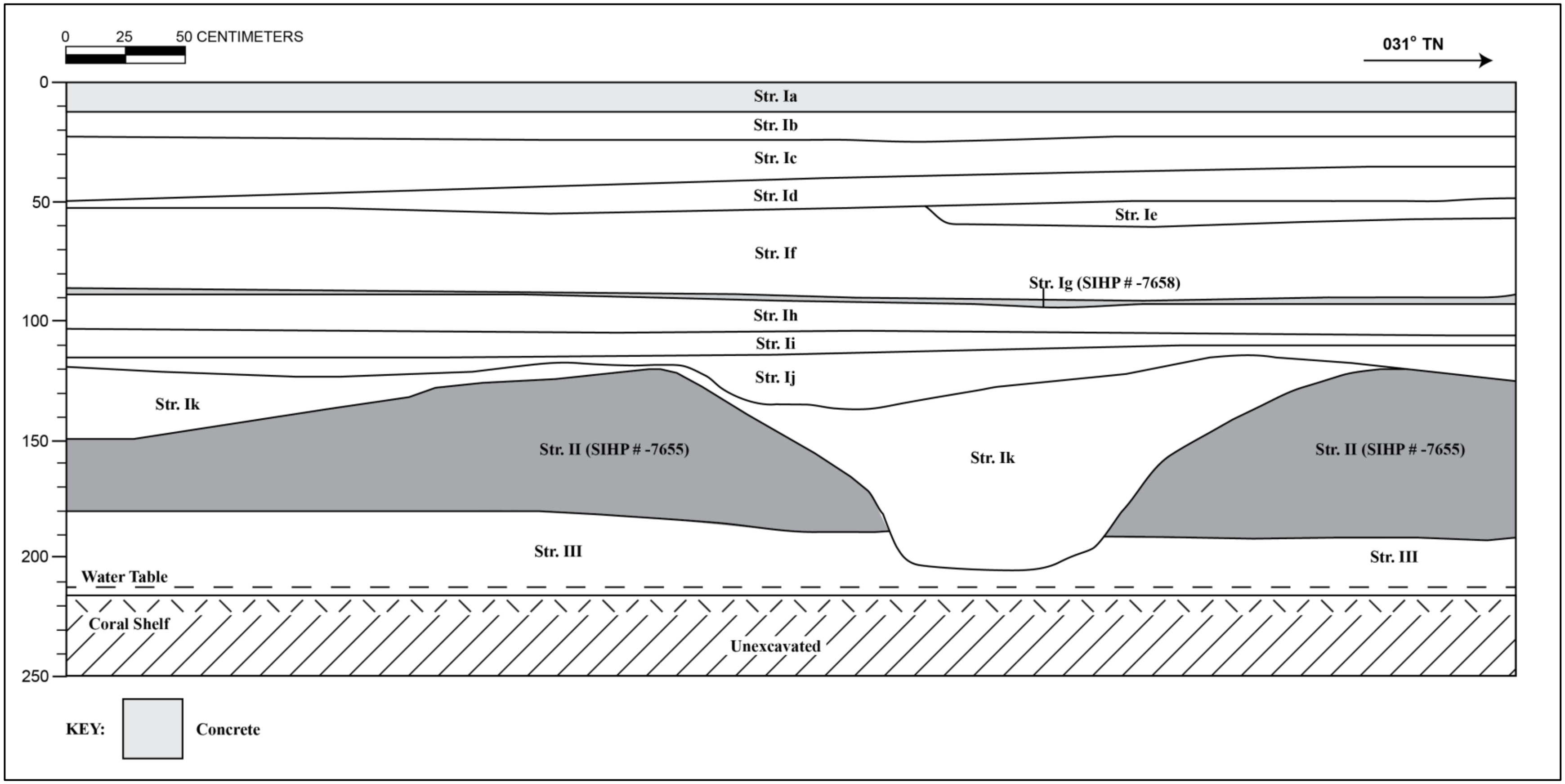

Figure 243. Profile of Block B East TE 28, showing the compacted cinder layer (SIHP # -7658) within the northwest sidewall

Figure 244. Photograph of a buried asphalt surface (SIHP # -7658) in the northwest end of Block B East TE 19, indicated by the red arrow

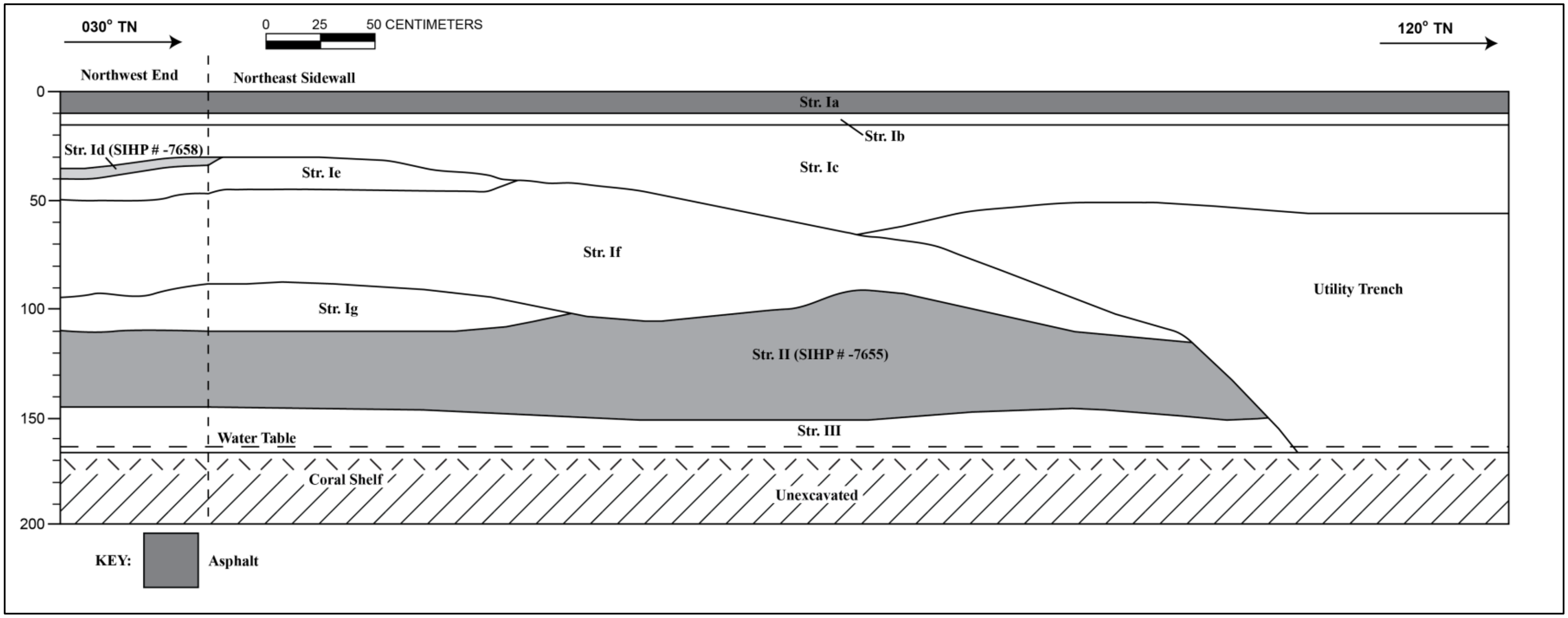

Figure 245. Profile of Block B East TE 19, showing the buried asphalt surface (SIHP # -7658) in the northwest end of the excavation

Figure 246. Photograph of a buried asphalt surface (SIHP # -7658) in the northeast end of Block C West TE 8, indicated by the red arrow

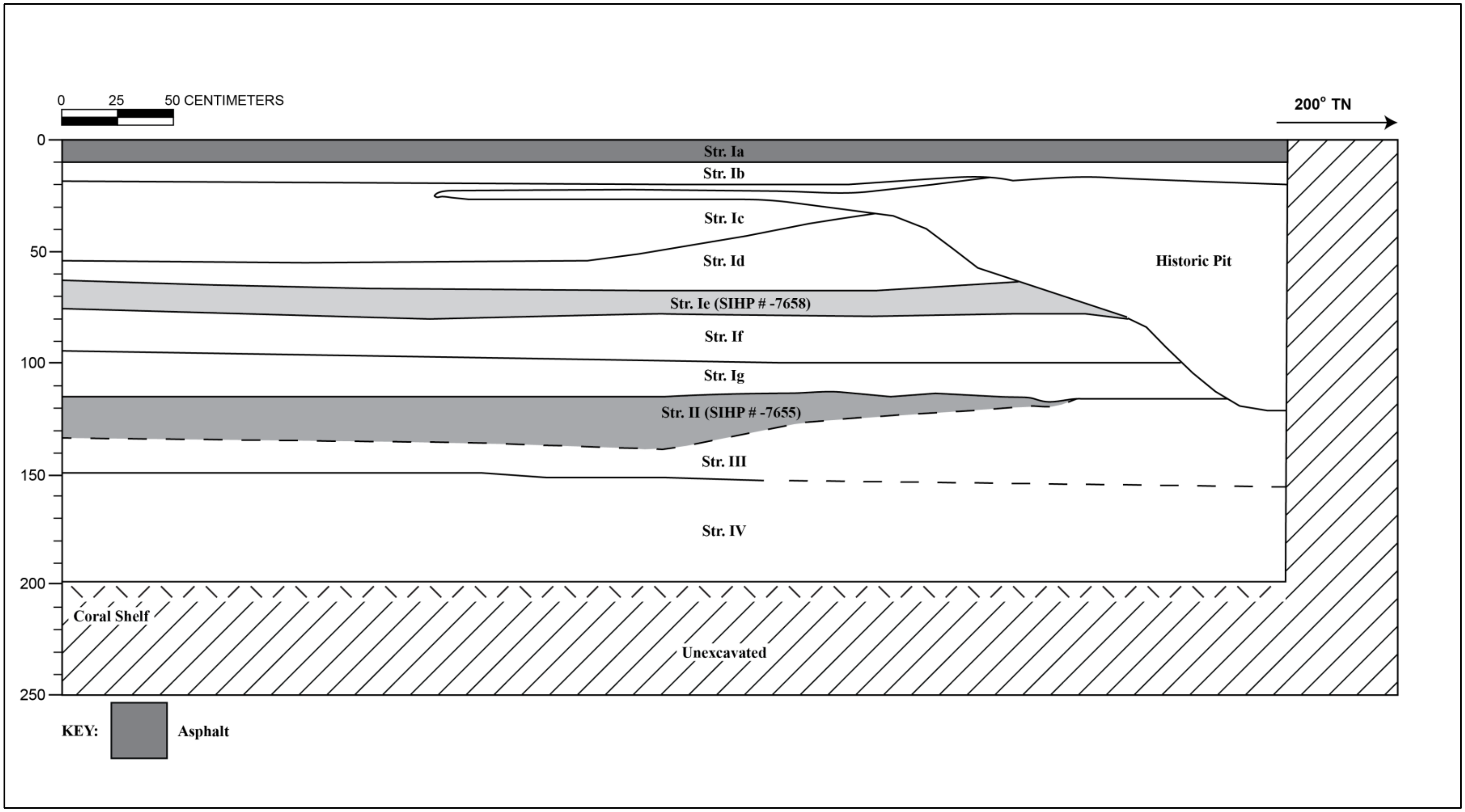

Figure 247. Profile of Block C West TE 8, showing the buried asphalt surface (SIHP # -7658) in the eastern sidewall

Figure 248. Photograph of a disturbed asphalt surface (SIHP # -7658) within Block C West TE 25, indicated by the red arrow

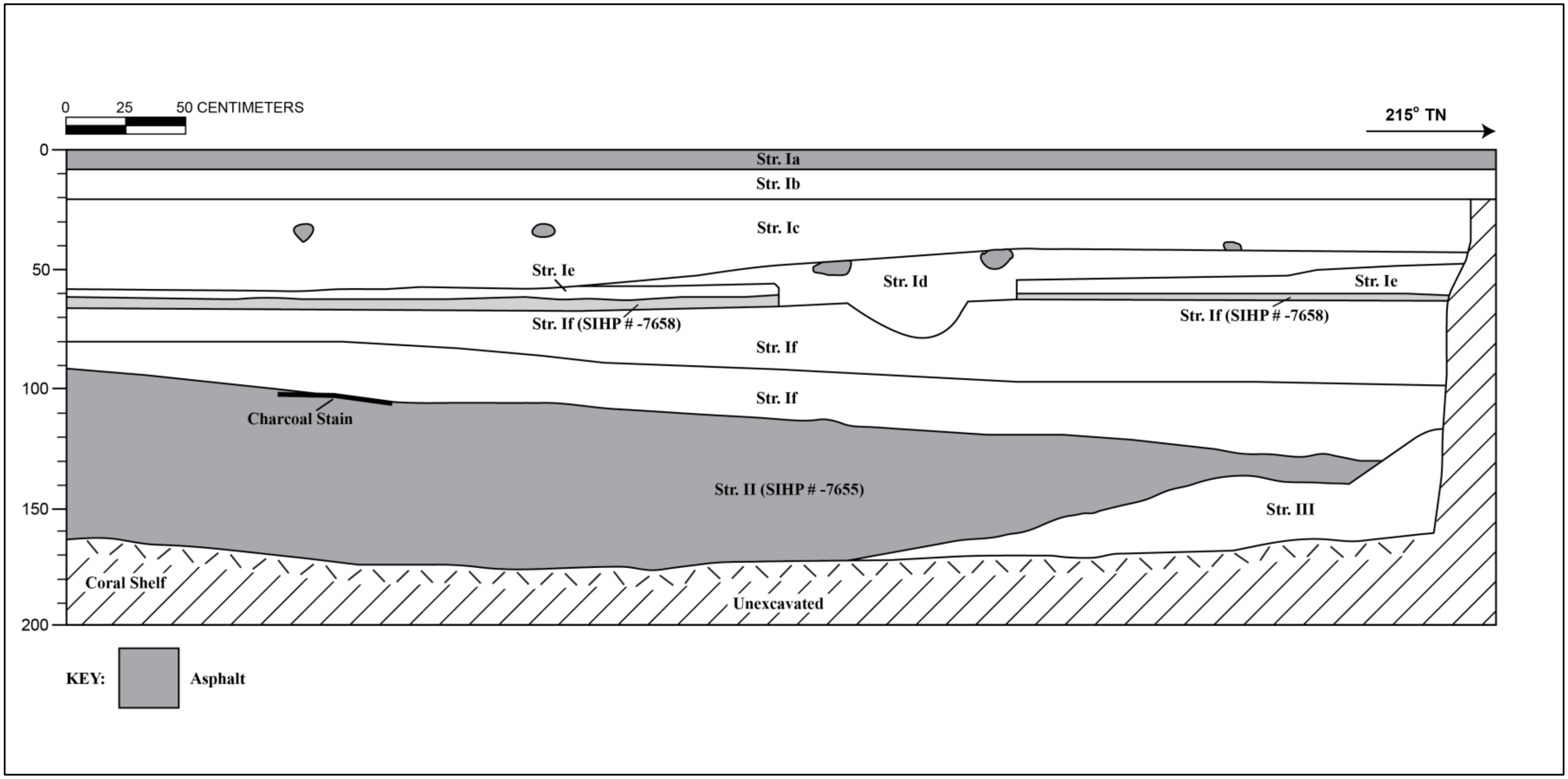

Figure 249. Profile of Block C West TE 25, showing the disturbed asphalt surface (SIHP # -7658) in the southeast sidewall

subsequent disturbance are likely associated with building activity between the 1939–1941 aerial photograph (see Figure 239) and the 1976 construction of Ward Warehouse.

In addition to the two aforementioned asphalt surfaces observed within the Block B East project area (TE 10 and 19), three additional test excavations were conducted in which a buried asphalt surface was identified overlying former concrete foundation slabs (Figure 250 and Figure 251). The three asphalt structures and three concrete structures were identified in Block B East Test Excavations 5, 8, and 9. The upper boundary depths for the asphalt layers were between 20 and 50 cmbs, with a range in thickness from 5 to 12 cm. The upper boundary depths for the concrete surfaces below the asphalt layers have a range of 45 to 63 cmbs, with an average thickness of 14 cm. The concrete surfaces are directly overlying the crushed coral fill and hydraulic fill associated with land reclamation events.

The first possible structure can be seen on the 1927 aerial (see Figure 238), overlapping with the northern portion of TE 8; however, this structure was likely a shed or storage facility rather than a permanent structure with a concrete slab foundation. No structures can be seen in the 1939–1941 aerial photograph (see Figure 239); however, the 1952 aerial shows structures and parking areas present across the entire project area (see Figure 240). The 1952 map, in conjunction with the presence of an asphalt parking area across the *mauka* side of the project area on the 1970 aerial (see Figure 241), suggests the concrete slabs are associated with structures dating between 1939 and 1952. The buried asphalt surfaces located above the concrete slabs are therefore likely associated with later building activity, ranging between the 1952 aerial photograph and the 1976 construction of Ward Warehouse.

SIHP # -7658 includes four layers of buried concrete slabs within the Block B East and C West project areas. Three of the concrete slabs were identified within in Block B East, Test Excavation 4 and the intersecting Test Excavations 7 and 37 (Figure 252 and Figure 253). TE 4 is located approximately 10 m from TE 7 and 37. The upper boundary depths for the concrete layers ranged between 45 and 90 cmbs with thickness ranging from 10 to 15 cm. The concrete surfaces are directly overlying the crushed coral fill and hydraulic fill associated with land reclamation events. As with the concrete slabs observed within Test Excavations 5, 8 and 9, no structures can be seen on the 1927 and 1939–1941 aerials (see Figure 238 and Figure 239), with the exception of the single building near TE 8, likely representing a less substantial structure. Structures can first be seen on the 1952 aerial (see Figure 240), while a parking area is present in the area on the 1970 aerial (see Figure 241). This suggests the concrete slabs are likely associated with structures dating between 1939 and 1952, however, they could be associated with unknown structures present anytime between 1939 and the 1976 construction of Ward Warehouse.

The concrete structure identified in Block C West was located in TE 31. This structure consists of a shallow concrete slab, scored with a decorative pattern and red paint visible in two areas (Figure 254 and Figure 255). The concrete surface has a high step in the northeast portion of the test excavation, which transitions into a grouted paving stone surface. The grouted paving stone surface and high step were observed at 15 cmbs, while the remaining portion of the concrete slab was present at 41 cmbs. This concrete slab appears to be associated with the first phase of a walkway constructed as part of the existing Ward Warehouse structure, eventually filled over and reworked during varying additions and landscaping changes between 1976 and the present.

Figure 250. Photograph of a buried asphalt surface (SIHP # -7658) (red arrow), overlying a concrete slab (SIHP # -7658) (yellow arrow) within Block B East TE 5

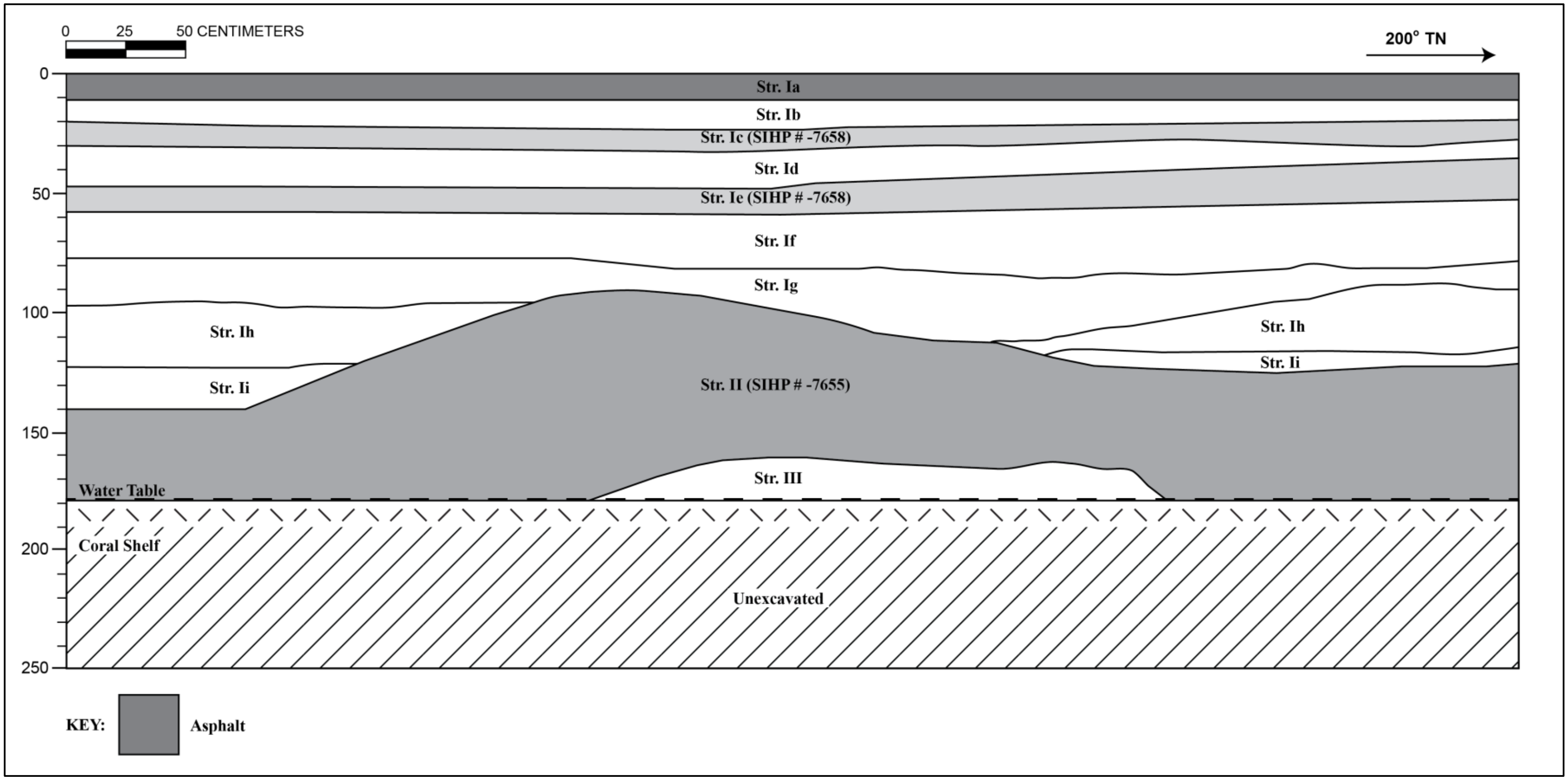

Figure 251. Profile of Block B East TE 5, showing the buried asphalt surface (SIHP # -7658), overlying a concrete slab (SIHP # -7658) in the southeast sidewall

Figure 252. Photograph of a buried concrete slab (SIHP # -7658) within Block B East TE 7

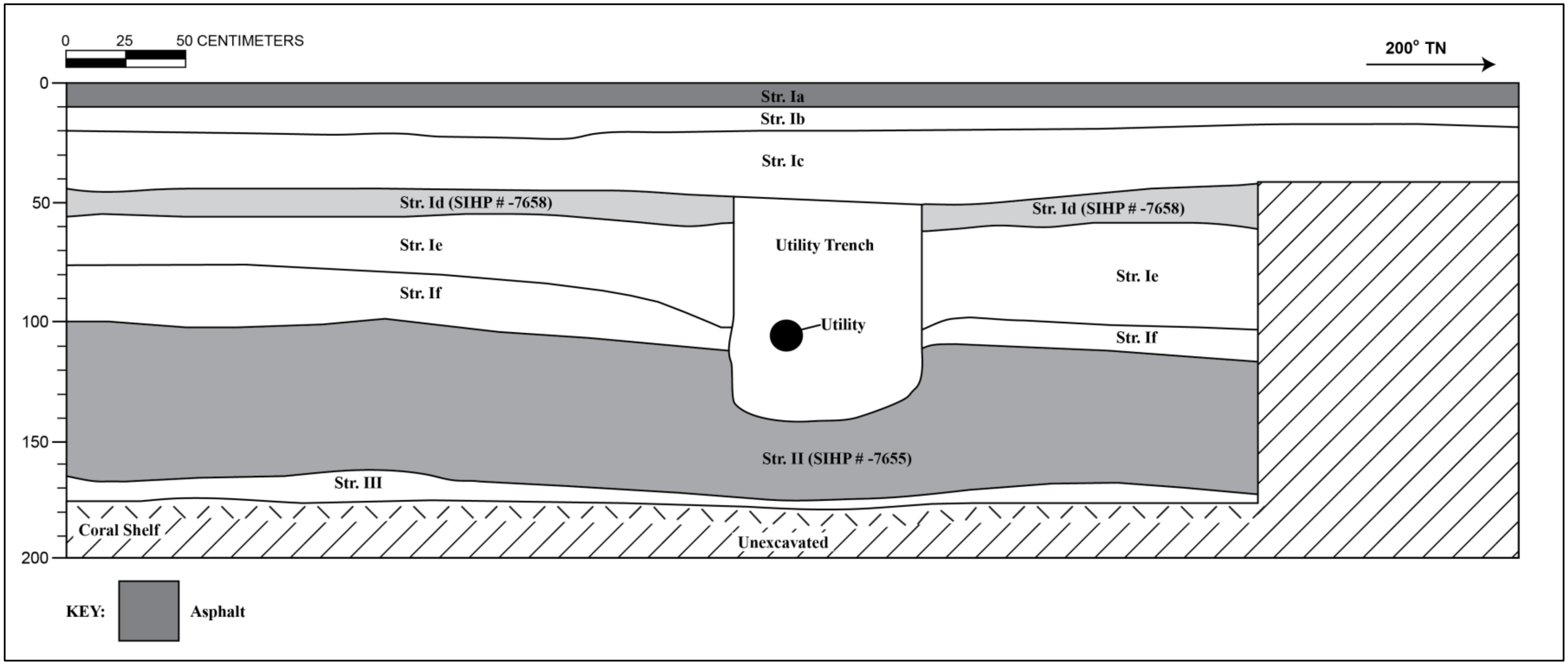

Figure 253. Profile of Block B East TE 7, showing the buried concrete slab (SIHP # -7658) in the east sidewall

Figure 254. Photograph of the buried concrete walkway (SIHP # -7658) within Block C West TE 31. Note the red pain at the far end (red arrow), and the grouted paving stones in the near end (yellow arrow)

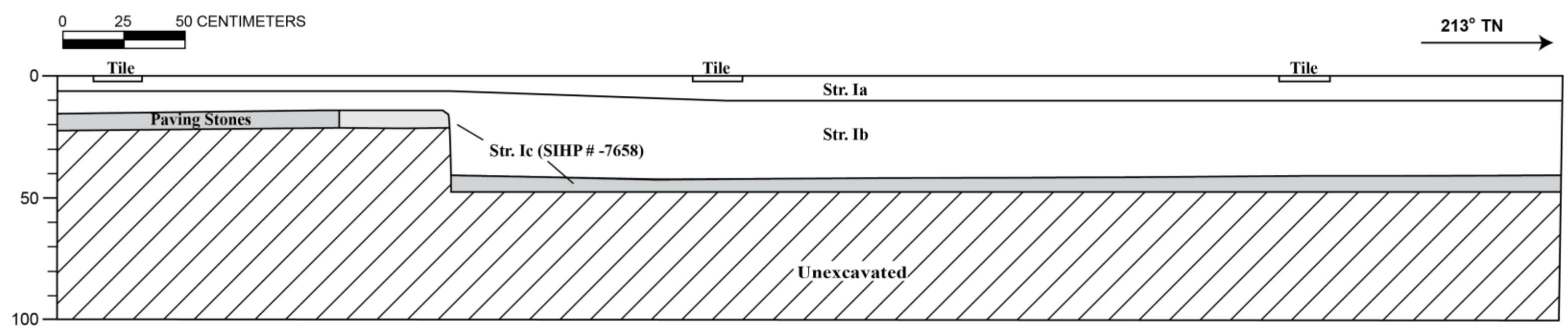

Figure 255. Profile of Block C West TE 31, showing the buried concrete walkway (SIHP # -7658), in the southeast sidewall

Three buried coral and tar pavements associated with SIHP # -7658 were encountered along the *makai* edge of the Block B East project area, within Test Excavations 30, 31, and 32 (Figure 256 and Figure 257). These buried former surfaces were encountered at depths ranging from 27 to 43 cmbs, with a thickness ranging from 5 to 10 cm. These observed pavements differ from the buried asphalt surfaces and are overlying a disturbed and reworked sand layer, possibly associated with the former shoreline. An old beach road can be seen on the 1897 Monsarrat Map (Figure 258) located near TEs 30, 31, and 32, replaced by the current Ala Moana Boulevard by 1939 (see Figure 239). These buried surfaces may be associated with the old beach road; however, due to disturbance to the underlying sand, which was thought to be a result of land restructuring associated with land reclamation and the surrounding urban development, it may be associated with various roadways and parking areas following the 1919–1926 land reclamation.

In addition to the buried former land surfaces, SIHP # -7658 includes four buried wooden posts observed along the *makai* edge of both the Block B East and Block C West project areas. Of the four posts, only one was observed within Block B East (Test Excavation 14), while three were observed within the Block C West project area (Test Excavations 27, 29, and 32). The wooden remnants collected from the posts appeared to consist of milled wood, all extending through the natural sediment to approximately 5 cm above the coral shelf (Figure 259, Figure 260, and Figure 261). The upper boundaries ranged from 35 and 70 cmbs, beneath imported fill overlying the disturbed natural sediments. The wooden post remnants may represent portions of a fence line formerly located along the southwest boundary of the two project areas. The exact time frame for these posts is difficult to determine, however, they may have been associated with a fence bordering the old beach road first identified on an 1884 map (Figure 262), or with the various stages of development including the current Ward Warehouse structure. It can only be determined, based on their milled characteristics, that they represent a post-Contact structure.

In summary, SIHP # -7658 contains 42 buried former land surfaces, consisting of asphalt, concrete, coral and tar pavement, oiled, rolled surfaces, and wooden posts, associated with multiple historic land use periods. With the exception of the wooden posts, the buried structures are all overlying the hydraulic dredge and crushed coral fill associated with the 1919–1926 Kewalo reclamation. The fill overlying SIHP # -7658 is associated with grading and construction of the current Ward Warehouse structures. Urban development within the Block B East and Block C West project areas changed drastically between the 1927 and the 1970 aerial photographs, indicating that construction within the project areas was constantly on-going and changing. It is likely addition structures and surfaces were present within the project areas that are not pictured on any maps or aerial photos. SIHP # -7658 is assessed as significant under Hawaiʻi state historic property significance criterion "d" (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR §13-284-6. This assessment was based on the historic property's potential to provide additional information on twentieth century commercial infrastructure within Kakaʻako.

Figure 256. Photograph of a coral and tar buried surface (SIHP # -7658) within Block B East TE 30, indicated by the red arrow

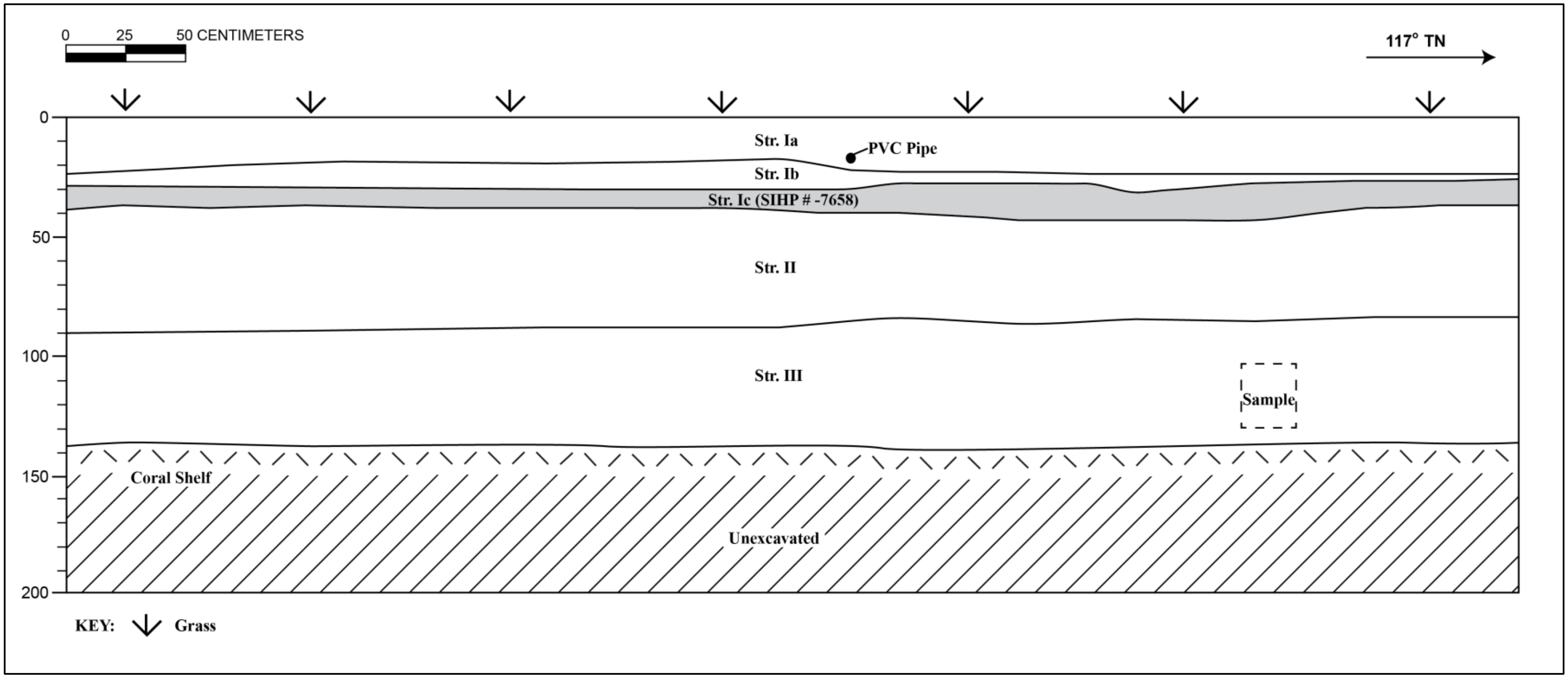

Figure 257. Profile of Block B East TE 30, showing the coral and tar buried surface (SIHP # -7658), in the north sidewall

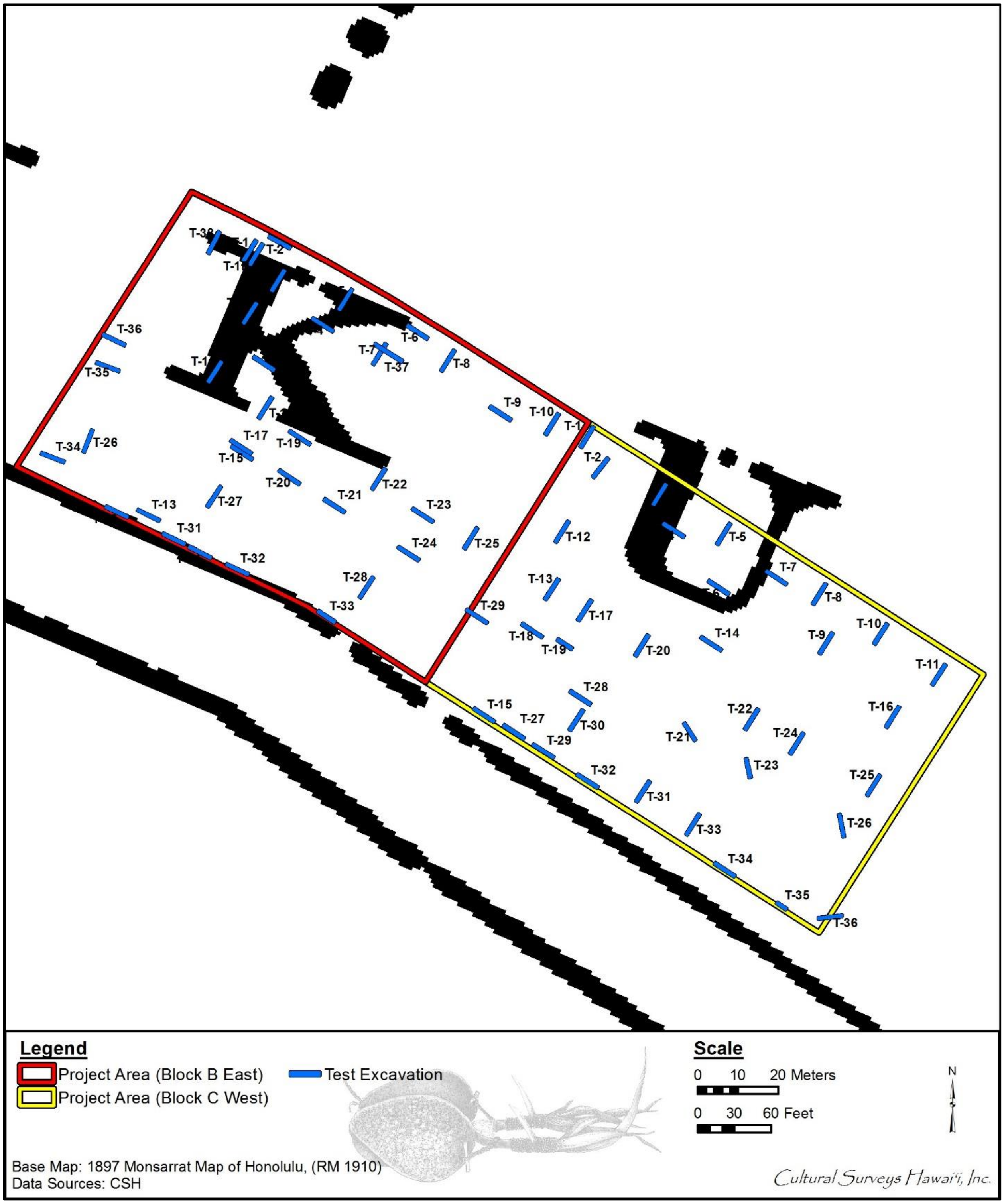

Figure 258. 1897 map of Honolulu by M.D. Monsarrat (Hawai‘i Land Survey Division, Registered Map 1910), showing an overlay of the Block B East and Block C West project areas and test excavations locations

Figure 259. Photograph of a wooden post likely associated with a historic fence line (SIHP # -7658) within Block C West TE 31

Figure 260. Photograph of the sidewall within Block B East, TE 14, showing the former location of a wooden post (SIHP # -7658) within the sidewall

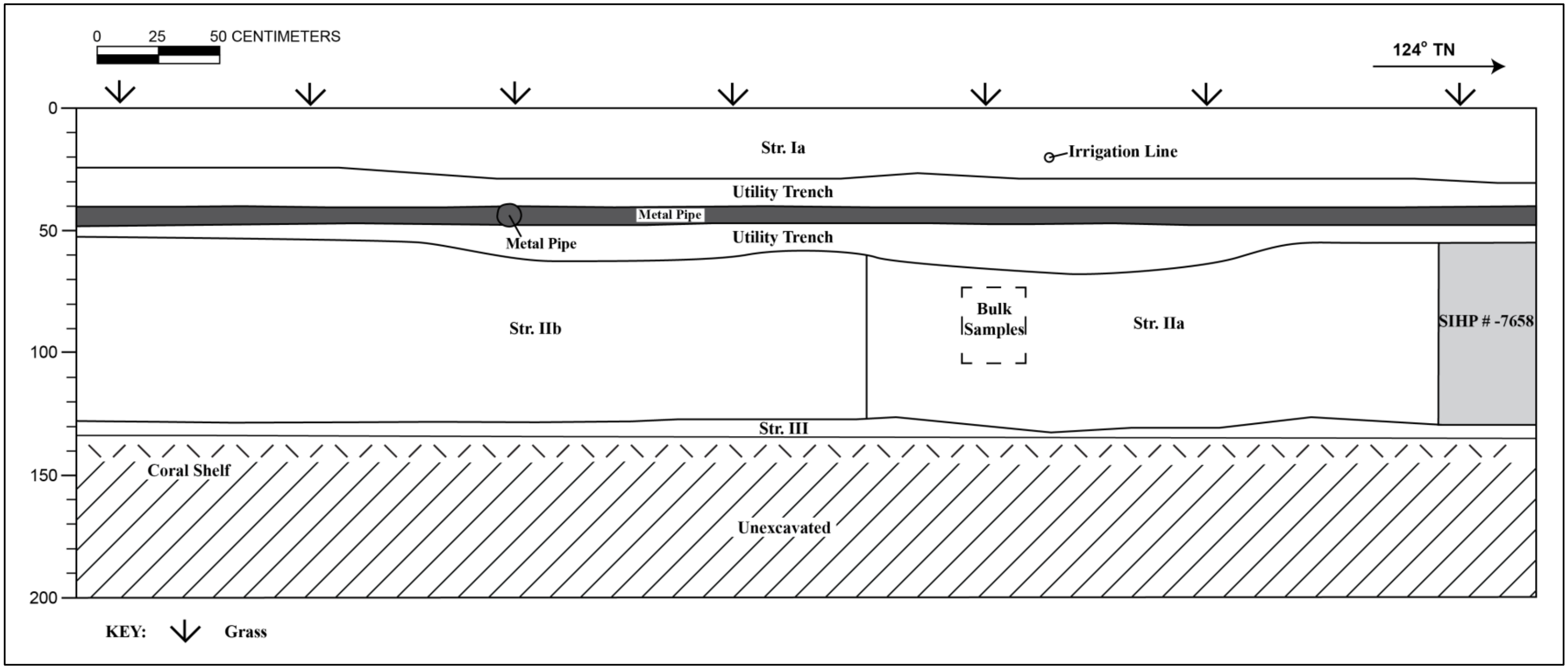

Figure 261. Profile of Block B East TE 14, showing the location of a wooden post (SIHP # -7658), in the north sidewall

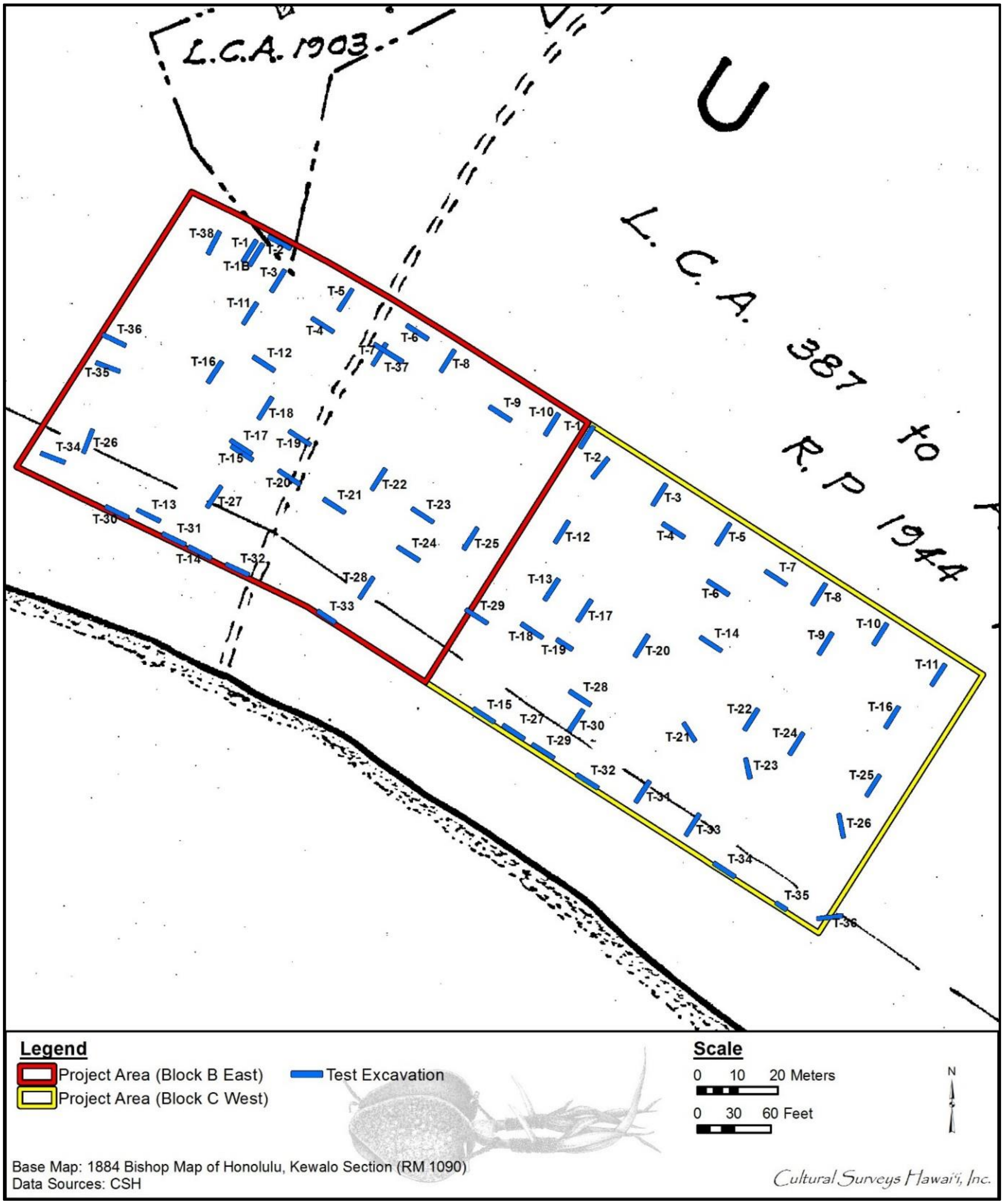

Figure 262. 1884 map of Honolulu, Kewalo Section (portion), by S.E. Bishop, with an overlay of the Block B East and Block C West project areas and test excavations locations (Hawai‘i Land Survey Division, Registered Map 1090)

Section 7 Research Objectives

Based on historic background research and previous archaeological investigations, the AISP for the Block C West project formulated three research objectives. Information obtained from the AIS investigation greatly informed each of these objectives and is presented below for each question.

7.1.1 Research Objective 1

The Block C project AIS investigation (Yucha et al. 2014), located immediately adjacent to (south of) the current project area, documented a sand A horizon and Jaucas sand beneath the overlying fill layers in the majority of the project area: however, no cultural material or features were identified. Does similar stratigraphy exist within the Block C West project area, and if so, is there any evidence of traditional Hawaiian use of this coastal area (e.g. habitation, burials, fishing practices) or of early Western use? What might the presence, or absence, of cultural deposits indicate about cultural use of the Kakaʻako shoreline?

Within the central and *mauka* portions of the Block C West project area, the AIS test excavations documented buried historic salt pan remnants (SIHP # -7655) overlying natural wetland sediment. Within the *makai* portion of the project area, test excavations documented disturbed natural marine sandy clay deposits. These results differ greatly from the Jaucas sand deposits observed within Block C. This change in stratigraphy, however, was already intimated by the presence of wetland deposits along the northwestern edge of the Block C project area. Within T-33, T-37, and T-38, the Block C AIS documented the presence of natural wetland sandy clay deposits overlain by a peat A horizon (Figure 263). These test excavations appear to mark the transition from the Jaucas sand deposits within Block C to the natural wetlands utilized as salt pan beds within Block C West. Within the southwestern corner of Block C, another stratigraphic transition was indicated by the absence of Jaucas sand within T-29, which documented hydraulic reclamation fill over natural marine sandy clay. The results of T-29 (Block C) correspond with the results of the Block C West *makai* test excavations which documented fill overlying disturbed natural marine sandy clay overlying in situ marine sandy clay. Given the high degree of previous disturbance to the natural sediments within the *makai* portion of Block C West, largely due to utility installation, it may be that Jaucas sand deposits in this area were previously removed.

The absence of evidence of traditional Hawaiian use of the Block C West area may reflect the high disturbance to this area within the historic period, in the form of alternation to the natural wetlands to create salt pan structures, or the installation of utility lines and disturbance caused by general infrastructure development. Alternately, it may substantiate the idea that the coastal area of Kakaʻako was only lightly or intermittently occupied and/or utilized for cultural activities. Given the absence of substantial Jaucas sand deposits in this area, even within the Block C project area which contained thin, low-lying sand deposits, it may be that the higher, more dune-like deposits located just southeast of Block C West (located *mauka* of the Auahi and Kamakeʻe Street intersection) provided more suitable terrain for temporary occupation, burials, and tool making activities, as evidenced by the presence of a dense traditional cultural deposit and burial complex within that area (SIHP # 50-80-14-6855) (refer to Sroat et al. 2014; Bell et al. 2006).

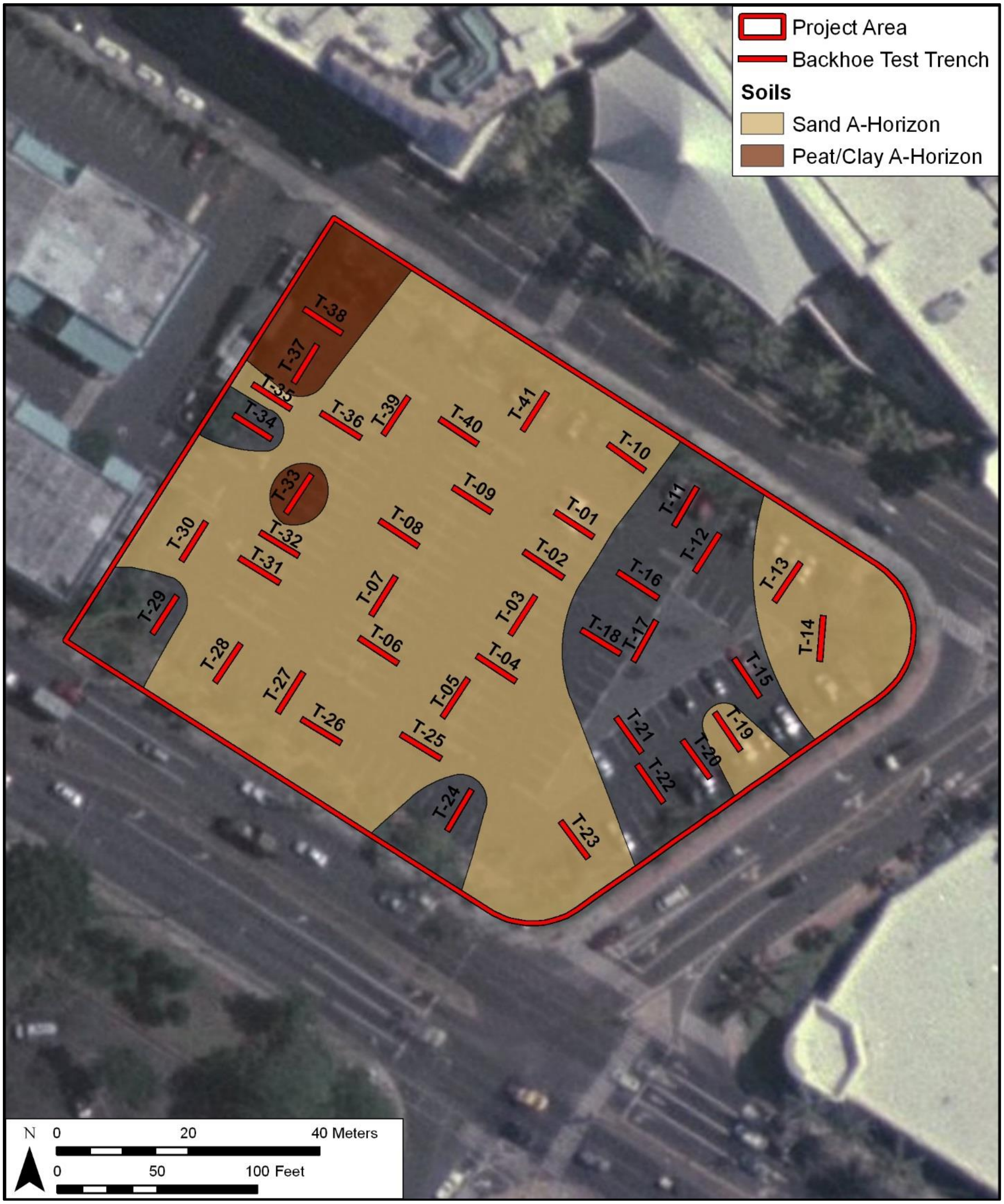

Figure 263. Figure from the Block C AIS report (Yucha et al. 2014) depicting trenches where A horizon/Jaucas sand deposits and wetland (peat/clay) deposits were encountered (Google Earth 2008)

7.1.2 Research Objective 2

Is there evidence of salt pan deposition within the western portion of the project area? Can the southern boundary of the Kaka‘ako salt pans be identified within the project area?

The 1883 Baldwin map indicated that the Block C West project area is located at the southern fringe of an extensive area of historic salt pans (refer to Figure 18). The map appeared to indicate that only the western border of Block C West lay within this area. The results of the Block C West AIS investigation clearly documented, however, that historic salt pans extended across the entire *mauka* and central portions of the project area (for a detailed description of the historic salt pans refer to Section 6.1). As the salt pan berms and laminated salt pan beds were observed within test excavations along the southern boundary of the Block C West project area, but not within the Block C project area, the Block C West AIS investigation has clearly established the southern boundary of the zone of Kaka‘ako salt works, as depicted by the cross-hatching symbol on the 1883 Baldwin map.

7.1.3 Research Objective 3

What evidence exists of the various reclamation projects within the Block C West project area and can any deposits be correlated with specific reclamation projects?

The following discussion pertains to the combined Block C West and adjacent Block B East (Pammer et al. 2014—*draft*) project areas. Land reclamation fill deposits were observed overlying natural sediments in a total of 59 of the combined 74 test excavations, 31 in the Block B East project area and 28 within the Block C West project area (Figure 264). A clear geographic distribution was observed in the central and *mauka* portions of the project area, and notably absent within the *makai* portion. The hydraulic dredge, which is derived from a combination of hydraulic pumping and truck dumping of sediment from the ocean floor, is comprised of platy lenses of sandy or silty clay, ranging from gleyed to pale yellow in color. The clearest observable characteristic of the hydraulic fill was the presence of microstratigraphic banding. The topmost layer of land reclamation fill typically consisted of a gravelly crushed coral fill material, differing from the hydraulic clays by providing a dry, permeable, and stable land surface. Land reclamation fill was largely absent in test excavations exhibiting a high natural ground surface (Block B East, Test Excavations 15 and 17; Block C West, Test Excavation 10)

Background research indicates that while land reclamation had begun in Kewalo prior to 1913, the Block B East and Block C West project areas remained fallow until dredging of the Kewalo Basin, which took place from 1919–1926. As the two project areas are located directly *mauka* of the Kewalo Basin, they were likely among the first pieces of land to be filled with this dredged material. A 1920 report by the Department of the Interior notes:

> The development of Kewalo Basin as a lumber trade terminal and fishing fleet base has been given considerable study and preliminary investigations have been carried on during this period. Surveys were made, including the necessary borings and soundings, for a channel into this basin from the sea 15 feet deep and 150 feet wide as the first unit of development. A contract was awarded for dredging this channel for $39,000. Part of the material dredged has been utilized for reclaiming a piece of land for the Territory 200 feet square at the southeast corner of the bishop estate fill now owned by the Territory; part of the material is being pumped ashore reclaiming

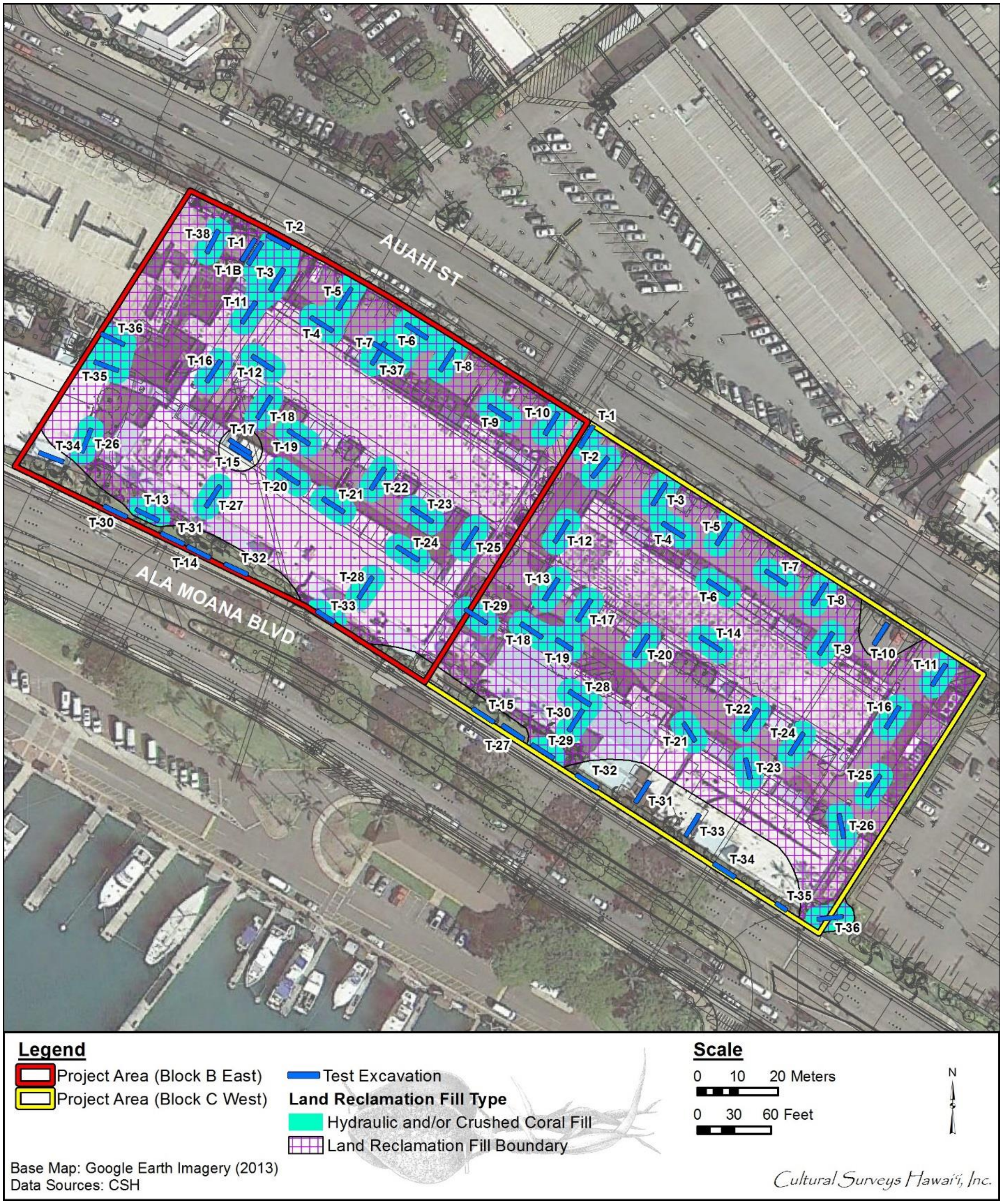

Figure 264. Aerial photograph showing the extent of the land reclamation fill, including both hydraulic fill and crushed coral fill, documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

> some of the Ward estate lands and the balance wasted at sea. [Department of the Interior 1920:2:52]

The above report, pertaining to the fiscal year ending 30 June 1920, suggests land reclamation within the Ward Estate lands, which would include the current project area, was ongoing in the first half of 1920. A 1914 report on the Kewalo Reclamation describes the dredging process:

> By this [hydraulic] method the material dredged is carried in suspension or by the influence of water which is forced through large pipes and laid upon the lands and intervening streets, and afterwards is distributed and leveled, the water having drained off through ditches provided for the purpose. The work is done in large sections around which bulkheads have been constructed. A section can be filled in about thirty days, the dredger working about fifteen hours per day. And in about two months after a section has been filled the ground will have dried out so as to be fit for use as before. [Hawaii Reports 1914:351]
>
> It appears in evidence that though the method employed the finest of the material which is carried upon the land settles when the water which transports it becomes quiet and as the water runs off a sludge or mud remains which forms a strata more or less impervious to water. This strata, however, is covered by the coarser and more porous material. . . . it appears that by mixing in to a depth of a few inches ordinary soil small plants will grow without difficulty. . . [Hawaii Reports 1914:351]

This report suggests dredging and filling an area was relatively quick (three months total), indicating the two project areas may have been completely reclaimed by the end of 1920. It appears the hydraulic and crushed coral fill were placed as one reclamation event, the hydraulic clay proceeding the crushed coral in an effort to first “drain off” the marshy water. Figure 265, Figure 266, and Figure 267 depict the Block B East and Block C West project areas with an overlay of the trench locations, showing the distribution of the hydraulic fill (see Figure 265), crushed coral fill (see Figure 266), and the trenches that contained both (see Figure 267).

A 1927 aerial photograph depicts the filled and leveled Block B East and Block C West project areas, relatively barren with few to no structures (Figure 268). An active dredge is positioned within Kewalo Basin, a trough or pipeline extending from the dredge to the shore, continuing reclamation of the shoreline *makai* of the project area. A large, southwest-northeast trending swath of barren white dredge material is evident in the northeastern portion of Block B East, extending to the east through the northwest edge of Block C West.

This unique and easily identifiable, early to mid-twentieth century land reclamation deposit was used throughout excavations within the project area as an initial relative dating technique. The strata and deposits overlying the hydraulic fill post-date the 1919–1926 land reclamation events, which were most likely completed within the project areas by the end of 1920. Therefore, the strata underlying the hydraulic fill, consisting of the salt pan remnants (SIHP # -7655) and disturbed sand, could be considered older than the early-twentieth century land reclamation deposit.

The modern land surface within the project area was comprised of asphalt within the parking lot and concrete within the interior of the Ward Warehouse structures and adjacent walkways. The

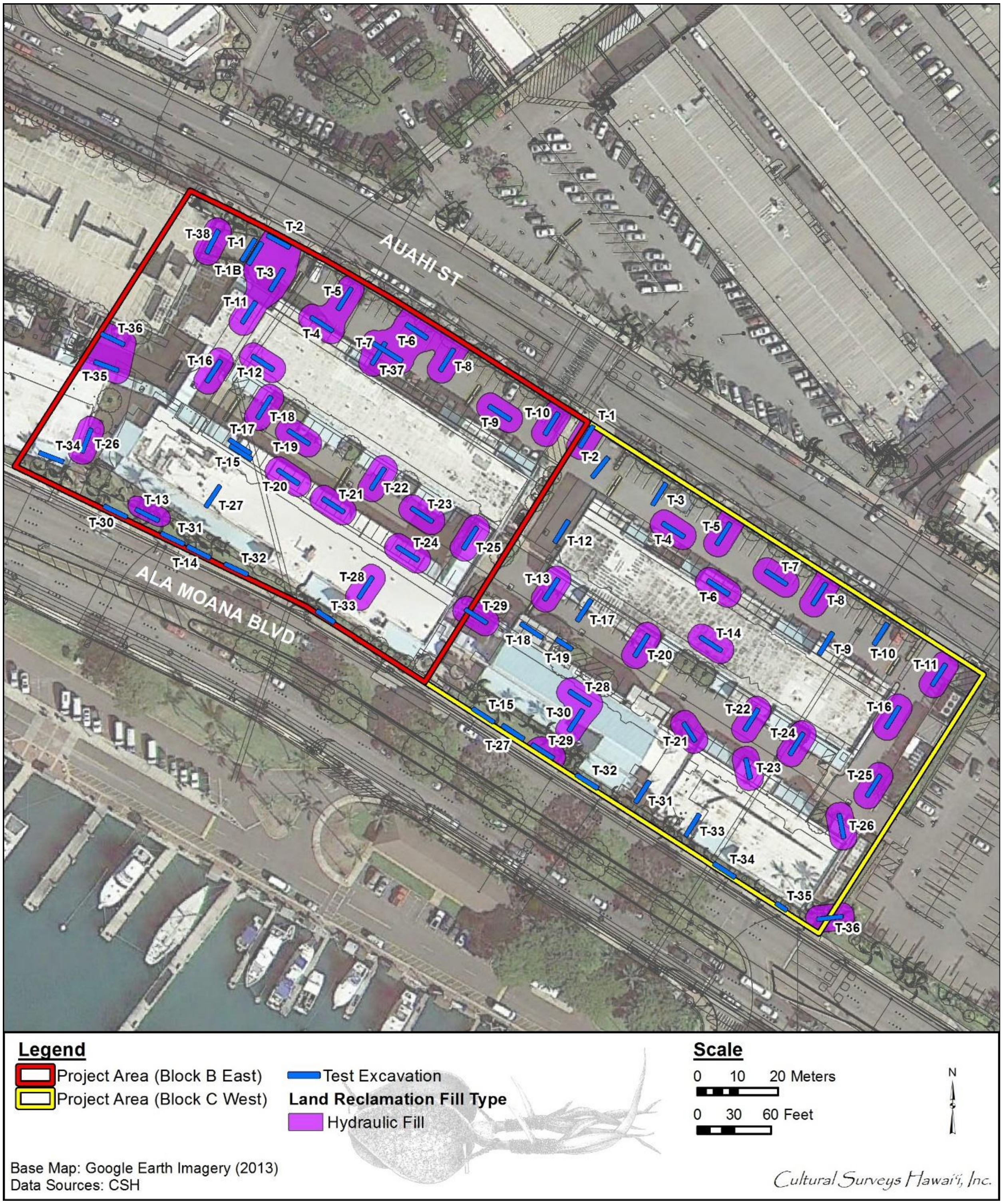

Figure 265. Aerial photograph showing the extent of the hydraulic fill documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

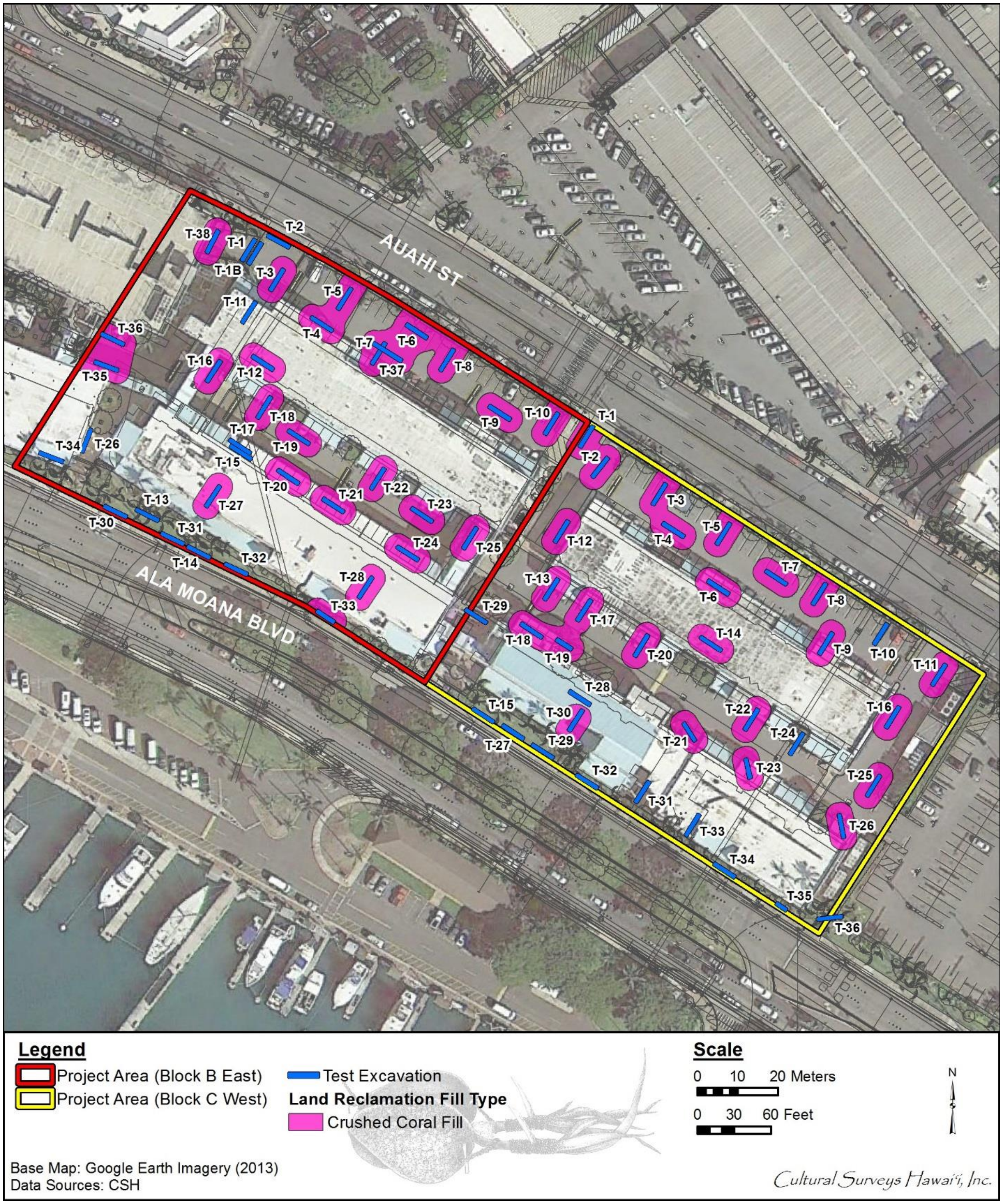

Figure 266. Aerial photograph showing the extent of the crushed coral fill documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

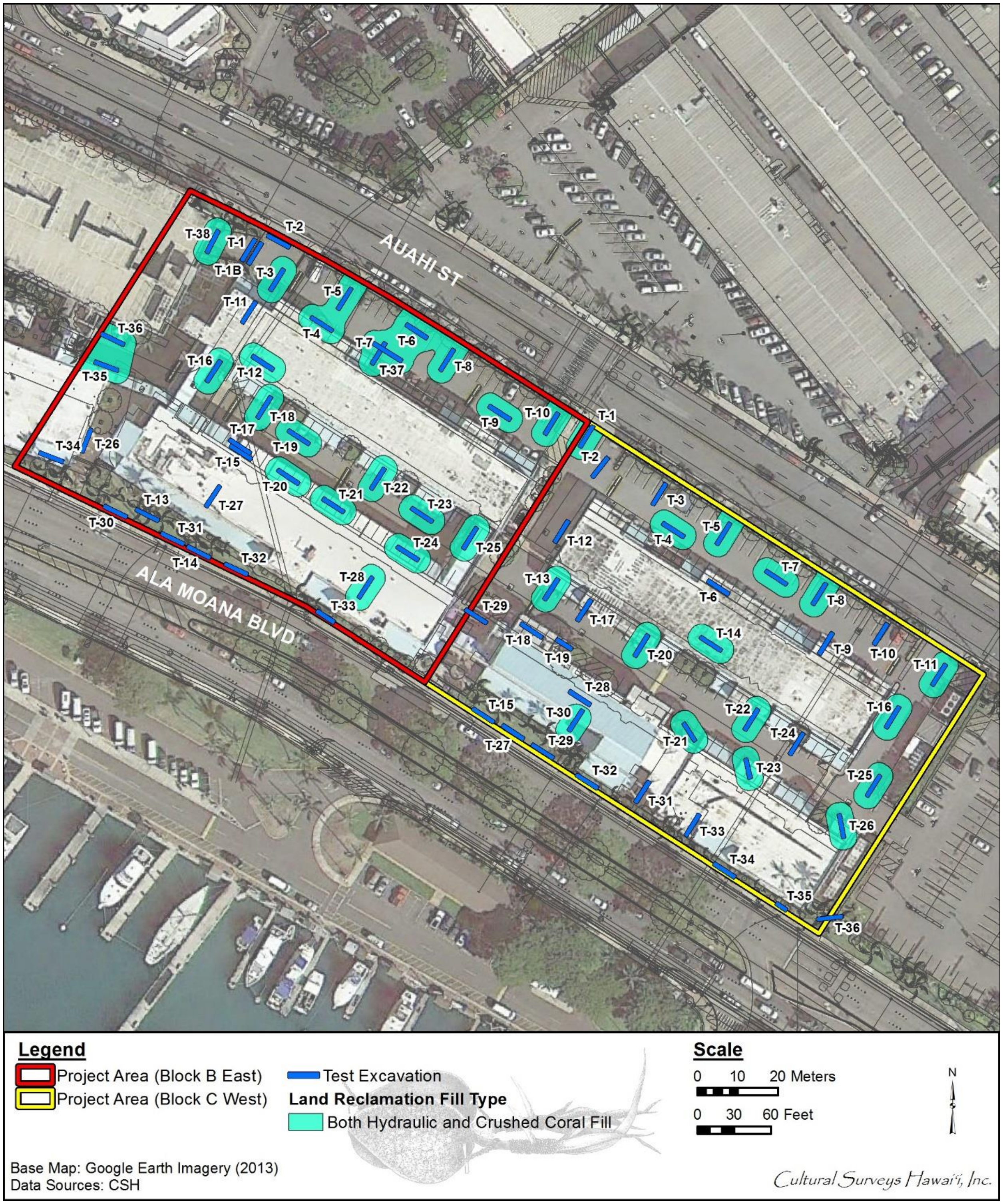

Figure 267. Aerial photograph showing only the trenches that contained both hydraulic fill and crushed coral fill, documented within the Block B East and Block C West project areas (source: Google Earth Imagery 2013)

modern land surface was universally designated Stratum Ia. Based on a review of aerial imagery, the white dredge fill material is visible as the Block B East and Block C West project area land surface within the 1927 and the 1939–1941 aerial photos (Figure 268, Figure 269). By 1952, development within the two project areas appears significantly heavier, which would have included the addition of fill to the land reclamation materials (Figure 270). The project areas were further altered by the time of the 1970 aerial photo, these structures likely representing the final fill layers placed prior to the 1976 construction of the current Ward Warehouse commercial complex (Figure 271).

Figure 268. 1927 USGS aerial photograph showing dredge activity within and adjacent to the project area (U.S. Geographic Service; mosaic of photograph sheets from Hawai‘i Coastal Geology Group)

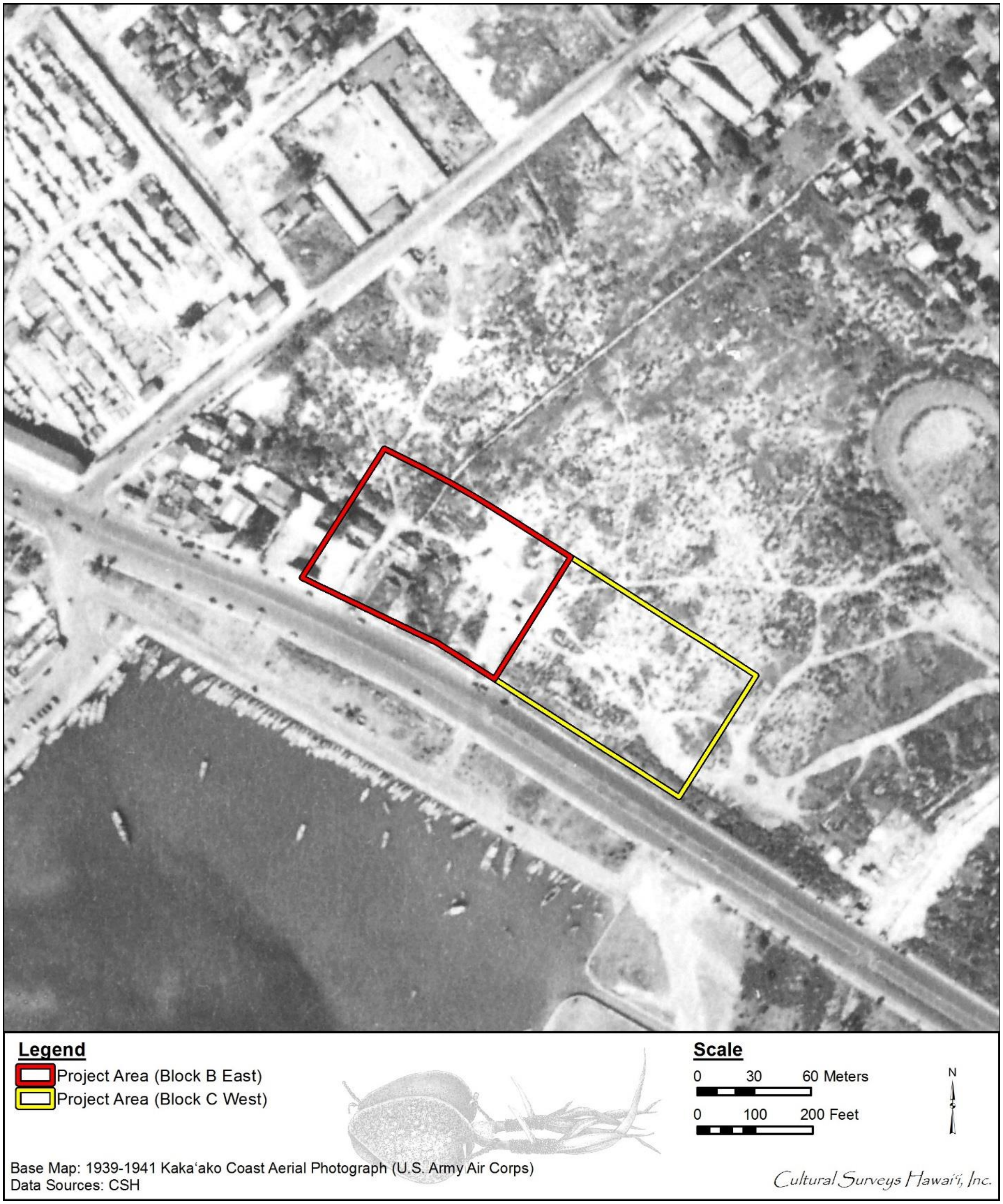

Figure 269. 1939–1941 aerial photograph (U.S. Army Air Corps) of Kakaʻako with an overlay of the Block B East and Block C West project areas showing white dredge fill material still visible as the land surface

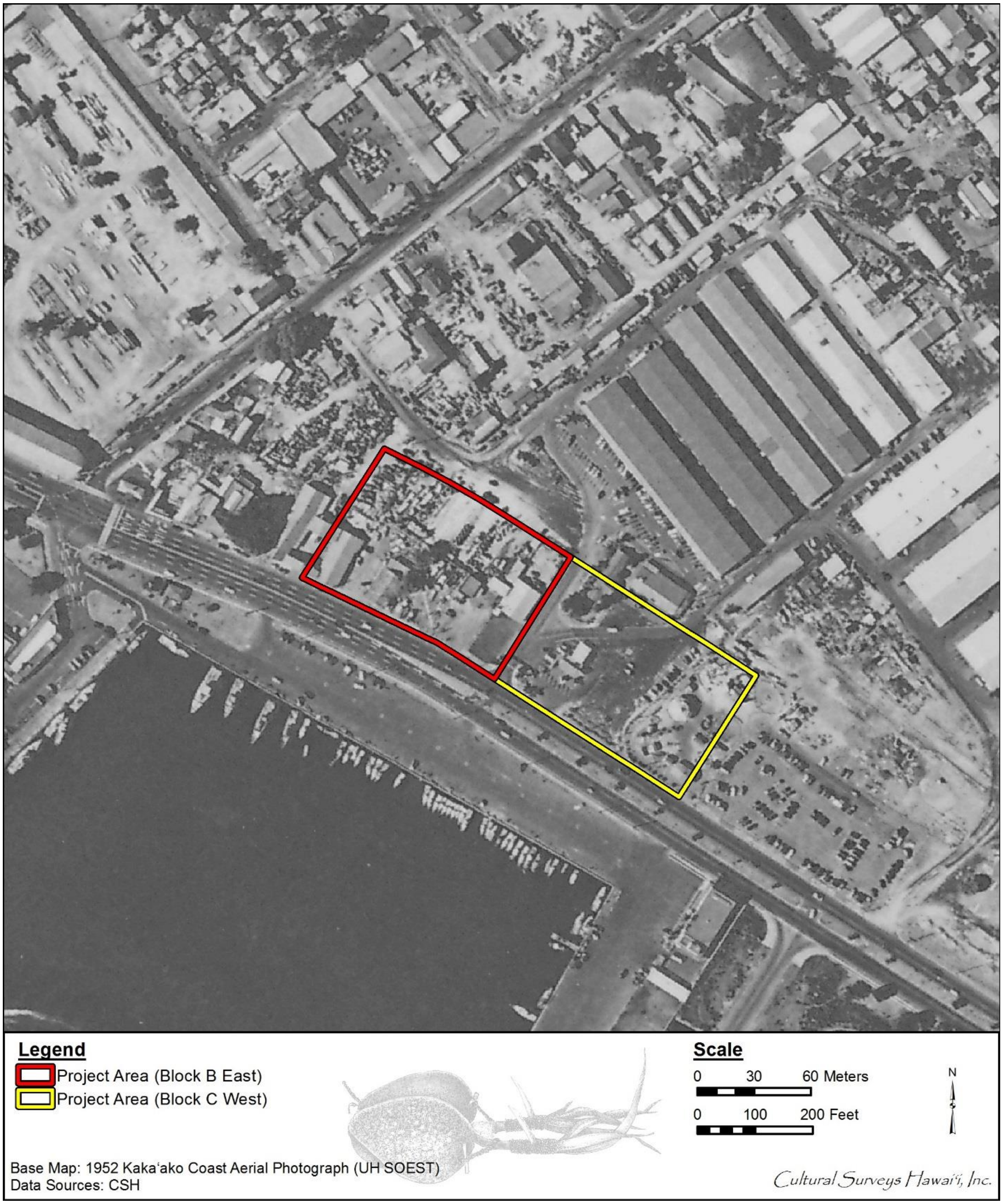

Figure 270. 1952 aerial photograph with an overlay of the Block B East and Block C West project areas showing development within the two project areas (U.S. Army Air Corps, mosaic of sheets from Hawaiʻi Coastal Geology Group)

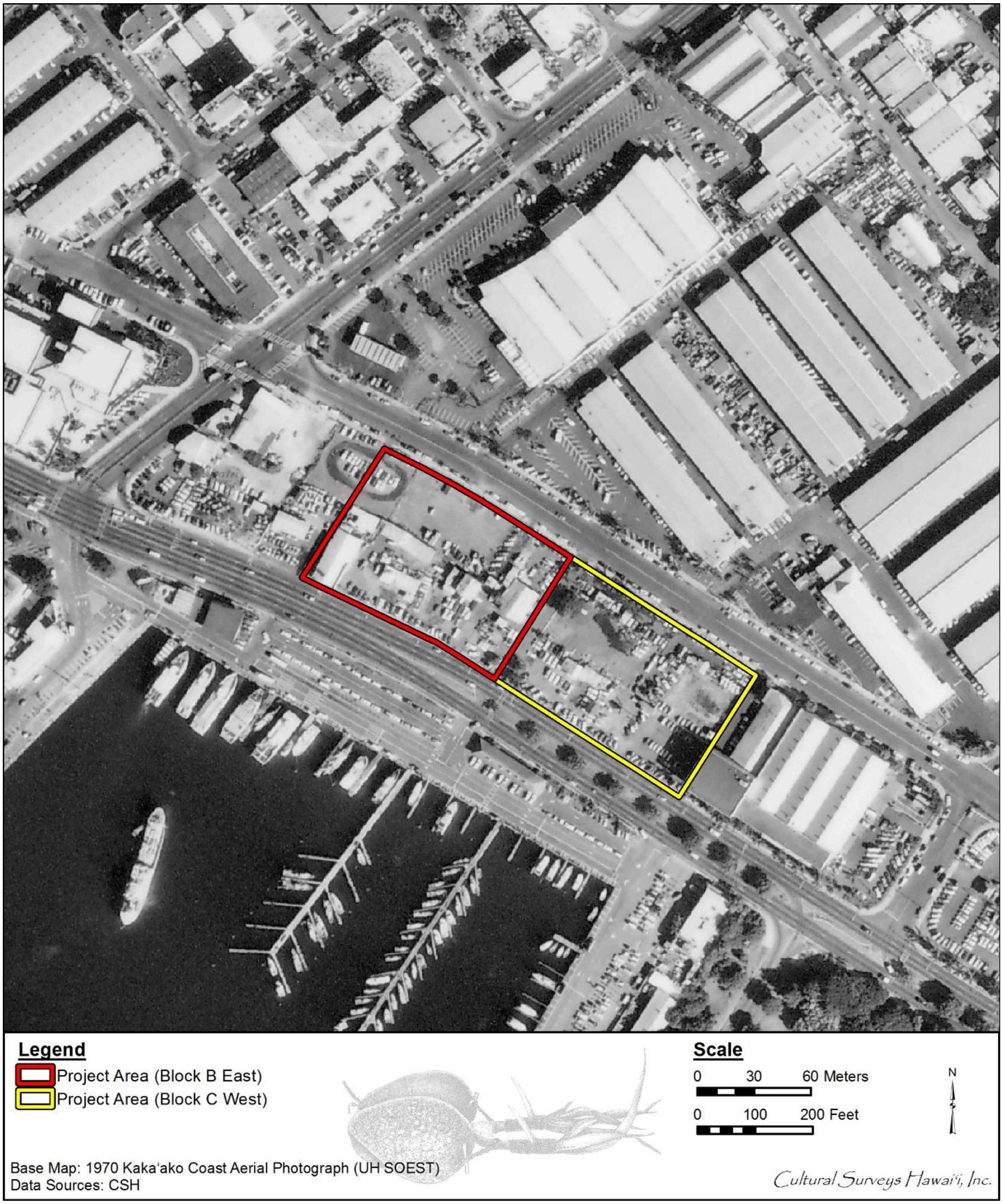

Figure 271. 1970 aerial photograph (R.M. Towill), with an overlay of the Block B East and Block C West project areas further development within the project areas

Section 8 Summary and Interpretation

The fieldwork component of this archaeological inventory survey was conducted between 14 April 2014 and 5 June 2014. Fieldwork consisted of a 100 percent pedestrian inspection of the project area and the excavation of 36 backhoe-assisted test excavations, comprising approximately 133.78 square m, or 1440 square ft, of excavated area. The majority of test excavations were distributed throughout the general project area, within both exterior (parking lot/courtyard) and interior (Ward Warehouse commercial space) locations.

In general, the stratigraphic sequence within Block C West from the present land surface to the coral shelf included the modern developed land surface and variable layers of imported fill, overlying buried historic surfaces and associated grading fill, overlying crushed coral and hydraulic (dredge) reclamation fill, overlying historic salt pan remnants and/or natural wetland and marine sediments.

Background research indicates that the Block C West project area was filled during dredging of the Kewalo Basin, which took place from 1919–1926. As the project area is located directly *mauka* of the Kewalo Basin, it was likely among the first pieces of land to be filled with the dredged material. Historical records indicate that dredging within the project area was on-going by the middle of 1920, and was likely completed by the end of that same year. The reclamation deposits observed within the project area consisted of crushed coral fill over hydraulic dredge marine clay. The hydraulic dredge, which is derived from a combination of hydraulic pumping and truck dumping of sediment from the ocean floor, is comprised of platy lenses of sandy or silty clay, ranging from gleyed to pale yellow in color. The clearest observable characteristic of the hydraulic fill was the presence of microstratigraphic banding. The topmost layer of land reclamation fill typically consisted of a gravelly crushed coral fill material, differing from the hydraulic clays by providing a dry, permeable, and stable land surface. A clear geographic distribution was observed in the central and *mauka* portions of the project area, and notably absent within the *makai* portion.

The area of reclamation fill within Block C West aligned almost exactly with the area of underlying historic salt pan remnants (SIHP # -7655). The historic salt pan remnants, which were documented within 24 test excavations in Block C West (along with 32 test excavations within the adjacent Block B East), consisted of a system of man-made berms enclosing low-lying, level salt pan beds. The berms consisted of anthropogenically altered local marine sandy clay modified into linear berm structures. The berms ranged in height from 32 to 130 cm to above the coral shelf and ranged from relatively wide berms measuring over 6 m to potentially much smaller berms. Their orientation appeared to run *mauka-makai* and northwest-southeast, indicating a grid-like system. Several test excavations also documented more than one berm building event, indicating continued use and modification of the berm system.

The salt pan beds consisted of natural wetland sediment overlain with laminated organic material. The organic laminations consisted of distinct micro-layers approximately 1-4 cm thick, observable as variations of color and texture, and containing flat leaf-like organic structures and grass-like stalks. Pollen analysis of the laminated organic layer and underlying wetland sediments noted an unusual dominance of *kolea* (*Myrsine*), an endemic Hawaiian evergreen tree that is likely insect or bird-pollinated. The strong presence of *kolea* in the pollen signature may indicate that the *kolea* leaves were utilized to the line the salt pan beds. As noted by William Ellis, traditional Hawaiian salt pans were “frequently lined with large evergreen leaves” (Ellis 1827).

Also documented within the Block C West project area (as well as the adjacent Block B East project area) were numerous buried historic surfaces (SIHP # -7658). SIHP # -7658 included asphalt, concrete, and oil-rolled surfaces as well as wooden posts associated with mid-twentieth century development of the project area. With the exception of the wooden posts, the buried structures were all observed overlying the hydraulic dredge and crushed coral fill associated with the 1919–1926 Kewalo reclamation. The fill overlying SIHP # -7658 is associated with grading and construction of the current Ward Warehouse structures. Aerial photographs suggest urban development within the Block C West project area changed drastically between the filling of the project area and the 1976 construction of the current Ward Warehouse commercial complex. Based on aerial photos, the buried surfaces are likely related to development between 1927 and 1976.

Stratigraphy within the Block C West project area differed along the *makai* edge of the project area, consisting of disturbed and reworked coastal marine sandy clay sediments overlying in situ marine sandy clays. The overlying fill deposits consisted of modern fill associated with the existing structure and landscaping. Disturbance to the natural marine sandy clay sediments appeared to be associated with the installation of various utility lines observed running parallel and perpendicular to Ala Moana Boulevard, often located just above or at the coral shelf. The natural sandy clay marine deposits appeared very similar to the historic salt pan berm sediments (SIHP # -7655) and may represent the source of these archaeosediments.

Section 9 Significance Assessments

The two historic properties observed within the current study area were evaluated for significance according to the broad criteria established for the Hawaiʻi Administrative Rules (HAR) §13-284-6. The five criteria are:

a. Associated with events that have made an important contribution to the broad patterns of our history;
b. Associated with the lives of persons important in our past;
c. Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value;
d. Have yielded, or is likely to yield information important for research on prehistory or history;
e. Historic property has cultural significance to an ethic group, including, but not limited to, religious structures, burials, and traditional cultural properties.

Table 38 lists the historic properties along with their significance assessments and mitigation recommendations. These significance assessments are included in this AISR for the review and concurrence of the SHPD.

SIHP # 50-80-14-7655 consists of subsurface historic salt pan remnants, documented as laminated organic material and associated man-made berms. SIHP # -7655 is assessed as significant under Hawaiʻi state historic property significance criterion “c” (embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value) and criterion “d” (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR § 13-284-6. The historic property reflects land-use activities related to historic salt pan operations, and has the potential to offer insight into these practices.

SIHP # 50-80-14-7658 consists of buried historic surfaces, including asphalt, concrete, coral and tar pavement, oil-rolled surfaces, and fence-lines associated with mid-twentieth century development of the project area. SIHP # -7658 is assessed as significant under Hawaiʻi state historic property significance criterion “d” (have yielded, or may be likely to yield information important in prehistory or history) pursuant to HAR § 13-284-6. SIHP #-7658 has provided, and can potentially provide, additional information on twentieth century commercial infrastructure within Kakaʻako

Table 38. Archaeological Historic Property Significance and Mitigation Recommendations.

SIHP #	Test Excavation (Block C West)	Formal Type/ Description	Significance Per HAR 13-284-6	Mitigation Recommendation
-7655	1, 3-8, 10, 11, 13, 14, 16-26, 30, and 33	Subsurface Salt Pan Remnants	“c” and “d”	Archaeological Data Recovery and Archaeological Monitoring
-7658	1-4, 6-11, 14, 16, 17, 20, 22-26, 27, 29, 31, 32, and 36	Subsurface Historic Paving and Building Remnants	“d”	Archaeological Monitoring

Section 10 Project Effect and Mitigation Recommendations

The following project effect discussion and cultural resource management recommendations are intended to facilitate project planning and support the proposed project's required historic preservation consultation.

10.1 Project Effect

The proposed project will potentially affect two historic properties (SIHP #s -7655 and -7658) identified within the project area. CSH's project specific effect recommendation is "effect, with agreed upon mitigation commitments." The recommended mitigation measures will reduce the project's potential adverse effect on significant historic properties.

10.2 Mitigation Recommendations

This AIS indicates that the Block C West project area contains: 1) historic salt pan remnants consisting of low-lying wetlands converted to salt pan basins enclosed by man-made berm structures, located beneath land reclamation fill within the central and *mauka* portions of the Block B East and Block C West project areas (SIHP # -7655); and 2) buried mid-twentieth century development land surfaces, consisting of asphalt, concrete, coral and tar pavement, and oil-rolled surfaces (SIHP # -7658), observed throughout the Block B East and Block C West project areas. Due to the inherent limitations of any sampling strategy, however, it is possible that additional historic properties or features, potentially including human burials and non-burial archaeological deposits, may be uncovered during construction activities.

The recommended mitigation measures for the two historic properties encountered within the Block C West project area consist of data recovery and archaeological monitoring (see Table 38).

10.2.1 Data Recovery

In consultation with the SHPD, it has been determined that an archaeological data recovery program is an appropriate mitigation for the historic salt pan remnants SIHP # 50-80-14-7655, located within the central and *mauka* portions of the project area. This archaeological data recovery program would begin with an archaeological data recovery plan for the review and approval of the SHPD. An End of Data Recovery Fieldwork Letter Report would need to be accepted by the SHPD prior to the construction project breaking ground.

10.2.2 Archaeological Monitoring

This AIS represents a good faith effort to identify and document the historic properties located within the project area. Due to the inherent limitations of any sampling strategy, however, it is possible additional historic properties or features, potentially including human burials and non-burial archaeological deposits, may be uncovered during construction activities. In order to mitigate the potential impact to SIHP #s -7655 and -7658, or any as yet unidentified cultural resources within the project area, it is recommended that project construction proceed under an archaeological monitoring program. A program of on-site archaeological monitoring is recommended for all subsurface project construction activities within the Block C West project area.

This monitoring program will facilitate the identification and proper treatment of any archaeological deposits disturbed by project construction, and will enable collection of additional samples and information related to the two identified historic properties. The archaeological monitoring program will include additional documentation, sampling, and analysis of SIHP #s -7655 and -7658. In addition, the natural marine sediments present in the *makai* portion of the project area will be fully recorded and closely examined for potential historic properties. Although the AIS identified largely disturbed marine sandy clay sediments in this area, the adjacent Block B East project area (refer to Pammer et al. 2014—*draft*) did identify in situ Jaucas sands as well as isolated human skeletal remains (SIHP # -7656). The details of the monitoring program will be included in the project's archaeological monitoring plan to be reviewed and approved by the SHPD.

10.2.3 Disposition of Materials

The artifacts associated with this archaeological inventory survey were collected from private lands; accordingly, this material belongs to the landowner, Howard Hughes Corporation (HHC). This collection is comprised of historic artifacts collected from fill materials and sediment samples collected from the salt pan remnants (SIHP # -7655). The artifacts associated with this archaeological inventory survey will be temporarily curated at the CSH storage facility. CSH will make arrangements with the landowner regarding the disposition of the project's collection. Should the landowner request different archiving of material, then the archive location will be determined in consultation with the SHPD.

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Appendix A SHPD AISP Acceptance

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

ESTHER KIA‘AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

HISTORIC PRESERVATION DIVISION
DEPARTMENT OF LAND AND NATURAL RESOURCES
601 Kamokila Boulevard, Suite 555
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February 10, 2014

Ms. Ena Sroat, MA
Cultural Surveys Hawai‘i, Inc.
P.O. Box 1114
Kailua, Hawaii 96734

LOG NO: 2013.6922
DOC NO: 1402SL11
Archaeology

Dear Ms. Sroat:

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Archaeological Inventory Survey Plan for the Block C West Project
Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu
TMK (1) 2-3-001:005 por.

Thank you for the opportunity to review this draft report titled *Draft Archaeological Inventory Survey Plan for the Block C West Project, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK (1) 2-3-001:005 (portion)* (Sroat et al., December 2013). We received this submittal on December 10, 2013. The 2.2-acre Block C West project area is owned by Victoria Ward, Limited (VWL) and is part of the VWL's 60.5-acre Ward Neighborhood Master Plan. The project area is bounded to the northeast by Auahi Street, to the southwest by Ala Moana Boulevard, to the southeast by a parking lot, and to the northwest by the Ward Warehouse complex..

The archaeological inventory survey plan (AISP) contains an adequate discussion of the environmental setting and an extensive discussion of the traditional and historical background. The previous investigations and specific research questions concerning temporal and spatial land use changes provide a framework for the AIS of Block C West. The field methods involve excavation of about 89 backhoe trenches, the final number and placement of which will be determined in consultation with SHPD based on spatial identification and documentation of possible A horizon deposits, features, and/or Jaucas sands within the project area. The trench excavation methods will involve, where possible, identification and mapping in plan view and hand excavation of cultural layers, midden remains, artifacts, and pit features; and hand excavation of the Jaucas sands. Artifact assemblages present in fill deposits and large historic trash-filled pits will be subjected to field documentation (photographs of representative samples and qualitative and quantitative analysis) with collection of only a representative sample of artifacts for more detailed analysis in the laboratory. Traditional Hawaiian artifacts and faunal shell and bone, and charcoal and other botanics will be collected (or sampled, as appropriate) for analysis in the laboratory.

Please revise the following:

(1) Remove any mention of a supplemental AIS and insert agreed-upon language from Block M AISP.
(2) Make all changes in text identified within AISP for Block M for consistency; and
(3) Update Yucha et al. 2013 draft and LaChance et al. 2013 in progress to show current status of these project references; also revise inconsistencies in references cited section.

This plan is accepted pursuant to Hawaii Administrative Rules (HAR) §13-284-5 with the understanding that the above **minor revisions are made** in the final document. Please make these revisions and send one hardcopy of the document, clearly marked **FINAL**, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.
Aloha,

Susan A. Lebo

Susan A. Lebo, PhD
Oahu Lead Archaeologist

Appendix B LCA 387 to the A.B.C.F.M.

F.R. = Foreign Register
F.T. = Foreign Testimony
N.R.= Native Register
N.T.= Native Testimony

LCA 387 Claim to the A.B.C.F.M.*

*A.B.C.F. M.=American Board of Commissioners for Foreign Missions

LCA No. 387*Oʻahu, General Claim, Mission Claims

To the Board of Commissioners for quieting Land titles, Gentlemen:

The undersigned as agents of the Mission of the American Board of Commissioners for foreign missions a the Sandwich Islands beg leave to present for your examination, the accompanying documents; being statements of grants made to various individuals of the mission at sundry times & places, for the purpose of affording facilities for the prosecution of the Missionary work in these Islands by the Missionaries of the said A.B.C.F.M. to the end, that if upon examination, they shall be found valid, the said grants may be confirmed in such manner as the laws of the Sandwich Islands may require. The following is a list of claims to be considered, viz.

Kauai - Premises & lands at Waiole, Koloa & Waimea
Oahu - Premises & lands at Honolulu, Ewa, Waialua, Kaneohe, Hauula & Punahou
Molakai - Premises & lands at Kaaluaha & out stations - if any
Maui - Premises & lands at Lahaina, Lahainaluna, Kanipali, Wailuku & Hana
Hawaii - Premises & lands at Kailua, Kealakekua, Kau, Hilo, Kohala & Waimea.

The lands & premises at the above-mentioned stations are in care of the resident missionaries of the A.B.C.F.M. at said stations. We have thought it best to enumerate all the stations though some of the claims have not been received, & some have been already presented to the Board.
Signed, Samuel N. Castle, Edwin O. Hall, agents
Honolulu, March 125h, 1847

The claims herewith sent are for Waialua, Honolulu, Punahou, Kaneohe, Waiole, Koloa, Waimea, Kaui, Hilo, Kealakekua, Kailua, Waimea, Hawaii, Kohala.

I believe Kau, Lahainaluna, Lahaina, Wailuku, Hana & Molakai are already sent in.
S.N.C.

F.R. 31-33v2
[No. 387], Honolulu, Statement of Mission Lands Claims at Honolulu.

Premises occupied by Mr. Dimond, given by Kalaimoku to Reverend William Ellis of F. M. [Foreign Missions] Society, & by him to the Mission of A.B.C.F.M, at these islands. The original grant was much larger then the spot at present enclosed by Mr. Dimond.

2d. All the parcels of land enclosed by the mission in the district known as Kawaihao, which whole distinct was given by Kaahumanu, 1st to Mr. Bingham for the use of the mission & also any enclosed portions of said district, if there be any such, not in actual possession of the natives. The mission buildings & land upon said lands. Also a portion of ground enclosed & upon which stands an adobie school house, at present occupied by Mr. Wilcox.

In addition there is a land in Koolau called Kaluanui, given by Kaahumanu to Mr. Bingham.
S.N. Castle, Edwin O. Hall, agents.

To the Board of Commissioners &c, Gentlemen:

In compliance with your public notice relative to claims of land &c I beg leave to state that I have no lease or written document of the Mission premises now occupied by myself in the Northwest part of Honolulu called Kaumakapili.

This station was commenced by myself soon after the general meeting of the American missionaries held in May 1837.

The land upon which the dwelling house, the station school house & meeting house are erected, was said to belong at that time to Konia, wife of Paki. Several of the chiefs then in authority, viz. Kinau, Kekuanaoa, Kona & Paki, after mature deliberation, informed me that they had set apart the yard in which the dwelling house is built, & the one where the station schoolhouse is erected, for a new missionary station & told me that I might commence operations at pleasure.

In the fall of 1838, the same persons set apart our meeting house yard as a place upon which to erect a house of worship to Almighty God. These 3 several yards are each enclosed with adobie walls, & their boundaries & dimensions are nearly as follows:

1st. Residence of the missionary measures about 46 yards & is bounded by a narrow lane. The mauka side is about 53 yards long, the northwest end is about 46 yards wide & the makai side is 60 yards long.

2d. The schoolhouse yard lies contiguous to the enclosure above described on the Southwest and is an oblong square, bounded on the Southeast side by the narrow lane & is 46 yard long and about 24 yards wide.

3d. The meeting house yard lies a few rods mauka of the mission dwelling house. The makai end is bounded by the public road & measures 48 yards, the northwest side is about 70 yards long &

the mauka end is 40 yards wide, the southeast side is 61 yards long
Signed, Lowell Smith
Honolulu, July 14, 1846

F.R. 33-34v2
[No. 387], Punahou [margin note illegible]

The undersigned claim in behalf of the mission of A.B.C.F.M. at the Sandwich Islands all that tract of land known as Punahou lot mauka & makai; to be used for the purposes for which it was granted.

That portion of said land which lies mauka of the Wai'un [?] road is said to be bounded nearly as follows: commencing by Allen's bridge which crosses the street near Allen's house & running inland to near the top of Ualakaa. Thence east into the valley near a certain rocky knowl [sic. knoll] pointed out by natives as the corner, thence toward the sea along a line running a short distance [illegible] east of that part of said land which is enclosed & extending to the road which runs from Honolulu to Waikiki just mauka of Allen's house, thence along said road to place of beginning.

The boundaries of that part which lies on the sea shore we cannot define so definitely, but presume there will be no difficulty in determining them as it is commonly known as pertaining to Punahou. This part embraces fishing grounds, coral flats & salt beds.

The above land was given by Boki to Mr. Bingham; then a number of the above named mission & the grant was afterwards confirmed by Kaahumanu. We have heard several persons mentioned as being acquainted with the facts & circumstances respecting this grant of land among whom are Reverend H. Bingham, Asa Thurston, William Richards, Levi Chamberlain, Governor Kekuanaoa, Laanui, John Ii, &c&c.
Signed, Daniel Dole, W.H. Rice.

I was told that Punahou extended from the road near to Allens, back to the top of Ualakaa, then the northern boundary was said to run from the top of Ualakaa eastward into the valley so far that the eastern line would include much of the rocky hill near the spring in passing down the road near Allens. There, there was a large flat on the sea shore embracing fishponds & salt beds & coral flats.
The above was written by Mr. Bingham from United States
W. Richards

F.R. 34-35v2
[No. 387], Kaneohe, Land connected with the mission station at Kaneohe

About 4 acres are held by the mission enclosed by a fence; it has been occupied about 12 years. The station was taken by permission of the King & the land given by an agent of Liliha, widow of Boki, since deceased.

In addition to the above there is a taro land, known among the natives as an ili aina; not designated by any particular boundaries. This was given for the use of the mission by Liliha - widow of Boki.
(No signature)
Kaneohe, December 8,1846

F.R. 35-36v2
[No. 387], Ewa, April 20, 1847

To the Commissioner, &c, Gentlemen:
I hereby make application for confirmation of title to a piece of land called Kionaole, a small ili in the ahupuaa of Waiawa, Ewa. I hereby enclosed a draft of said land, the measurement of which is as follows: Beginning at Northwest course & running south 74 fathoms, thence east 70 fathoms, thence north 20 fathoms, thence west 26 fathoms, thence north 44 fathoms & thence west 40 fathoms to the place of beginning. Said land comprises about 3 acres more or less.

Also a fish pond situated near the river joining southeast corner on a piece of waste land reckoned as belonging to Manana, an ahupuaa on the opposite side of the river. Said fish pond was dug out for me by my church members in 1838 & measures 27 fathoms by 14 (see draft).

I would also ask for a grant to the Protestant Church at Ewa for the use of their pastor, one of the moo paahao, of which there are two in Waiawa. As they have not been cultivated for more than 3 years & are now overgrown with bulrushes, there is no probability that both will be wanted again for the aupuni. Each moo contains 3 or 4 acres each. The members of the church wish one of them to cultivate, the avails of which are to be devoted to religious purposes.

Also, my house lot within the ili aina of Waiawa called Panaio, & three or four acres of land adjoining the Protestant Chapel for a church yard and burying ground, to be confirmed by title in the same manner as similar grants are confirmed.

For authority respecting the grant of my land marked out i the enclosed draft. I beg to refer you to Governor Kekuanaoa executor of Kinau, who gave me the said land in 1836 or early in 1837.
Signed, A. Bishop

[DIAGRAM]

F.R. 28v2
No. 387, [American Board of Commissioners for Foreign Missions], [Oahu claims, continuation of claims from other islands]

Extract from a letter addressed to Mr. Castle dated February 17th, Waialua and Signed P.J.

Gulick.

"P.S. I opened this to say a few words relative to the land connected with our premises. What it seems desirable to retain is a long narrow strip of probably 20 acres; bounded on the East by a road which crosses the river, or brook, Anahula, about 1/4 of a mile east of Mr. Emerson's residence, On the south by the brook Lanahula, On the west by the road which crosses said brook just opposite Mr. Emerson's house & On the north by a crooked stone wall built by Mr. Lock & Mr. Wilcox.

It has also been a stone wall on the east and a doby west, built by our Brethren. It is the better part of the land called Lokoea, but on the west & north it is said to fall considerably within the boundaries of Lokoea. With these data & the papers, I think you can make a more correct statement that I can; unless I get it surveyed. I don't know that I can do any better than I have now done.
Signed P.J. Gulick.

N.R. 229-231v2
No. 387, [Missionary claim]

Unirrigated farm land at Waialua, Oahu. Conveyance of a portion of land for dry farming at Waialua.

Because of my thought of the importance of knowledge and education which will benefit the Kingdom of Hawaii; and because I also think Mr. Loke /Mr. Looke/ has a good school at Waialua and the students are preparing to be educated to end the idleness and deficiencies of this land, therefore I agree and explain that a portion of land at Waialua shall be transferred to said school without payment or tax. the diagram of this land is below, however, the north side is not exactly like the diagram. The ancient boundary will prevail on that side until the time when I understand the correctness of the new move. The steam is not conveyed with the land. It is, however, the boundary on this side. If the supplies of the school are taken on the stream this is not a wrong, however, the fish are protected.

Furthermore, there are given some divisions of water for this land, three days in one week on the north side of the stream, and on the south side, two days. On those two days the water shall flow to irrigate the crops.

Furthermore, John Ii, the School Superintendent of Oahu, shall administer that land and he is also the perpetual custodian of that land.

It /the land/ is conveyed absolutely to that school; it shall not be arbitrarily taken, nor shall it be disturbed unless the school is at fault or its haole teacher or his successor, perhaps. The land shall be administered so as to benefit the school. The land may not be given over to anyone else. It is given only for the benefit and to supply the needs of the school. Here is the diagram of the land:

/see diagram/ [No diagram in this text]

This diagram is not absolutely correct, as it was not surveyed with a transit. The beginning of the measurement is at the corner marked I, at a place close to the wooden road over the water /bridge or causeway?/

This word is recorded at Honolulu on the 14th day of September, 1841.
KEKUANAOA
Witness: Paalua, Limaikaika /Armstrong/

In accordance with Kekuanaoa's thought explained in this paper, giving me the administration of that kula farm land at Waialua, I agree that this land be conveyed to said school, and Locke or his successor, perhaps, the one who teaches at that school, to stimulate intellectual growth here in Hawaii.

Recorded at Honolulu this 14th day of September, 1841.
JOHN II, School Superintendent of Oahu

We two consent to all the words in this document.
KAMEHAMEHA III, KEKAULUOHI

F.T. 260v3
No. 387, American Mission, Part 1, Section 5, Division 1, 22 February, Emerson Waialua

1. Kuakoa, sworn, I know this land at Kawaipuole in Waialua.

It is bounded:
Mauka by Kukipa's land
Waianae by an old adobe fence
Makai by my fence
Waimea by land of mine and a kalo patch of Poli and a river called Anahulu, and a kalo patch of mine.

2. This land is in Olohana, an ili, the land is called Manawai. It is an orange garden

bounded:
Mauka by a stone wall and a dry stream
Waianae by stream of Kawailoa
Makai by konohiki's land
Kolauloa by a pali.

3. This piece is an ili aina of Kawailoa at Paalaa.

It is kalo and kula bounded:

by konohiki's land, Mauka
Waianae by a pali
Makai by konohiki's land
Kolauloa by a stream of Paalaa.

Claimant got the piece No. 1 from Kinau in 1832 and has lived there constantly ever since, and no one has ever disturbed him.

He got No. 2 from Gideon Laanui in Kinau's time, 1838, and has occupied it without disturbance in peace ever since.

He got the piece No. 3 from Kinau in 1835 and has held it ever since in peace.

Olopana, sworn, the preceding testimony is correct and true, which I now of my own knowledge, and that Mr. Emerson has lived there to the present time in peace.

Continued page 302.

No. 2. Mr. Emerson did not think required a survey and states it at less than acre.

F.T. 302v3
No. 387, Sandwich Islands Mission Claim, Part 1. Section 5, Division 1, J.S. Emerson, from P. 260 [p. 260 claim for Waialua Oahu]

Kilioe, sworn (from Kauikawaha's written Report to Claimant and translated by him for the Commissioner), I heard D. Oleloa & Kaukualii ,his wife, say the Kinau wrote to them at Kauai thus "Laanui sought for land for the Missionary located at Waialua & he has found it within your land viz. Hawailoa - Give Your assent that it be given him" To which we Daniela ma gave our assent in writing.

Kamalie, sworn, I heard the same things as Kilioe says - and I heard before, at a time when Hawailoa was our land as hoaainas - my mother's brother named Wana, one of Laanui's family, came to us and said "Your land is given by the foreigner, Mr. Emerson by Kinau - so says Laanui.
Continued 306 page, Division 2

F.T. 306-307v3
No. 387, Sandwich Islands Mission, Part 1, Section 5, Division 2, P.I. Gulick, from p. 302

Reverend I.S. Emerson, sworn, In about 1837 Kinau granted to me a certain part of the land now coccupied by Mr. Gulick to aid the Church. This grant included the Western end, containing probably 3 to 5 acres. It did not I think to include the spot of Mr. Gulick's house lot. that spot, as I understood Mr. Locke came into an unwritten contract between him & Laanui, by which Mr. L.

[Locke] was to pay Laanui a certain sum per annum for the remainder of the land which Mr. Gulick now claims. This land has been in the possession & use of the Mission from about 1838 to this time.

Witness admitted Mr. Metcalf's survey [as] correct.

"E ike auanei na kanaka a pau ma keia palapala ke nana mai lakou.

Owau o M. Kekuanaoa ka makua Kane a kahu waiwai o Victoria Kamamalu. Ua Kuai lilo loa aku au no`u iho a no kuu poe hooilina a hope paha i kekahi mau Eka Umikumamaono a me ka hapa Eka aina e waiho la ma Kawailoa & Waialua Mokupuni Oahu. Aia keia aina maka aoao mauka iho o ka pa ona Gulicka la. Ua komo pu keia me kahi i Ku mua ai kona hale.

Eia ke kumu o ka lilo ana o keia aina no ka loaa ana mai ma kuu lima na Dala maikai $82.50. No laila aole o`u kuleana i koe. ua lilo loa ia Gulika a me kona mau hooilina a hopepaha.

No ka oiaio Kekakau nei au i kou inoa i keia la 23 October, 1850, M. Kekuanaoa
Ike maka, Kahiwalani

F.T. 341-343v3 [Claim 5877 of Keakaku]

F.T. 368v3
Cl. 387, American Mission, Part 1, Section 6, Ewa, May 14, 1856

Artemis Bishop testified that in 1836 this land called "Kianaole" in the district of Ewa was given to witness for the American Board of Missions and that the 2 surveys of T. Metcalf of the same, dated March 2, 1849, correctly desribe the lot which has been occupied & used for the Mission without interruption to the present time.

Note. Governor Kekuanaoa has seen these surveys & approved of them before the Commission.

See page 343

N.T. 592-593v3
No. 387, Honolulu Mission, Part 1, Section 5, Waialua, Emerson

Kuakoa, sworn, I have seen his land at Kawaipuolo in Waialua.

The boundaries are:
Mauka, Huki's lot
Waianae, the old mud wall
Makai, my fence

Waimea, Kuokoa's land, Poli's patch, Anahulu River and one patch for me.

2. Olohana ili land in Kawailoa named Manawai and is an orange grove.

Mauka, a stone wall and dry stream
Waianae, Kawailoa stream
Makai, the konohiki's land
Koolauloa, a precipice.

3. Hawaiiloa's ili land at Paalaa, a taro land and the pasture.
Mauka, the konohiki's land
Waianae, a precipice
Makai, the konohiki's land
Koolauloa, Paalaa's stream.

Section 1 from Kinau in the year 1833 and he has always lived there to the present. No one has objected.

Section 2 is from G. Laanui during Kinau's time in 1838 and life has been comfortable; No one has objected. Section 3 is from Kinau in 1835. No one has objected.

Olopana, sworn, The statements just made by Kuokoa are true, accurate and right and I have known the same way. Emerson has always lived there to the present. No one has objected.

N.T. 677v3
No. 387, Emerson, Part 1, Section 5, October 8, 1850

Kuokua, sworn, I have seen Emerson's land at Kawailoa Paalaa in Waialua. I have known the boundaries, but I have not known who had given him his land except that I had heard only it was given by Kinau and Kamekualii; however, I am not very sure.

F.T. 115-116v3
Cl. 387, part 1, americal Sandwich Island Mission, Oahu, 23 March [1849], section 2 Punahou, Oahu, [illegible], William H. Rice, agent, present

[Margin note: Mr. Lee's notes]

John Ii, sworn for claimant, I am well acquainted with Punahou and its boundaries. It consists of two parts, one inland and the other a sea land.

It is bounded:
Mauka by the large land called Manoa
Waialae by Mauna Pohaku
Makai by kula land of Allen, Kapeau, myself & others.

I think it extends nearly down to the road leading from Honolulu past Allen's place, Honolulu side by the road leading from the old Allen place to Manoa and by my land.

The makai part of Punahou is bounded:
Mauka by Kewalo and Koula
Waititi side by Kalia
Seaward it extends out to where the surf breaks
Honolulu side by Honoliilii.

This land was given to Mr. Bingham for the Sandwich Island Mission by Governor Boki in 1829. It was given upon the same terms as all their other lands were given to them; and the Grant was confirmed, so far as silence proved it, for in truth she [he?] had no right to set aside this grant.

From that time to this, the Sandwich Island Mission have been the only possessors and konohikis of the land. I was a witness to the gift. The title of the Mission is perfectly clear.

The name of the makai part is Kukulaaeo. There are several tenants on the land of Punahou whose rights should be respected.

Z. Kaauwai, sworn, I know this land. I heard Boki say to Hoapili Kane concerning the gift of this land to Sandwich Island Mission that the had given it to Mr. Bingham.

Boki's wife made some objections to giving it to Mr. Bingham, claiming it has hers as received from her father, Hoapili Kane but Hoapili Kane confirmed the gift and it was adjudged to be right & propert.

From what I heard at the time of the boundaries, I should think Mr. Metcalf's survey correct.

[Award 387; (Oahu) R.P. 1600; Beretania St. Honolulu Kona; 2 ap.; 5.36 Acs; R.P. 1600; King St. Honolulu Kona; 1 ap.; .41 Ac.; King St. Honolulu Kona; 3 ap.; 6.66 Acs; no R.P.; R.P. 5698; Printers Lane Honolulu Kona; 1 ap.; .36 Ac.; R.P. 1947; Panaio; 3 ap.; 4.13 Acs. (A. Bishop); R.P. 1931, Punahou Manoa Kona; 1 ap.; 224.68 Acs; R.P. 1945; Punahou Manoa Kona; 1 ap.; 77 Acs; R.P. 1941, 1945, 1958 R.P. 1931; Punahou Honolulu; 1 ap.; 36.90 Acs (S.N. Castle and Amos S. Cooke); R.P. 1932; Kawaiahao Honolulu; 1 ap.; 1.23 Ac. (S.N. Castle); R.P. 1941; Kawaiahao Honolulu; 1 ap.; 1.30 Ac.(Maria P. Chamberlain); R.P. 1941 Punahou Honolulu; 1 ap.; 26.66 Acs (Maria P. Chamberlain); R.P. 1944; Kukuluaeo; 3 ap.; 77 Acs (Ephraim W. Clarke; R.P. 1944; Kawaiahao Honolulu; 2 ap.; 1.64 Ac. (Ephraim W. Clarke); R.P. 1934; Kawaiahao Honolulu; 1 ap.; 1.5 Ac. (Amos S. Cooke); R.P. 1945; Kawaiahao & Punahou Honolulu; 3 ap.; 27.97 Acs (E.M. Rogers); R.P. 1933; Kaumakapili Honolulu; 1 ap.; .53 Ac. ; R.P. 1600; Kaumakapili Honolulu Kona; 1 ap.; .6 Ac.; R.P. 1600; Kaumakapili Honolulu Kona; 1 ap.; .19 Ac.; (Lowell Smith); R.P. 1938; Pukauki Kaneohe Koolaupoko; 1 ap.; 16.1 Acs; R.P. 1958; Waikapoki Kaneohe Koolaupoko; 1 ap.; 5.13 Acs (ABCFM); R.P. 1951; Kawailoa Waialua; 2 ap.; 10.81 acs (John S. Emerson); R.P. 1940; Kawailoa Waialua; 1 ap.; 24.56 acs. (Peter I. Gulick)]

LCA 387 Award to to the A.B.C.F.M.

The boundary of the Kukulāʻo lands given to the A.B.C.F. M. is on the last page of the award.

C. No 387 (Sec. S. Sandwich Islands Mission
Punahou

This is a claim made by the S. Sandwich Islands Mission, on behalf of the American Board of Commissioners for foreign Missions, for a certain land situated in the district of Waikiki, Island of Oahu, called "Punahou", and consisting of two distinct pieces: one, known by the name of Punahou proper, and the other, a sea-land, called "Kukuluaeo."

From the evidence submitted to the Board, it appears, that this land was given by Governor Boki about the Year 1829 to Hiram Bingham for the use of the Sandwich Islands Mission, and that the same, with the exception of certain portions occupied by Kauhi, Wahineino, and other Natives, has been in the peaceable possession of the said Mission, from the date of such Gift up

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to the present time.

We consider the Title of the "American Board of Commissioners for Foreign Missions" to "Punahou proper", and to the Sea land "Kukuluaeo", to be the same in its nature as that set forth in the Award of February 1st 1849 of the Lot now occupied by Henry Dimond, and designated as Claim "No 387 - part 1 of Honolulu Claims".

We do therefore Award to the "American Board of Commissioners for Foreign Missions" the aforesaid lands of "Punahou proper" and "Kukuluaeo", with the exception of those portions occupied by Natives; - to have and to hold to them, and to their Successors, during the existence of the "Sandwich Island Mission": - that is to say - so long as the "Sandwich Islands Mission" shall continue to exist, and labor to promote the Christian faith they profess. But if they should cease to exist, or to pursue the object of their profession, these lands will then revert to the Sandwich Islands Government.

The above Award, however, is made upon the express understanding, that if the "American Board of Commissioners for foreign Missions", shall desire to lease, sell, or otherwise dispose of these lands, or any portion thereof, they shall be at liberty to do so, by first obtaining the consent of the Sandwich Island Government, to such lease, sale, or other disposition.

The correct metes and bounds of the above awarded lands, are contained in the following surveys, made by T. Metcalf on the 6th and 9th days of May 1848.

"Notes of Survey of Punahou premises"
"Commencing at Mauka N. corner of enclosed

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premises by Road leading to Manoa valley - and running S. 40° W. 1 ch. 5 7/12 ft. along wall to slight angle. thence S. 35° W. 15 ch. 26 1/3 ft. along Road to W. corner of enclosed Premises. thence S. 26° W. 16 3/4 ch. along road to makai W. Corner of this land. (9 3/4 ch. on to new Road) thence S. 63° 15' E. 22 ch. 29 ft. along Pauoa to Stake. at makai S. corner of this land. thence N. 58° 45' E. 7 ch. 8 1/2 ft. along Keauhou to Rock marked + angle - thence N. 64° 45' E. 26 ch. 47 ft. along Holipaka to Rock marked + on stoney rise - angle - Thence N. 55° E. 11 ch. 59 5/12 ft. along Pilipili to pile of stones by path - angle. thence N. 15° 30' E. 6 1/4 ch. along Pilipili to Rock on makai side of stone wall by Path N. 1° 15' W. 7 ch. 54 7/12 ft. to E. angle of this lot - thence N. 37° 45' W. 13 ch. 13 3/12 ft. along Mauka side of this land to Waikele Path - angle. thence N. 37° 15' W. 9 ch. 19 10/12 ft. to stake at intersection of Roads leading up Manoa valley. thence N. 27° W. 20 ch. 13 ft. to point on Puluuala - the mauka N. Corner of this land - then direct down Ualakaa to place of commencement - Including an area of Acres 224 68/100

J. Metcalf Sur.

May 6. 1848.

See diagram Page 603.

"Notes of Survey of "Kukuluaeo" the sea-land belonging to Punahou".

"Commencing at buried stone at Mauka N. corner of this land - joining "Kewalo" on mauka and Peku on N. W. side, and running S. 16° W. 8 ch. 41 ft. along Peku to angle - thence S. 5° 45' E. 5 ch 19 10/12 ft. along and to E. corner of large fish Pond, thence S. 12° 15' E. 6 ch. 23 7/12 ft. to E. corner of Laeoha's house angle - thence S. 5° 45' W. 2 2/3 ch. to, and indefinitely into Sea. Then from point of Commencement and running S. 61° 45' E. 17 ch. 19 10/12 ft. along Kewalo to post in front of Onewa's house - angle. thence S. 60° E 21 ch. 6 7/12 ft. along Kewalo to angle (about 4 ch. makai of Samuel Toddy's house) thence S. 31 E.

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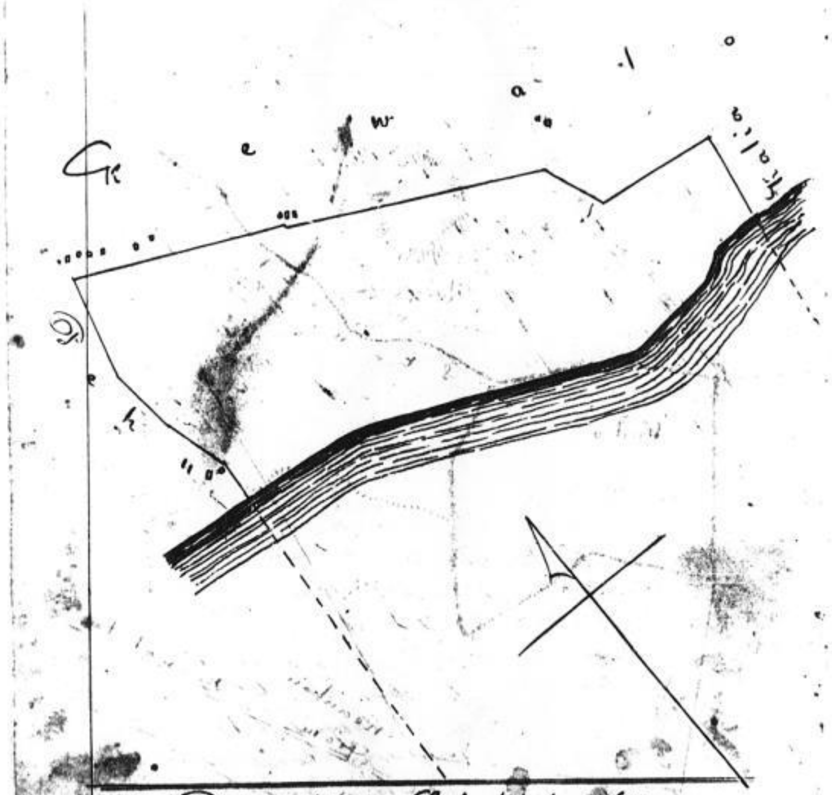
5½ ch. along Kewalo to angle - thence S. 81° E.
9 ch. 59 5/12 ft. along Kewalo to Mauka E. corner
of this Land - thence S. 11° W. 7 ch. 9 3/12 ft.
along land called Kalia, &c, and Indefinitely
into Sea - Containing an Area of dry land of
Acres 77

May 9 1848. J. Metcalf Svr.



Cert. Part 2 of No 387. S. I. Mission 6

To Bill of Survey of T. Metcalf
Commission Wm L Lee
J. H. Smith
Z. Kaauwai
M. Kamehameha
Ioane Ii

Hale Kawanaka
7 April 1849

15
5
20

Appendix C LCA 1903 to Lolohi

Land Commission Claim, LCA No. 1903 to Lolohi

N.R. 293v3

To the Great President of the Land Commissioners,- William L. Lee, and his companions, Greetings to You and your commissioners: As directed by you to the claimants to state their claims I have some claims for salt works at Kukuluaeo:

2 salt beds
15 Hooliu /Literally - cause to leak, therefore, drains./
2 Poho kai /depressions where salt is gathered/
1 salt kuIa

A small farm is at lower Kaliu, close to the kawa /leaping place/ of Puehuehu.
4 lo`i
1 cultivated kula.
These are my claims.

I am, with thanks,
LOLOHI
Honolulu, 15 December, 1847

F.T. 220v3
Cl. 1903, Lolohi

Peka wahine, sworn, I know this place. It is on the salt plains, Honolulu, used for making salt.

Mauka is a stream of salt water
Waititi also several salt ponds, Napula, Kumiao and others own them.
Makai, Government road
Honolulu, Peke, Kaula, Lilea, Bolabola, Poe.

Claimant received this land from his father who died last year and held it a long time back in Kinau's time.

2. Honolulu aina, kalo.

Eseta, sworn, deferred, Witness being claimant's wife.
Paalua, sworn, confirmed the testimony in claim. 1
Resumed p. 223

F.T. 223v3
Cl. 1903, Lolohi, 26 November [1849], from page 220

Puhi, sworn, I know this place called Kaliulalo, Honolulu aina, consisting of 4 kalo patches & kula.
Mauka is Kanakaokai
Waititi, Puhana
Makai, same
Ewa, Keliula land, Kekualoa.

Claimant received this from Kuke - Tahitian in 1844 and has held it in peace ever since.

N.T. 549v3
No. 1903, Lolohi, November 23, 1849

Peke, sworn, I have seen his place at Kukuluaeo in Honolulu.

Salt land, the boundaries are:
Mauka, a salt water ditch
Waikiki, Napela
Makai, government road
Ewa, Kaula, Lilea, Polapola and my land.

Lolohi had acquired this interest from his parents when Haaliho had returned from Briton. Lolohi's parents had received it during the lifetime of Kinau and he has been living peacefully on this interest; no one has objected.

Paulua, sworn, Our testimonies are alike; no one has objected.

The hearing on Lohilohi's taro section will be heard on Monday. See page 550

N.T. 550-551v3
No. 1902!, Lolohi, From pg. 549, November 26, 1849
[should be 1903]

Puhi, sworn, I have seen his land at Kaliu in Honolulu district.

4 taro patches, 1 pasture:
Mauka, Kanakaokai
Waikiki, Paahana
Makai, Paahana also
Ewa, Kaliuluna which is Kekualoa's land.

Lolohi's land is from Kuke given in the year 1844 and he has been living comfortably. No one has objected.

Kelalaina, sworn, Our testimonies are alike. No one has objected.

[Award 1903; Land Patent 8174; Kaliu Honolulu Kona; 1 ap.; .69 Ac.; Land Patent 8237; Kukuluaeo Honolulu Kona; 1 ap.; .74 Ac.]

Land Commission Award 1903 to Lolohi*

*Note map of parcel on the page bottom that is partially within Block B East

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Helu 1903 Lolohi

Ua koi mai oia no kona Mau**wahi ma** Kalia a Kukuluaeo Honolulu **no ka mea, ua loaa ia ia keia** Mau **wahi**

a ua noho keakea ole ia a hiki i keia manawa.

Oia ka makou e hooko nei no Lolohi **he kuleana hoi kona malalo o ke ano Alodio. Ina e uku mai oia i ko ke Aupuni hapa** kolu; **alaila, ua ku pono ia ia ka palapala sila Alodio.**

Pono nae ia ia ke uku no ka hookolokolo a me ka hooholo ana i ka olelo. Penei,

W. L. Lee
G. M. Robertson
J. H. Smith
Ioane Ii
J. Kekaulahao

	$	ken.
No ka rumi a me ke pai ana i ka olelo ma ka Nupepa,	1	
No ke kope ana i ka olelo koina 1 *aoao,*		50
No ka palapala kii,		50
No ka hana ana i ka la 23 o Novemaba	1	
No ke kope ana i na olelo a na hoike, 2 Aoao	1	50
No ka ana ana i ka la 27 o Iulai 1850 2 Apana	5	
No ke kope ana, 2 Kope	1	
No ka hooholo ana i ka olelo, 12 Augate 1850	2	50
	$12.00	

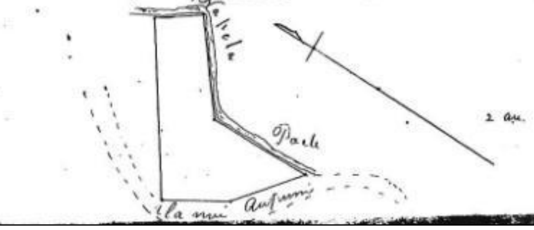
Eia na palena,

Anaia e A. G. Thurston.

Apana 1. Aina ma Kalia, Honolulu, Oahu

Apana II. (loko Paalaa) ma Kukuluaeo Honolulu, Oahu.

Ma ia Apana 896 Anana



Appendix D Consultation Letter (OHA)

CULTURAL SURVEYS HAWAI‘I

ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL DOCUMENTATION SERVICES - SINCE 1982

20 June 2014

Dr. Kamana‘opono Crabbe
Administrator
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711 Kapi‘olani Blvd.
Honolulu, Hawai‘i 96813

O‘ahu Island
P.O. Box 1114
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Branch Offices:
Hilo, Hawai‘i
Kona, Hawai‘i
Lāwai, Kaua‘i

Subject: Cultural Surveys Hawai‘i, Inc.’s (CSH) request for consultation regarding archaeological inventory survey results for the Block B East and Block C West Project Areas, Kaka‘ako Ahupua‘a, Honolulu (Kona) District, O‘ahu Island (TMK: [1] 2-3-001:005 por.)

CSH Job Codes: KAKAAKO 119-120

Aloha Dr. Crabbe:

On behalf of Victoria Ward, Limited and The Howard Hughes Corporation, CSH has recently completed archaeological inventory surveys (AIS) for the Block B East and Block C West project areas within the Ward Neighborhood Master Plan area (Figure 1). For the purposes of consultation and to provide the Office of Hawaiian Affairs (OHA) with the preliminary results of these archaeological investigations, a brief summary of the AIS findings is presented below. Following your review of the information provided, CSH requests that OHA reply with any questions, comments, or concerns regarding the Block B East and Block C West project area AIS findings.

Block B East Project Area

The Block B East project area comprises the central portion of the Ward Warehouse commercial complex. A total of 38 test excavations were completed (Figure 2). The majority of the test excavations, extending from the *mauka* project area boundary along Auahi Street to the *makai* edge of the *makai* Ward Warehouse commercial building, contained buried historic salt pan remnants (Figure 3). The salt pan remnants consist of a complex of man-made berm structures arranged in a grid formation around low-lying salt pan beds (Figure 4). Only along the *makai* project area boundary, directly adjacent to Ala Moana Boulevard, were disturbed natural sand deposits encountered. Within Test Excavation 31 in this area, an isolated human cranial fragment was documented within disturbed sand (Figure 5). Careful cleaning of the surrounding area did not identify any additional human remains, nor within any of the closely adjacent test excavations. Cultural monitors from ‘Oiwi Cultural Resources were on hand to assist

WWW.CULTURALSURVEYS.COM - INFO@CULTURALSURVEYS.COM with treatment of the *iwi kūpuna*, which has been left in place pending the results of burial treatment consultation. Also identified within the Block B East project area was the historic Ward Estate *‘auwai*, modified in the early twentieth century into a concrete-encased channel (visible as an elbow-shaped line within Figure 4, adjacent to Test Excavations 15 and 17).

Block C West Project Area

The Block C West project area comprises the southern portion of the Ward Warehouse commercial complex. A total of 36 test excavations were completed (see Figure 2). As with Block B East, the majority of the project area documented buried historic salt pan remnants, extending from the *mauka* project area boundary along Auahi Street to the *makai* edge of the *makai* Ward Warehouse commercial building (see Figure 3). Disturbed marine and sand deposits were encountered along the *makai* project area boundary fronting Ala Moana Boulevard, with no significant finds in this zone.

Consultation

Consultation with the State Historic Preservation Division (SHPD) concerning the results of the Block B East and C West AIS investigations has been ongoing throughout the AIS fieldwork. In addition, on 16 June 2014, the AIS findings were presented to the recognized cultural descendants of the project, including detailed information concerning the *iwi kūpuna* identified within Block B East. On 14 May 2014, the Block B East AIS *iwi kūpuna* findings were also presented to the O‘ahu Island Burial Council (OIBC).

Once again, CSH welcomes OHA’s input in this consultation process. Please review the information and figures provided in this consultation letter and contact CSH with any questions, concerns, or comments that OHA may have regarding the AIS investigation and findings. Thank you for your consideration of this matter.

Sincerely,

Cultural Surveys Hawai‘i, Inc.

Matt McDermott
(mmcdermott@culturalsurveys.com)
Tel. (808) 262-9972

To: Office of Hawaiian Affairs **Page 3**

20 June 2014

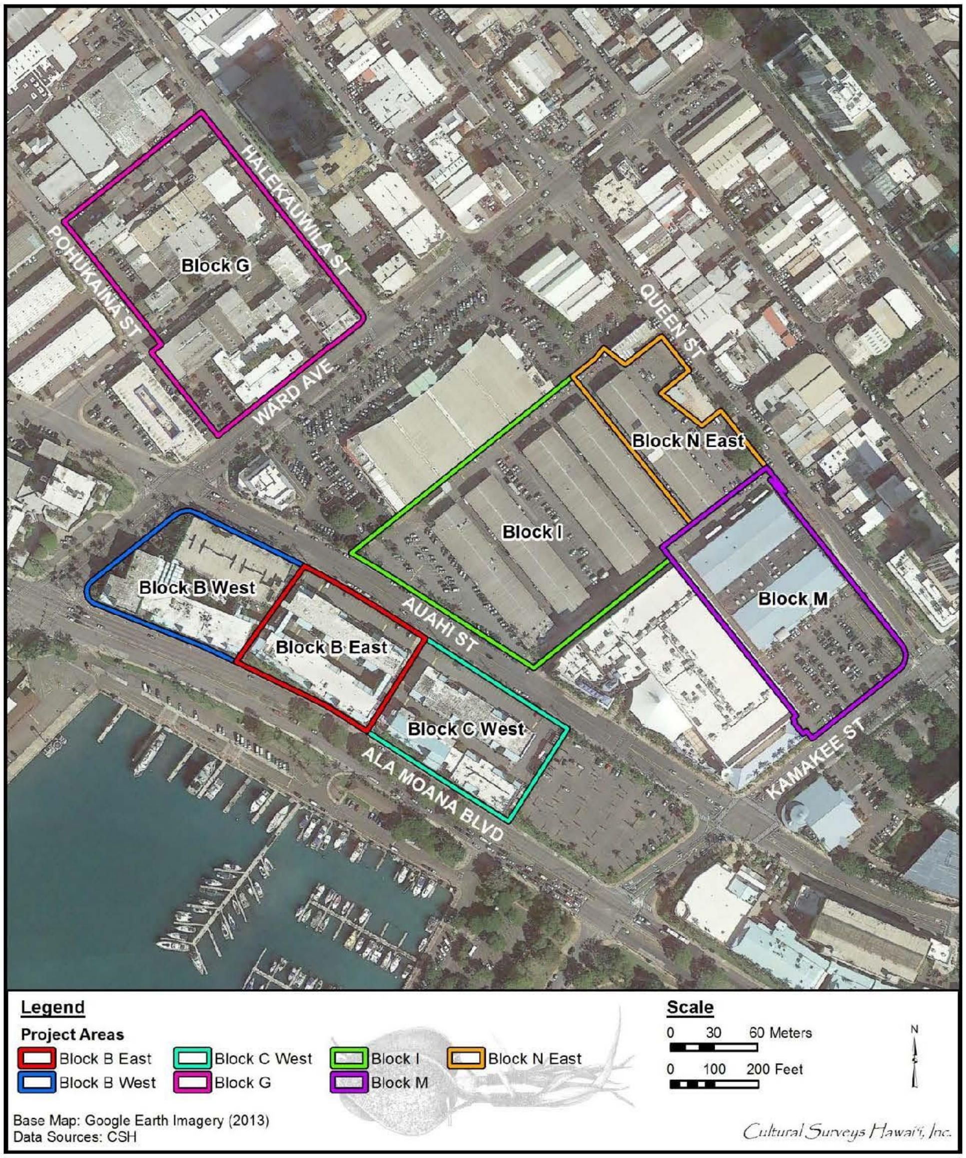

Figure 1. Aerial photograph showing the location of the Block B East and Block C West project areas within the Ward Neighborhood Master Plan Project area

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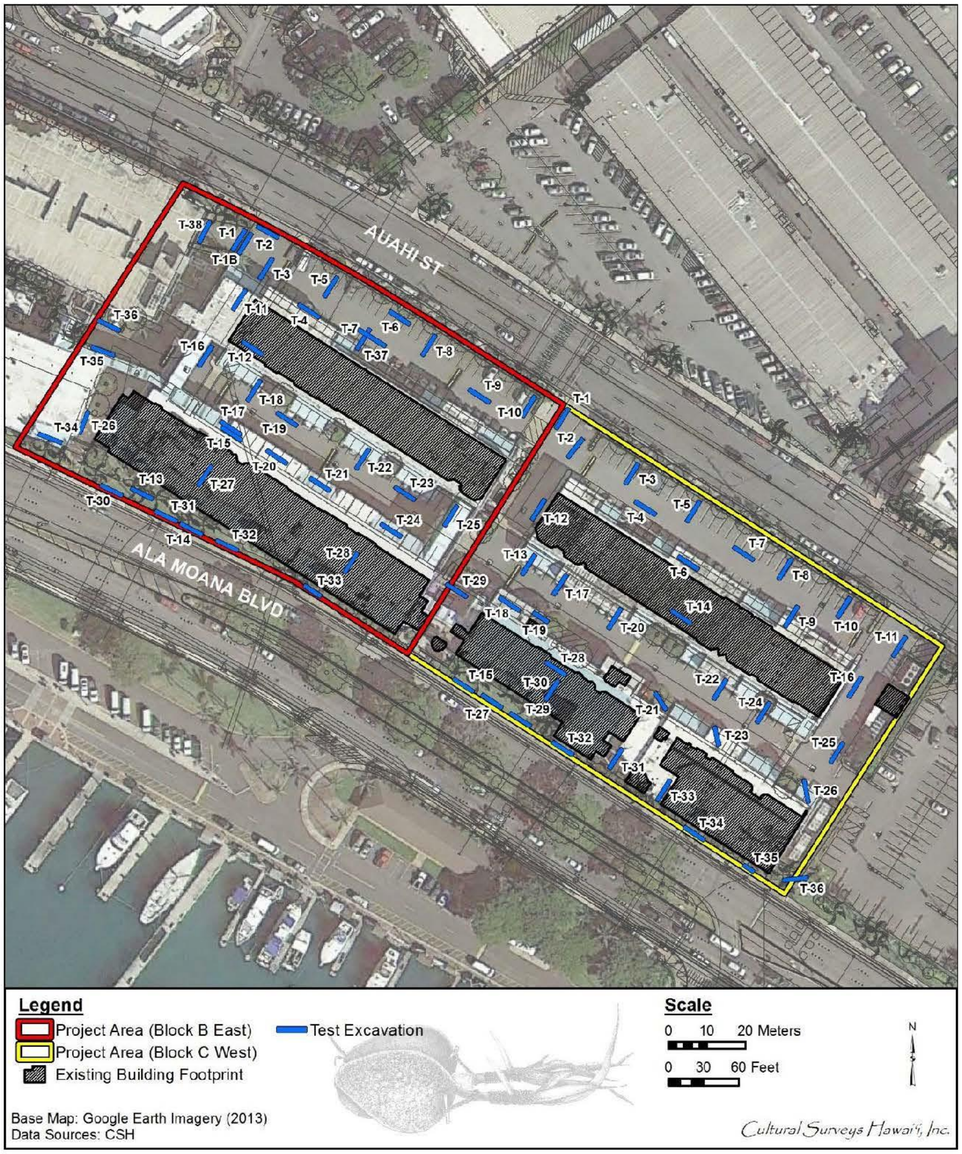

Figure 2. Aerial photograph showing the location of test excavations within the Block B East and Block C West project areas

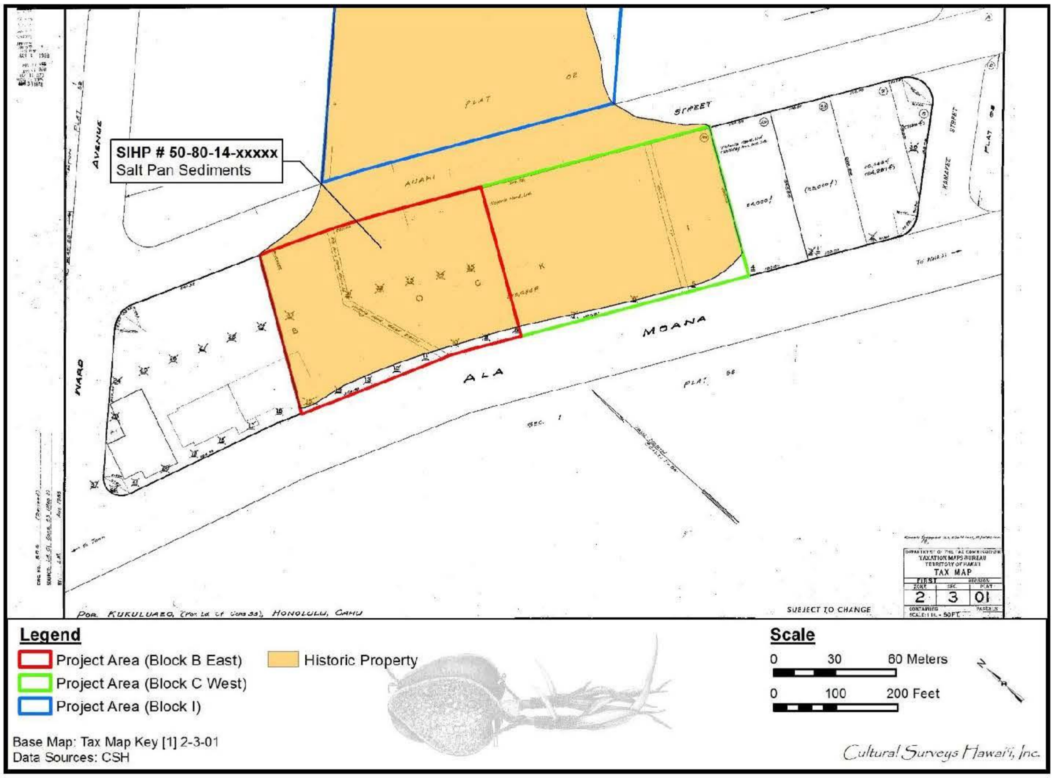

Figure 3. Figure showing the extent of documented historic salt pan remnants within Blocks B East and C West

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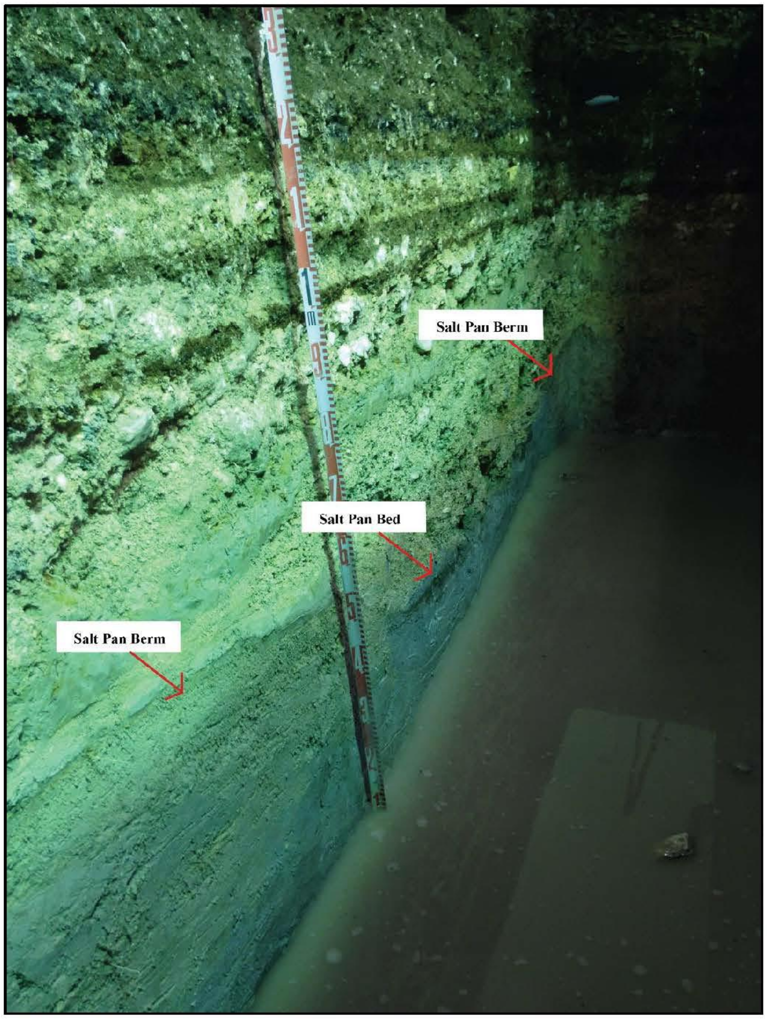

Figure 4. Photograph showing man-made historic salt pan berm structures and salt pan bed

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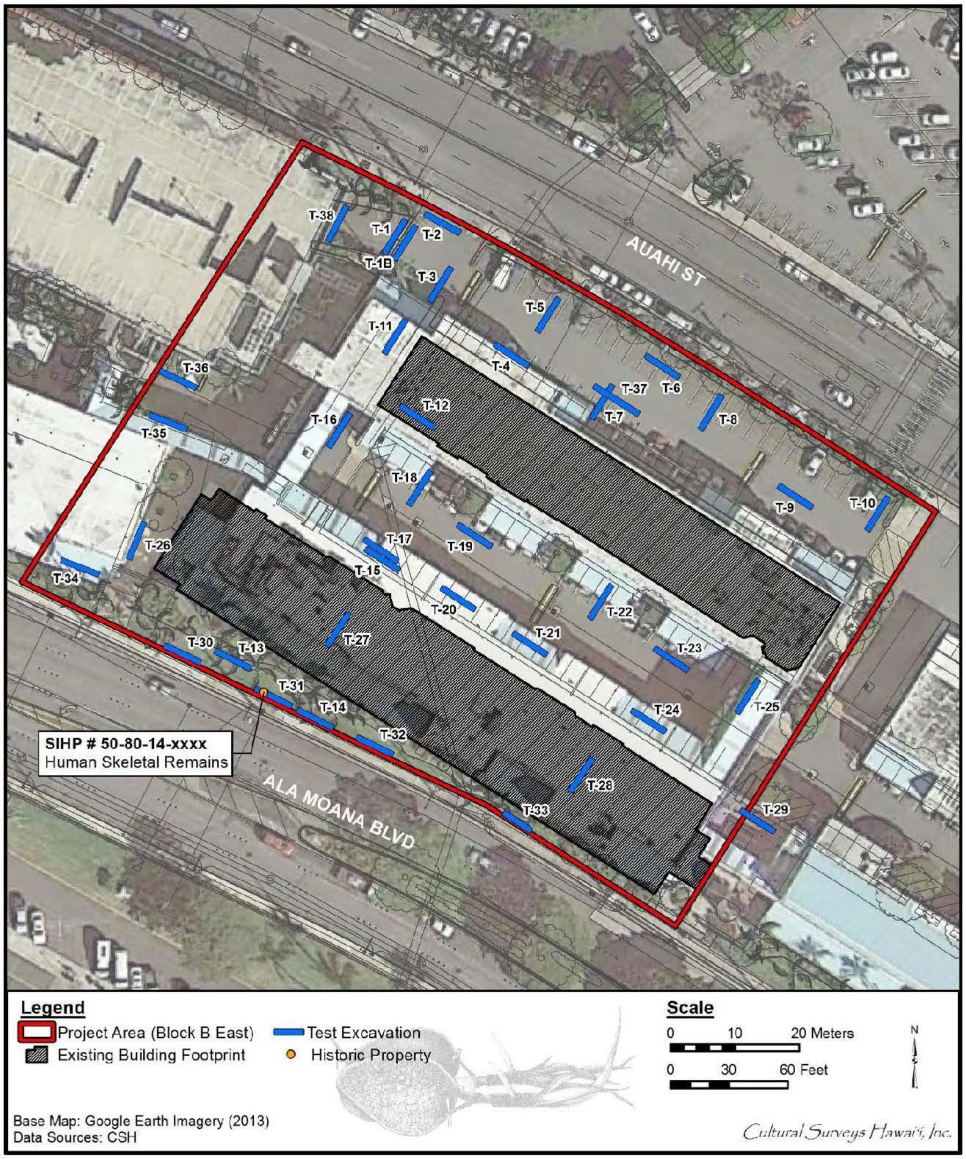

Figure 4. Figure showing the location of identified human skeletal remains within Test Excavation 31 of Block B East

Appendix E Pollen Analysis Report

POLLEN ANALYSIS OF SAMPLES
FROM SITES KAKAAKO 119 AND KAKAAKO 120
IN KAKA'AKO, O'AHU

By

Linda Scott Cummings

With assistance from
R. A. Varney

PaleoResearch Institute
Golden, Colorado

PaleoResearch Institute Technical Report 14-058

Prepared for

Cultural Surveys Hawaii, Inc.
Waimanalo, Hawaii

June 2014

INTRODUCTION

Sites KAKAAKO 19 and KAKAAKO 120, located between Auahi Street and Ala Moana Boulevard within Kaka'ako, in Honolulu County, O'ahu, are situated in an urban parking lot of Ward Warehouse Central. Stratigraphic sediments observed in subsurface test trenches included peat and clay deposits indicative of wetlands. These sediments, and salt pan remnants, were sampled for pollen analysis and microscopic charcoal quantification to provide information about past vegetation and environmental conditions. Two strata (II and III) were targeted for sampling.

METHODS

Pollen

Due to the highly organic nature of these samples, our normal chemical extraction technique was modified. Quantities that varied from approximately 3 to 16 cubic centimeters (cc) of organic-rich sediment were selected for most of the samples. Two samples (9 and 11) contained large quantities of carbonate sand, so larger quantities (30 and 50 cc) of these samples were started. All samples received hydrochloric acid (10%) to remove any calcium carbonates present, and all samples displayed strong reactions indicating presence of carbonate shell fragments to varying degrees. Next the samples were screened through 250-micron mesh. The samples were allowed to settle for 2 hours, after which the supernatant was poured off and the samples were transferred to 50-ml tubes. The samples then received a 30 minute treatment in hot hydrofluoric (HF) acid to remove inorganic particles. The samples were acetylated for 5 minutes to remove extraneous, non-pollen organic matter.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University, the University of Colorado Herbarium, and the Bishop Museum Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the percentage pollen diagram. The percentage pollen diagram was produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment. Microscopic charcoal fragments were tallied and are presented as a ratio to the pollen recovered. The total number of microscopic charcoal fragments for each sample was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains. Total microscopic charcoal values also were calculated in a similar manner as total pollen concentration.

ETHNOBOTANIC REVIEW

Ethnographic studies and published historic documents and accounts have been valuable indicators of possible or even probable plant uses. The ethnobotanic literature provides evidence for the exploitation of numerous plants in historic times, both by broad categories and by specific example. Although ethnographic sources document historic use of some plants as a carryover from the past, loss of plant knowledge most likely occurred as cultures moved from subsistence to agricultural economies and/or agricultural practices were introduced from abroad. The ethnobotanic literature serves only as a guide for potential uses, not as conclusive evidence of those uses. Pollen, phytoliths, starch, and macrofloral remains, when compared with the material culture (artifacts and features) recovered by archaeologists, can become indicators of use. We review plants represented by pollen in the following paragraphs to provide an ethnobotanic background for discussing the remains recovered in this study.

Cultivated Plants

Ipomoea batatas (Sweet potato)

Ipomoea batatas (sweet potato) is a Polynesian introduction to Hawai'i. Approximately 230 cultivars of sweet potatoes were recognized and used by early Hawai'ians. Not only the tubers were eaten, but the stem tips and young leaves also were used as food. Tubers were fermented to make potato beer and various parts of the plant were used medicinally. Vines and leaves were used as pig food, and old leaves were used as padding under floor mats. Tubers also were used to fatten hogs and as bait for *'opelu* (mackerel scad) (Wagner et al. 1990:555). Grated sweet potato root also was apparently used as an emetic (Whistler 1992:161).

Oryza (*Laiki*, Rice)

Oryza sativa (*laiki*, rice) is one of six tropical species of rice that grows as either an annual or perennial swamp grass. Most rice fields are terraced to benefit from elaborate irrigation systems. “When the grains begin to ripen and the panicle droops with their weight, the water is drained from the field to hasten the harvest” (Neal 1965:69). Rice seed probably was introduced to Hawai’i from China in 1856. More suitable seed was brought from South Carolina in 1860, and by 1862 rice was the second most important crop in Hawai’i. This economic importance was short-lived, as it yielded to coffee in 1899, largely because of the ancient and rather impractical methods of rice culture, milling, and marketing used in Hawai’i (Neal 1965:71).

Saccharum (Sugar Cane)

Saccharum (sugar cane) is a member of the grass family (Poaceae), as is considered to yield one of the five most valuable plant products. The large canes, known as “noble canes”, grow only in cultivation. Sugar cane grown in Hawai’i includes many commercial varieties that are the result of hybridization (Neal 1965:77).

The prehistoric origin of sugar cane is variously reported as near central New Guinea (Neal 1965:77) or India around 500 B.C. (Toussaint-Samat 1992). Until the 19th century, the principal source of sucrose was the cultivated sugar cane, *Saccharum officinarum*, which has a sucrose content of about 13% in its fluids (McGee 1984). Early Polynesian immigrants introduced sugar cane into Hawaii and planted it in their gardens. They used it as a source of sugar and also as fiber for making hats and house thatching, although it is less durable than pili grass. The first sugar firm was established in Koloa, Kauai in 1835. Today, sugar plantations occupy approximately 5.5% of the total land area of the state, yielding 9-10 tons of sugar per acre. Although cane grows best at sea level, it may be grown to an elevation of 2800 feet on the lee sides of the islands. The crop requires 22–24 months to ripen and must receive adequate rainfall or be irrigated (Neal 1965:78).

From the Middle Ages until the late 19th century, processing of sugar cane followed the same basic procedure. At maturity, the cane fields were burned to clear cane leaves and other undesirables such as insects. The unburned, water-filled stalks were then cut and transported to a processing area where they were crushed and pressed. The green juice was cleared of impurities by heating with lime and a substance such as egg white or animal blood, which would coagulate the impurities that floated to the top, and were skimmed off. The remaining liquid was boiled down using shallow pans and poured into cone-shaped clay molds, called sugarloafs, where it crystallized into raw sugar. Additional steps could then be taken to further purify the sucrose crystals (McGee 1984). Byproducts such as molasses, alcohol, fuel fertilizer, and cattle feed also were gleaned from the crop (Neal 1965:78).

DISCUSSION

Two sites (KAKAAKO 119 and KAKAAKO 120) yielded 11 soil samples collected from peat, clay, and salt pan remnants that constituted Strata II and III (Table 1). Three trenches from each site were targeted for sampling. The testing area lies in a parking lot of Ward Warehouse Central between Auahi Street and Ala Moana Boulevard. Background research indicates the potential for historic trash pits, privies, and other historic features in this area. Pollen analysis and microscopic charcoal quantification was undertaken to address the record of vegetation and assist with identification of any human activity associated with this area.

KAKAAKO 119

The pollen record from KAKAAKO 119 includes samples from Strata II and III in three trenches (6, 21, and 22). These trenches are arranged approximately north to south with Trench 6 representing the *mauka*-side of the parking lot, through the central portion of the parking lot (Trench 22), and ending with Trench 21 representing the *makai*-side of the parking lot. All samples from this site were characterized as clayey peat with a gray-green color suggesting anaerobic conditions. The pollen record is dominated by *Myrsine* pollen (Figure 1, Table 2) in all samples from this site. *Myrsine* (*kōlea*) shrubs or trees are noted to grow in and around bogs and in mesic to wet forests, usually at elevations above 600 m (Wagner, et al. 1990:937-947). Recovery of this pollen as a dominant type in wetland sediments retrieved from locations near the coast suggests these shrubs/trees grew closer to the coast in the past and probably during the recent or historic past. This pollen has been a common component of samples examined from the Ward Village and Waikiki areas on the leeward side of Oahu

(Cummings 2013; Cummings et al. 2012). Recovery of *Myrsine* pollen in these locations suggests that the wetlands along the coast supported *kōlea* into historic times.

Occasional presence of small quantities of *Cocos nucifera* pollen indicates growth of coconut palms near the coast. Evidence of shrubby vegetation was minimal, as *Chenopodium* pollen was observed only in sample 5 from Trench 22. Plants in the Asteraceae (sunflower family) also were not abundant in the area, as this pollen was noted only in sample 2 from Trench 6. Poaceae pollen was noted in samples from Trenches 6 and 21, probably representing grasses growing within or proximate to the wetlands. Cyperaceae pollen was observed in most of the samples from this site, indicating sedges growing as part of the wetland vegetation community. *Typha* pollen was noted only in sample 1, documenting growth of cattails in the most recent deposits (Stratum II) sampled from this location. Spores representing ferns also were noted in each of the samples from this site, indicating that at least three different types of ferns grew in the area.

Pollen representing alien plants included *Casuarina* (Australian pine), *Leucaena* (*koa haole*), and *Prosopis* (*kiawe*). Small quantities of these pollen were distributed throughout the sediments examined from this site. *Casuarina* would have been part of the littoral vegetation community, while *koa haole* and *kiawe* would have grown nearby on drier sediments. Pollen from all of these trees is expected to be transported at least short distances on the wind. Further, recovery of relatively stable quantities of pollen representing these alien plants establishes these deposits as historic.

Pollen that might represent either land use or perhaps accumulation of trash include *Saccharum*, representing sugar cane that was observed in Trench 22. Only small quantities of large Poaceae pollen that exhibited a distinct surface texture typical of *Saccharum* were observed in samples 5 and 6. Although large, *Saccharum* pollen may be transported at least 100 meters, indicating that an area near this wetland could have been farmed for sugar cane. Alternatively, remnants of sugar cane might have been discarded in this area. The hirsute leaves should retain at least small quantities of pollen long after the plants have ceased pollinating, making pollen transport through discard a possibility over a longer period of time than merely the few weeks that the plants pollinate.

Foraminifera were observed in each of the samples from Site KAKAAKO 119, documenting exchange of water with the sea or the presence of brackish water in this location.

Stratum III sediments exhibited elevated microscopic charcoal frequencies that were many times more abundant than the pollen, which are calculated to be about 2 million and approximately 1.5 million pieces of charcoal per cc of sediment (Table 3). This suggests the possibility that fields in the area were burned or that ash was discarded in this area. This practice does not appear to have been carried forward into Stratum II at this location. Sample 1, the uppermost sample from Stratum II in Trench 6, also yielded nearly 1 million pieces of microscopic charcoal per cc of sediment, but due to the large total pollen concentration, the ratio between pollen and microscopic charcoal is low.

Total pollen concentration was high in all samples examined from this site. The lowest total pollen concentration was observed in sample 2 from Trench 6, suggesting more rapid accumulation of sediments at this time and place. This is followed by the largest total pollen concentration in the overlying sample 1, suggesting a very stable surface landscape. Trench 2 exhibited moderate total pollen concentrations, suggesting slightly more rapid sediment accumulation in this location. Finally samples from Trench 21 exhibit large total pollen concentrations, which is a trait of pollen records from bogs or shallow open water settings.

Site KAKAAKO 120

Site KAKAAKO 120 is represented by five pollen samples collected from three trenches (1, 6, and 23). From north to south, Trench 1 is *mauka*-side, Trench 6 is slightly less *mauka*-side, and Trench 23 is *makai*-side of the parking lot.

Like the samples from site KAKAAKO 119, the pollen samples from KAKAAKO 120 were dominated by *Myrsine* pollen, indicating growth of *kōlea* associated with the bog. Pollen evidence for vegetation is more diverse in this area than it was at the other site. This suggests drier habitats in the vicinity of this location.

Sample 7, representing the uppermost portion of Stratum IIb in Trench 1, yielded a large quantity of microscopic charcoal, suggesting local fires, perhaps for land clearing. Pollen also observed in this sample includes *Cocos nucifera*, Poaceae, and Cyperaceae representing coconut palms, grasses, and sedges growing in the general vicinity. *Casuarina* and *Prosopis* pollen indicate that Australian pine and *kiawe* also grew along the coast. Recovery of a small quantity of *Saccharum* pollen indicates sugar cane cultivation in the area or discard of sugar cane remains in a trash midden. Total pollen concentration for this sample was moderately large and similar to that noted in the Trench 21 samples.

Trench 6 is represented by two samples, both collected from Stratum II. Sample 9, the lowest, yielded the smallest quantity of *Myrsine* pollen observed in samples from these two locations. Moderate quantities of *Chenopodium* and Cyperaceae pollen reflect shrubby *‘aheahea* growing in drier habitats outside the bog and sedge growing in mesic or wet sediments near or in the bog. Small quantities of *Mangifera*-type Anacardiaceae and *Cocos nucifera* pollen represent mango and coconut palm trees growing in the area. Recovery of small quantities of *Casuarina*, *Leucaena*, and *Prosopis* pollen indicate that alien Australian pine, *koa haole*, and *kiawe* trees also grew in the area, labeling these deposits as historic. Small to moderate quantities of fern spores indicate that ferns also grew, probably in the shade of the *kōlea* at the edge of the bog. Ferns are well documented in this sample, which is the only one to yield Dicksoniaceae spores, representing tree ferns. Small quantities of *Oryza*-type and *Saccharum* pollen were noted in this sample suggesting local cultivation of rice and sugar cane. Total pollen concentration in this sample is very low, suggesting rapid sediment accumulation and possibly drying of the bog as a result. The lower sample exhibited a larger quantity of microscopic charcoal in comparison with the quantity of pollen, than did the upper sample from this location. This is consistent with the pattern observed in samples from Trenches 21 and 22.

Sample 8 yielded small quantities of *Mangifera*-type Anacardiaceae and Myrtaceae pollen indicating that mango and guava, or another member of the myrtle family, trees also grew in the vicinity of this bog. Recovery of small quantities of Low-spine Asteraceae, High-spine Asteraceae, and Liguliflorae pollen probably represent weedy plants in the sunflower family growing locally. *Boerhavia*-type pollen represents weedy *alena* probably growing mixed with the plants in the sunflower family in disturbed areas. These pollen types combine to indicate both sediment disturbance and a drier habitat. Small quantities of Poaceae and Cyperaceae pollen probably reflects grasses and sedges growing near the margins of the bog. Slightly larger quantities of pollen representing alien *Casuarina*, *Leucaena*, and *Prosopis* were observed in this sample, suggesting a slight increase in the local population of Australian pine, *koa haole*, and *kiawe*. This upper sample yielded small quantities of *Ipomoea batatas*-type, *Oryza*-type, and *Saccharum* pollen indicating cultivation of sweet potato, rice, and sugar cane. Alternatively, it is possible that this area functioned as a midden during the accumulation of these sediments, in which case these pollen might be associated with discard of agricultural products. Although the ratio between pollen and microscopic charcoal suggests a smaller quantity of microscopic charcoal in sample 8, when the values are calculated the underlying sample 9 yielded approximately 43,000 pieces of microscopic charcoal per cc of sediment, while sample 8 yielded more than 124,000 pieces of microscopic charcoal per cc of sediment. Total pollen concentration in sample 8 was only moderate at slightly more than 31,000 pollen per cubic centimeter (cc) of sediment examined. Foraminifera were not observed in either of these samples.

Samples examined from Trench 23, located closer to the coast, exhibit a more simple signature, reminiscent of that observed in samples from Trench 6. Other than *Myrsine*, which dominated the record, these 2 samples exhibited only small quantities of *Chenopodium*, *Artemisia*, *Cressa*, Poaceae, Cyperaceae, and the alien *Leucaena*, and *Prosopis* pollen in one or both of the samples, representing *‘aheahea*, *‘āhinahina*, cressa, grasses, sedges, *koa haole*, and *kiawe*. Very little microscopic charcoal was noted in either of these samples. The lower sample exhibited a much smaller total pollen concentration, at approximately 18,600 pollen per cc of sediment, suggesting more rapid sediment accumulation and disturbance. The upper sample represents sediment that appears to be relatively stable, since the total pollen concentration was more than 300,000 pollen per cc of sediment. Sample 10, the uppermost examined from this trench, yielded a small quantity of Foraminifera, suggesting the presence of open water. The sediment sample were consistent with the presence of open water in this area, as these sediment submitted was sandy rather than being a clay peat.

SUMMARY AND CONCLUSIONS

Pollen and microscopic charcoal analysis of samples collected and examined from KAKAAKO 119 and KAKAAKO 120 indicate these two areas were boggy and perhaps supported open water. Recovery of Foraminifera consistently in the samples from KAKAAKO 119 and in only one of the samples from KAKAAKO 120, suggests more open water in the vicinity of KAKAAKO 119. Certainly the more complex pollen signatures derived from samples collected from KAKAAKO 120, which, when combined with the lower total pollen concentrations from the lower samples in each of Trenches 6 and 23, suggests more rapid sedimentation in this area. The boggy area or areas represented in this study supported large stands of *kōlea*.

Local vegetation in the vicinity of the bogs included grasses and sedges, documented by recovery of Poaceae and Cyperaceae pollen in nearly all of the samples. Cyperaceae pollen, representing sedges, was particularly abundant in sample 9, representing the lower portion of Stratum II in Trench 6 and slightly abundant in sample 6, representing Stratum III in Trench 22. Sedges would have grown either at the edges of the bog or perhaps forming mats throughout the bog. Cyperaceae pollen was not sufficiently abundant to suggest that these peat bogs were sedge bogs. Fern spores were recovered in most of the samples examined, and were particularly abundant in sample 9, representing the lower portion of Stratum II in Trench 6. Dicksoniaceae spores were recovered only in this sample, suggesting local growth of at least a few tree ferns.

Evidence for pollen representing alien plants that included Australian pine, *koa haole*, and *kiawe* was well distributed throughout the samples examined from both sites, indicating that the sediments sampled are historic.

It is likely that the area supported sugar cane fields, as *Saccharum* pollen was noted in samples from Trench 22 (KAKAAKO 119) and in samples from Trenches 1 and 6 (KAKAAKO 120). A rice paddy might have been located in the vicinity of Trench 6, documented by recovery of *Oryza*-type pollen in both samples from this trench. Sweet potatoes also might have been cultivated near Trench 6, since *Ipomoea batatas*-type pollen was recovered from sample 8 in the upper portion of Stratum II. Alternately, the area sampled by Trench 6 might have been used as a trash dump or midden.

Comparing ratios of microscopic charcoal to pollen suggests that microscopic charcoal is more abundant in samples examined from Stratum III at KAKAAKO 119. The calculated absolute quantity of microscopic charcoal observed in these samples substantiates this observation, but indicates a surprisingly large quantity of microscopic charcoal in sample 1. At KAKAAKO 120 the largest quantity of microscopic charcoal observed was in samples 7, collected from Stratum IIb in Trench 1. This is, in fact, the largest quantity of microscopic charcoal noted in any of the samples examined from these two sites. A large quantity of microscopic charcoal also was noted in sample 10, collected in the upper portion of Stratum II in Trench 23. It is possible that these large concentrations of microscopic charcoal represent burning weeds to clear land between crop plantings. Charred Asteraceae tissue fragments were noted in samples 4 and 9, suggesting burning weedy plants, but large quantities of microscopic charcoal do not coincide with pollen evidence for weedy plants that are expected to accompany agricultural plots. Sugar cane also was burned as part of the harvesting process, but there is little evidence for the presence of burned grass stem other than three charred bilobate phytoliths recovered in sample 6, suggesting burning sugar cane debris. Microscopic charcoal also might represent ash discard or dumping in midden sediments. At least some of the microscopic charcoal in many of the samples were very tiny. It was not possible to discriminate between tiny microscopic charcoal fragments and possible petroleum contamination that accumulates in coastal sediments, therefore, for at least the upper samples it is possible that the microscopic charcoal count has been influenced by the presence of petroleum.

TABLE 1
PROVENIENCE FOR SAMPLES FROM SITES KAKAAKO 119 AND KAKAAKO 120, O'AHU

Sample No.	Trench	Stratum	Depth (cmbs)	Provenience/ Description	Analysis
KAKAAKO 119:					
1	6	2	133-134	Clayey peat, gray-green, w/red inclusions	Pollen
2			134-135	Clayey peat, gray-green	Pollen
3	21	2	160-161	Clayey peat, gray-green, w/red inclusions	Pollen
4		3	161-164	Clayey peat, gray-green	Pollen
5	22	2	145-147	Clayey peat, gray-green	Pollen
6		3	150-152	Clayey peat, gray-green	Pollen
KAKAAKO 120:					
7	1	2b	125-127	Clayey peat, gray-green, w/red inclusions	Pollen
8	6	2	151-152	Clay, gray-green	Pollen
9			152-155	Sandy clay, gray	Pollen
10	23	2	120-121	Peat, yellow gray	Pollen
11			121-125	Sandy clay, gray	Pollen

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SITES KAKAAKO 119 AND KAKAAKO 120, O'AHU

Scientific Name	Common Name	Nat	Pol	End	Ind
TREES:					
Cocos nucifera	Coconut, *Niu, alolani*		x		
Mangifera-type Anacardiaceae	Mango in mango family	Introduced from India			
Myrsine	*Kōlea, ʻŌliko, Kōlea lau nui, Kōlea lau liʻi*			x	
Myrtaceae	Myrtle family	x	x	x	x
SHRUBS:					
Chenopodium	Goosefoot, pigweed, lamb's quarters, Mexican tea, worm seed, *'aheahea, 'ahea, 'ahewahewa, alaweo, alaweo huna, 'aweoweo, kaha'iha'i*	x		x	
Artemisia	*ʻĀhinahina, hinahina, hina hina kuahiwi*	x		x	
HERBS:					
Low-spine Asteraceae	Sunflower family; Includes ragweed and others	x		x	x
High-Spine Asteraceae	Sunflower family; Includes *Bidens*	x		x	x
Liguliflorae	Sunflower family, chicory tribe	x			
Boerhavia-type	*Alena, anena, nena*	x			x
Cressa	Cressa				x
GRASSES, etc.:					
Cyperaceae	Sedge family	x		x	x
Poaceae	Grass family	x		x	x
Typha angustifolia-type	Cattail	x			
ALIENS:					
Casuarina	Australian pine (Ironwood, *Paina*)	x			
Leucaena	*Kao-haole ('ekoa, lilikoa*)	x			
Prosopis	*Kiawe*, mesquite	x			

TABLE 2 (Continued)

Scientific Name	Common Name	Nat	Pol	End	Ind
AGRICULTURE:					
Ipomoea batatas-type	*'Uala*, *'uwala*, cultivated sweet potato		x		
Oryza-type	*Laiki*, rice	Introduced by Chinese			
Saccharum	*Kō*, sugar cane	x			
SPORES:					
Dicksoniaceae	Tree fern family			x	x
Monolete bumpy	Ferns				
Monolete smooth	Ferns				
Trilete bumpy	Ferns				
Trilete smooth	Ferns				
Trilete spiny	Ferns				
OTHER:					
Foraminifera	Forams, single-celled protists with shells				
Scolecodont	Worm jaw				
Charred Asteraceae Tissue Fragment	Charred tissue fragment from a member of the sunflower family				
Microscopic Charcoal	Microscopic charcoal fragments				
Total Pollen Concentration	Quantity of pollen per cubic centimeter (cc) of sediment				

Plant names and information derived from (Wagner, et al. 1990)
Fern (spore) names derived from (Selling 1946)

Nat = Naturalized
Pol = Polynesian introduction
End = Endemic
Ind = Indigenous

Pollen identifications to species were made based on the fact that only 1 species is reported by (Wagner, et al. 1990). Species identification was not made based on morphologic characteristics observed under the microscope.

TABLE 3
MICROSCOPIC CHARCOAL RESULTS

Sample No.	Trench	Stratum	Depth (cmbs)	Microscopic Charcoal, Ratio	Microscopic Charcoal, Absolute Quantity
KAKAAKO 119:					
1	6	2	133-134	49	915,168
2			134-135	101	15,120
3	21	2	160-161	60	187,699
4		3	161-164	1607	2,010,871
5	22	2	145-147	181	119,836
6		3	150-152	3110	1,438,033
KAKAAKO 120:					
7	1	2b	125-127	3564	7,396,048
8	6	2	151-152	399	124,201
9			152-155	1794	43,379
10	23	2	120-121	303	961,955
11			121-125	128	23,907

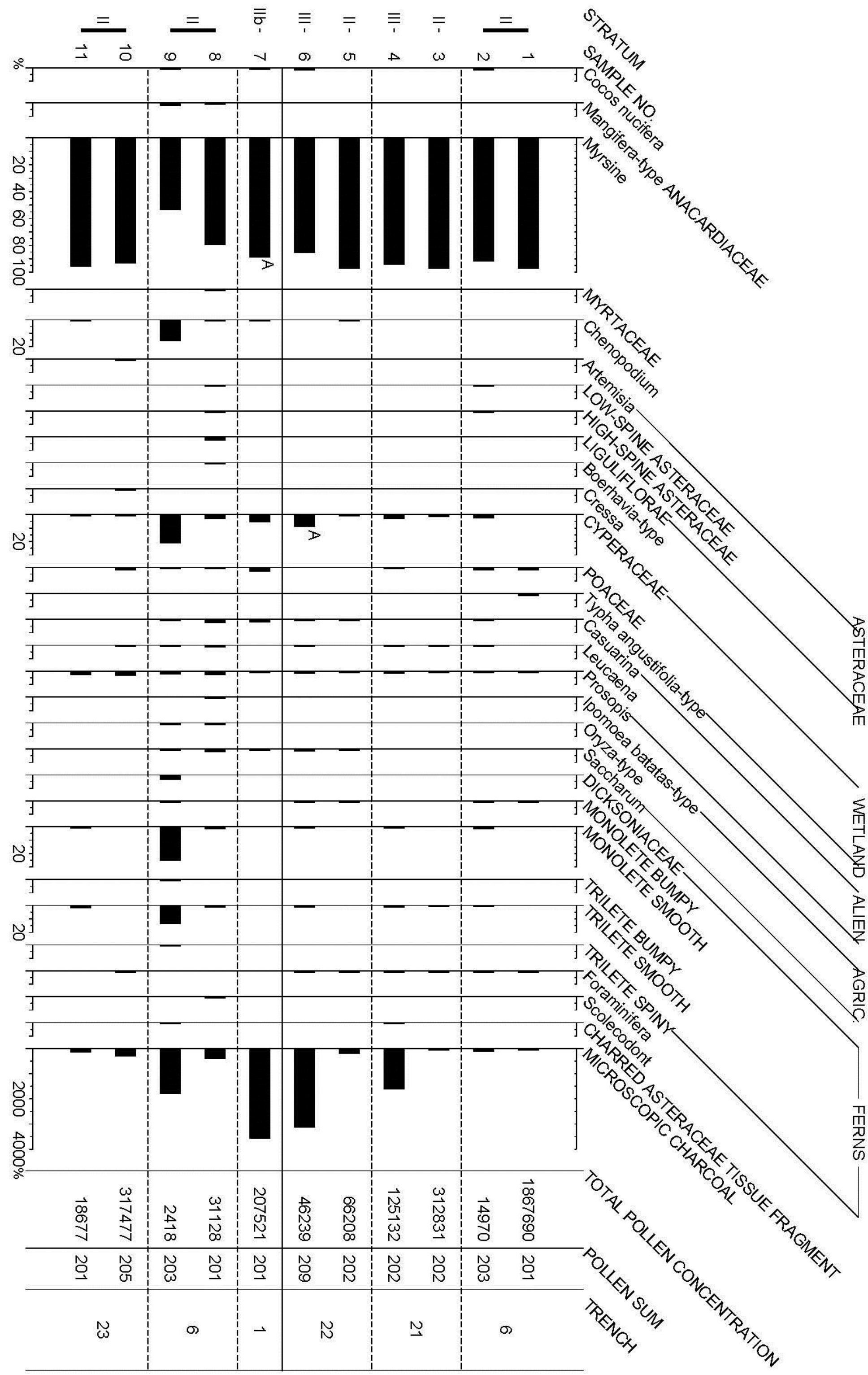

FIGURE 1. POLLEN DIAGRAM FOR KAKAAKO 119 (TOP) AND KAKAAKO 120 (BOTTOM), WARD WAREHOUSE CENTRAL, OAHU.

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